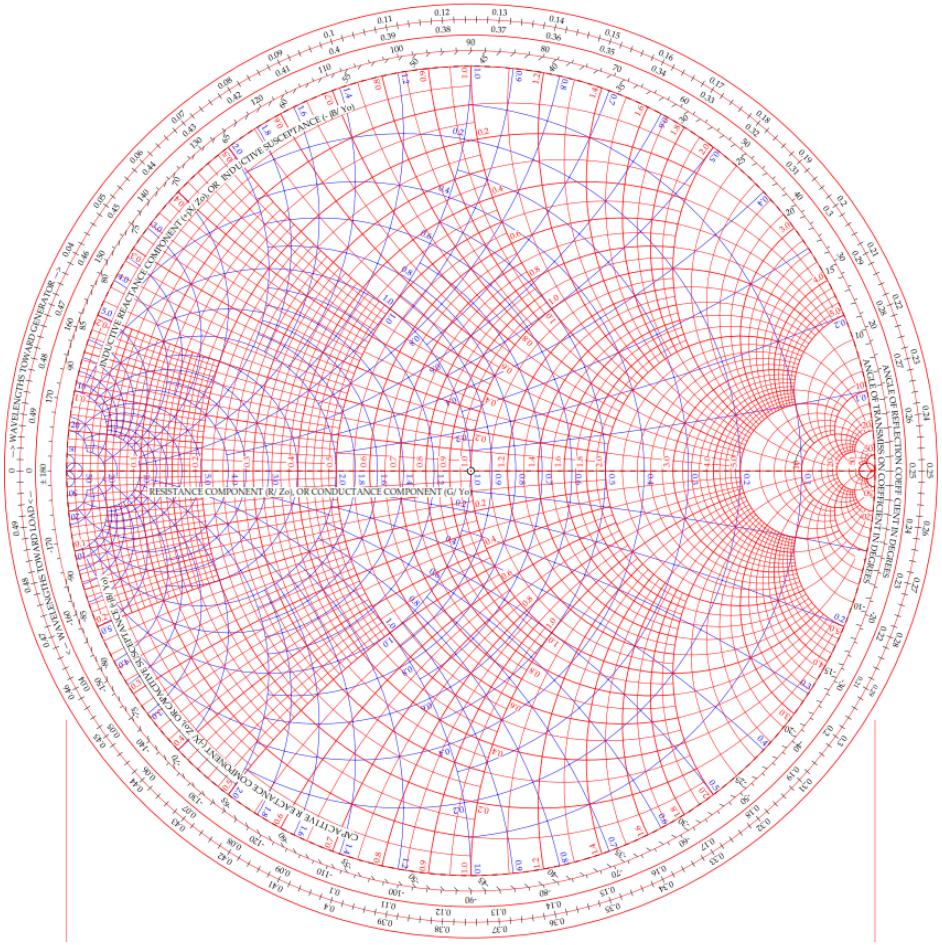
REFLECTION: Coefficient, Return Loss, VSWR



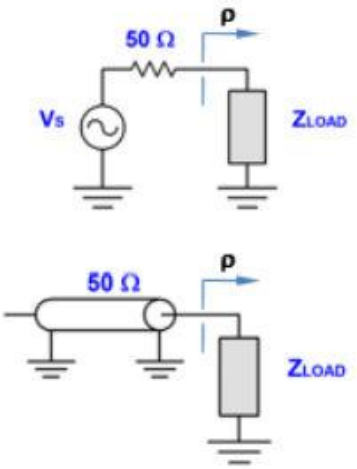
K5TRA

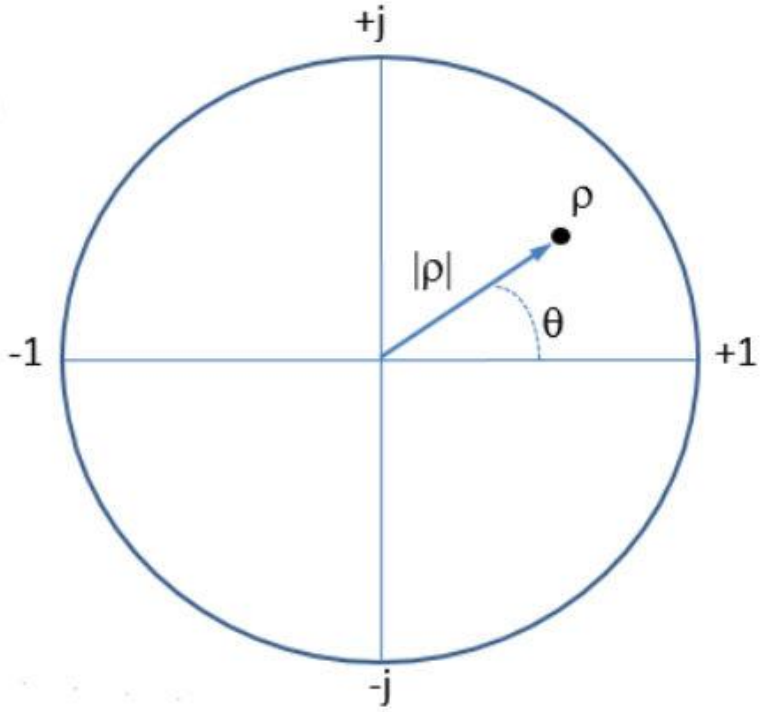
REFLECTION COEFFICIENT

- Voltage ratio of reflected traveling wave to forward wave
- A complex number (waves not necessarily in phase)
- Passive reflection coefficient magnitude ranges between 0.0 (no reflection) and 1.0 (total reflection)
- All possible passive reflection coefficients are contained within a circle of radius = 1.0, on the complex number plane.

REFLECTION COEFFICIENT

REFLECTION COEFFICIENT: ρ





$$\rho = \frac{V_R}{V_F} = \left|\frac{V_R}{V_F}\right| e^{j\theta}$$

RETURN LOSS

- Sometimes it is more convenient to represent reflection levels in dB
- The voltage reflection coefficient magnitude expressed in dB is called Return Loss:

$$RL = -20\ \log_{10}(\ |\rho|\ )$$

- For example, a reflection coefficient of 0.5 would be expressed as a 6 dB return loss

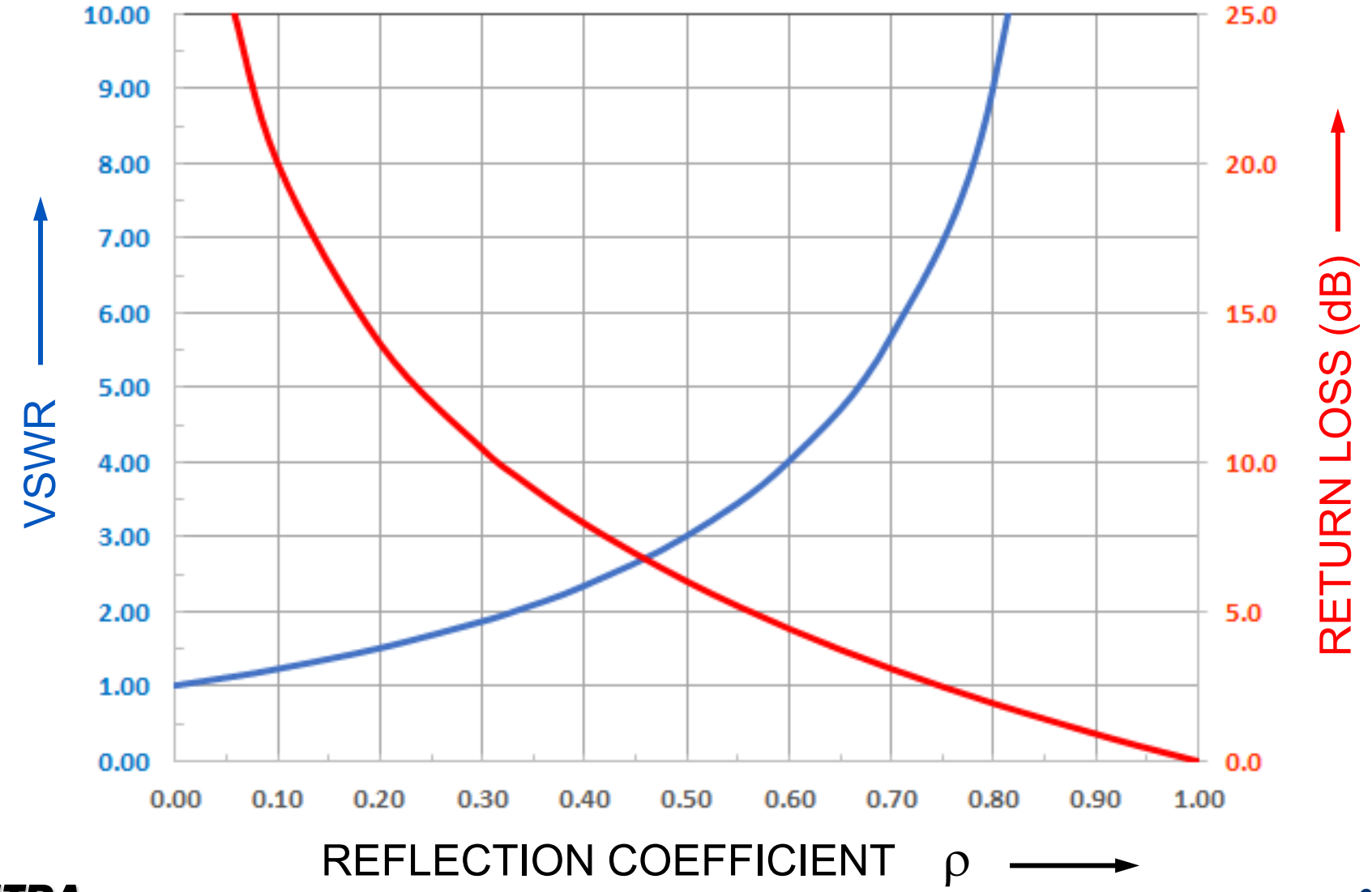
VSWR

- Hams often talk about mismatch and reflection in terms of VSWR (Voltage Standing Wave Ratio)
- The voltage reflection coefficient magnitude expressed as VSWR is:

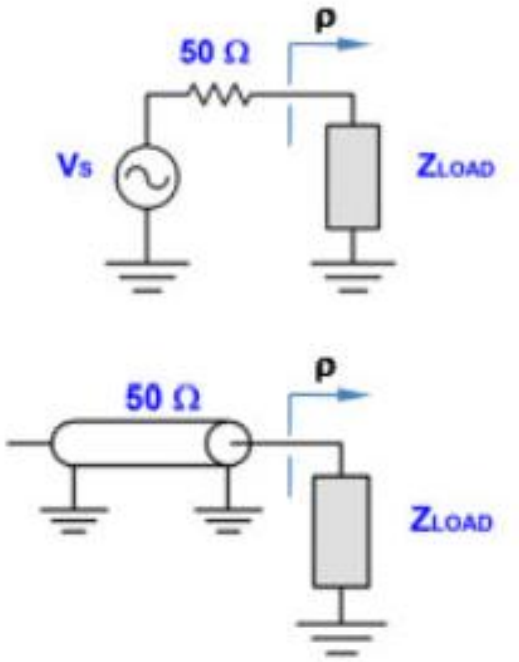
$$VSWR = \frac{(1+|\rho|)}{(1-|\rho|)}$$

- For example, a reflection coefficient of 0.5 would be expressed as a 3:1 VSWR

VSWR and RETURN LOSS



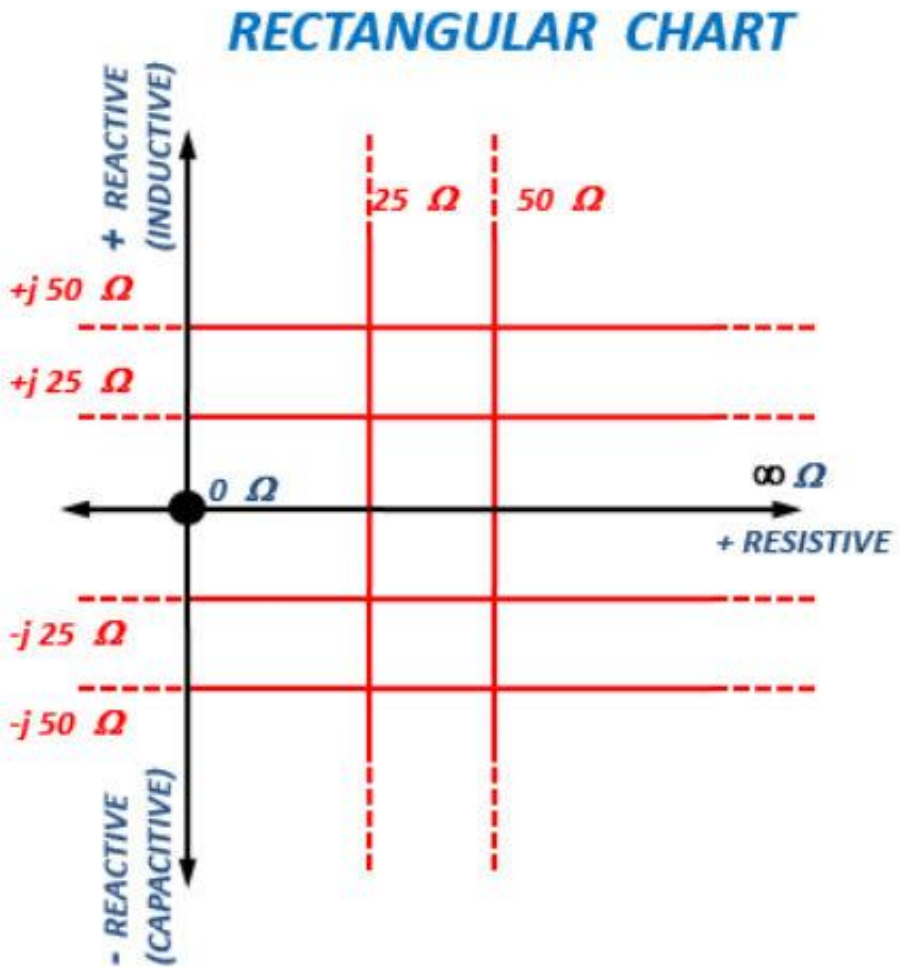
LOAD IMPEDANCE RELATIONSHIP WITH REFLECTION

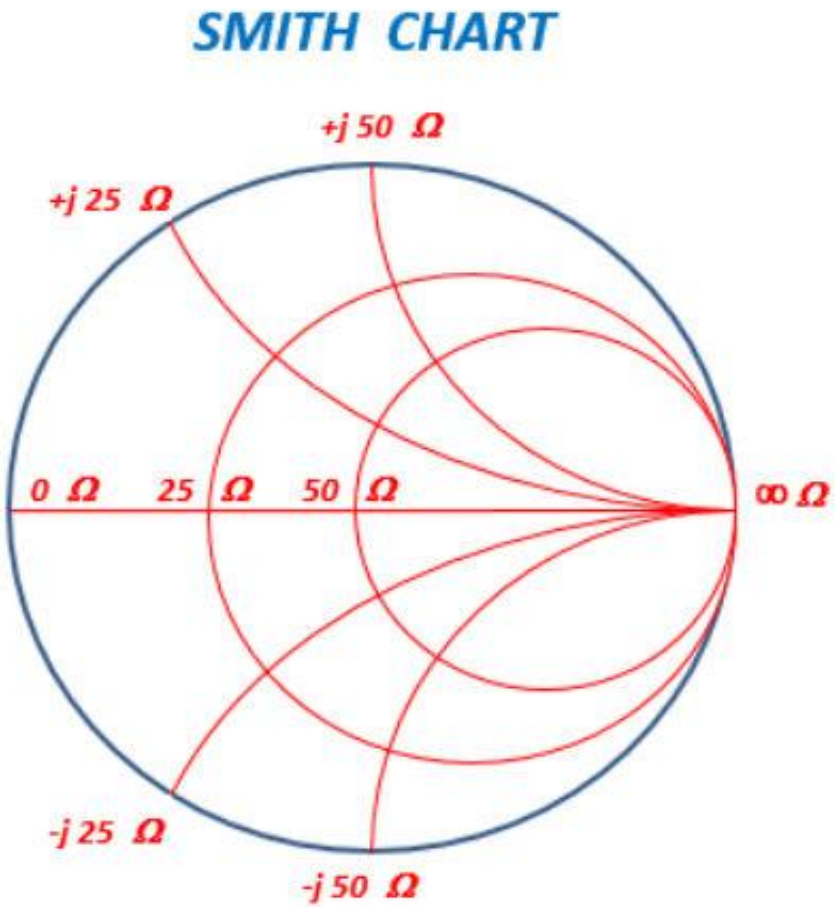


- Mismatch between a reference impedance (for example, 50 Ω) and a load impedance can be expressed as a reflection coefficient:

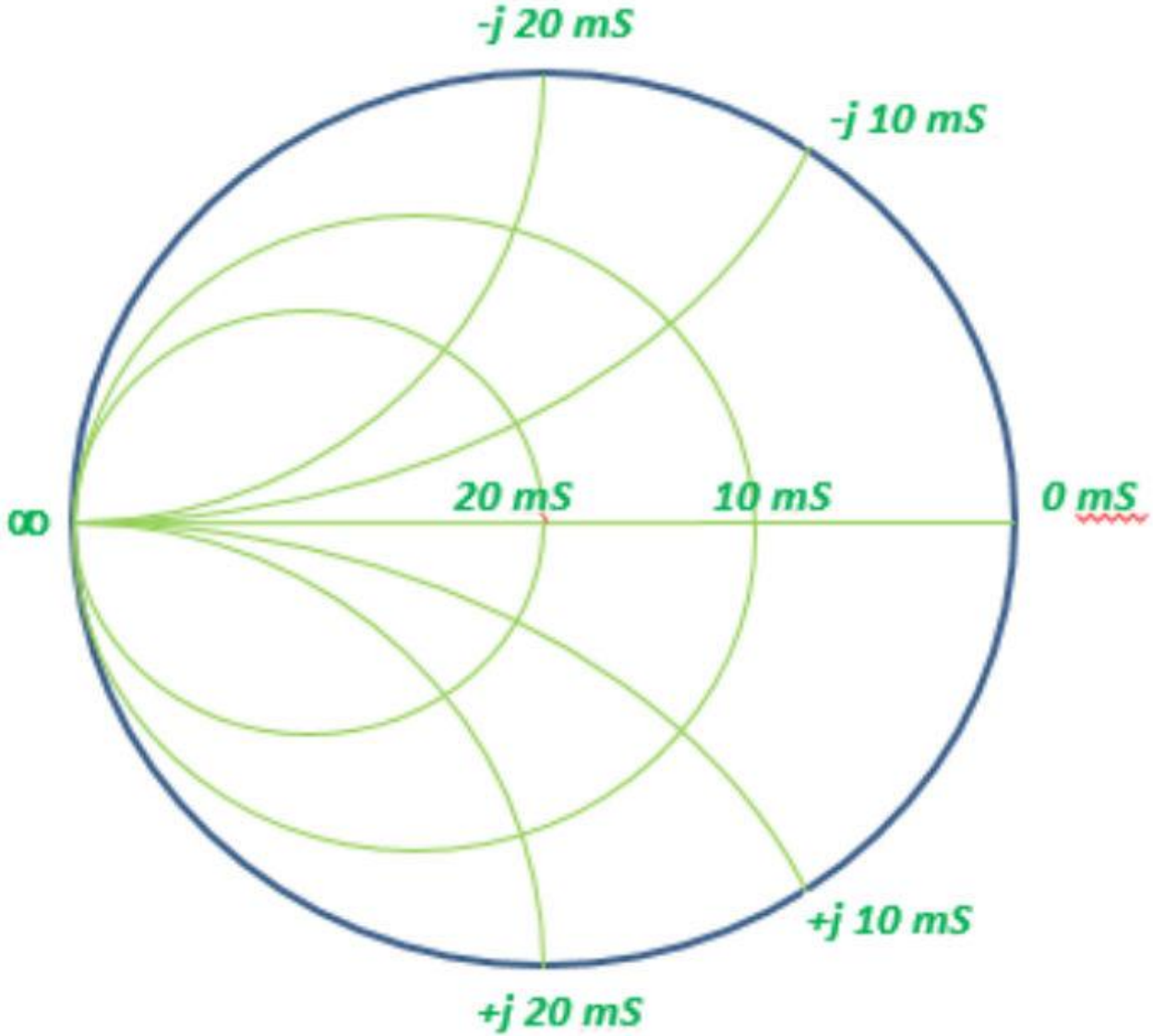
$$\rho = \frac{(Z_{LOAD} - Z_{REF})}{(Z_{LOAD} + Z_{REF})}$$

THE SMITH CHART: LOADS AS REFLECTION COEFF.

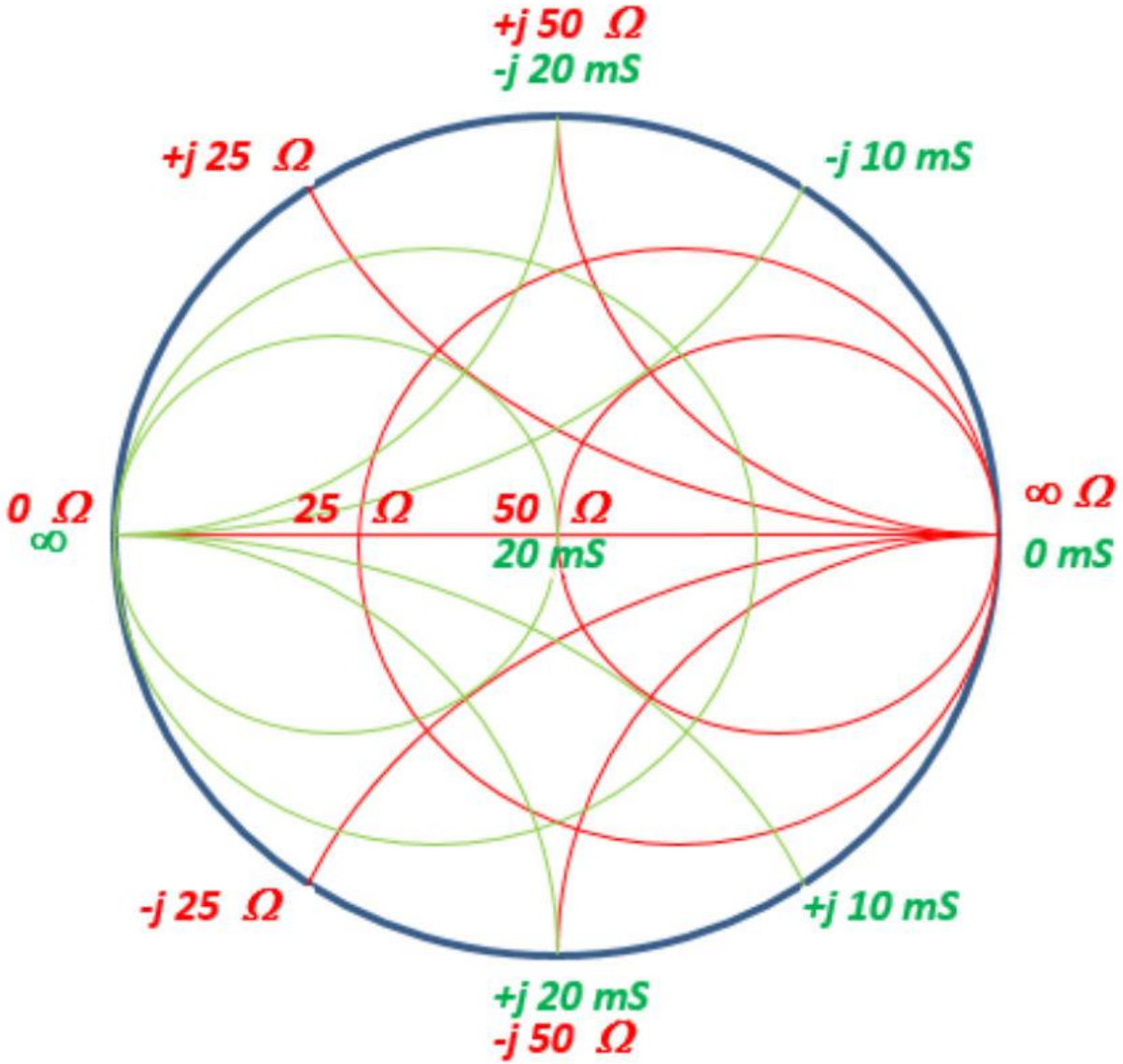




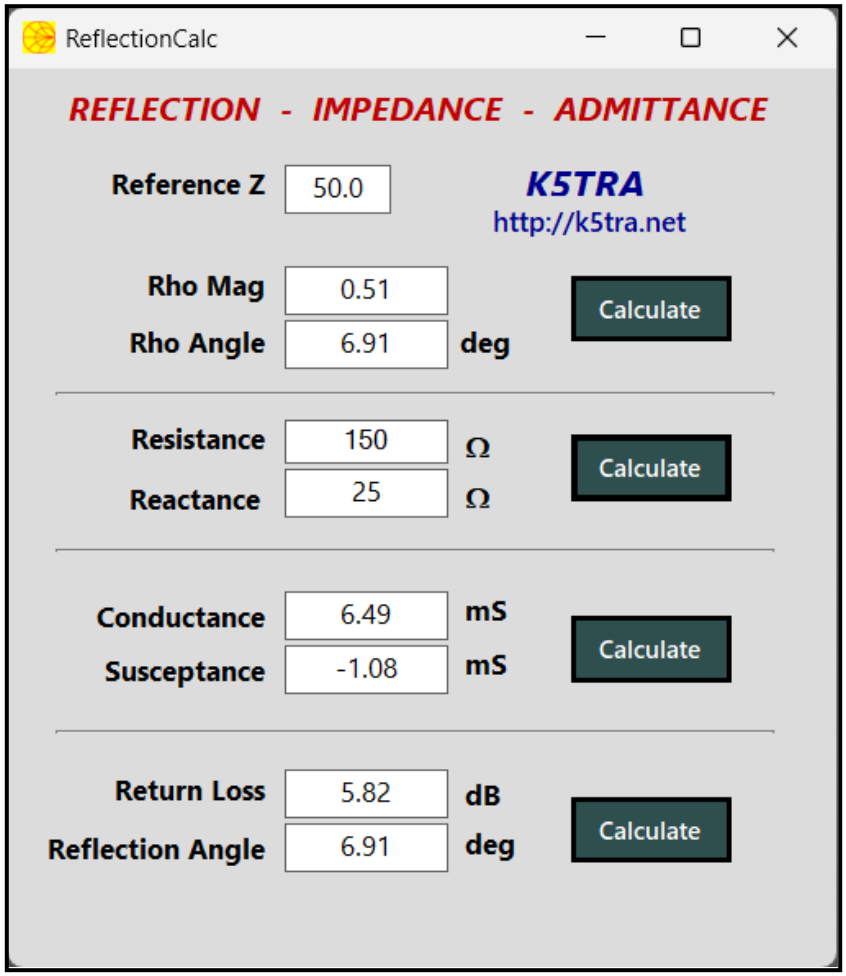
THE ADMITTANCE CHART – ALTERNATE SMITH CHART FORM



IMMITTANCE CHART: MOST COMMON SMITH CHART

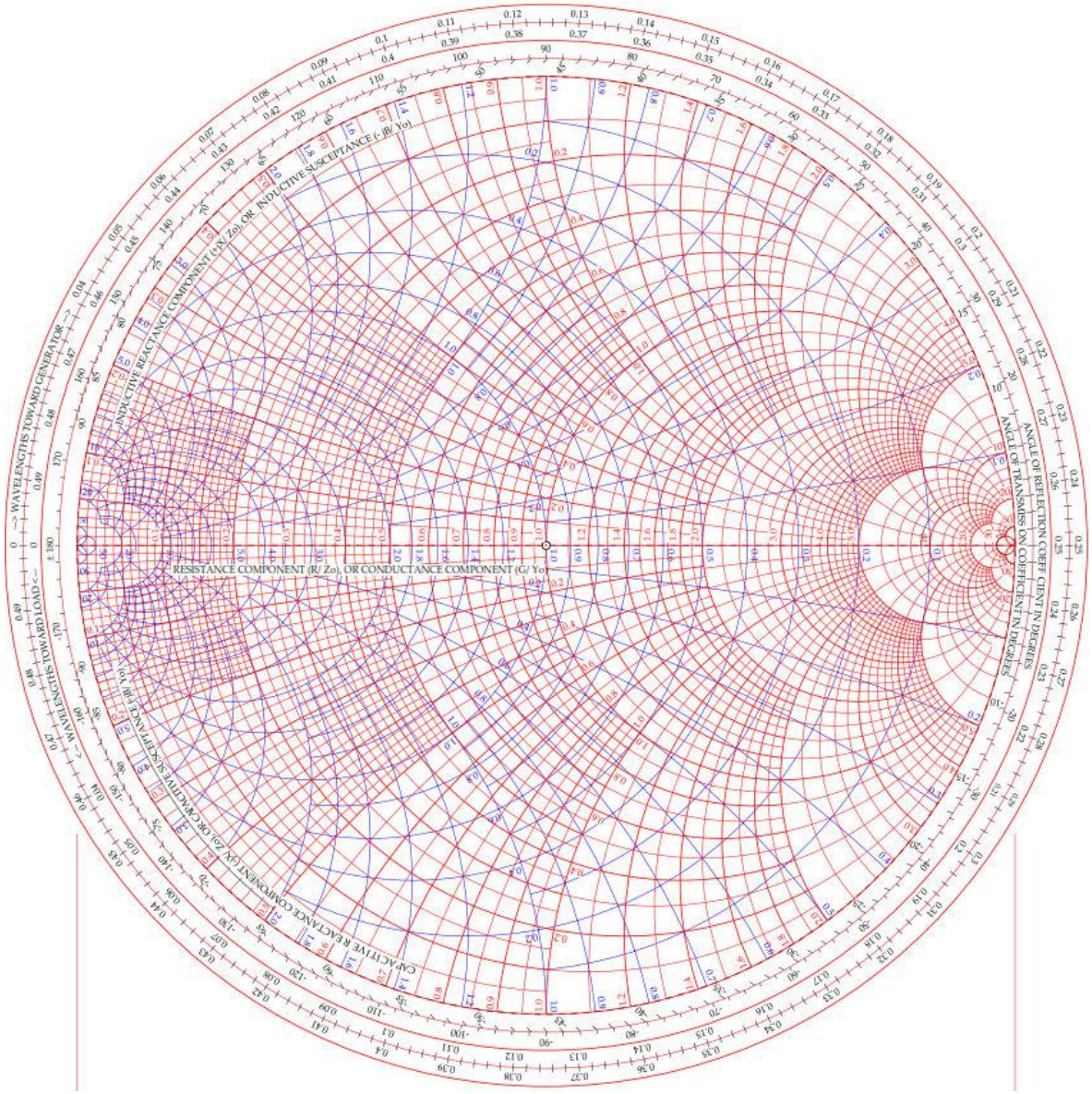


REFLECTION CALCULATOR



http://k5tra.net/technical.html
http://k5tra.net/Design%20Tools/Reflection.zip

SUMMARY

- Reflection due to load mismatch can be expressed as a reflection coefficient, a return loss or a VSWR.
- Calculation between these forms is straight forward.
- Calculation of reflection from load impedance, in a reference impedance system, is straight forward.
- This leads to the Smith Chart, a useful graphic tool.
- A downloadable reflection calculator tool was introduced.

Questo E' Tutto