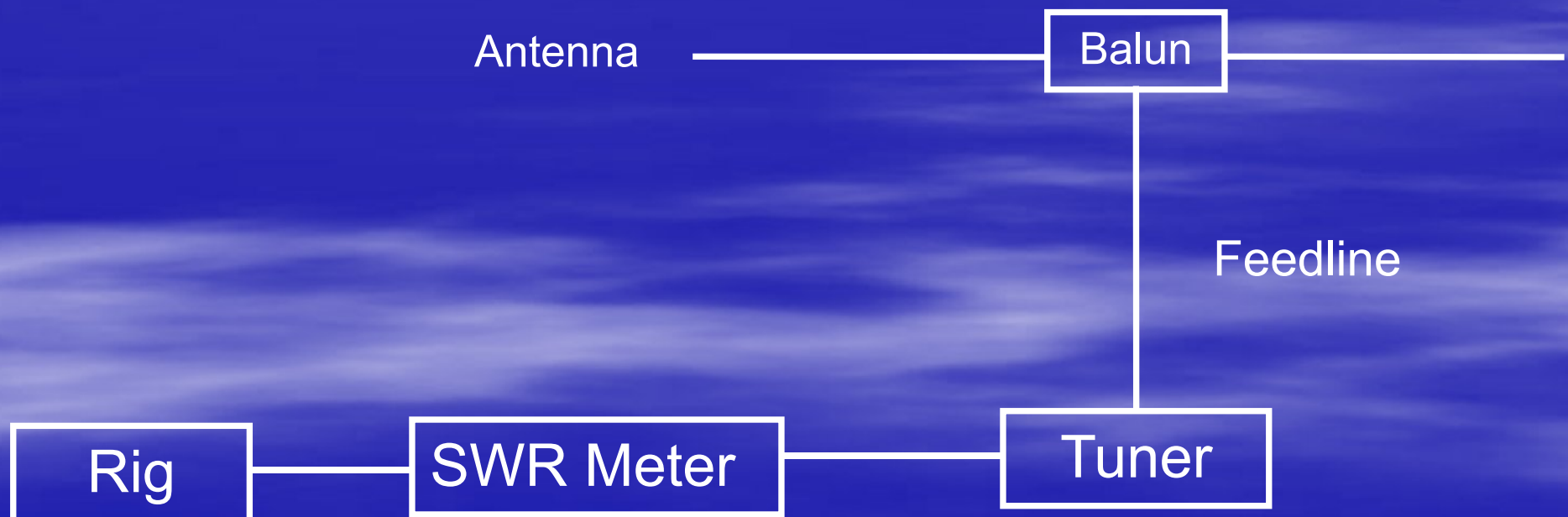


# **Does Your Antenna System Eat Your Transmitter Output?**

**A straight-forward method to evaluate  
your antenna system efficiency.**

# What do you mean – “Eat” my transmitter output?



# Antenna System Model

Radiation resistance

$R_R$

Balun Losses

$R_B$

Ground Losses

$R_G$

Feedline Losses

$R_F$

Tuner Losses

$R_T$

Efficiency, %

$R_R$

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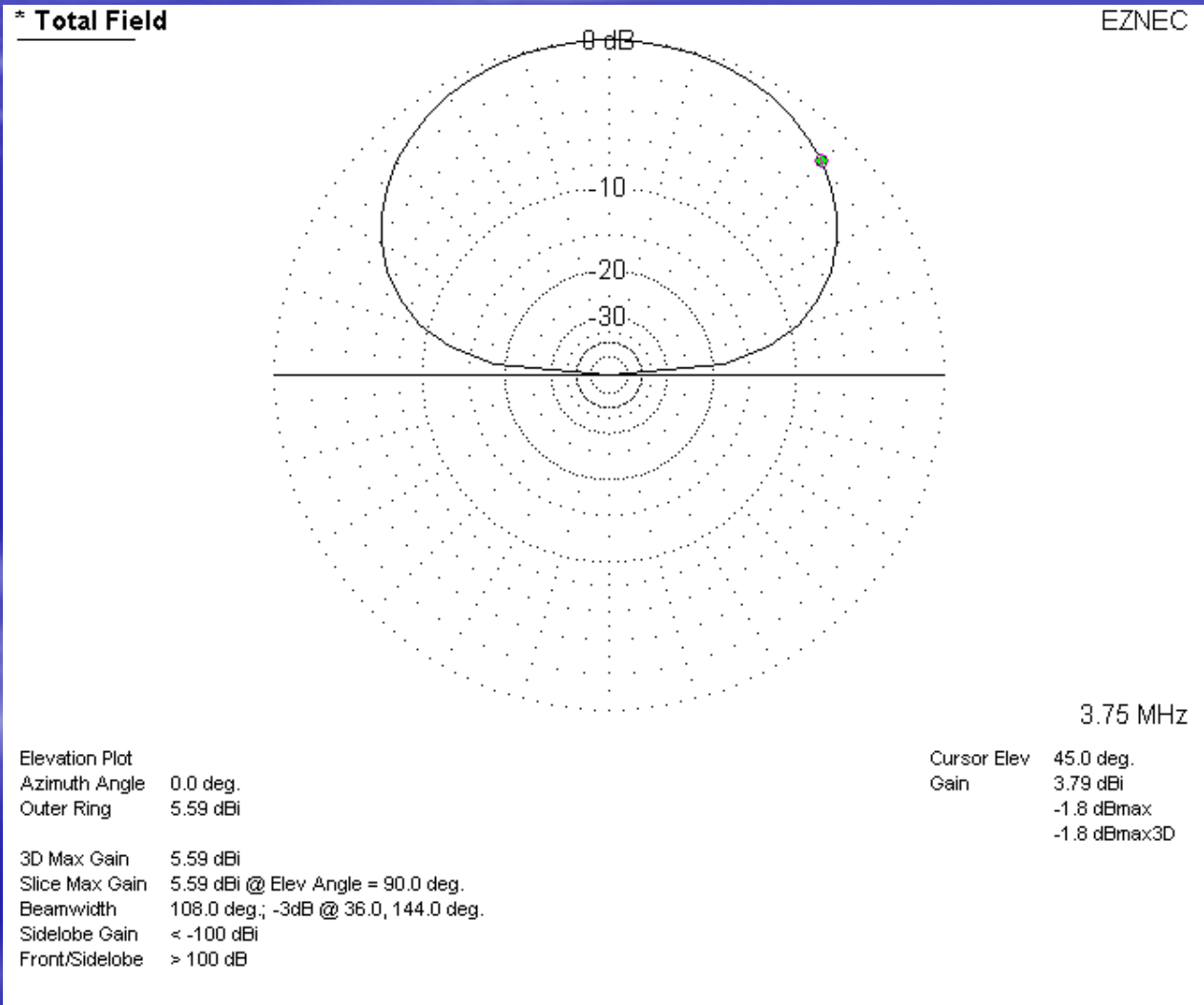
$$R_R + R_B + R_G + R_F + R_T$$

# The Antenna

- For a dipole,  $R_R$ , is approximately 50 to 75 ohms depending upon height above ground
- Reactance is inductive,  $+jX$ , if the antenna is longer than resonance
- Reactance is capacitive,  $-jX$ , if the antenna is shorter than resonance
- 3.7 MHz dipole 35 feet up, rocky ground –  
     $\cong 60$  ohms, max gain  $90^\circ$ , +2.6 db  
    at  $45^\circ$ , +1.6 db



# EZNEC 4 Plot



# The Balun

- **Matches the balanced dipole to the unbalanced feedline – BALUN  
BALanced to Unbalanced**
- **Can be a voltage balun or current balun – current balun preferred, has lower losses**
- **The greater the mismatch and reactance, the greater the losses**
- **Typical losses from 0.5 db to 8 db**

# The Feedline

- Has a characteristic impedance, typically 50 ohms
- The greater the SWR, the greater the losses
- Losses proportional to length and frequency

	Frequency, mHz			
Coax	1	10	50	100
RG-8	.15	.38	.85	1.21
RG-8X	.20	.63	1.4	2.0
RG-58	.40	1.5	3.7	5.4

Impedance – 50 ohms, 100 feet in length, loss in db.

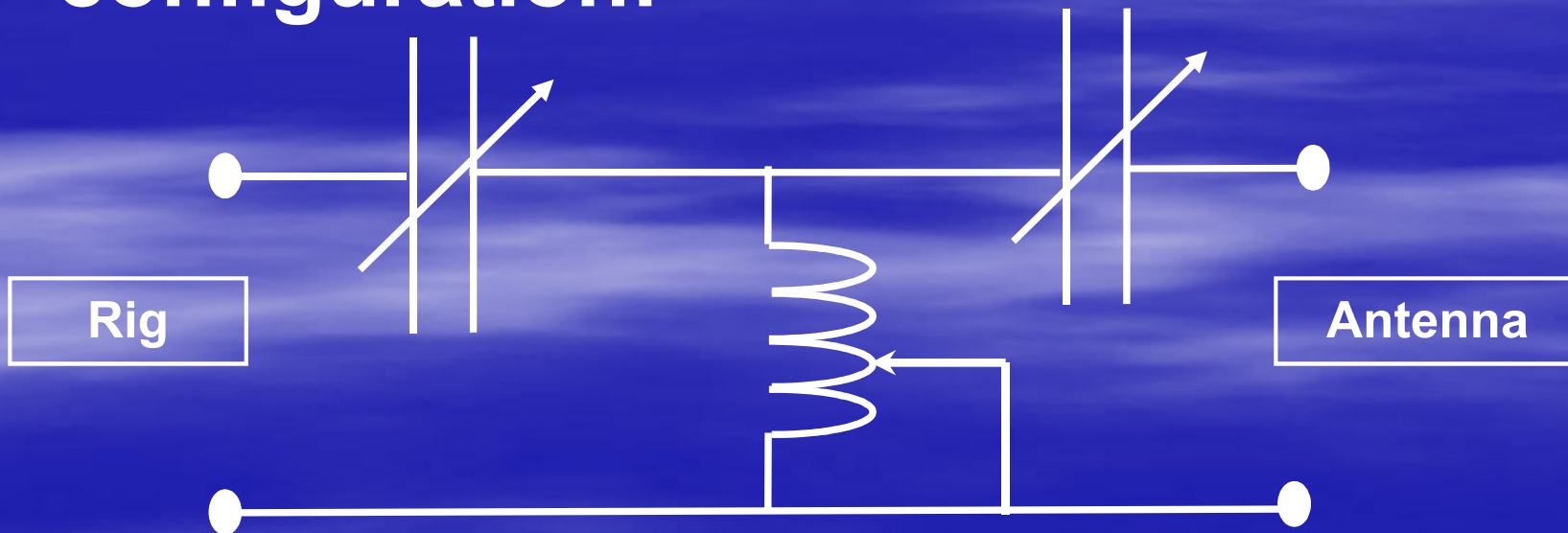
# What is an Antenna Tuner?

- **It does not tune your antenna!**
- **It matches the output of your transmitter to your antenna system. Your system is made up of:**
  - **Antenna**
  - **Balun**
  - **Feedline**
  - **Ground effects**
  - **Surrounding objects**



# The Tuner

- All tuners have some loss
- Most of today's tuners use a Tee configuration:



# Losses in a Tuner

- **Primarily in the inductor**
- **Some in the capacitors**
- **Minimize by setting output capacitor at highest capacitance that will allow a match**
- **The greater the SWR, the greater the losses**
- **Greatest losses in 4:1 balun for use with balanced feedline**

# Let's Summarize

**For a 3.75 MHz dipole at 35 feet**

- $R_R = 60$  ohms (radiation resistance)
- $R_{\text{Ground}} = -1$  db or more
- Balun losses =  $-.5$  db or more (estimate)
- Feedline losses
  - RG-8X, 66 feet long
  - $-0.3$  db loss or more
- Total loss so far:  $-1.8$  db or 34% loss

# What Are The Tuner Losses??



# Summary

## Losses – for our 3.75 MHz dipole antenna

Ground system	-1 db
Balun	-.5
Feedline	-.3
Tuner	-.5
<b>Total</b>	<b>-2.3 db</b>
<b>Power Loss</b>	<b>41%</b>

# Power Radiated for Antenna System

**Antenna Gain: 1.6 db (45° takeoff angle)**

**System Loss: -2.3**

**Power Radiated: 85% of transmitter  
output**

**This would be for a well-functioning system!**

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