Theory of Long Wire Antennas

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A long wire antenna is a straight conductor longer than about 1/2 wavelength.
As length increases, current distribution forms multiple standing-wave lobes.
The radiation pattern narrows in the plane of the wire with multiple main lobes.
End effects raise the resonant length above the ideal free-space length.
Height above ground and ground conductivity affect impedance and pattern.
End-fed long wires usually present high feed impedance at the end.
Feed impedance varies strongly with frequency and wire length.
Counterpoise or earth connection is needed for end-fed systems.
With balanced feed, the wire may be center-fed or off-center-fed.
For portable HF, random-length wires are common with tuners.
Antenna efficiency depends on conductor loss and ground loss.
Modeling is useful because simple formulas are only approximate.