Smith Charts and More

Sponsored by the Chelsea Amateur Radio Club (WD8IEL).

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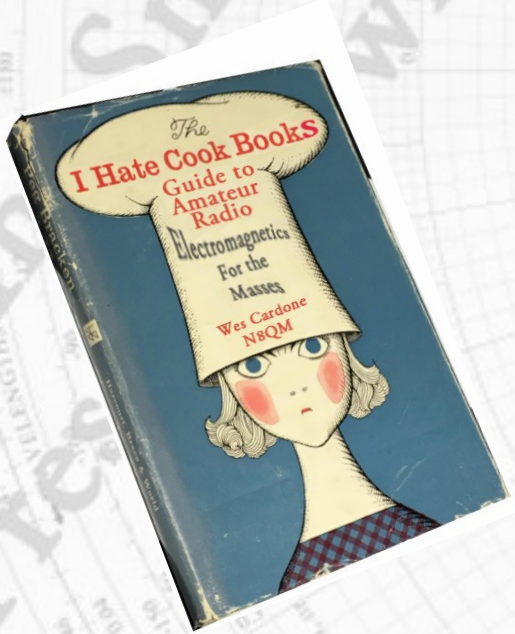
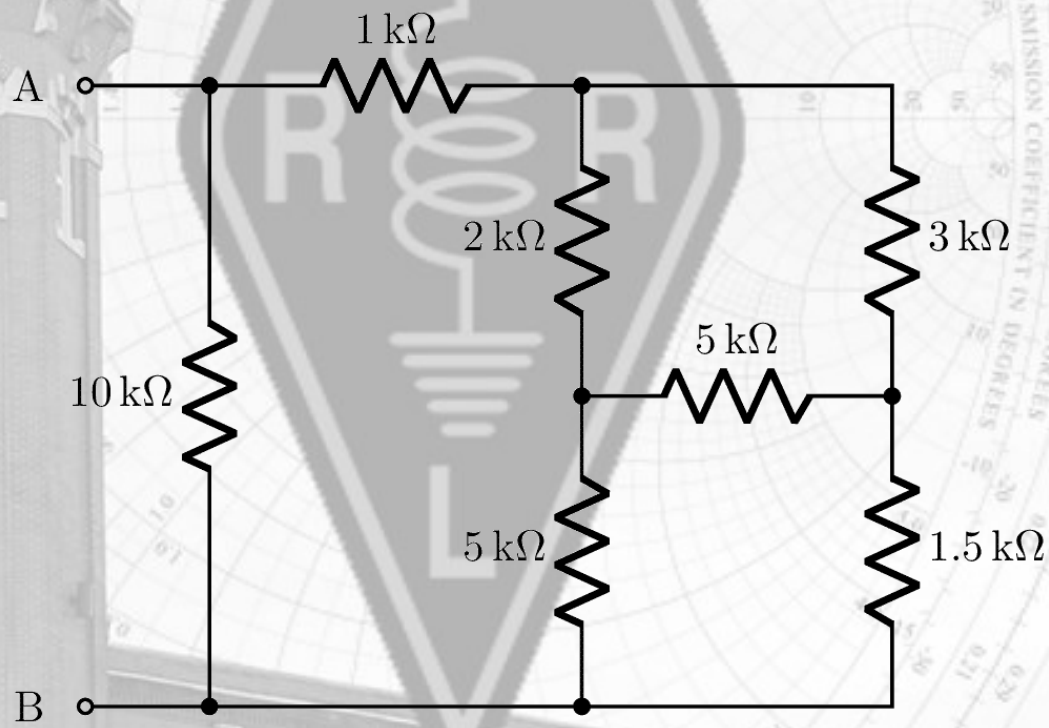


Strategic Overall Class Objectives

- Prepare for the FCC upgrade license exams efficiently.
- Have fun learning what you thought was a stumbling block.
- Use SimSmith—A Practical Example
- Center lessons on explicit FCC pool questions.

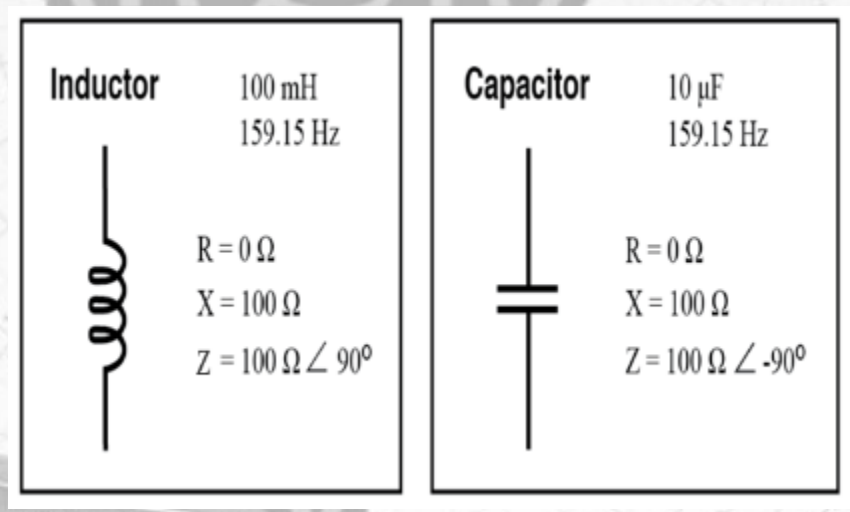
What Are Vector Impedances

- A vector impedance is looking at two components as a single entity.
  - Resistive
    - This is your everyday resistor
    - Dissipates energy as heat
    - Has a Power rating--Watts



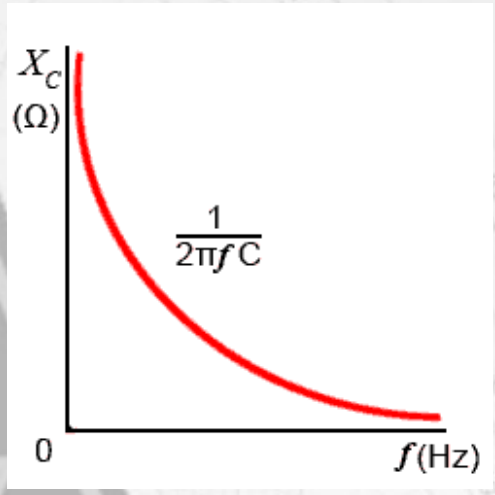
What Are Vector Impedances

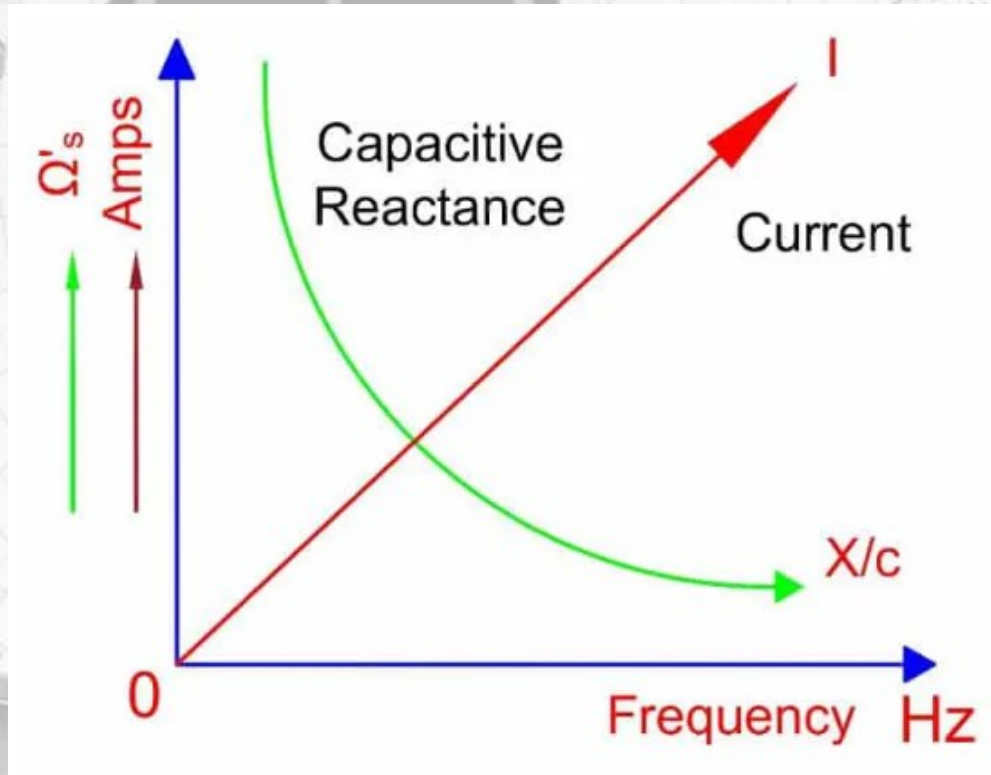
- A vector impedance is looking at two components as a single entity.
  - Resistive
    - This is your everyday resistor
    - Dissipates energy as heat
  - Reactive
    - Stores energy
      - Therefore…has no power rating except parasitic.
    - Does not dissipate or consume energy
    - Has two forms
      - Capacitive
      - Inductive



Capacitive Reactance

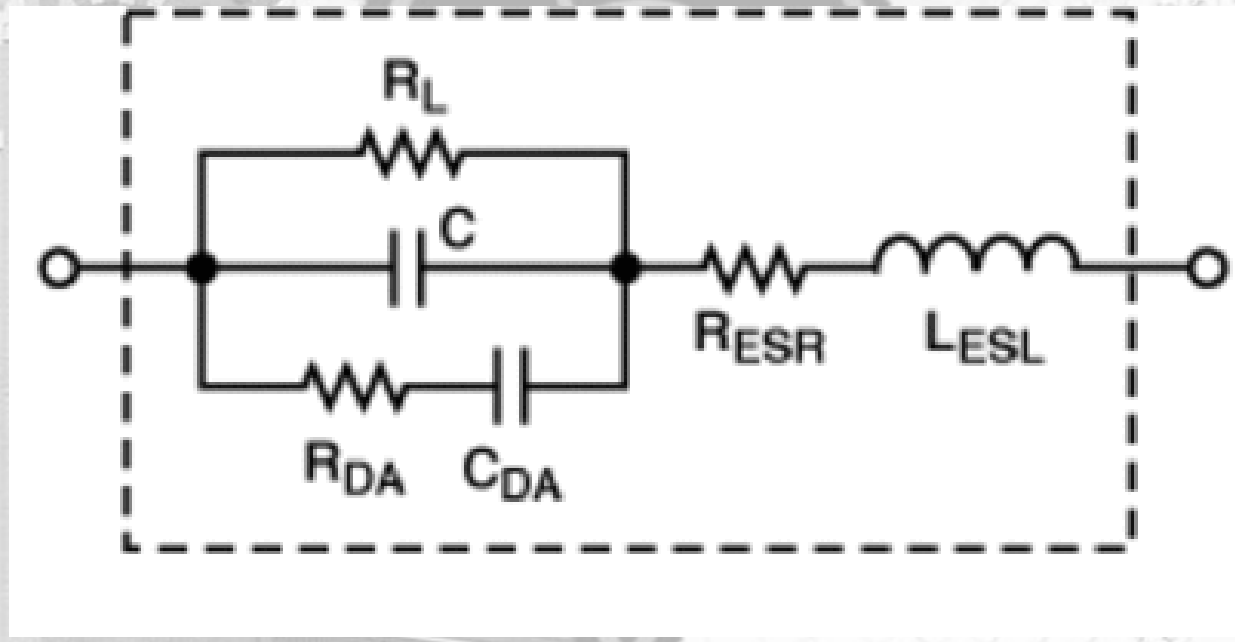
- Capacitive Reactance
  - Stores energy
    - Therefore…has no power rating except parasitic.
  - Does not dissipate or consume energy
- But its reactance does block AC current flow
  - Reactance (X_c) measured in Ohms
- Dependent on frequency
  - At freq=DC is like an open—X_c = infinity
  - At freq=infinity—X_c = 0





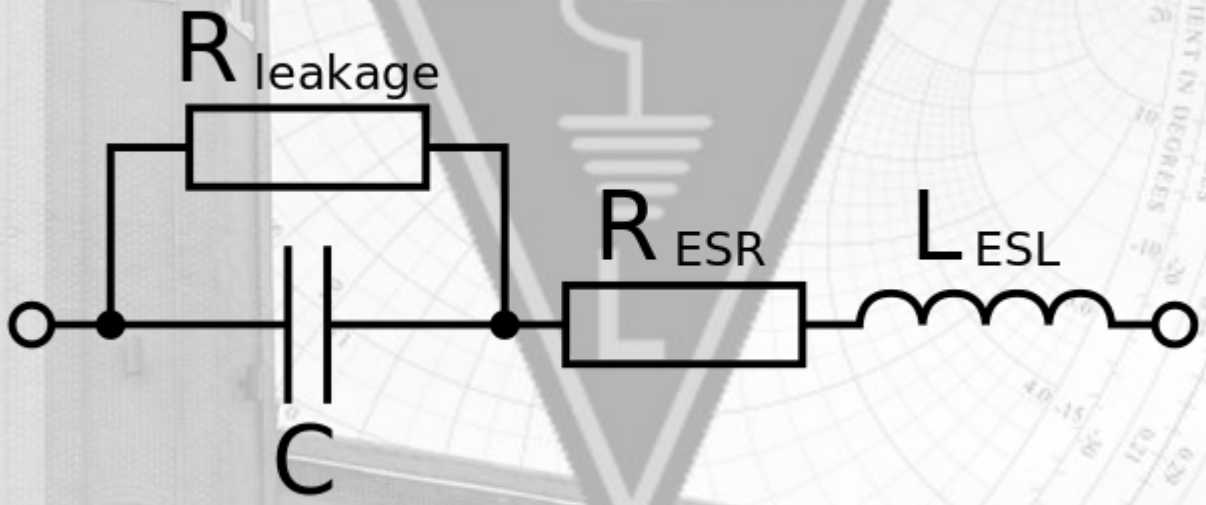
Capacitor at and Beyond Resonance

- Capacitors have parasitics
  - Inductance
  - Resistance
    - Series
    - Parallel
- Recall
  - X_c goes down with frequency
  - X_L goes UP with frequency
  - Do the two meet somewhere?
  - Is this called…"resonance?"



Capacitor at Resonance

- At DC
  - X_C = infinity
  - X_L = zero
- At frequency = infinity
  - X_C = zero
  - X_L = infinity
- What about in between?

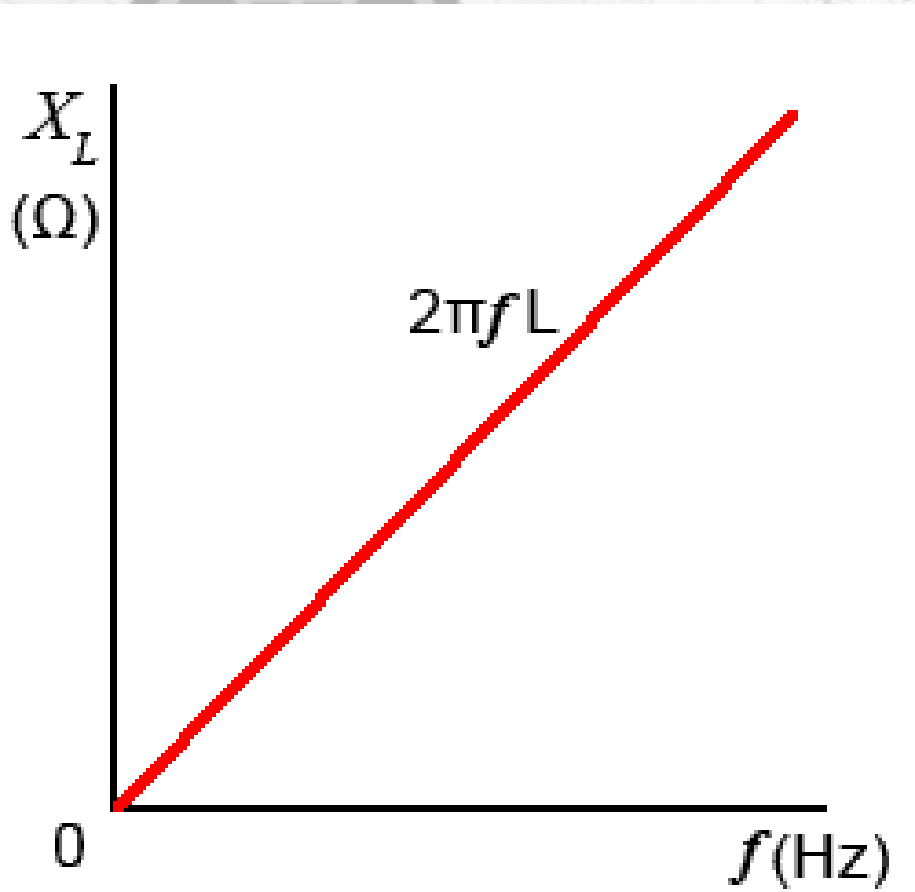


FCC Pool Question E5A02

- What is resonance in an LC or RLC circuit?
- ANSWER:
  - The frequency at which the capacitive reactance equals the inductive reactance.

Inductive Reactance

- Inductive Reactance
  - Stores energy
    - Therefore…has no power rating except parasitic.
  - Does not dissipate or consume energy
- But its reactance does block AC current flow
  - Reactance (X_L) measured in Ohms
- Dependent on frequency
  - At freq=DC is like a short—$X_L = 0$
  - At freq=infinity—X_L = infinity



Inductor at and Beyond Resonance

- Inductors have parasitics
  - Capacitance
  - Resistance
    - Series
    - Parallel
- Recall
  - X_c goes down with frequency
  - X_L goes UP with frequency
  - Do the two meet somewhere?
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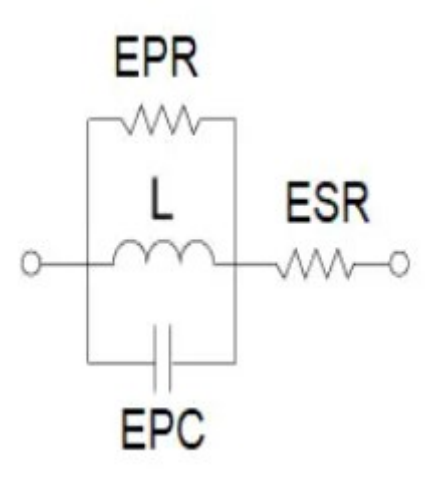
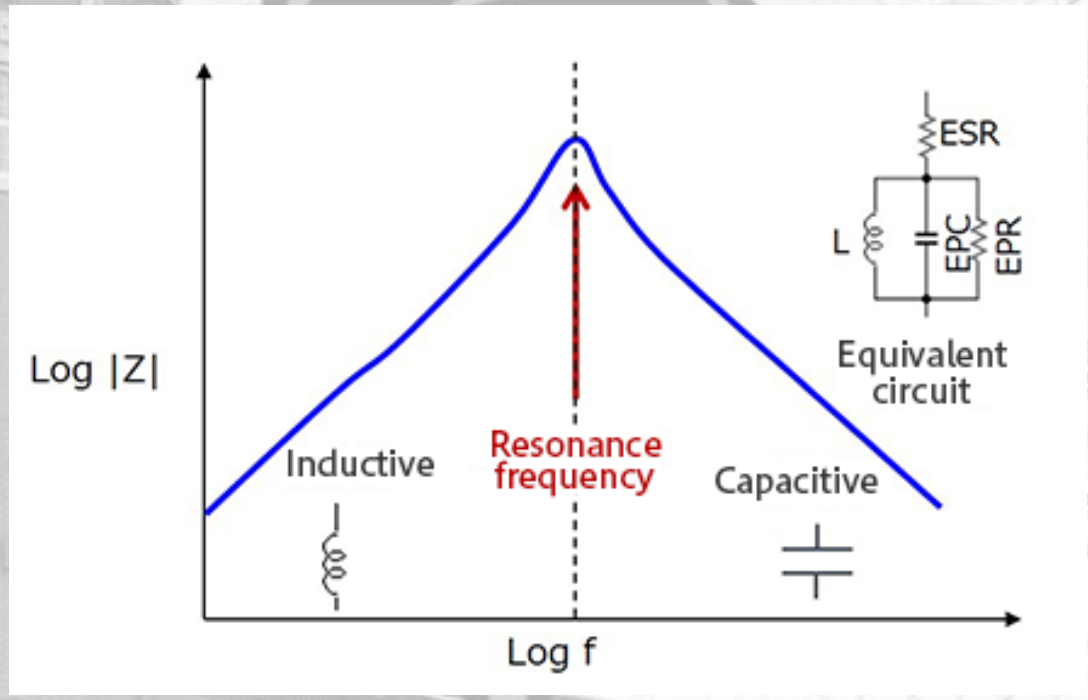


Inductor at Resonance

- At DC
  - X_C = infinity
  - X_L = zero
- At frequency = infinity
  - X_C = zero
  - X_L = infinity
- What about in between?



Putting Them Together

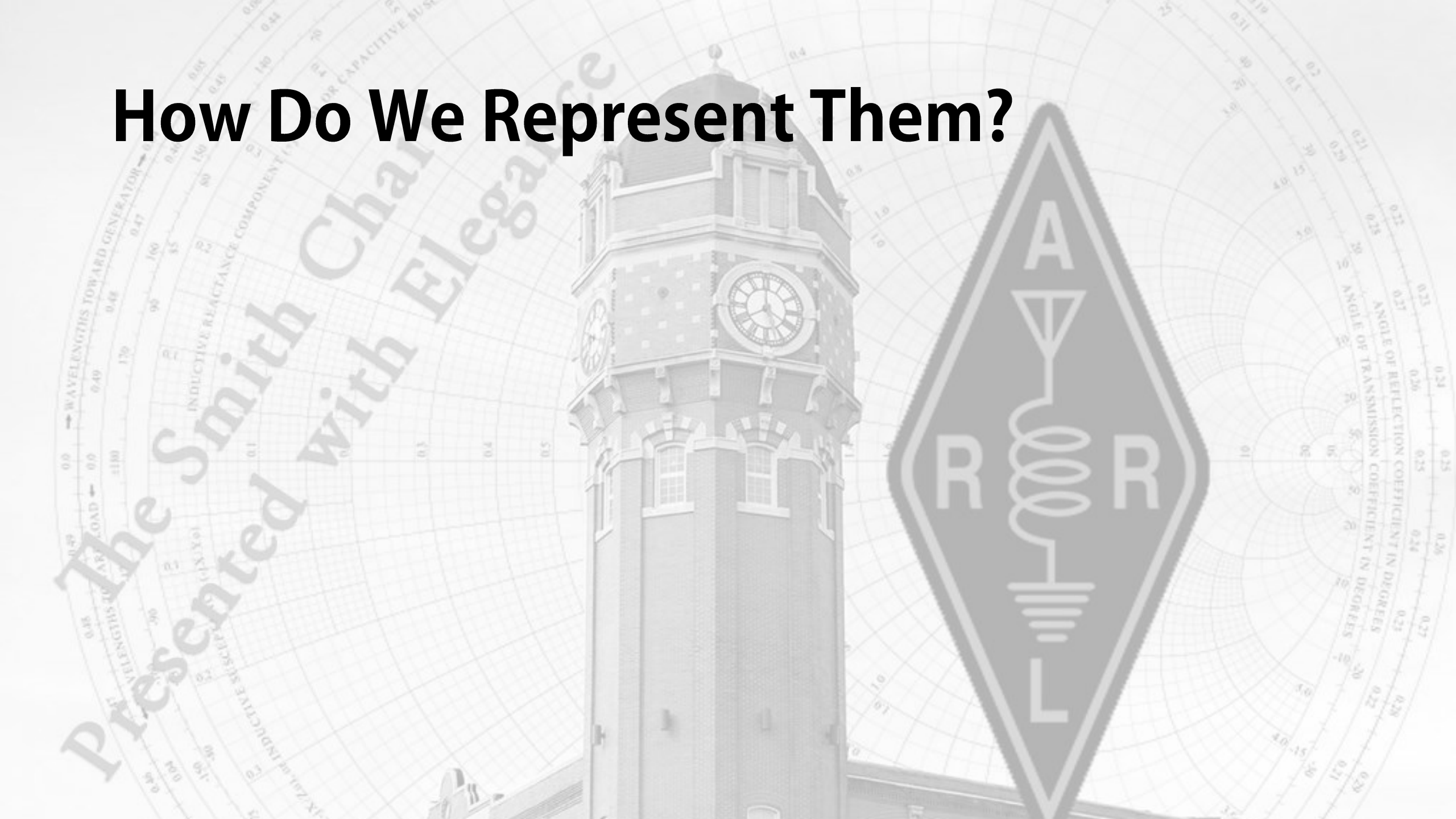
- Reactive
  - Stores energy
    - Therefore…has no power rating except parasitic.
  - Does not dissipate or consume energy
  - Has two forms
    - Capacitive
    - Inductive

FCC Pool Question G6A11

- What happens when an inductor is operated above its self-resonant frequency?
- ANSWER:
  - It becomes capacitive

Reactive

How Do We Represent Them?



Questions

The Smith Chart
Presented with Elegance