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# FEEDLINES

Transmission Lines

# Perfect Feedlines

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***A perfect feedline will have:***

- No radiation from the feedline itself
- No loss of signal while passing along the line
- Constant electrical characteristics throughout  
Such a feedline will pass 100% of the RF energy through it.

***NOTE: This perfect situation doesn't ever exist!***

# Balanced feedlines

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Open wire feedlines

Characteristic impedance of 200 – 600  $\Omega$  depending on the diameter of the wire and the distance between them.



$$Z_o = 276 \log_2(S/D)$$

**S=Distance between and  
D=diameter**



# Unbalanced feedlines

One side to ground

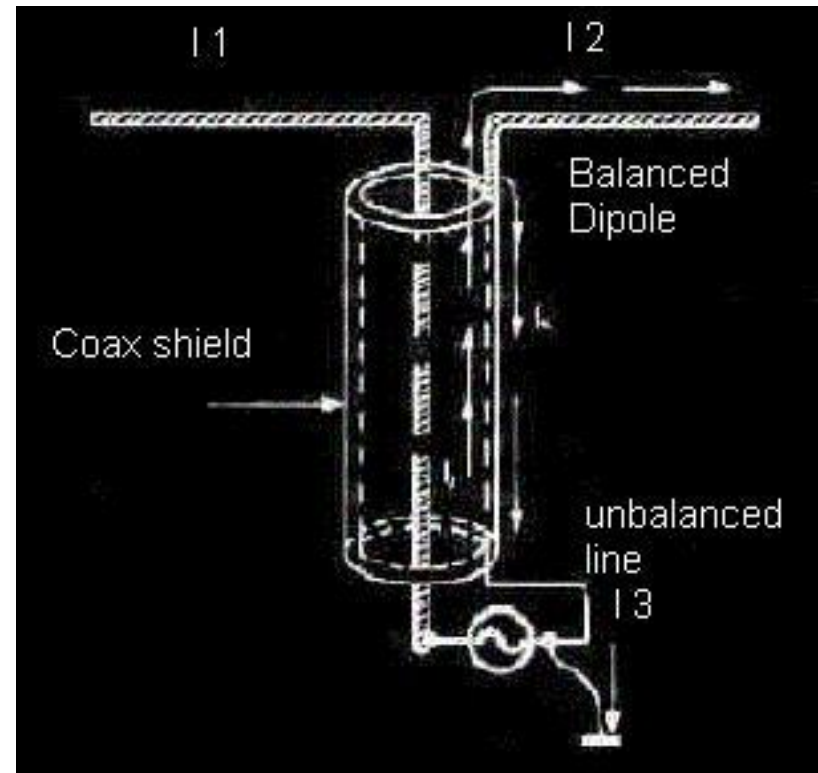
Other side carries

RF to antenna

Coaxial cable is waterproof

Hardline or Heliax is best for VHF/UHF and up (Heliax uses copper not braid for the shield)

– hard to bend -



$$Z_0 = 138 / \sqrt{e} \log D/d$$

$e$ =dielectric constant

$D$ =diameter of the outer conductor

$d$ =diameter of the inner conductor

# Feed Lines

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Feedlines connect a radio to an antenna (the load )

They must be matched to the radio system - they should have similar impedance

Radios usually have a 50 ohm input and output impedance

Antenna feedpoints can have a very wide impedance range

Remember - **Velocity factor** .66 - .95

# Feed Lines

Con't

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Feedlines can be easily made

The two favourite for amateur radio are the coaxial cable and open wire feedlines



# Feed Line Questions

See Page 45

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What connects your transceiver to your antenna?

**Feed Line**

What kind of feed line can be buried in the ground for some distance without adverse effects? **Coaxial Cable**

A transmission line differ from an ordinary circuit or network in communications or signal devices in one important way. That important way is **Propagation Delay**

# Feed Line Questions

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The characteristics of a transmission line is determined by the **Physical dimensions and relative positions of the conductors**

The characteristics of a transmission line is equal to the **Pure Resistance which, if connected to the end of the line, will absorb all the power arriving along it**

*Think of a paper towel absorption advertisement*

The characteristic impedance of a coaxial antenna feed line is determined by the **Ratio of the diameter of the inner conductor to the diameter of the braid**



# Feed Line Questions

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What factors determine the characteristic impedance of a parallel-conductor antenna feed line?

**The distance between the centres of the conductors and the radius of the conductors**

# Balanced & Unbalanced Feed Lines

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A balanced transmission line: **is made of two parallel wires**

What is parallel-conductor feed line? Two wires side-by-side held apart by insulating rods

What kind of antenna feed line is made of two conductors held apart by insulated rods? **Open-conductor ladder line**

What kind of antenna feed line can be constructed using two conductors which are maintained a uniform distance apart using insulated spreaders? 300, 450 or **600 ohm open-wire is most common.**



# Balanced & Unbalanced Feed Lines - 2

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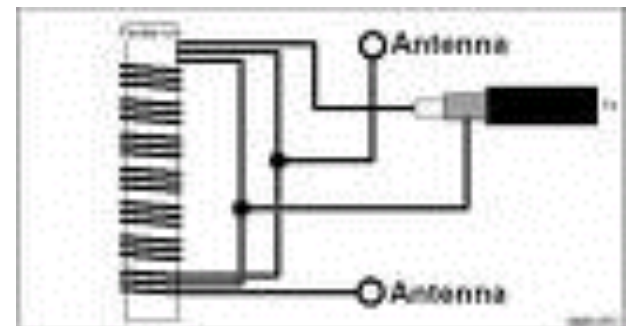
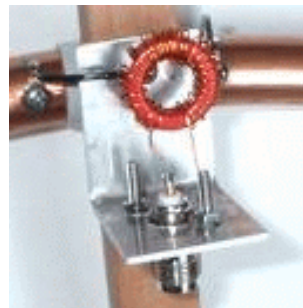
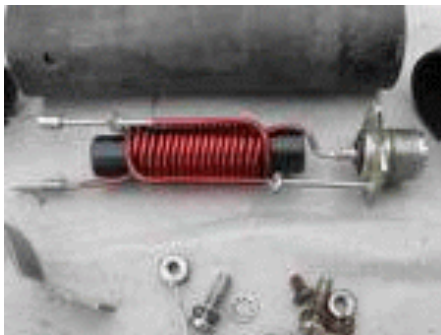
What is an unbalanced line? **Feed line with one conductor connected to ground**

What is a coaxial cable? **A center wire inside an insulating material which is covered by a metal sleeve or shield**

A flexible coaxial line contains: **Braid and insulation around a central conductor**

What device can be installed to feed a balanced antenna with an unbalanced feed line? **A balun**

What does the term "balun" mean? **Balanced to unbalanced**



# Balanced & Unbalanced Feed Lines - 3

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**Where** would you install a balun to feed a dipole antenna with 50-ohm coaxial cable?

**Between the coaxial cable and the antenna**

How can a 75 ohm transmission line could be matched to the 300 ohm feedpoint of an antenna:

**by using a 4 to 1 balun**



# Popular Antenna Feed Lines

Why does coaxial cable make a good antenna feed line? **It is weatherproof, and its impedance is higher than that of most amateur antennas**

What is the best antenna feed line to use, if it must be put near grounded metal objects? **Coaxial cable**

What commonly available antenna feed line can be buried directly in the ground for some distance without adverse effects? **Coaxial cable**

If you install a 6 metre Yagi antenna on a tower 50 metres from your transmitter, which of the following feed lines is best? **RG-213**

What are some reasons not to use parallel-conductor feed line? **It does not work well when tied down to metal objects, and you must use an impedance-matching device with your transceiver -why ???**

TV twin-lead feed line can be used for a feed line in an amateur station. The impedance of this line is approximately: **300 ohms**

# Connectors

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What common connector usually joins RG-213 RG-8U coaxial cable to an HF transceiver? A **PL-259** connector

What common connector usually joins a hand-held transceiver to its antenna? A **BNC** connector

Which of these common connectors has the lowest loss at UHF? A **type-N** connector

Why should you regularly clean, tighten and re-solder all antenna connectors? **To help keep their resistance at a minimum**



Why should you use only good quality coaxial cable and connectors for a UHF antenna system? **To keep RF loss low**

In what values are RF feed line losses expressed?  
**dB per unit length**

Losses occurring on a transmission line between transmitter and antenna results in: **less RF power being radiated**

If the length of coaxial feed line is increased from 20 metres (65.6 ft) to 40 metres (131.2 ft), how would this affect the line loss?  
**It would be doubled ( or by 100%)**

What are some reasons to use parallel conductor feed line? **It can operate with a high SWR, and has much less loss than coaxial cable**

# Line Losses

Con't

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If your transmitter and antenna are 15 metres apart, but are connected by 65 metres of RG-58 coaxial cable, what should be done to reduce feed line loss? **Shorten the excess cable**

The lowest loss feed line on HF is: **open “ladder” line**

As the length of a feed line is changed, what happens to signal loss? **Signal loss increases as length increases**

As the frequency of a signal is changed, what happens to signal loss in a feed line?

**Signal loss increases with increasing frequency**



# Standing Waves

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If the characteristic impedance of the feedline does not match the antenna input impedance then: **standing waves are produced in the feedline**

The result of the presence of standing waves on a transmission line is: **reduced transfer of RF energy to the antenna**

What does the standing wave ratio mean? **ratio of maximum to minimum voltages on a feed line**

What does an SWR reading of 1:1 mean?

**The best impedance match has been attained**

What does an SWR reading of less than 1.5:1 mean? **A fairly good impedance match**

**A resonant antenna having a feed point impedance of 200 ohms is connected to a feed line and transmitter which have an impedance of 50 ohms. What will the standing wave ratio of this system be? 4:1**

What kind of SWR reading may mean poor electrical contact between parts of an antenna system? **A jumpy or intermittent reading**

# Standing Waves

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What does a very high SWR mean? **The antenna is the wrong length, or there may be an open or shorted connection somewhere in the feed line**

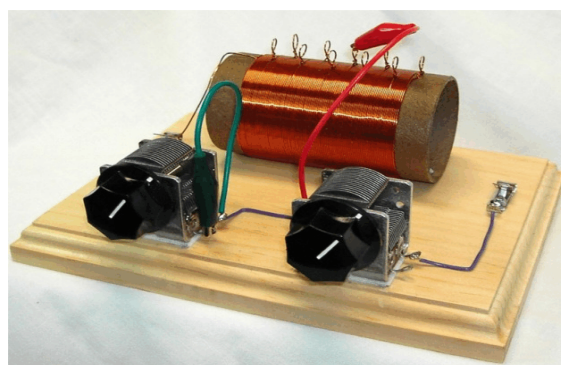
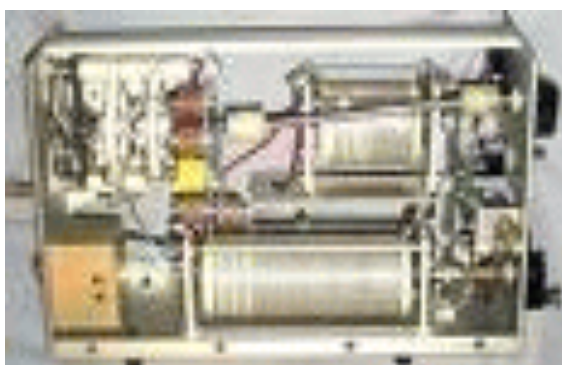
If your antenna feed line gets hot when you are transmitting, what might this mean? **The SWR may be too high, or the feed line loss may be high**

The type of feed line best suited to operating at a high standing wave ratio is: **600 ohm open-wire**

SWR meter measures the degree of match between transmission line and antenna by: **by comparing forward and reflected voltage**

# Impedance Matching

What device might allow use of an antenna on a band it was not designed for? **An antenna tuner**



What does an antenna matching unit do? **It matches a transceiver to a mismatched antenna system**

What would you use to connect a coaxial cable of 50 ohms impedance to an antenna of 35 ohms impedance? **An impedance-matching device**

When will a power source deliver maximum output to the load? **When the impedance of the load is equal to the impedance of the source**

# Impedance Matching

What happens when the impedance of an electrical load is equal to the internal impedance of the power source? **The source delivers maximum power to the load**

Why is impedance matching important? **So the source can deliver maximum power to the load**

To obtain efficient power transmission from a transmitter to an antenna requires: **matching of impedances**

If an antenna is correctly matched to a transmitter, the length of transmission line: **will have no effect on the matching**

If the centre impedance of a folded dipole is approximately 300 ohms, and you are using RG8U (50 ohms) coaxial lines, what is the ratio required to have the line and the antenna matched? **6:1**