14-2: Common Antenna Types

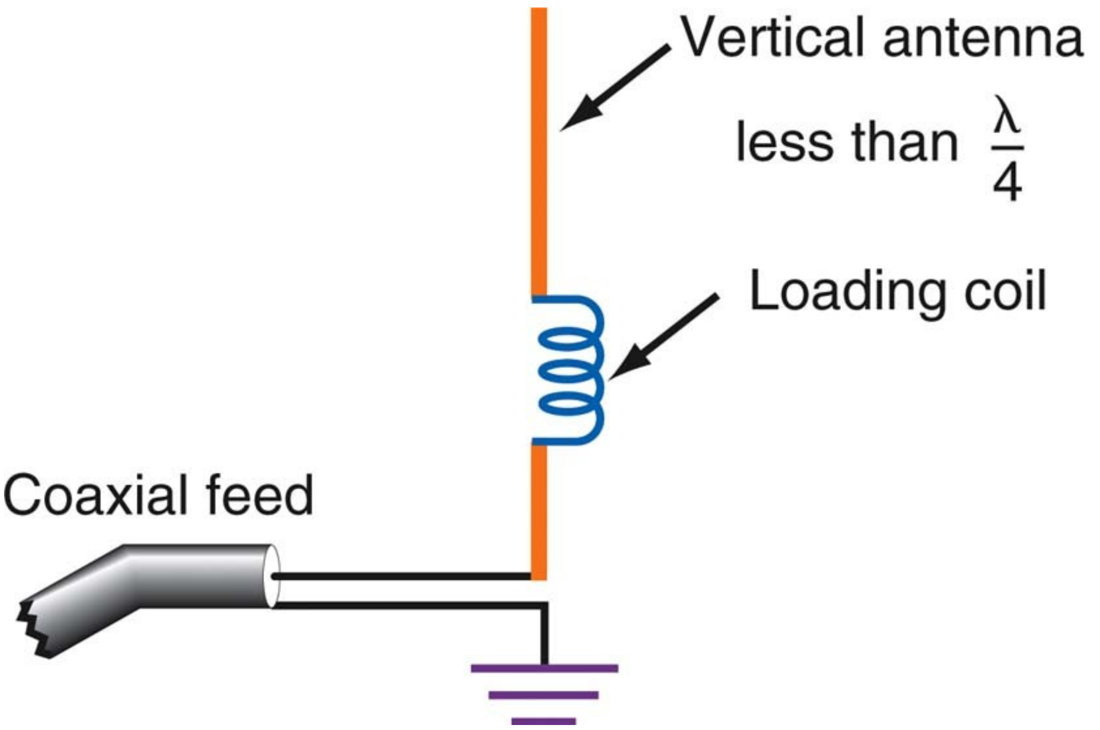

Figure 14-22: Using a base leading coil to increase effective antenna length.

14-2: Common Antenna Types

Directivity

- **Directivity** refers to an antenna's ability to send or receive signals over a narrow horizontal directional range.
- The physical orientation of the antenna gives it a highly directional response or directivity curve.
- A directional antenna eliminates interference from other signals being received from all directions other than the desired signal.

14-2: Common Antenna Types

Directivity

- A highly directional antenna acts as a type of filter to provide selectivity.
- Directional antennas provide greater efficiency of power transmission.
- Directivity, because it focuses the power, causes the antenna to exhibit gain, which is one form of amplification.

14-2: Common Antenna Types

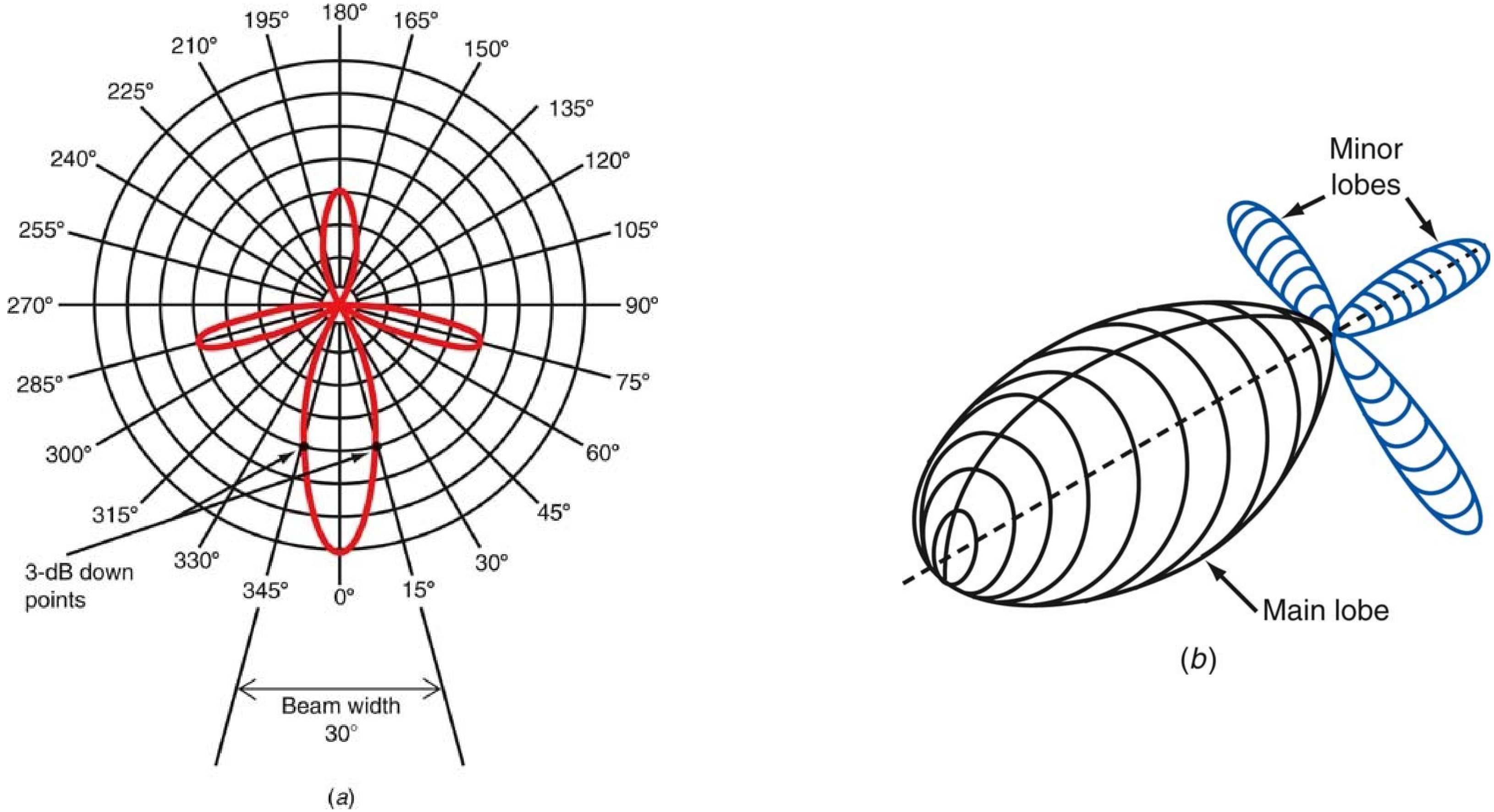

Figure 14-25: Radiation pattern of a highly directional antenna with gain. (*a*) Horizontal radiation pattern. (*b*) Three-dimensional radiation pattern.

14-2: Common Antenna Types

Directivity

- To create an antenna with directivity and gain, two or more antenna elements are combined to form an **array.**
- Two basic types of antenna arrays are used to achieve gain and directivity:

1. Parasitic arrays.
2. Driven arrays.

14-2: Common Antenna Types

Parasitic Arrays

- A **parasitic array** consists of a basic antenna connected to a transmission line plus one or more additional conductors that are not connected to the transmission line.
- These extra conductors are referred to as **parasitic elements** and the antenna is called a **driven element**.
- A **Yagi antenna** is made up of a driven element and one or more parasitic elements.

14-2: Common Antenna Types

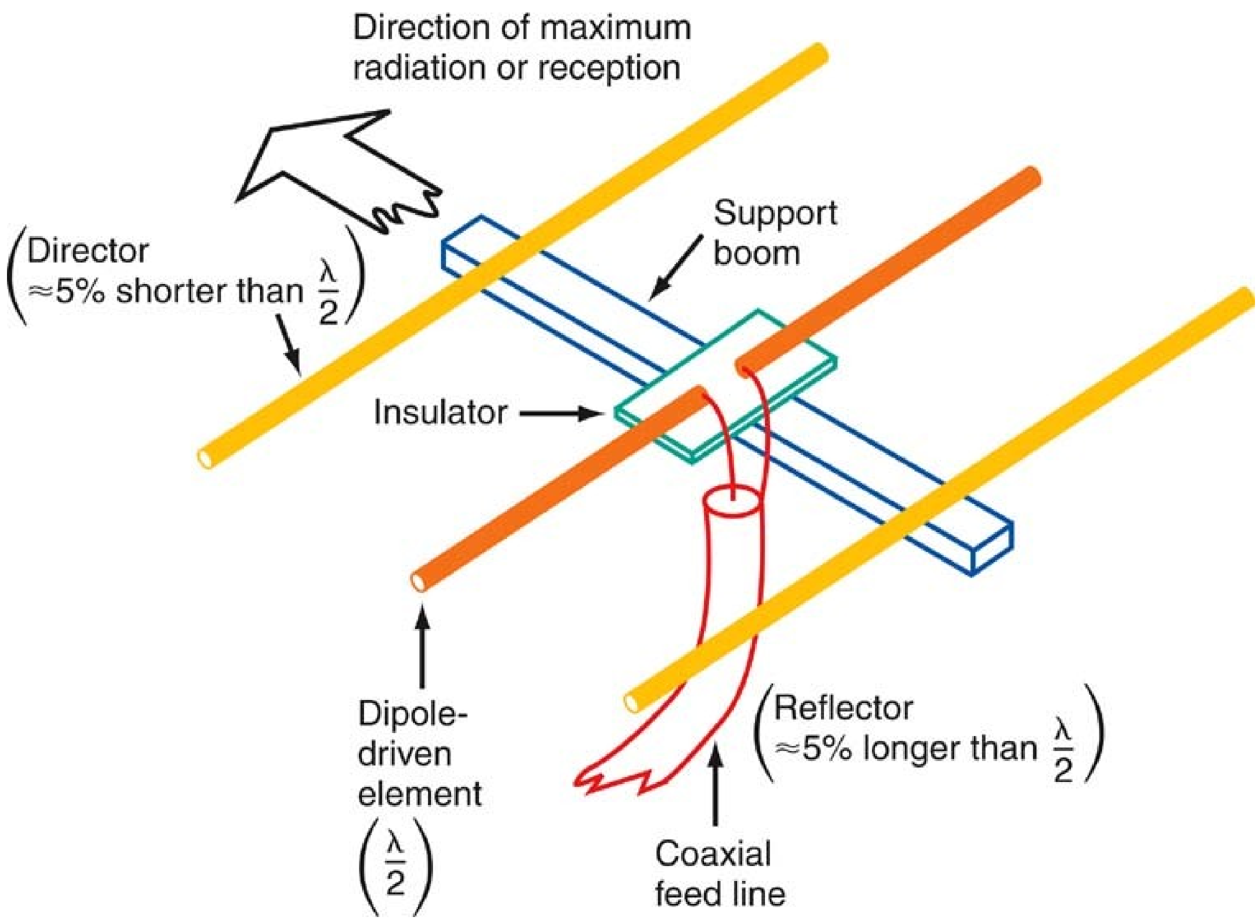

Figure 14-26: A parasitic array known as a Yagi antenna.

14-2: Common Antenna Types

Driven Arrays

- A **driven array** is an antenna that has two or more driven elements.
- Each element receives RF energy from the transmission line.
- Different arrangements of the elements produce different degrees of directivity and gain.
- The three basic types of driven arrays are the **collinear**, the **broadside**, and the **end-fire**.
- A fourth type is the **wide-bandwidth log-periodic antenna.**

14-2: Common Antenna Types

Driven Arrays: Collinear Antenna

- **Collinear antennas** usually consist of two or more half-wave dipoles mounted end to end.
- Collinear antennas typically use half-wave sections separated by shorted quarter-wave matching stubs which ensure that the signals radiated by each half-wave section are in phase.
- Collinear antennas are generally used only on VHF and UHF bands because their length becomes prohibited at the lower frequencies.

14-2: Common Antenna Types

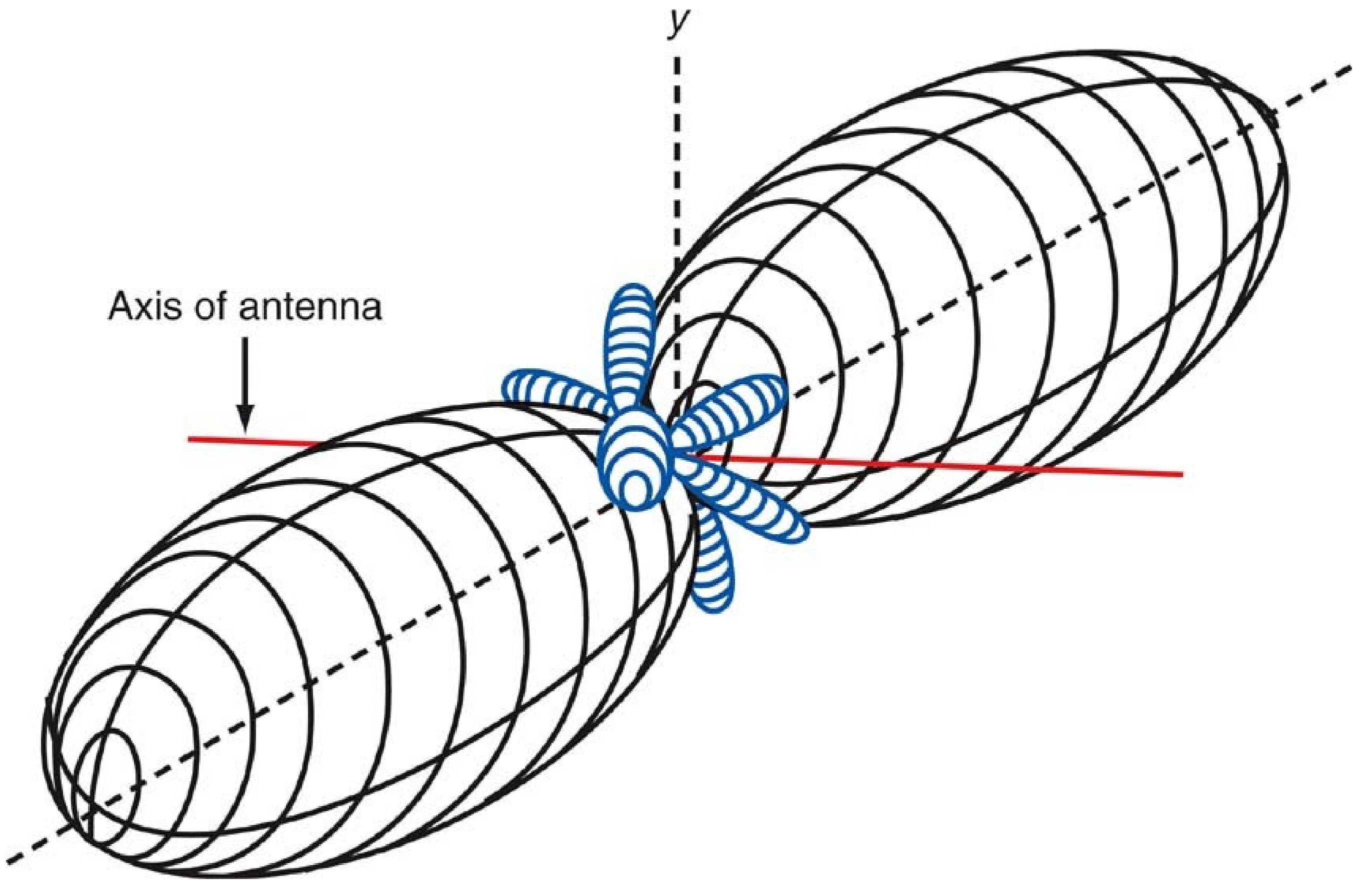

Figure 14-29: Radiation pattern of a four-element collinear antenna.

14-2: Common Antenna Types

Driven Arrays: Broadside Antenna

- A **broadside array** is a stacked collinear antenna consisting of half-wave dipoles spaced from one another by one-half wavelengths.
- This antenna produces a highly directional radiation pattern that is broadside or perpendicular to the plane of the array.
- The broadside antenna is bidirectional in radiation, but the radiation pattern has a very narrow beam width and high gain.

14-2: Common Antenna Types

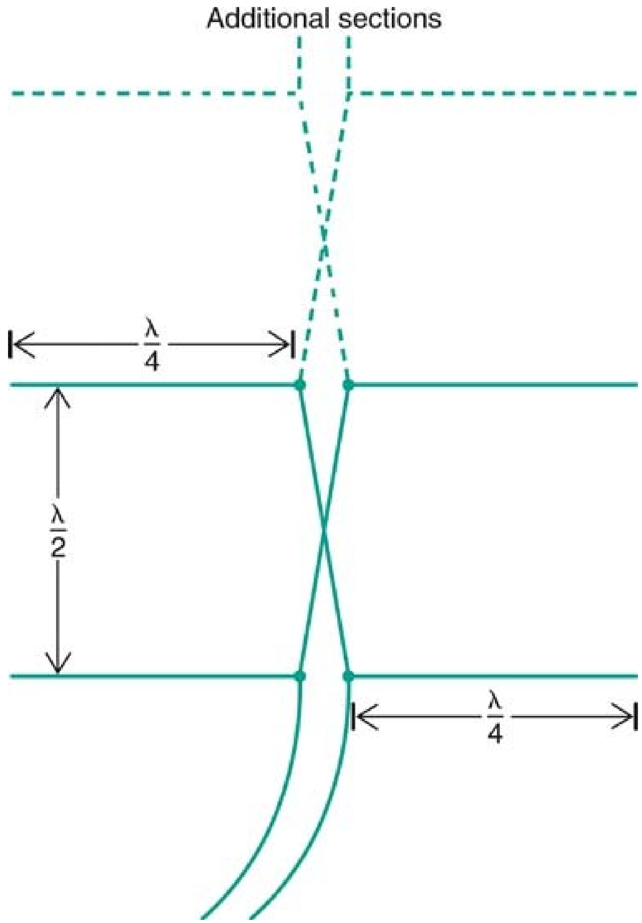

Figure 14-30: A broadside array.

14-2: Common Antenna Types

Driven Arrays: End-Fire Antenna

- The **end-fire array** uses two half-wave dipoles spaced one-half wavelength apart.
- The end-fire array has a bidirectional radiation pattern, but with narrower beam widths and lower gain.
- The radiation is in the plane of the driven elements.
- A highly unidirectional antenna can be created by careful selection of the optimal number of elements with the appropriately related spacing.

14-2: Common Antenna Types

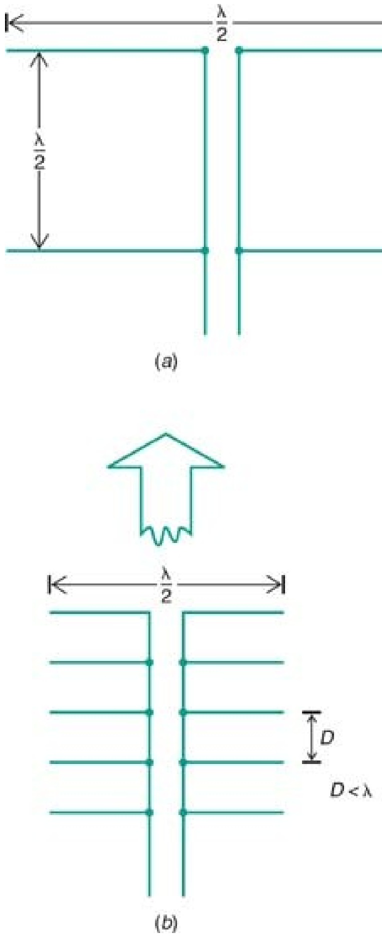

Figure 14-31: End-fire antennas. (*a*) Bidirectional. (*b*) Unidirectional.

14-2: Common Antenna Types

Driven Arrays: Log-Periodic Antennas

- A special type of driven array is the **wide-bandwidth log-periodic antenna.**
- The lengths of the driven elements vary from long to short and are related logarithmically. The spacing is also variable.
- The great advantage of the log-periodic antenna over a Yagi or other array is its very wide bandwidth.
- The driving impedance is constant over this range.
- Most TV antennas in use today are of the log-periodic variety so that they can provide high gain and directivity on both VHF and UHF TV channels.

14-2: Common Antenna Types

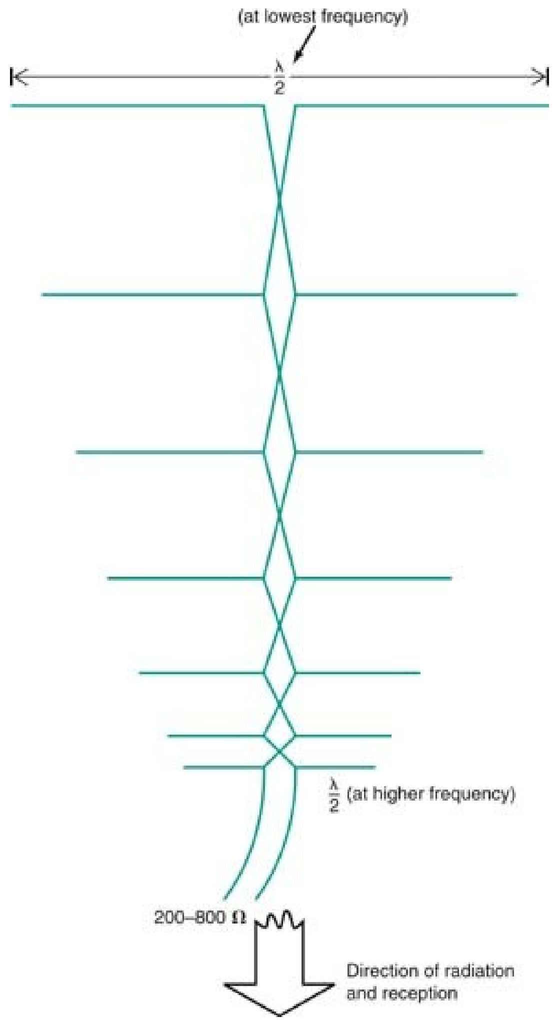

Figure 14-32: Log-periodic antenna.

14-2: Common Antenna Types

Impedance Matching

- One of the most critical aspects of any antenna system is ensuring maximum power transfer from the transmitter to the antenna.
- When the characteristic impedance of the transmission line matches the output impedance of the transmitter and the impedance of the antenna, the SWR will be 1:1.
- When SWR is 1:1, maximum power transfer will take place.

14-2: Common Antenna Types

Impedance Matching

- A **Q section**, or **matching stub**, is a one-quarter wavelength of coaxial or balanced transmission line of a specific impedance that is connected between a load and source and is used to match impedances.
- A **balun** is a transformer used to match impedances.
- An **antenna tuner** is a variable inductor, one or more variable capacitors, or a combination of these components connected in various configurations.

14-2: Common Antenna Types

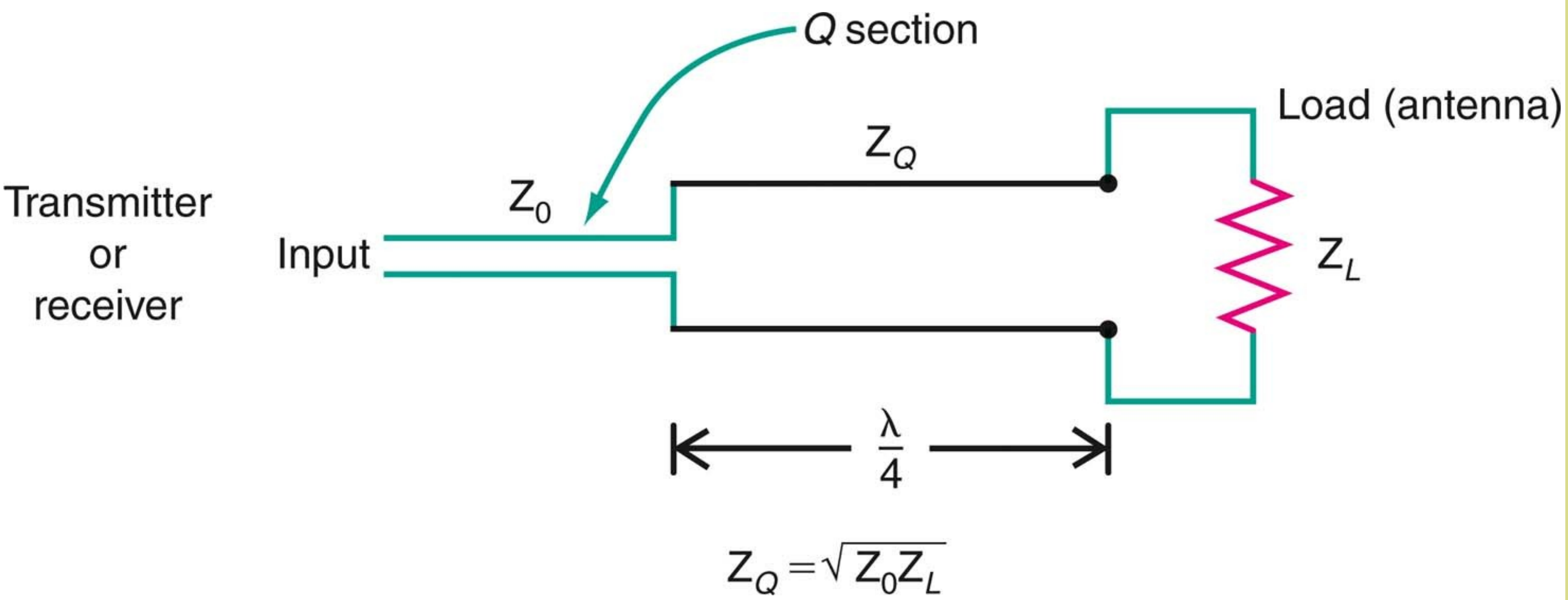

Figure 14-33: A one-quarter wavelength matching stub or *Q* section.

14-2: Common Antenna Types

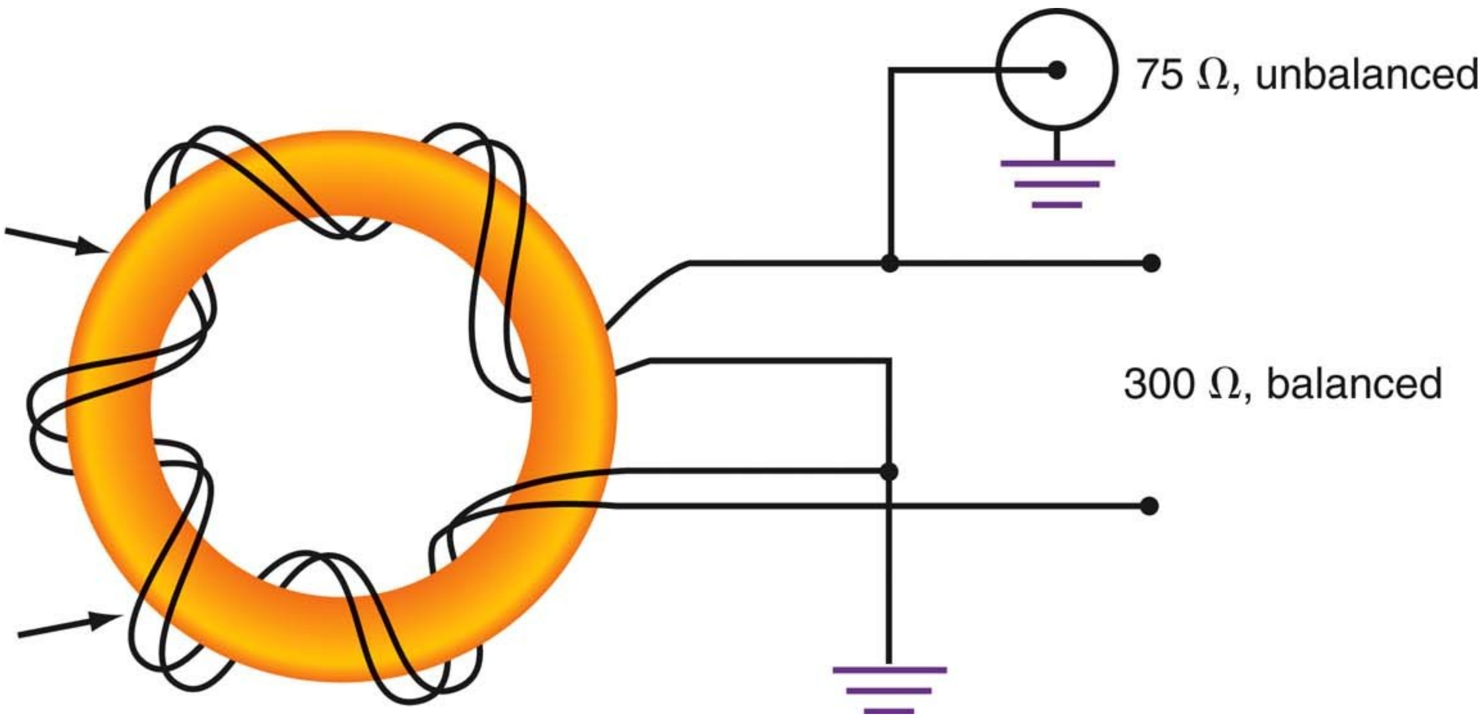

Figure 14-34: A bifilar toroidal balun for impedance matching.