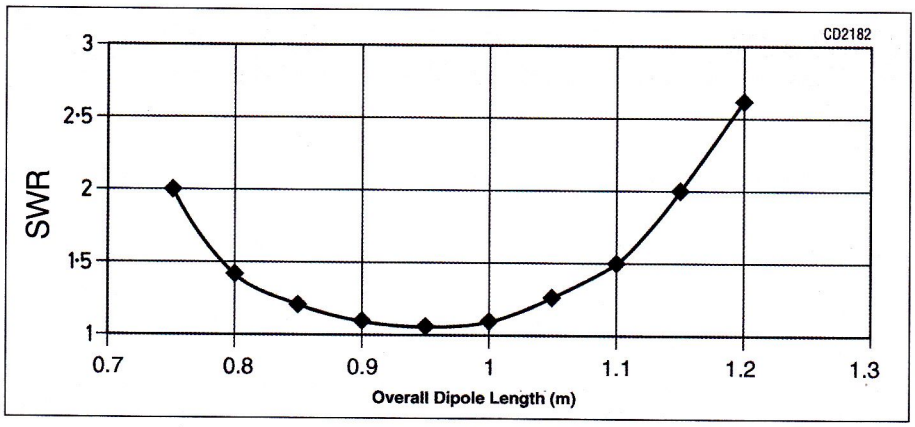

Fig 20: Graph of how the SWR of a half wave dipole for the 2m band varies as the length of the legs is varied.

Matching antennas

IF THE SIZE OF the antenna is correct, ½ wavelength long at the wanted frequency if it is a dipole, for example, then the antenna will match the transmitter and feeder. This means that the power from the transmitter will be properly radiated by the antenna. If the antenna is used on the wrong frequency, so that it is not the correct size, some of the power will be reflected back down the feeder instead of being radiated by the antenna.

A similar effect can be seen in a pool, where a wave is reflected by the side of the pool.

Antenna Tuning Unit (ATU)

THE ATU IS A device that can be fitted in the feeder, usually at the transmitter end for convenience, that can cope with any power reflected by the antenna and allow the transmitter to send the power to the antenna and for the antenna to radiate it well.

An ATU is quite common in HF installations, where a single antenna often has to be used for several bands due to space limitations. The antenna will only match well on one band. All the others will be a compromise and an ATU will be needed for good results. Without an ATU, if the mis-match is severe, the transmitter could be damaged. Alternatively, protection devices in the transmitter will reduce or shut down the power.

Standing waves and SWR meters

IF SOME OF the RF power is reflected at the antenna, this will mix with the power going up the feeder and cause an effect called 'standing waves'. The waves travelling up the feeder combine with those reflected down, to give the appearance of stationary or standing waves.

An SWR (standing wave ratio) meter can measure the power flowing back down the feeder, allowing the operator to adjust the ATU until the antenna system is matched and the reflected power to the transmitter is minimised.

If the reading on the SWR meter has unexpectedly increased, it means that more signal is being reflected back from the antenna. The most likely cause is some damage to the antenna. Possibly it has suffered in the wind or been hit by a large bird. The cause should be investigated before continuing to transmit.

A dipole antenna is a good match only when cut to the correct length. At other lengths the match will be poorer, depending on how far from the ideal length it is. **Fig 20** shows the effect of varying the length of the two halves of a dipole.

In your practical assessment, you will set up an adjustable dipole, a transmitter and an SWR meter. The dipole will probably be made using two extendible aerials like those found on small portable broadcast radios.

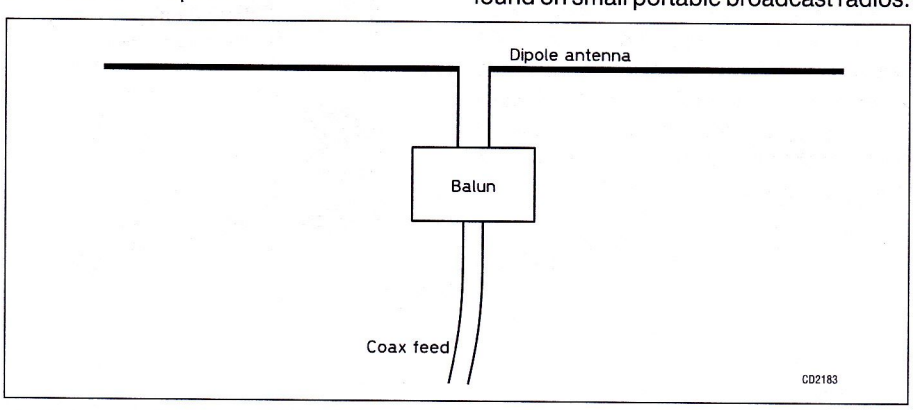

Fig 21: Insert a balun at the point where coaxial cable meets a dipole antenna.

If the dipole is too short, corresponding to the left side of Fig 20, the SWR will be high. Gradually lengthen the two halves, keeping them equal, checking the SWR after each adjustment. The power will be low, but do not adjust the dipole whilst transmitting.

You should come to a point where the SWR is a minimum. Note the length of the dipole but continue the experiment, making the dipole longer each time.

It is not usual to have an ATU for the VHF and UHF bands (which is where you will conduct this experiment), but, if you did have one, it would be possible to set the dipole to the wrong length, insert the ATU and adjust it to make the transmitter think the dipole was correct. The SWR will appear low to the transmitter, which will then work quite happily.

Baluns

LOOK CAREFULLY AGAIN at the dipole antenna. The dipole is symmetrical, that is to say the two halves are the same. It is called a 'balanced' antenna and requires two signals, one for each half of the dipole. The signals are balanced because when the wave on one side is going up, the wave on the other side is going down (rather like a balanced see-saw).

A coaxial cable is not electrically symmetrical and is called 'unbalanced'. It has one centre 'live' conductor and an earthed screen. It is not suitable to directly feed a dipole. A device called a balun (balanced to unbalanced transformer) takes the signal on the coaxial cable and converts it to two signals suitable for feeding the dipole.

If the coaxial cable is connected directly to a dipole, RF current will flow back down the screen of the cable. This current will radiate, and the screening properties of the cable will be upset. Since the cable runs back into the house, radiation will take place inside the house and may cause some interference to the television or other electronic devices. This must be avoided.

Dummy loads

A DUMMY LOAD is a carefully constructed resistor, capable of absorbing all the power from the transmitter and presenting a good match, ie no power is reflected. It must also be well screened, to minimise any unwanted radiation. This allows the transmitter to be set up and tested without radiating any significant power.