



## 9. ANTENNAS AND FEEDLINES

# Chapter 9.3 Antennas Systems

# ARRL Amateur Extra Class





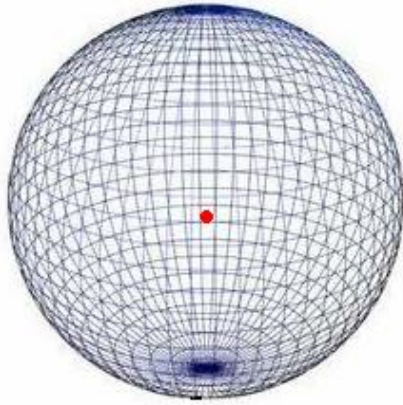
## EFFECTIVE RADIATED POWER

# Antenna Gain

Isotropic antenna

No gain

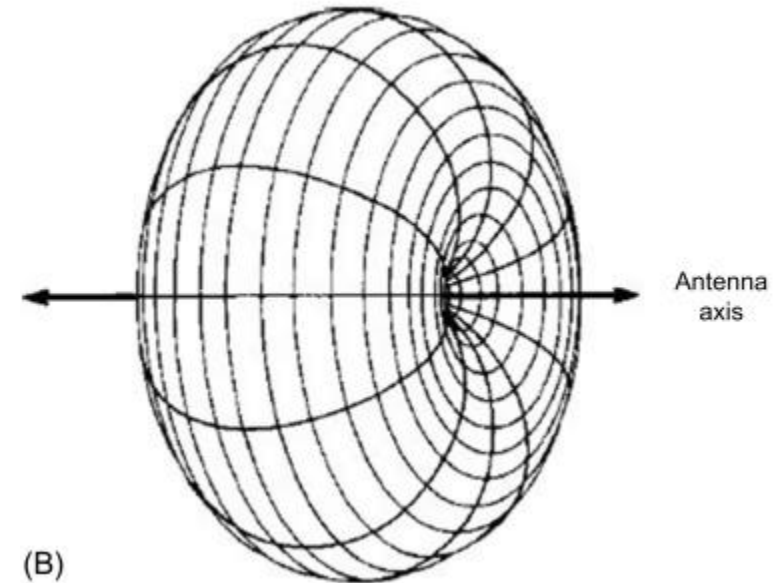
0dB



Dipole antenna

Gain perpendicular to the wire

2.15dBi





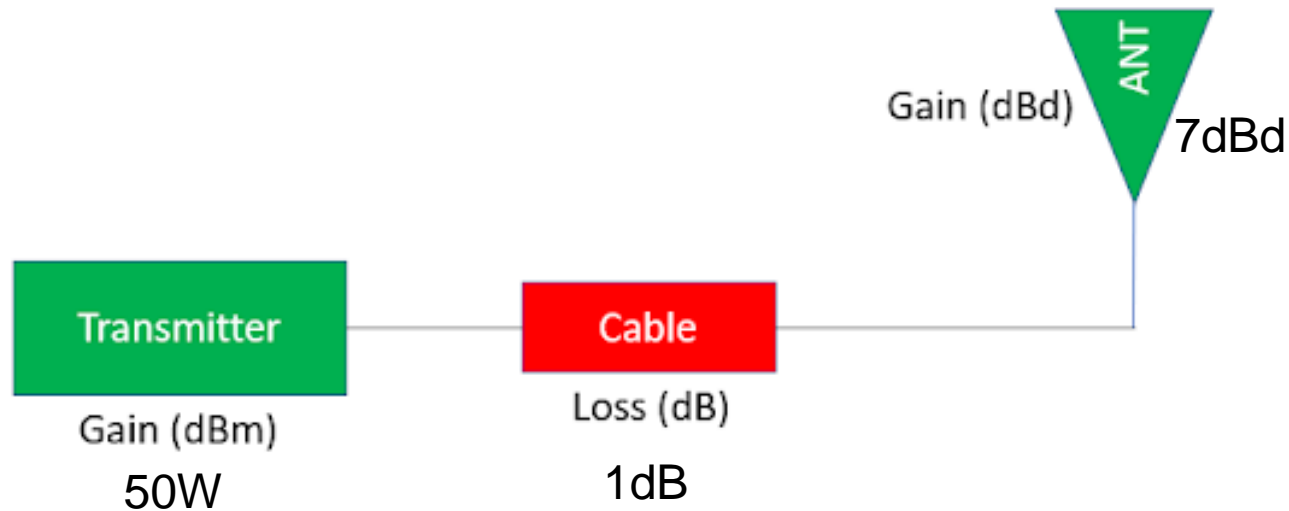
# Effective Radiated Power

## TPO

- Transmitter Power Output

## ERP

- Radiated power compared to using a standard dipole?
- $ERP = TPO \times \text{Antenna system gain}$



$$ERP = TPO \times \text{gain}$$

$$\text{Gain} = -1 + 7 = 6\text{dB}$$

$$\text{dB to linear: } \log^{-1}\left(\frac{\text{dB}}{10}\right)$$

$$ERP = 50 \times \log^{-1}\left(\frac{6}{10}\right)$$

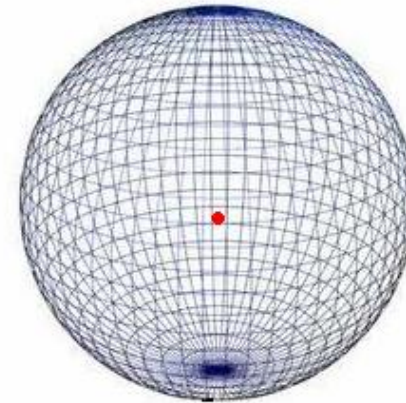
$$ERP = 200\text{W}$$



# Effective Isotropic Radiated Power

## EIRP

- Relative to an **isotropic** antenna
- $EIRP = ERP + 2.15dB$
- $ERP = EIRP - 2.15dB$





# IMPEDANCE MATCHING

## Delta match

$\frac{1}{2} \lambda$  dipole

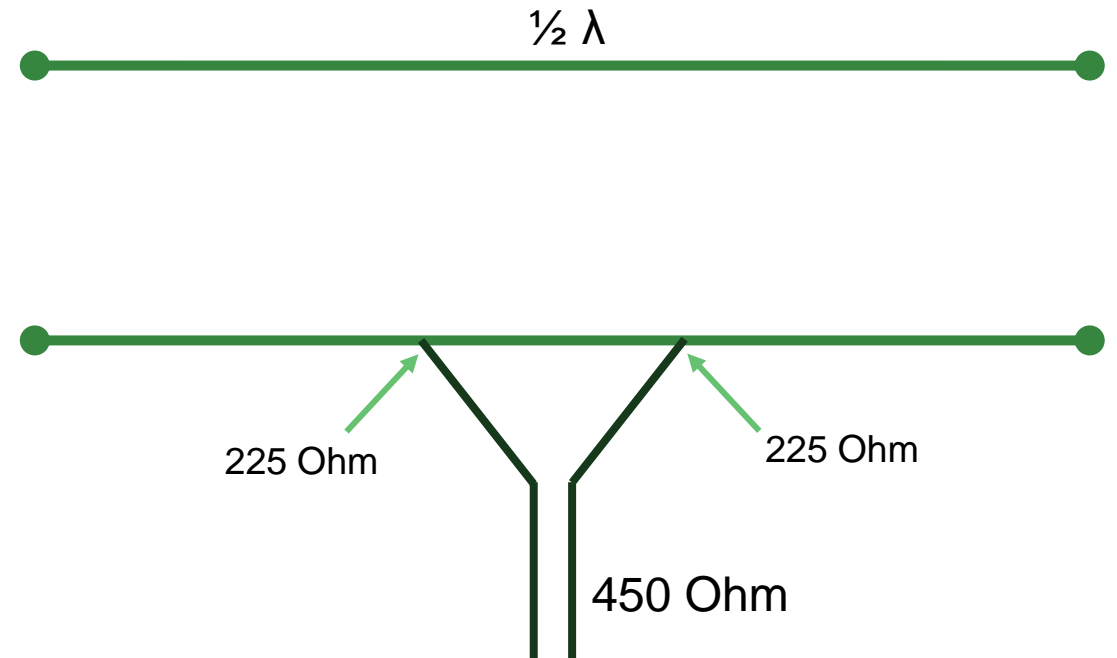
- 72 Ohm in the center
- High impedance at the ends

At some point, the impedance is 450 Ohm

NOTE: no break in center

Delta (  $\Delta$  ) match

For balanced feed lines





# IMPEDANCE MATCHING

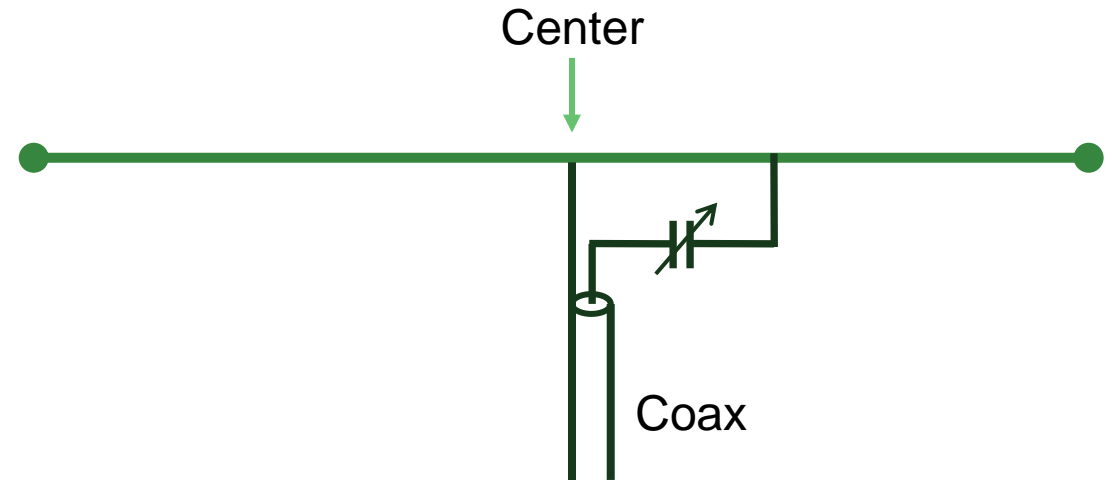
## Gamma match

”Shorted transmission line”

- Less than  $\frac{1}{4} \lambda$  = inductive
- Compensate with series capacitor

Gamma (  $\Gamma$  ) match

For coax-fed beams





# IMPEDANCE MATCHING

## Hairpin match

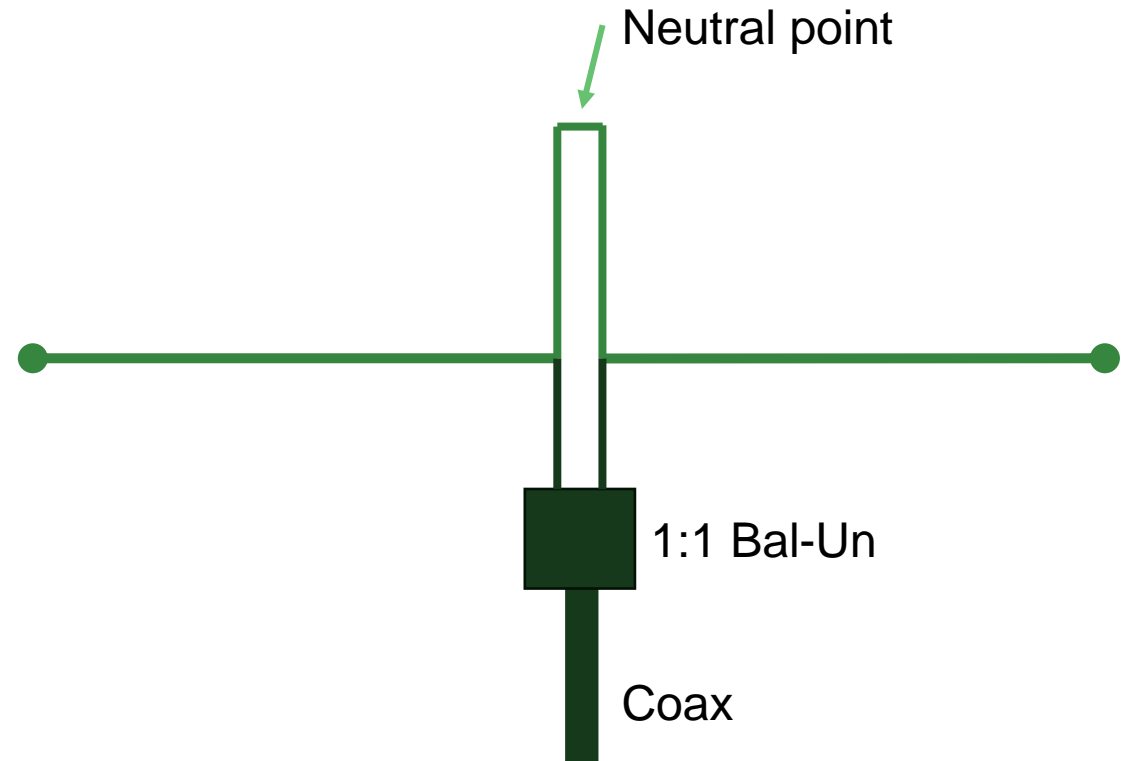
Assumes shorted antenna

- Short antenna = capacitive

Need to add inductance

Hairpin = shorted transmission line

Neutral point gives mechanical stability





## IMPEDANCE MATCHING

### Stub match

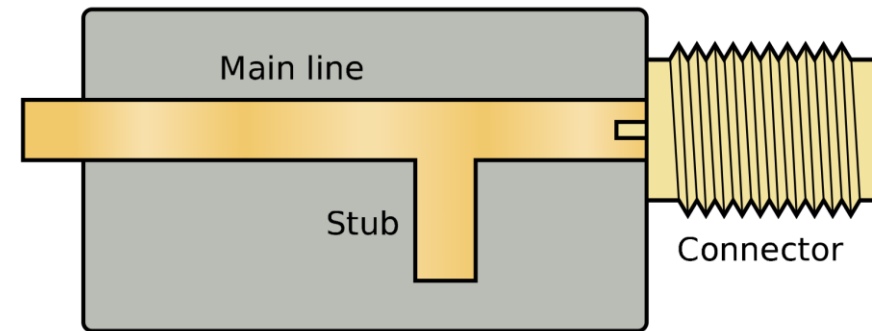
Similar to hairpin match, but stub placed somewhere on the feedline

Can be shorted or open

More common for shorter wavelengths

Smith chart helps calculate

.. $\frac{1}{4}$   $\lambda$  open stub becomes notch filter







# QUESTIONS?

ONLINE EXAM REVIEW AND PRACTICE QUESTIONS:

**<http://www.arrl.org/examreview>**