13 Waves – Part 3

Introduction

When we talk about the spectrum being divided up into bands, this is just for our convenience; there are no natural divisions although, as we have seen, some of the properties of different bands really *are* different! Let's look at **Figure 1**, and see how the frequencies are divided up.

The divisions

- **Very low frequencies** (VLF) cover the range from a few kilohertz up to 30 kHz. Very long-range communication is possible, but at *very* small bandwidths. It is used for special purposes.
- **Long waves** (LW) are used for medium-distance commercial broadcasting and have frequencies from 30 kHz to 300 kHz.
- **Medium waves** (MW) are used for commercial broadcasting, and use frequencies from 300 kHz to about 1.5 MHz (1500 kHz). Typical range is about 200 km.
- **Short waves** (SW) encompass both the low-frequency (LF) and high-frequency (HF) amateur radio bands. There are nine narrow amateur bands in the SW spectrum between 1.8 MHz and 30 MHz. Some of these bands give round-the-world communication.
- **Very high frequencies** (VHF) span the range between 30 MHz and 300 MHz. Relatively short-range communication is possible. They were once used for broadcast TV before it moved to UHF. There are now three

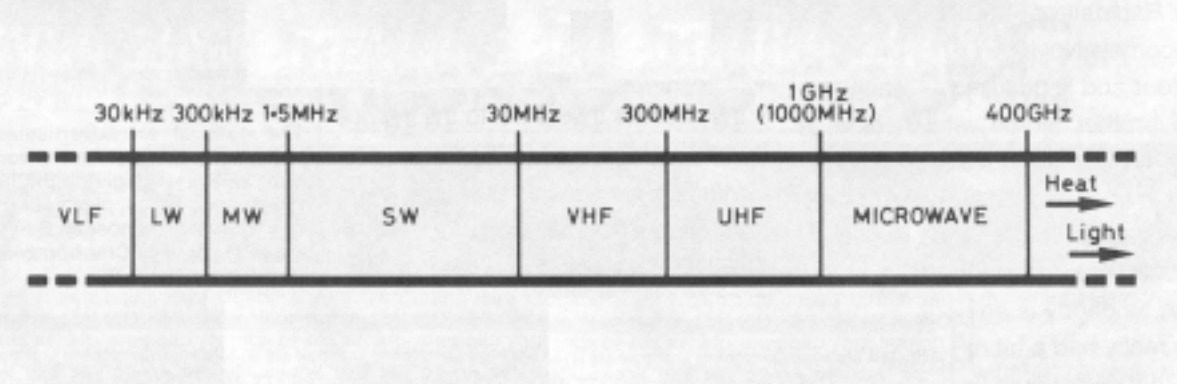

Figure 1 Diagram of radio frequency spectrum

amateur bands here – 6 m, 4 m, and 2 m. Repeaters are used to extend the usable range of mobile stations. VHF waves are not usually reflected by the ionosphere, but when they are, ranges of several thousand kilometres are possible. Weather affects these waves on a regular basis, however. In addition to amateur users, the VHF part of the spectrum is also used by the police, the fire and ambulance services, weather satellites, and many others,

- **Ultra-high frequencies**, sometimes called *centimetre waves*, cover the range from 300 MHz to 1000 MHz (or 1 GHz). The only amateur band in this range is the 70 cm band, and we share it with radar, TV and cellular telephone users as well.
- **Microwaves** begin at 1 GHz and extend to about 400 GHz. They are *never* reflected by the ionosphere, are partially attenuated by buildings, and are reflected from aircraft and cars. Microwave absorption in the atmosphere is quite significant, and rain and fog can attenuate microwaves quite heavily.
- **Heat, light** . . . Above 400 GHz we run into the infra-red bands and on into the visible light and ultra-violet bands. We generally take 400 GHz as being the limit of what we class as radio waves.

Bandwidth again

Complex signals need more bandwidth than simple signals. Even if it were possible, we would not be able to transmit a single television channel in the whole of the MW broadcast band! When TV used part of the VHF band, only five channels were possible in the range from 45 MHz to 68 MHz. By moving TV to the UHF band, we now have 47 channels between 470 MHz and 855 MHz!

It's your choice!

The number of permutations you have amongst all the modes and all the bands is enormous! Only you can decide what you are interested in and what you want to learn about. That is the attraction of amateur radio!