BROADCASTING BASICS

CHAPTER 2

Types of Broadcasting

By definition, broadcasting means "to transmit by radio or television," but, with developments in technology that have taken place, that simple phrase now includes many different types of transmission. Let's start with a summary of the main types in use today in the United States and overseas. Many of the systems mentioned below differ only in the way they are transmitted—studio systems for radio and television generally have fewer variations. Don't worry if you don't fully understand all of the terms used in this chapter: they will be explained later in the appropriate sections.

Analog Radio

Radio broadcasting for local stations in the United States, and throughout the world falls into two main types: AM and FM—standing for *amplitude modulation* and *frequency modulation*, respectively. These are the particular methods of radio transmission, used for many years for traditional broadcasting to home, car, and portable receivers. In North America, AM is used in the *medium frequency* (MF) (also known as *medium wave)* band, whereas FM uses the *very high frequency* (VHF) band.

One radio station frequently feeds only one transmitter, and therefore is referred to as an AM station or an FM station. It is, however, quite possible for a station to feed both AM and FM transmitters in the same area, or to feed more than one transmitter covering different areas, in which case the term AM or FM may refer only to a particular transmitter and not to the station as a whole.

In some overseas countries, AM is also used in the *long wave* band, with frequencies somewhat lower than the MF band, and slightly different propagation characteristics—good for broadcasting over a wide area. AM is also used for *shortwave* radio broadcasting—also known as HF from the name of the *high frequency* band that is used. This is used for broadcasting over very long distances (usually internationally).

We cover analog radio in more detail in Chapters 12 and 16.

Digital Radio

There are four main over-the-air digital radio systems in the world, all different from each other in several respects: IBOC, DAB, ISDB-TSB, and DRM.

IBOC

Digital radio broadcasting for local stations in the United States, introduced for regular use in 2003, uses a proprietary system called HD Radio, generically known as IBOC. IBOC stands for *In-Band On-Channel* and is the particular method of digital radio transmission. There are two versions: one for AM broadcasting and one for FM. They offer significant quality improvements over equivalent analog AM and FM transmission, while broadcasting to the same destinations of home, car, and portable receivers. FM IBOC can also carry additional data information services. A key feature of IBOC is that it can share the same band and channel as an analog radio transmitter (hence the name), so no additional radio spectrum space is needed for a radio station to add an IBOC digital service.

We cover IBOC in more detail in Chapters 13 and 16.

DAB

Digital radio for national and some local services outside the United States—in Europe, Canada, and elsewhere—primarily uses

a system called DAB. First introduced in the United Kingdom in 1995, DAB stands for Digital Audio Broadcasting, which is also known as Eureka 147 and, in the United Kingdom, as Digital Radio. DAB has quality advantages similar to FM IBOC but is fundamentally different in that it is intended for multiprogramming network services. Unlike IBOC, it cannot share a channel with an analog broadcast. Each DAB transmission requires much more RF spectrum since it contains multiple program services, plus data (typically six to eight, depending on quality and the amount of data). This makes it impractical for use by a single radio station. DAB can only be used where suitable frequency bands are available, with channel capacity not allocated to other services. In Europe, it is currently being transmitted using frequencies in the VHF band, and in Canada in the *L-Band* (see explanation of Frequencies, Bands and Channels in Chapter 4). These bands are fully allocated for other purposes in the United States, including broadcasting, land mobile and military communications.

ISDB-TSB

ISDB-TSB stands for Integrated Services Digital Broadcasting–Terrestrial Sound Broadcasting and is the digital radio system developed for Japan, where the first services started in 2003. Like DAB, ISDB-TSB is intended for multiprogram services, and is currently using transmission frequencies in the VHF band. One unique feature of this system is that the digital radio channels are intermingled with ISDB digital television channels in the same band.

DRM

DRM stands for Digital Radio Mondiale, a system developed primarily as a direct replacement for AM broadcasting in the *shortwave* band for international broadcasting, although DRM can also be used in the medium wave and long wave bands. DRM uses the same channel plan as the analog services, and, with some restrictions and changes to the analog service, a DRM broadcast can

possibly share the same channel with an analog station. DRM is a mono (single audio channel) system when used with existing channel allocations, but stereo (two- channel) audio may be possible in the future if wider channels are available. DRM started trial implementations in several countries in 2003.

Satellite Radio

XM and Sirius

There are two similar but competing satellite radio services in the United States: XM Satellite Radio and Sirius Satellite Radio, both licensed as Satellite Digital Audio Radio Services (SDARS). XM and Sirius are subscription services, and each broadcasts more than 100 digital audio channels, intended primarily for reception by car, portable, and fixed receivers. XM uses two high-power *geostationary* satellites (their location in the sky does not change relative to the earth's surface) that transmit with frequencies in the *S-Band* (see explanation of Frequencies, Bands and Channels in Chapter 4). This provides coverage of the complete continental United States and parts of Canada and Mexico. Sirius is similar except that it uses three nonstationary satellites, with more coverage of Canada and Mexico than XM. Both systems use ground-based *repeaters* to fill in many of the gaps where the satellite signals may be blocked.

WorldSpace

WorldSpace Satellite Radio is an international satellite radio service that broadcasts more than 100 digital audio channels, some by subscription and some free of charge, to many countries around the world. There are currently two geostationary satellites covering Africa, the Middle East, most of Asia, and much of Europe. A third satellite is planned for South America, with a fourth for further coverage in Europe. Some WorldSpace channels are also carried on XM Radio in the United States. Transmissions are intended for

reception by portable and fixed receivers, using frequencies in the *L-Band*.

Analog Television

NTSC

In North America, Japan, and some other countries, television has been broadcast for many years using the NTSC system. NTSC stands for National Television System Committee, which developed the original standard. The standard defines the format of the *video* that carries the picture information, and also how the video and audio signals are transmitted. NTSC is broadcast over the air on channels in the VHF and *ultra high frequency* (UHF) bands. NTSC television can also be carried on analog cable and satellite delivery systems. In the United States, NTSC is now being phased out and replaced by ATSC digital television, with a proposed date of 2009 for the end of analog transmissions.

PAL and SECAM

Many countries in Europe, Australia, and other parts of the world use a color television system called PAL. The underlying technologies used are the same as NTSC, but the color coding and picture structure is different. PAL stands for Phase Alternating Line, which refers to the way the color information is carried on alternating lines. SECAM is another color television system used for transmission in France, Russia, and a few other countries. SECAM stands for the French words Sequential Couleur avec Mémoire, which refer to the way the color information is sent sequentially and stored from one line to the next. PAL television signals are transmitted in a similar way to NTSC, but the size of the RF channel is different; the SECAM system has several differences from both NTSC and PAL.

We cover PAL and SECAM in more detail in Chapter 5, and NTSC in more detail in Chapters 5, 14, and 16.

Digital Television

Over-the-air digital television, DTV, is also referred to as Digital Terrestrial Television Broadcasting or DTTB. There are three main DTV systems in the world, all with significant differences: ATSC, DVB-T, and ISDB-T. China is in the process of developing its own system but, at the time of writing this book, details have not yet been finalized.

ATSC

ATSC stands for Advanced Television Systems Committee and is the DTV standard for the United States, where DTV broadcasting started in 1996. ATSC has also been adopted by Canada, Mexico, and Korea, and is being considered by some other countries. The ATSC system allows transmission of both *standard definition* (SD) and *high definition* (HD or HDTV) program services, with capabilities including widescreen *16:9 aspect ratio* pictures, *surround sound* audio, *electronic program guide*, *multicasting*, and *datacasting*. ATSC DTV is transmitted over the air in the same VHF and UHF bands as NTSC television, using vacant channels in the NTSC channel allocation plan for the country. Cable television systems also carry DTV programs produced for ATSC transmission, but do not actually use the transmission part of the ATSC standard.

We cover ATSC in more detail in Chapters 6, 15, and 16.

DVB-T

Terrestrial DTV in Europe, Australia, and many other countries uses the DVB-T standard, which stands for Digital Video Broadcasting–Terrestrial. DVB-T allows transmission of both SD and HD programs, and most of its capabilities are generally similar to ATSC. The particular picture formats used, however, are usually based on the analog television system used in the relevant country. Currently, most countries using DVB-T, apart from Australia, do

not transmit in high definition, but Europe is now considering the possibility of adding HD services.

Like ATSC, DVB-T is transmitted over the air in the VHF and UHF television bands. The main difference from ATSC, apart from the picture formats used, is in the method of transmission. ATSC uses a modulation system called 8-VSB, whereas DVB-T uses COFDM with QAM or QPSK modulation (all of these terms are explained in later chapters). As in the United States, DTV services will eventually replace analog television broadcasting.

ISDB-T

Japan uses ISDB-T, the Integrated Services Digital Broadcasting–Terrestrial standard, to broadcast both SD and HD programs in the VHF and UHF television bands. Modulation and other transmission arrangements have some similarities to DVB-T, but the system uses *data segments* in the transmitted signal to provide more flexible multiprogram arrangements for different services and reception conditions.

Satellite Television

Medium- and Low-Power Services

Many television services are distributed in the United States and elsewhere using medium- and low-power geostationary satellites in the C and Ku-Bands (explained in Chapter 4), some with analog and some with digital transmissions. Although many of these are intended for professional users (e.g., distribution to cable television headends or to broadcast stations), some can be received by consumers using large satellite dishes, typically 6 to 10 feet in diameter. These are sometimes known as "big ugly dishes" (BUDs). Some channels are transmitted *in the clear* and are free of charge, whereas others are *encrypted* and require a subscription to allow them to be viewed. Many network feeds are carried but few, if any, individual broadcast stations have their programs distributed in this way.

Digital Satellite Broadcasting

In the United States, direct broadcasting by satellite (DBS) digital television services to the home, also known as direct to home (DTH), are provided by several operators (at this time, the main ones are DirecTV and Dish Network). They use a small number of high-power geostationary satellites to provide several hundred subscription channels, including both SD and HD, and carry many local broadcast station channels. These DBS services use transmissions in the Ku-Band that can be received over most of the United States with a small 18 to 24 inch diameter dish.

There are numerous DBS service providers in other parts of the world. Key features are the capability to cover very large areas—many countries or even a continent—from one satellite, generally with capacity for large numbers of program channels. Services in Europe and some other countries use the DVB-S (Digital Video Broadcasting–Satellite) standard, and Japan uses ISDB-S (Integrated Services Digital Broadcasting–Satellite).

In Japan, some analog television services have been transmitted using high-power satellites. These services are being phased out in favor of digital DBS.

Cable Television

Cable television systems provided by multiple service operators (MSOs) distribute large numbers of television and audio program channels over networks of cables spanning urban and suburban areas. They do not usually cover large rural areas due to the greater distances between homes. Such services carry a subscription fee and always carry program services from all or most of the broadcast stations in the area, as well as numerous other channels.

Analog Cable

Traditional analog cable carries television channels at *radio frequency* (RF) on one or two cables connected into the home, using

similar bands as over-the-air broadcast television, but with slightly different channels and a wider range of frequencies. In the United States, apart from the channel allocations, the cable television signal is basically identical to NTSC broadcast over-the-air.

Digital Cable

Digital cable services can be carried on the same cable as analog, using different channel allocations for the analog and digital signals. In the United States, digital cable carries SD and HD DTV programs produced for ATSC transmission, but the modulation system used is *quadrature amplitude modulation* (QAM), which is different from the over-the-air standard. Both DVB and ISDB have digital cable variants of their DTV standards. Services in Europe and some other countries use the DVB-C (Digital Video Broadcasting–Cable) standard, and Japan uses ISDB-C (Integrated Services Digital Broadcasting–Cable).

Groups and Networks

Terrestrial Broadcasting

Most large towns in the United States have at least one or two local AM or FM radio stations and one or more television stations. Large cities usually have many more. Some of these stations are individually owned, but many belong to station groups that also own other stations, in some cases many hundreds. Some stations, known as "O and Os" (owned and operated), are owned by the broadcast networks themselves.

The major television networks in the U.S. are ABC, CBS, Fox, NBC, and the Public Broadcasting Service, but there are others. The major radio networks are ABC Radio, American Urban Radio, AP Radio, CBS, Jones Radio, UPI Radio, USA Radio, Westwood One, and the public broadcasting National Public Radio and Public Radio International, but there are many others. Networks produce programs, often including news services, for distribution to stations that they

own and to other stations in the network, known as *affiliates*. Local radio and TV stations may produce some of their own programming, especially local news and weather, which is slotted in between the network programming. Commercial stations sell their own advertising time, with locally originated advertisements, transmitted in addition to any network-originated advertising they are required to carry.

Some station group owners may produce or originate programming (particularly news-type programs) at a central location and distribute it to their individual stations at remote locations. This arrangement is known as *centralcasting*.

Cable and Satellite

The term network is also often used to describe companies that produce one or more programs for distribution to multiple cable and satellite operators, but not to terrestrial broadcast stations. Examples of cable and satellite networks are CNN (Cable News Network) and HBO (Home Box Office); there are many others.

Internet Radio and Television

With the rise of the Internet in the 1990s, a new distribution medium for radio and television programming developed. *Streaming* technologies make possible the distribution of audio and video over the Internet. Unlike broadcasting, the programming is available only to those with access to the Internet using compatible computer equipment and software.

Service Implications

How and whether broadcasters decide to provide streaming services to Internet customers requires many decisions. Rights management, copyright payments, and control of distribution of copyrighted material are all major factors in what programs and

advertisements can be made available to consumers and how much they must pay to use them. However, it is clear that distribution of streaming audio and video media via the Internet is now a major force in program distribution. It can serve as an alternative distribution medium, provide a value-added service that may add revenue from a given program, and allow distribution beyond traditional borders to the entire world. See Chapter 7 for more details on this topic.