An Introduction to Microwave Technology

In the world of electrical communications there are two ways to transmit a message between two points: with an analog signal or a digital signal. With analog transmission, the signal carrying the information is continuous; for example, when talking into the telephone, a voice is transmitted as a voltage signal of continuously varying amplitude and frequency. With digital transmission, the signal is a series of discrete levels, or pulses (1's and 0's) corresponding to "on" and "off", respectively.

Digital microwave radio systems are used to transmit and receive information between two points that can be separated by up to 60 kilometers (and sometimes farther) in a telecommunications network. The information can be voice, data, or video as long as it is in a digital format.

A typical microwave radio consists of three basic components: a digital modem for interfacing with digital terminal equipment, a radio frequency (RF) unit for converting a carrier signal from the modem to a microwave signal, and an antenna to transmit and receive the signal. The combination of these three components is referred to as a radio terminal. Two terminals are required to establish a microwave communications link, commonly referred to as a microwave hop.

There are two basic configurations for microwave terminals: non-protected and protected or monitored-hot-standby (MHSB). The non-protected configuration is a single standalone terminal. The protected or MHSB configuration has a redundant set of electronics that serves as a back up to the in-service electronics in case of a failure.

One very important characteristic of digital microwave radio transmission is its immunity to noise. Noise refers to unwanted electromagnetic waveforms that corrupt a message signal. Noise is inevitable in electrical communications systems. In order to transmit an electrical signal over a long distance it is

necessary to boost the signal level at intervals along the transmission path; this is the job of a device called a repeater.
Microwave radio offers several advantages over cable-based transmission. Microwave radio is simpler, faster, more feasible and more flexible to implement than cable systems. Because there is no buried cable involved, microwave systems do not require right-of-way, and they are not susceptible to cable cuts. Microwave is also easy to move if there is a change in a network

Applications

Cellular

Cellular carriers often face aggressive schedules to provide service for customers and to generate immediate revenue. In order to turn up their networks, cellular carriers need to connect their cell sites to switching stations. To make this connection, they usually choose microwave, because it is reliable and can be commissioned within a day.

Local Distribution

Many businesses use microwave in their private networks because it's the fastest way for them to install digital communications. Microwave offers businesses a low cost, high security alternative to traditional communications systems.

Control & Monitoring

Public transport organizations, railroads and other public utilities are major users of microwave. These companies use microwave to carry control and monitoring information to and from power substations, pumping stations, and switching stations.

Long Distance Carrier Connections

A significant part of the cost of a long distance telephone call is in the local connection to a long distance carrier. Microwave radio links the end user to the long distance carrier, reducing the cost of this connection. In areas where long distance service is available but there are no local lines, microwave can provide the "last mile" connection.

Disaster Recovery

Natural disasters can wreak havoc on a telephone network. Microwave is often used to restore communications while transmission equipment damaged by earthquakes, floods, hurricanes or other natural disasters is being repaired.

Future Markets

New markets and applications continue to emerge for wireless communications. Future wireless communications markets will include rapid growth of PCS/PCN (Personal Communications Networks) and ESMR (Enhanced Specialized Mobile Radio) networks, as well as higher bandwidth applications that support video and data in large local area and wide area networks.
Other potential applications include the use of microwave as the "last mile" connection into rural communities. The future may also bring the convergence of telecommunications, computers, and other markets, to satisfy user demands for rapid, interactive exchange of information.