

Technician Class Course

Session 7



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FEED LINE



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Antenna versus Feed Line

- For efficient transfer of energy from the transmitter to the feed line and from the feed line to the antenna, the various impedances need to match.
- When there is mismatch of impedances, things may still work, but not as effectively as they could.

Feed Line types

- The purpose of the feed line is to get energy from your station to the antenna.
- Basic feed line types.
 - Coaxial cable (coax).
 - Open-wire or ladder line.
- Each has a characteristic impedance, each has its unique application

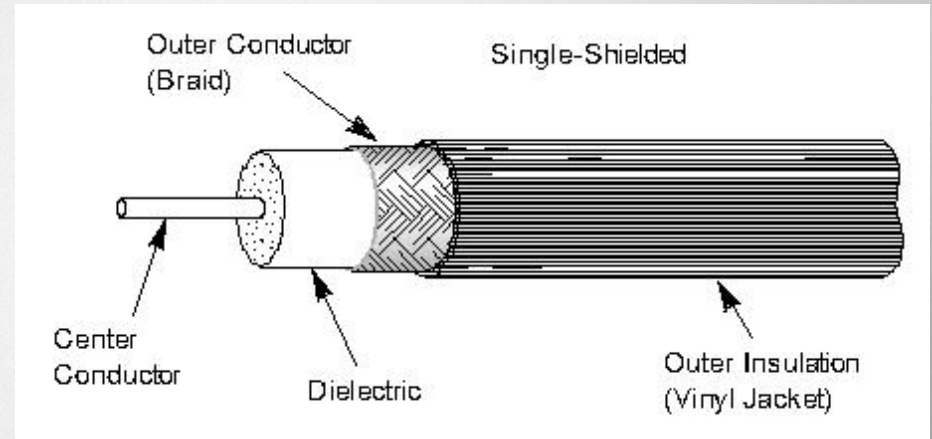


Characteristic Impedance

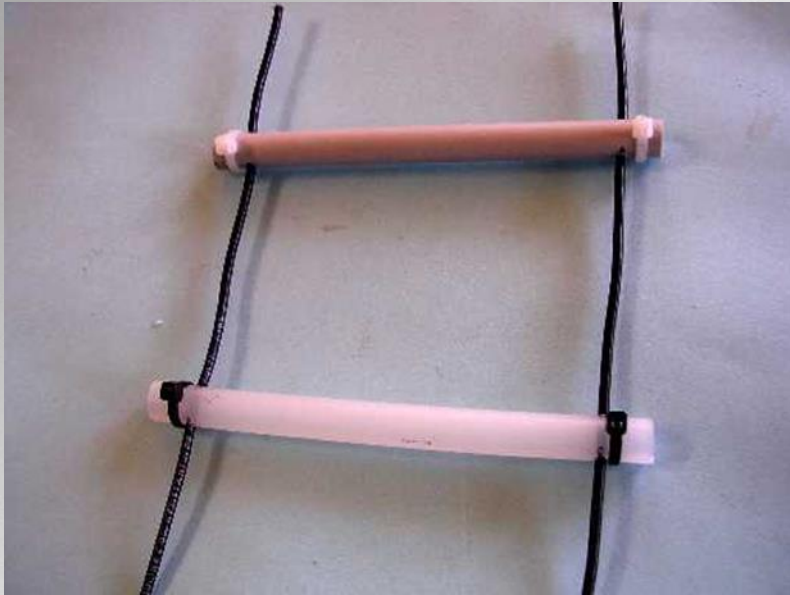
- Impedance of transmission line is based on:
 - spacing of conductors
 - diameter of conductors
 - material between the conductors

Coax

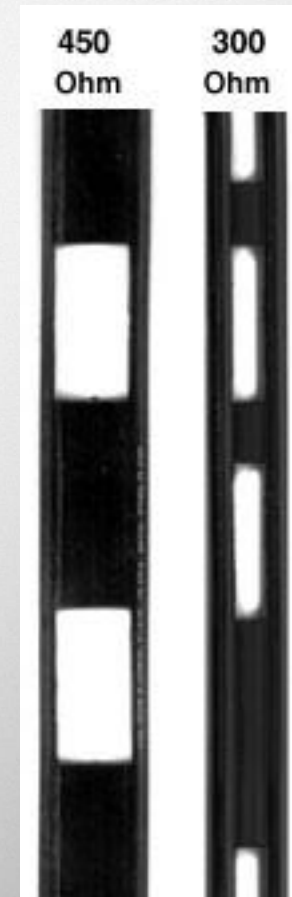
- Most common feed line.
- Easy to use.
- Matches impedance of modern radio equipment (50 ohms).
- Some loss of signal depending on coax quality (cost).



Open-wire and Ladder Line



- Typically 300, 450 or 600 ohms
- Plastic versions sometimes called 'window line'



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SWR, TEST EQUIPMENT AND ANTENNA MATCHING TUNER



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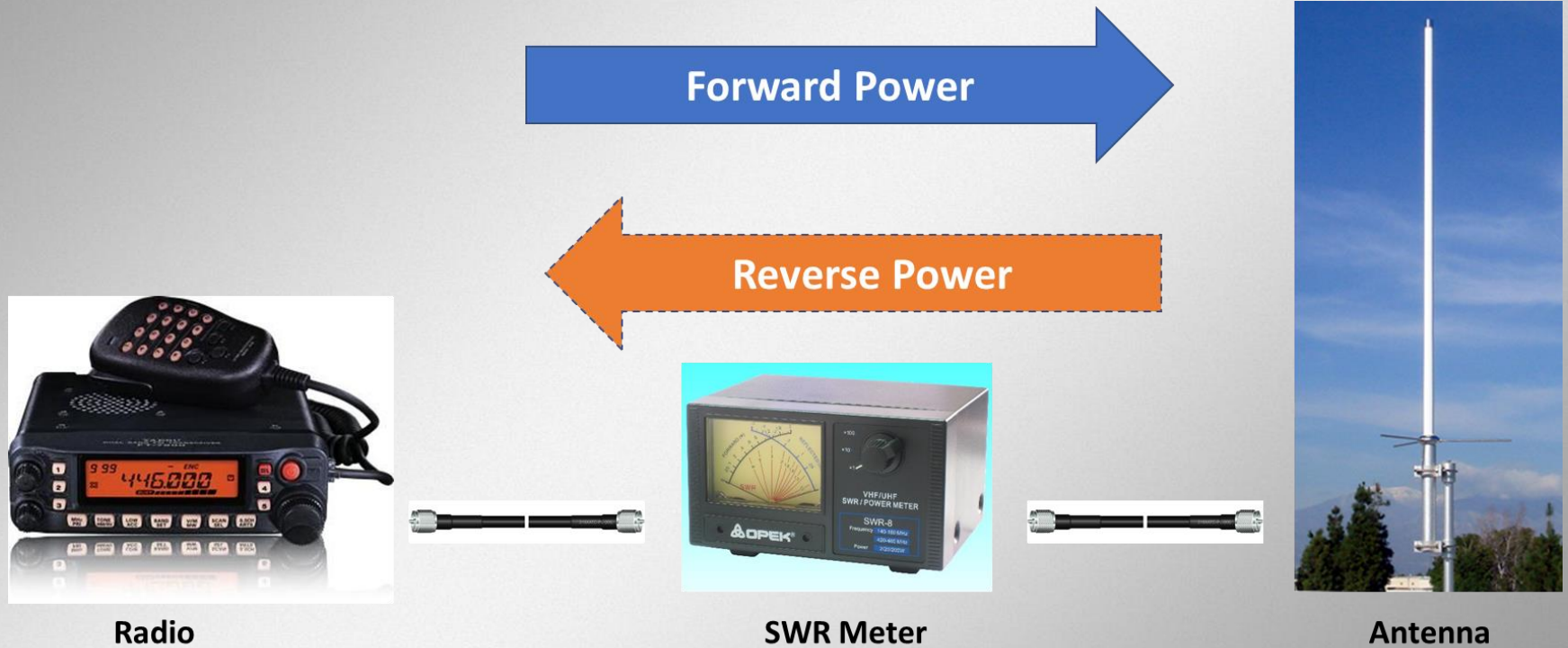
Test and Matching Equipment

- Proper impedance matching is important enough to deserve some simple test equipment as you develop your station repertoire.
- Basic test equipment: SWR meter.
- Matching equipment: Antenna tuner.

Standing Wave Ratio (SWR)

- If the antenna and feed line impedances are not perfectly matched, some RF energy is not radiated into space and is returned (reflected) back to the source.
 - Something has to happen to this reflected energy – generally converted into heat or unwanted radio energy (bad).

Forward and Reverse Power



SWR Meter and Antenna Tuner



Cross-needle SWR Meter



Manual Antenna Tuner

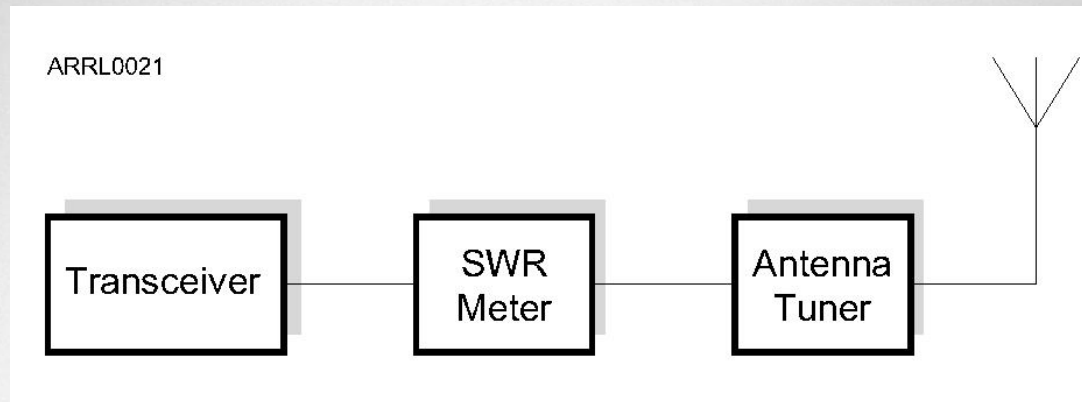


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SWR Meter

- The SWR meter is inserted in the feed line and indicates the mismatch that exists at that point.
- You make adjustments to the antenna to minimize the reflected energy (minimum SWR).



$$\text{SWR} = \frac{1 + \sqrt{P_r/P_f}}{1 - \sqrt{P_r/P_f}}$$

$$\text{VSWR} = \frac{|V_{\text{max}}|}{|V_{\text{min}}|}$$



Nothing is Perfect

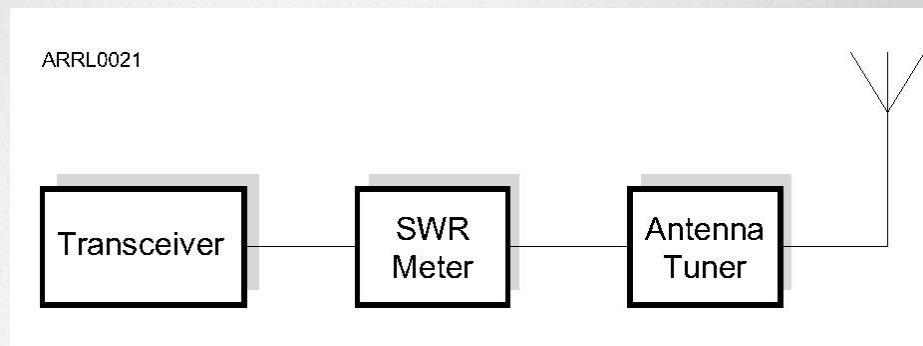
- Although the goal is to get 100% of your radio energy radiated into space, that is virtually impossible.
- What is an acceptable level of loss (reflected power or SWR?)
 - 1:1 is perfect.
 - 2:1 should be the max you should accept (as a general rule).
 - Modern radios will start lowering transmitter output power automatically when SWR is above 2:1.
 - 3:1 is when you need to do something to reduce SWR.

Antenna Tuner

- One way to make antenna matching adjustments is to use an antenna tuner.
- Antenna tuners are “impedance transformers” (they actually do not tune the antenna).
 - When used appropriately they are effective.
 - When used inappropriately all they do is make a bad antenna look good to the transmitter...the antenna is still bad.

How to use an Antenna Tuner

- Monitor the SWR meter.
- Make adjustments on the tuner until the minimum SWR is achieved.
 - The impedance of the antenna is transformed to more closely match the impedance of the transmitter.



Antenna Tuner

- Where is the best place to locate the antenna tuner?
 - Nearest the antenna?
 - Nearest the radio and SWR meter?
- Remember: there are cables in between the antenna, SWR meter and radio
- In high power applications, cables can breakdown if the SWR is high (“hotspots”)



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Antenna Tuner

