Listening to Ham Radio stations-IX

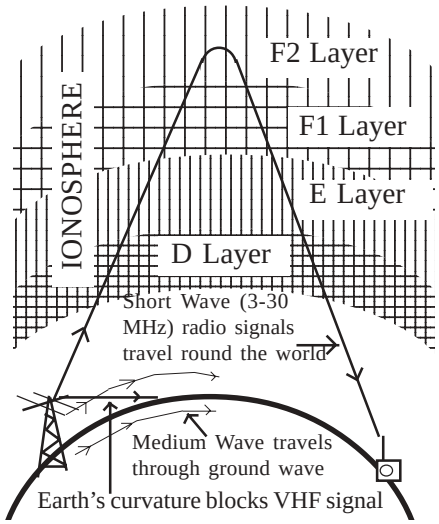
Propagation of Radio Waves

To listen to ham radio operators, one should also have some knowledge about the characteristics of radio wave propagation. Radio waves propagate in various ways. Each subdivision of the radio frequency spectrum has its own propagation characteristics through land, water and the atmospheric envelope covering the earth. There are various components of a radio wave transmitted from an antenna. The ground waves are the components, which travel along the surface of the earth. The sky waves leave the antenna to reach various ionized layers of air in the earth's atmosphere. Except for very short distances, these waves do not follow the natural curvature of the earth. Earth's curvature is a direct block to line-of-sight propagation of radio waves. It has been observed that lower radio frequencies (e.g. the Medium Waves) mainly propagate through ground waves. The ground waves get attenuated after traveling a few hundred kilometers due to the absorption by the earth and the sky waves radiated from a transmitting station cannot reach the receiving station when enough distance separates two stations so that their antennas fall behind the earth's curvature.

But it was observed that with the aid of short wave frequencies (ranging roughly from 3 to 30 MHz), it was possible to set up communication with any point on earth! Little radio transmitters with radio frequency power (RF power) as low as 1 watt are even capable of sending signals to thousands of kilometers away! Oliver Heaviside in England and A.E. Kennally in America, in 1902, suggested that there must be some kind of reflecting medium in the upper atmosphere that caused the radio waves to be returned back to Earth at considerable distances from the transmitter. This reflecting medium is known as the 'ionosphere'. Under the action of solar radiation and hail of meteorites, an ionized layer is formed in the upper part of the Earth's atmosphere starting at an altitude of 50 kms above the surface of the earth and extending up to an altitude of 400 kms or more. Short wave radio signals are reflected from this layer just as light rays are reflected from the surface of a mirror, or sound wave from a barrier. Likewise, this layer can be compared to the edge of a billiard table. If the ball does not go straight into the pocket, it can be directed on the rebound! In the same way, the short wave radio signals radiated by distant radio stations get to our receiver on the rebound. They can continue traveling to several places round the world, for the Earth also acts like the edge of a billiard-table!

The ionosphere does not play very important role in the propagation of Medium Wave (MW) frequencies (300-1600 kHz). Since long distance communication can be accomplished with Short Wave (SW) frequencies, ham radio operators are mainly concerned with short wave frequencies. They also need to have knowledge about different ionospheric layers (See Fig. 1) and the propagation characteristics of different radio frequencies. Ham radio operators use short wave frequencies like 14 MHz, 21 MHz and 28 MHz etc. for coast-to-coast transoceanic worldwide communication. Even then, in many cases they may require the relay of messages when one station cannot copy the radio signal from a particular radio station. It is not always necessary for the radio stations to be located close to each other for a successful communication to establish. Depending upon the angle of reflection from the ionosphere, the reflected radio signal may fall at a far away place from its place of transmission skipping a nearby place. Then the nearby place where the radio signal is not received is said to be in skip with the sending station.

There are some frequencies (above 30 MHz), which can be used for line-of-sight communication only, i.e. they usually don't get reflected back from the ionosphere. These are used for short distance point-to-point communication with high-rise antennas. If both the stations are in line-of-sight, the communication becomes extremely reliable, because, in this case ionosphere has no role to play. Ham radio operators use the Very High Frequencies (VHF) in the range of 144-146 MHz for short distance communication using walkie-talkies.



❑ **Sandeep Baruah, call-sign: VU2MUE**

❑ *Contd. from page 10*

tone is fast and less prone to error than pulse dialing. Touch-tone can send signals around the world via the telephone lines, and can be used to control phone answering machines and computers. Each transmitted digit consists of two separate audio tones that are mixed together (the four vertical columns on the keypad are known as the high group and the four horizontal rows as the low group). Standard DTMF dials will produce a tone as long as a key is depressed. No matter how long you press, the tone will be decoded as the appropriate digit. The shortest duration in which a digit can be sent and decoded is about 100 milliseconds (ms).

Do you know why does the phone still work when the electricity goes out?

This is because a phone works as long as it gets between 6 and 12 volts at about 30 milliamps. In other words, it takes very little power to operate a telephone. A pair of copper wires is used to connect the house and the exchange. The telephone exchange supplies the power that our phone needs through the copper pair. So even if the power goes out in the house, the phone still gets the power it needs through the phone line. The telephone exchange office has an extensive battery system, as well as a backup generator, to supply power during a power failure. If the power goes out, the batteries and generators keep the office fully powered. Hence, providing the power to the telephones.

❑ **Kinkini Dasgupta Misra**