The Essence of Ham Radio - VI

Radio frequencies for ham radio communication

The ham radio operators operate in different allotted bands of radio frequencies starting from 1.820 MHz to about 5840 MHz. The long distance worldwide communication is accomplished using frequencies ranging from 1.820 MHz to 29.700 MHz. These range of frequencies are commonly known as the 'Short Wave' (SW) frequencies or 'High Frequencies' (HF). If you observe the dial of an ordinary domestic radio set, it would be noticed that the dial marks different short wave bands with an indication of frequencies as well as wavelengths. These are called 'short waves' on the basis of their 'wavelength'.

The radio frequencies where the ham radio operators can be found are:

Short wave (High Frequencies):

1.820-1.860 MHz
3.500-3.700 MHz
3.890-3.900 MHz
7.000-7.100 MHz
10.100-10.150 MHz
14.000-14.350 MHz
18.068-18.168 MHz
21.000-21.450 MHz
24.890-24.990 MHz
28.000-29.700 MHz

Very High Frequencies (VHF):

144-146 MHz

Ultra High Frequencies (UHF):

434-438 MHz

Super High Frequencies (SHF):

1260-1300 MHz

Extremely High Frequencies (EHF):

3300-3400 MHz
5725-5840 MHz

The most favourable short wave frequencies in which we can find the ham radio operators from around the world talking with each other are 7-7.1 MHz, 14-14.350 MHz, 21-21.450 and 28-29.7 MHz. Some of these frequencies can even be found in our ordinary radio receivers! The lower short wave frequency ranges like the 1.820-1.860 MHz and 3.5-3.9 MHz are however not suitable for reliable long distance communication.

The dial of an ordinary radio also gives indication of the wavelength in meters (say the 49m band). Every radio frequency has its own wavelength; Lower the frequency, more is its wavelength. The radio waves are a form of electromagnetic energy. The electromagnetic energy spectrum spreads from frequencies of a few hertz (say 30 Hz) to thousands of Giga (10^9) hertz manifested in different forms. The part of this spectrum, which the human eye can perceive is called the light. In fact, the perception of rainbow through our eyes is possible due to our eye's ability to sense a range of frequencies of the electromagnetic spectrum starting from 4×10^{14} hertz or (the red colour) to 7×10^{14} hertz (the violet colour). Interestingly human eyes cannot sense the frequencies of electromagnetic spectrum just below and above this range. It is said that had our eyes been able to sense the whole spectrum of electromagnetic energy, the rainbow would have been simply become broader with a wider range of colour varieties and we could have very well be able to see the radio waves as well! Thus, the electromagnetic "spectrum" includes all the various forms of electromagnetic energy from **extremely low frequency (ELF)** energy (e.g. the 50 hertz frequency of domestic electric supply), with very long wavelengths, to X-rays of 0.01^{-10} nanometer wavelength (about the size of an atom) and gamma rays of less than 0.01 nanometer wavelength (about the size of an atomic nucleus), which have very high frequencies and correspondingly shorter wavelengths (1 nanometer, nm = 1/1,000,000,000 m). In between these extremes are radio waves of more than 1mm wavelength, microwaves, infrared radiation (710 nm- 1mm), visible light (400-700 nm), and ultraviolet radiation (10-310 nm), in that order.

The Radio Frequency (RF) part of the electromagnetic spectrum is generally defined as that part of the spectrum where electromagnetic waves have frequencies in the range of about 3 kilohertz to 300 Giga hertz [One kilohertz (kHz) equals one thousand hertz, one megahertz (MHz) equals one million hertz, and one Giga hertz (GHz) equals one billion hertz] and used for transmission of information in electronic communication. In reality there is no sharp dividing line between the various forms of electromagnetic waves, but one form slowly takes on the identity of the next.

Electromagnetic energy travels in the form of a wave. Just like the ripples produced in a water pond when we throw a stone. The lowest part of the wave is called a trough. The highest part of the wave is crest. The height of the wave is called amplitude. A wavelength is the distance from two corresponding points on subsequent waves, for example from crest to crest or from trough to trough. The number of waves that pass through a given point in one second is called the 'frequency', measured in units of cycles per second called Hertz. It has been found that the equation that relates wavelength and frequency is: l x n=v, where 'l' is wavelength, 'n' is the frequency and 'v' is the velocity of the wave. For radio wave, the speed is equal to 3,00,000 km. The practical formula to calculate the wavelength (in metre) of a particular frequency (in MHz) is:

Wavelength (in metre) = 300/Frequency (in MHz)

For example, a 10 MHz radio frequency has a wavelength of 30 metre, whereas a radio wave of 30 MHz frequency has a wavelength of 10 metre, i.e. higher the frequency lower is the wavelength. Though technically the various radio frequencies have been clearly demarcated, conventionally the dial of an ordinary broadcast radio receiver indicates the frequencies ranging from 500 kHz up to about 1600 kHz (1.6 MHz) as the Medium Wave Frequencies or 'Medium Waves'. These are the frequencies, which normally propagate only to a few hundred kilometers and hence most of the local broadcast stations transmit in these frequencies to cater to the need of a particular region (within a radius of 500 km).

In the next issue we shall discuss about the propagation of radio waves. The ham radio operators need to have good knowledge about the propagation characteristics of different radio frequencies to establish a successful radio contact.

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