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November 3rd, 1998

Digital Audio Processing
E85.2600, Prof. K. Peacock

Chapter 7 "Art of Digital Audio" Abstract

In Chapter 7, John Watkinson focuses on the method of transferring digital information from a digital audio source to a receiver. The ability to transmit information without any loss in quality is one of the fundamental benefits of digital audio. If samples are sent between two digital machines in the analog realm, the signal must be dithered and requantized to affect the transfer. By sending samples via digital pathways, there should be no loss in information quality. The methods of transmitting digital data include cables and broadcast systems.

Since so much of my time has been devoted to digital recorder technology, I thought I would broaden out my academic scope by taking a closer look at digital audio broadcasting (DAB). Having spent two years working in Boston, I know that at least on radio station in the U.S. (WGBH) is currently transmitting programs over the airwaves in a digital format. Why aren't other radio stations hopping on this digital bandwagon? AM and FM radio formats are truly antiquated systems by today's standards of audio fidelity. Although FM can transmit in stereo and at high levels of sonic quality, FM is still prone to many reception problems, especially when listening on a portable receiver or in a moving vehicle. DAB was designed to overcome the problems which plague FM radio.

One of the main methods by which DAB achieves robust transmission is by reducing its bandwidth. Audio data reduction (presumably similar to types used on MiniDisc or MPEG players) combine with a lower sampling frequency of 32 kHz to help decrease the amount of information necessary for acceptable transmission. With reduced bandwidth, a greater amount of redundancy can be built into the broadcast system and thus protect it from the numerous errors introduced by signals arriving from so many different directions. "Multipath reception" is the term for signals being received from many locations. It is the nature of broadcast that transmissions will reflect off various surfaces (mountains, airplanes, etc.) and also be absorbed by similar obstacles.

To ensure that a broadcast is interpretable at the receiving end, error correction similar to that used in digital recorders is built into the transmissions. The interleaving of transmitted samples is one basic coding technique. Unlike recording interleaving, however, broadcasting distributes the samples over a variety of frequencies instead of over a length of tape. Since impediments to a transmission are usually frequency specific, only parts of a broadcast will be affected by a particular obstacle. For example, odd samples may be transmitted at 30 MHz while even samples are transmitted at 50 MHz. Even if the transmission is completely obstructed at 30 MHz thereby deleting all odd samples, the even samples still remain to reproduce the waveform. As with digital recording, concealment is used to interpret lost interleaved samples. In practice, of course, the interleaving methods for DAB are as similarly complicated as in digital recording.

So far, however, DAB has yet to be fully implemented in the U.S. as compared to its quick acceptance by European nations. One of the main problems with DAB in the U.S., according to Ken Pohlmann, is that it requires transmission over certain reserved frequencies to be most effective. Some of these frequencies include the standard UHF and VHF used for current television broadcasting. DAB could possibly "ride on the back" of these TV frequencies, but supposedly theis procedure would cause a decrease in television transmission quality. Also, the band of super-high frequencies (in the MHz or GHz range) which are most conducive to DAB transmission is currently reserved by the U.S. military for airplane telemetry. Hopefully these political and social barriers to DAB use in America will

be overcome so that we can enjoy the increased fidelity of digital radio broadcasting in the near future.