South Bristol Amateur Radio Club
Foundation Course

Lesson 5

11.0 Feeders.
(Syllabus section 5a.1 to 5a.2)
(Manual page 12)

11.1 The cable that connects the radio to the antenna is called the feeder.

11.2 The most widely used type of feeder is coaxial cable due to its screening properties. Coaxial cable has an inner conductor that carries the signal and an outer conductor (the braid or shield) around it with a suitable insulator in-between.

11.3 There are many types of connectors used for coaxial cable; the most common being the PL259 and BNC connectors. See pictures on page 12 of the manual.

11.4 To minimise signal loss it is always better to use the thickest type of coaxial cable as possible with the highest quality braid. The braid (the outer part of the cable) is a screen that keeps the signals within the cable and must be continuous through all connectors used.

12.0 Antennas.
(Syllabus section 5b.1 to 5d.1)
(Manual pages 12 - 14)

12.1 The purpose of the antenna is to:

(a) radiate the RF signal generated by the transmitter and
(b) pick up the radiated signals that will be passed to the receiver.

12.2 If the antenna is orientated horizontally it will have horizontal polarisation and similarly if mounted vertically it will have vertical polarisation. In VHF/UHF systems it is important that both transmitting and receiving stations use the same polarisation to minimise signal loss.

12.3 There are five types of antenna that we need to look at for this course:

- Half-wave dipole.
- Quarter-wave ground plane.
- Five-eighths wave ground plane.
- Yagi.
- End-fed wire.

These are described and shown on pages 12 & 13 of the manual.

12.4 Note that the Greek letter lambda (λ) is the symbol used for wavelength. So a quarter-wave ground plane may be described as a λ/4 ground-plane.

12.5 The sizes of HF and VHF antennas are different because they are related to the wavelength, though they operate on the same basic principles.

12.6 The λ/2 dipole has a length approximately equal to a half wavelength at the operating frequency.

12.7 The λ/4 ground-plane, 5λ/8 ground-plane and a vertically mounted λ/2 dipole are omni-directional with a vertical polarisation pattern. This means they radiate and pick up signals from all directions.

12.8 Note that if an antenna is not correctly designed or tuned for the frequency it will not work effectively. To use an antenna not designed for the frequency an antenna tuning unit (**ATU**) should be used so the transmitter will feed the antenna with the least amount of loss (lowest SWR - see section 13).

12.9 The Yagi antenna is directional and has gain because of its focusing ability. A Yagi may be mounted vertically or horizontally.

12.10 The gain of an antenna is measured in dBs (decibels). See table below for some examples.

dB	**Gain**	**dB**	**Gain**
0	1x	9	8x
3	2x	10	10x
6	4x	13	20x

12.11 As an example, a 5W transmitter feeding a Yagi with 6dB of gain would have the same effect, in the given direction, as transmitting 20W into a /2 dipole. The gain would also be helpful on receive.

12.12 The antenna gain therefore gives an apparent increase in power in the given direction. In general the greater the number of elements, the greater the gain.

12.13 The effective radiated power (**ERP**) is the power fed to the antenna multiplied by antenna gain. In the example above the power is 5W the gain is 6dB (4x) giving 20W ERP.

12.14 The dipole is an example of a balanced antenna. This type of antenna is fed in the middle and requires two feed connections, one to each half of the dipole. Coaxial cable, as we have seen, has one conductor and is unbalanced, which makes it unsuitable to connect directly to a balanced antenna. A device called a **balun** is required that converts the **bal**anced antenna feed to the **un**balanced coaxial cable.

12. Antennas such as the ground plane, where only one feed connection is required, are unbalanced and can be fed directly with co-axial cable.

13.0 Standing Wave Ratio (SWR)

(Syllabus section 5e.1 to 5f.1)
(Manual page 14)

13.1 With an ideal station, all the power generated by the transmitter will pass up the co-axial cable into the antenna and be radiated away. The antenna, feeder and transmitter will all be perfectly matched. However, this is usually not the case! In most stations, the antenna is not a perfect match and this causes some of the power to be reflected down the feeder into the transmitter.

13.2 The waves travelling up the feeder mix with reflected waves coming down the feeder and form standing waves. A Standing Wave Ratio (SWR) meter can measure this and allow the operator to adjust the antenna or ATU for the minimum reflected power. Fig. 1 (below) shows the correct setup for this.

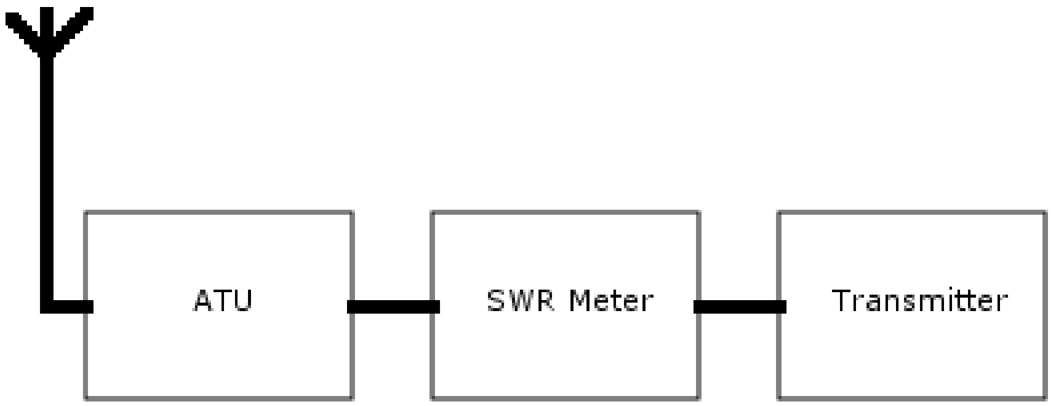

Fig 1 – Connection of ATU, SWR Meter and Transmitter

13.3 A perfect match (with no reflected power) will give an SWR of 1:1. As more power is reflected back the SWR will increase. At an SWR of 2:1 about 10% of the power is reflected back. At 3:1 about 25% is reflected back.

13.4 A high SWR reading can be caused by a fault in the antenna or the feeder but **not** the transmitter.

13.5 A high SWR can damage the transmitter so it is advisable to have the lowest SWR as possible.

13.6 In order to carry out checks on the feeder or transmitter it may be necessary to operate the transmitter without radiating a significant signal. Instead of feeding an antenna we can use a **dummy load**. A dummy load is a screened resistor that will provide a very good match (low SWR) to the transmitter whilst radiating very little RF power.