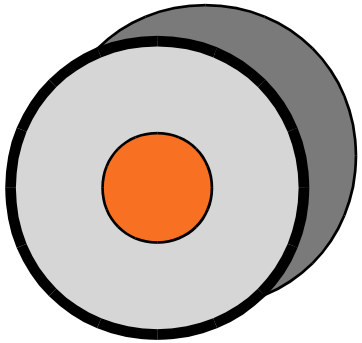
Chelmsford Amateur Radio Society

Foundation Course
(5) Feeders & Antennas

Feeders

- Two basic feeder types: Coax, Twin Wire

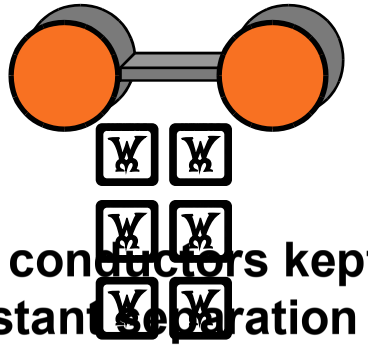
Coax



Inner Conductor is shrouded by dielectric, with outer (braided) screen.

For Radio 50Ω Coax is used (TV is 75Ω)

Twin Feeder



Two conductors kept at constant separation by insulation - no screen

Balanced Feeder

Balanced/Unbalanced

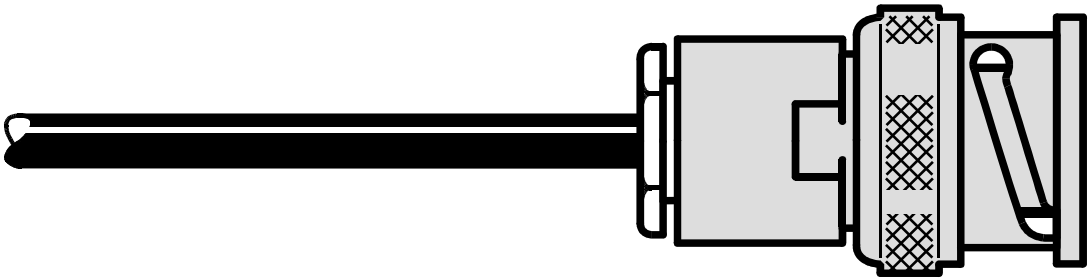
- Coax is unbalanced - Inner has voltage, Outer is earthed.
- Coax is widely used as its outer acts as a screen
- Twin feeder is balanced - conductors have equal and opposite voltages/currents/fields.
- In order to connect an unbalanced feeder to a balanced antenna (eg coax feeding a dipole) a transformer known as a balun is needed.
- BALUN: BALanced - UNbalanced
- Without a Balun rf currents flow on the outside braid, and the screening properties of coax are lost

Coax Connectors

- A wide variety of connectors exist.
- Common RF Connectors include BNC, PL259, N-type, SMA etc.
- Ensure both the inner conductor and outer braid are assembled correctly.
- Poor condition connectors are a major cause of bad SWRs etc.
- Screening must be continuous through plugs and sockets.
- Foundation Licence requires good understanding of two connectors - BNC, PL259.

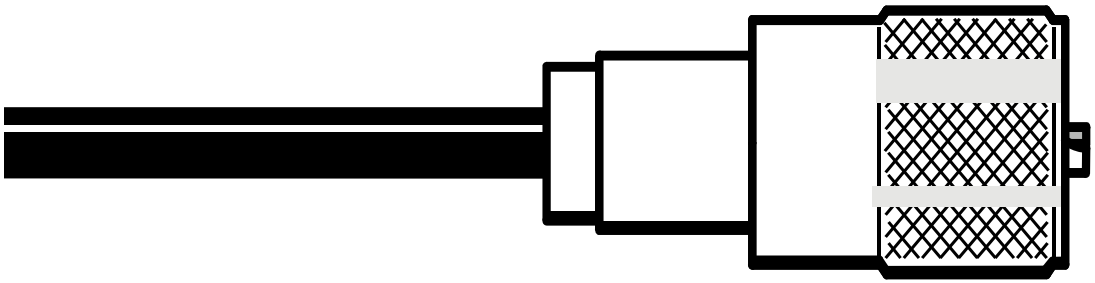
BNC Connectors

- **BNC Connectors have a Bayonet locking action and are commonly used for lower power interconnections.**
- **Take care not to mix incompatible 50 and 75 Ohm versions which have different inner pin sizes.**



PL259 Connectors

- **Common HF/VHF connector with reasonable power handling.**

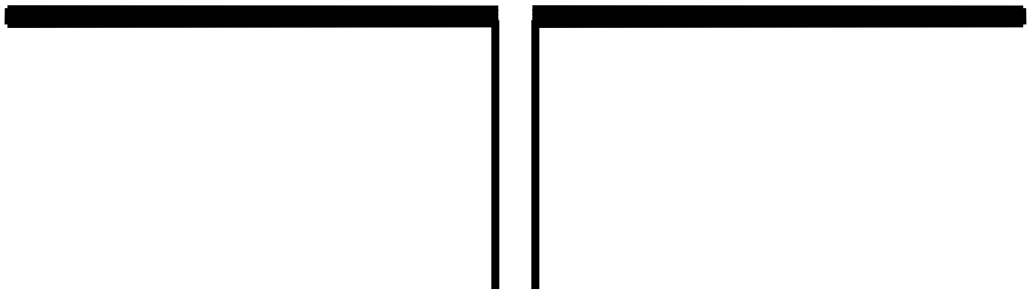


Antennas

- **Antennas transform AC signals into propagating radio waves.**
- **Gain is the directing of power in the wanted direction**
- **Need to know the following types:-**
  - Dipole
  - Quarterwave ground plane
  - Five-eighths ground plane
  - Yagi
  - End-fed wire
- **Antenna size is determined by the operating wavelength, ~.**
- **Example: a 2m ~/4 is a third of the size of a 6m ~/4.**

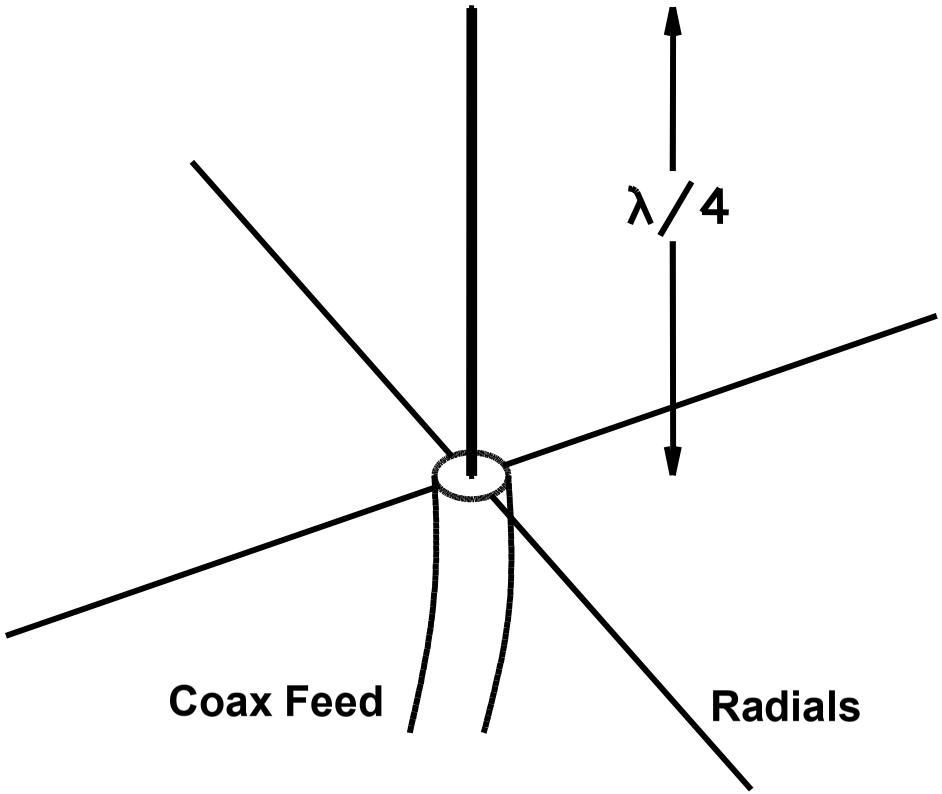
Dipole

- **Simple - but requires a balanced feed via a balun.**
- **Each leg is ~/4 long - ~/2 across in total.**



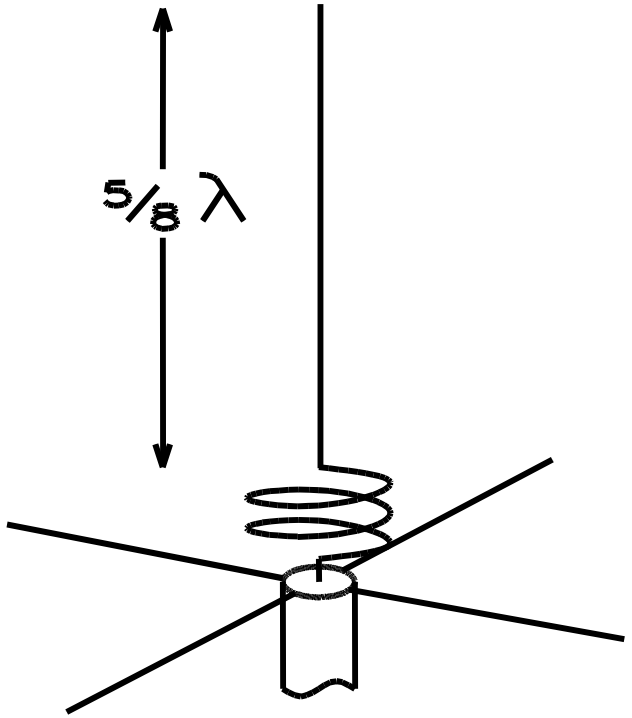
Quarter Wave: ~/4

- Radials simulate a groundplane and are also ~/4 long
- Sometimes called a 'groundplane' antenna



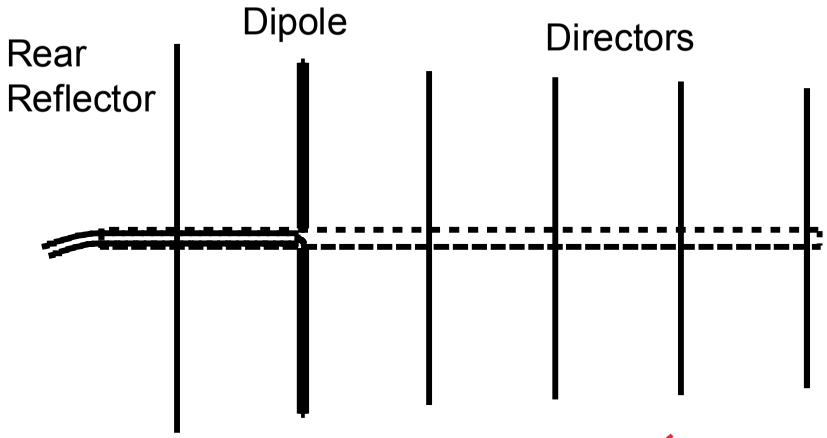
Five-Eighths: 5~/8

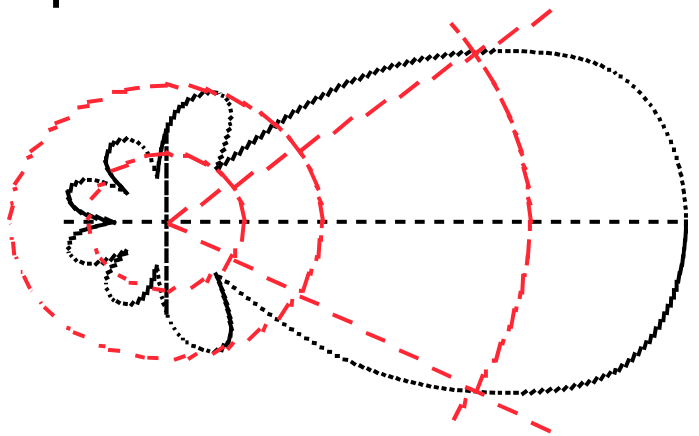
- 5~/8 - Common antenna for mobile use
- Better impedance match and gain than basic quarterwave
- Radials emulate groundplane like the quarterwave



Yagi

- Dipole acts as pick up
- Front Directors ‘focus’ to give Gain
- Rear Reflector gives back/front isolation
- Yagis may be horizontal or vertical

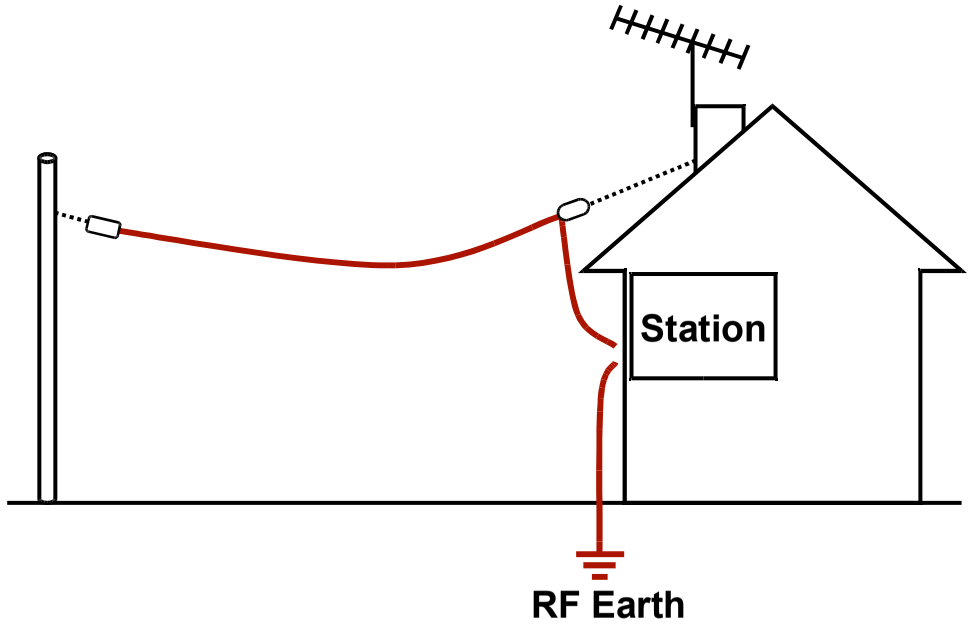




Gain - Circles are at -3dB, 10dB & 20dB

End Fed Antennas

- Common at HF where wavelengths are long
- Needs an ATU to match it for HF multiple bands
- Is unbalanced
- Has strong RF voltages and currents near the house. These are likely to couple into TV and other equipment and cause EMC problems



Gain/ERP

- ERP = Effective Radiated Power
- ERP is the power radiated in the direction of the maximum radiation
- ERP is the product of the power supplied to the antenna, multiplied by the gain of the antenna.
- ERP = Power x Gain (in linear units, not dB)

Polarisation

- Polarisation is the plane of the antennas radiating electric field.
- Common polarisations are Horizontal and Vertical.
- Transmitter and receiving antenna polarisations need to match for optimum signal strength.
- Verticals (~/4, 5~/8) give vertical polarisation.
- Yagis and Dipoles may be either horizontal or vertical depending on their mounting.
- In complex situations polarisation can rotate.

Antenna Match - SWR

- Antennas must be suited for the frequency of the transmitted signal. This is a challenge for multiband operation.
- SWR - Standing Wave Ratio is a measure of the mismatch of the antenna system to the nominal impedance of the radio.
- A high SWR will result in Output Power being reflected back to the Transceiver - Inefficient and Potentially Damaging.
- At HF most antennas are not matched for the wide range of frequency bands, unless a matching unit is used.
- SWR Meters are valuable for checking correct antenna design, installation and operation - and indicating faults
- Dummy Loads permit radio tests without radiating a signal