The BE Guide to HD Radio
All the Basics and More

HD Radio
Innovative Digital Audio Broadcast for the Real World

- Simultaneous broadcast of both conventional analog and digital signals on the same channel
- Uses current frequency—you may even be able to use your current transmitter
- HD Radio digital AM has FM-analog quality
- HD Radio digital FM has near-CD quality
- Provides display of Program Associated Data, station branding and enhanced data services
- Capable of multicasting additional digital audio channels on frequency
- Data tunneling for file transfer

Exploring the possibilities of HD Radio™ is like entering an alternate universe.

Multiple program channels on a single frequency. Text messages on the radio display. File downloads. New ways to make profits. These are just a few HD Radio benefits radically changing the world of radio.

As a digital form of broadcasting, HD Radio has the ability to carry so much more over the allotted spectrum: more radio program channels, more data, more of anything that can be digitized and packaged as content. HD Radio supersizes and personalizes analog radio, giving broadcasters the chance to break into new formats, new platforms and new ways of profiting from the airwaves.

Why HD Radio is Important to You

Think of it: one station on one frequency delivering many program feeds. It's happening now. The first real world, commercial multicasts—multiple digital channel transmissions—in early 2005 used Broadcast Electronics (BE) HD Radio equipment. By multicasting several program feeds, terrestrial radio stations in any given market can approach satellite program variety. A station could have music on one channel, news on another and sports programming on yet another. Or, run three completely different music formats or multiple languages. Or, present variations of the same format targeted to different demographics. Simultaneously, "now playing" text and station branding for readout on the HD Radio receiver can be customized for each of the channels. A small investment in the additional HD Radio equipment required for multicasting can yield big growth in advertising revenue.

Additionally, HD Radio lays the technological foundation for radio receivers to provide data to a car's traffic navigational system or deliver other revenue-generating file transfers.

In the world of terrestrial radio where localism is king and listeners want to hear about their community, all these applications allow the station to be the "hyper-local" source for local information on weather, news, traffic, community events and more.

At the very least, HD Radio will make a big difference in the sound of AM and FM stations. All one has to do is listen to a digital radio tuned to an HD Radio broadcast. Absent are the hisses and pops typical of analog radio; it's the closest you'll get to CD quality on the broadcast dial.

Did we mention that HD Radio fits into the same spectrum as current analog AM and FM broadcasts? Broadcasters do not have to eliminate their analog broadcasts to implement HD Radio, and listeners are not required to buy new receivers, or asked to choose between competing radio services on differing frequencies. HD Radio is broadcast together with today's analog broadcasts within each station's currently licensed broadcast spectrum.

Comparatively inexpensive to implement, HD Radio will mature as a technology at the same rate as its consumer adoption.

Total Radio GUARANTEED

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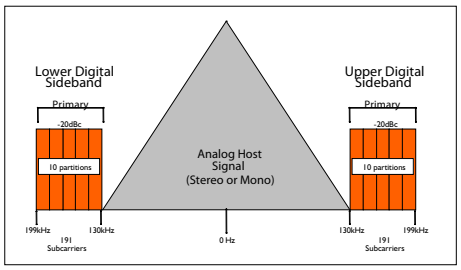
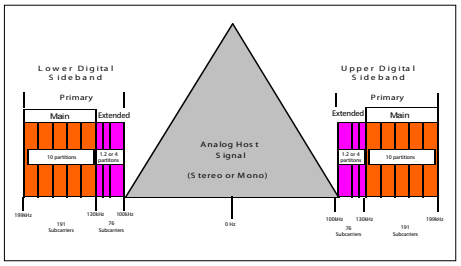
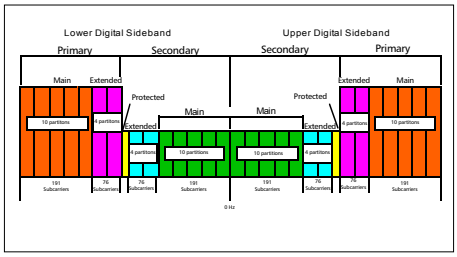


FM HD Radio—Hybrid Mode



FM HD Radio—Extended Hybrid Mode



FM HD Radio—Full Digital Mode

How HD Radio Works

HD Radio is a digital radio standard developed by iBiquity Digital Corporation and recognized by the U.S. Federal Communications Commission (F.C.C.). HD Radio works the same as traditional analog radio transmission, except that the audio is digitally formatted and transmitted as a continuous digital data stream together with the analog waveform signal.

- On the broadcast end, audio is digitally compressed and broadcast by a transmitter designed specifically for HD Radio. Audio is also transmitted in its analog form, as usual. The radio station sends out the analog and digital radio signals on the same broadcast frequency, along with the signals for text data.
- On the listener end, the signals are received and decoded. An HD Radio tuner picks up the digital audio transmission with its accompanying text. Older analog receivers continue to pick up the analog broadcasts.

The transition to digital is a smooth one for both radio stations and their listeners because HD Radio rides on top of the existing analog spectrum without compromising the transmission quality of analog broadcasts. BE manufactures a line of HD Radio transmitters and other HD Radio products that allow a broadcaster to make a seamless transition to digital radio.

Listeners can continue to enjoy their favorite stations on today's analog receivers as well as on the new digital HD Radio receivers coming on the market.

Currently, stations broadcasting in HD Radio are operating in a hybrid mode of both analog and digital transmission in order to reach both analog and digital receivers. Eventually, as analog receivers are replaced by digital tuners, these broadcasters may be able to turn off their analog signals and use that spectrum for more program channels or data applications.

History of HD Radio

Development of HD Radio began in 1991, when three major U. S. broadcasting companies joined together with the goal of creating a digital radio standard. In the decade that followed, a variety of research initiatives emerged. In 2000, broadcasters and technology development companies consolidated their efforts, forming iBiquity Digital Corporation.

The U.S. Federal Communications Commission (F.C.C.) adopted the In-Band On-Channel (IBOC) HD Radio technology from iBiquity Digital as the sole digital standard for U.S. radio in 2002, and soon after BE began shipping a line of HD Radio transmission products that met the challenges of introducing digital into a mostly analog facility.

Within two years, HD Radio was available to listeners in the largest U.S. radio markets. Today, millions of people in the U.S. live and work within HD Radio reception areas.

When the data question came into play, BE worked with the industry to come up with a solution that spanned the studio and transmitter sites, as well as involving outside data services providers. Then, when multicasting was added to the list of HD Radio possibilities, BE again tested and refined the development of new technology to make it happen. Broadcast Electronics was the first manufacturer to offer a complete line of data products and an HD Radio data importer with the capability of allocating channel bandwidth for multiple program services.

BE HD Radio equipment is being used in all major and many small U.S. radio markets, by the country's large and small broadcast groups, as well as by stations outside the U.S. As HD Radio grows, these broadcasters have the confidence that their BE systems will grow with it. All BE HD Radio products come with BE's Total Radio™ guarantee, ensuring product compatibility with whatever the future holds for HD Radio.

Benefits to Both Broadcasters and Listeners

Broadcasters who have installed BE's HD Radio equipment on their AMs report FM stereo sound quality. FM broadcasters who have implemented BE HD Radio equipment report program reception at almost CD quality levels. Digital transmission also eliminates the pops and hisses heard on analog channels.

Many BE broadcasters believe HD Radio's quality will do a lot to restore listenership to the broadcast band. HD Radio may even return music programs to the AM band. But more important, these broadcasters view the digital nature of HD Radio as having important and useful benefits in the local markets they serve, whether they are large cities or small towns. Stations competing against other audio entertainment and information delivery systems can direct their programming to special audiences, whether it's a local ethnical group or a particular demographic previously unattainable. They can offer new ways to communicate with their listeners, whether it's running out text of an advertiser's telephone number or on-radio emergency traffic and weather alerts. And, in doing so, they can realize ways to make money.

HD Radio gives you more business opportunities for your radio station: a main program channel available on both analog and digital receivers that serves your largest audience, plus new channels and data services aimed at new listeners and advertisers.

Broadcasters are Supporting HD Radio

Radio conglomerates, chipmakers and receiver manufacturers are all behind HD Radio. Dozens of U.S. broadcasters are installing HD Radio transmission systems every month, and thousands of other stations have committed to convert to HD Radio in the next few years. BE has been the leader in delivering HD Radio systems to several other countries. Government regulatory authorities and broadcast associations around the world have gained a growing appreciation of HD Radio over other digital audio broadcast methods.

For listeners, some luxury-brand car makers will begin delivering HD Radio receivers before the end of 2005. Consumers can expect to see HD Radio receivers in many more auto models in the next few years. HD Radio auto receivers that can be installed after the car is purchased are already for sale in stores around the U.S. HD Radio tabletop models for the home and office can also be purchased now. As with any growing consumer electronics product category, we can expect HD Radio receivers to have more features at lower prices over time.

FMi 703

New HD Radio Features and Applications

FM Multicast Capability

FM broadcasters can expect to multicast— the transmission of multiple program channels—several supplemental channels of unique programming over HD Radio. Since these channels ride on top of the analog station's licensed channel, no additional spectrum is required. This makes multicasting an appealing option for broadcasters who would like to offer new programming but until now were limited by the availability of licensed frequencies.

Within broadcasters' existing frequency bands, stations that transmit multiple programs can allocate fewer or larger numbers of "digital bits" to each programming channel. Decisions about how their bandwidth is used can be made based on format and audience expectations. Bandwidth may soon be dynamically modifiable during different dayparts (times of the day). This is why bandwidth scaling products such as BE's **IDi 10/20 Data Importer** are such an important part of a broadcaster's system today.

BE multicasting products are being used by stations in order to address an increasingly diverse public market. Reading services for the blind and other public programming now being broadcast as an FM side-channel using a separate frequency and a special receiver are prime candidates for multicasting.

Other stations are adding program channels complementary to the main program service. An example is an oldies format station that multicasts a Beatles-only companion channel or a news station that multicasts its programming in Spanish, plus dedicates another channel to traffic updates. Another station is broadcasting two music channels of the same format, but with one for an older audience and the other for a younger demographic.

Several program providers in the U. S. are about to launch services for stations' supplemental channels to ease the implementation of multicasting.

BE's IDi 20 Data Importer can optimize bandwidth for, as an example, a continuous music format and two talk formats which alternate according to the time of day .

FXi 60/250 FM Analog and HD Radio Exciter

XPi 10 HD Radio Data Exporter

ASi 10 AM HD Radio Signal Generator

Data and Text Capability

Stations that have converted their transmission systems to BE HD Radio today can immediately begin transmitting text messages, which will be displayed on HD Radio-compatible receivers.

How much data can be sent? For AM, enough to display the station name as well as song title and artist on the face of the tuner. Initially, FM broadcasters will be able to send out what's known as Program Associated Data or PAD, typically song title and artist name. Stations will also be able to provide text advertisements and station branding—program name, slogans and other promotional messages—to help build listener loyalty.

In the future, broadcasters may want to add extra information such as album name and year and, artists' biographies to their display broadcasts. Text feeds of breaking news, weather, sports information, traffic updates and more are all possible.

Text broadcasting has very little impact on the operations of the existing studio. Broadcast Electronics' **AudioVAULT** digital audio automation and production system for example, has an internal compact disc "ripper" for downloading song cuts that will also collect and store song title and artist header information. **Now Playing** and **Now Playing Plus**, which are part of **The Radio Experience** software package from BE, can be integrated into the studio system to transmit PAD and other data over both the analog and digital signals.

Web Interface for Now Playing Plus Message Management

BE also provides its customers with Web services that give broadcasters access to news bureaus, weather services and other third-party data service providers for text generation that can be provided as a public service or accompanied by advertising.

Data services enabled by HD Radio are not limited to on-screen text displays. Using a feature called data tunneling that transmits data for special non-broadcast applications, broadcasters can send their listeners the latest traffic information for their in-car navigation systems to help them avoid delays due to accidents or road construction. Future developments could include images, such as album art and other file-based services, as well as the transmission of information services as data streams or file transfer.

More Technology on the Way

Multicast separate channels of audio. Sending out text for on-radio read-outs of the station name, frequency, artist and song title, news, traffic, and weather. All of this is available to broadcasters today. Just as important, HD Radio has built the foundation for even more advanced features and services. BE is working closely with both iBiquity Digital, the developer and licensee of HD Radio, and third-party content providers to bring these innovations to market in ways that minimize impact on station operation and maximize revenue potentials. Systems from BE provide the most advanced and practical implementations of HD Radio technology, so they are the preferred testing platform for these new services.

Frequently Asked Questions

Much of the following has been adapted from iBiquity's online guide for AM and FM broadcasters, The HD Radio Playbook™. Broadcasters are invited to visit www.hdradioplaybook.com for detailed information on marketing, promoting and converting to HD Radio.

What is HD Radio?

HD Radio represents the next generation in AM and FM broadcast technology. HD Radio is the pure digital transmission medium that greatly improves the sound quality of radio broadcasts, virtually eliminating static, hiss, pops and fades and offers data display capabilities on receivers and opens up the opportunity for multicasting: broadcasting multiple high-quality channels on each frequency.

What are the benefits to the listener?

HD Radio allows today's radio listener to continue listening to current analog broadcasts while enjoying the new features of digital broadcasts. They'll be able to drive around your city—behind buildings, inside parking lots, through rugged terrain—without hearing interference and static that they might experience now. AM broadcasts will sound as good as today's FM stereo broadcasts, and FM will sound like CDs. They'll also have access to additional format choices when stations begin multicasting.

What are the benefits to the advertiser?

Your sponsors will now have additional avenues to reach your listeners. Data displays can feature visual information such as addresses, phone numbers or coupon codes; multicast channels can feature more targeted programming and the high-quality, interference free transmission means that your sponsor's message is more likely to be heard!

How does HD Radio work?

HD Radio stations transmit a data stream within the same licensed bandwidth used to transmit their analog broadcasts. This data stream contains the programming for the station, data for the receiver display and any additional multicast programming.

1. Stations will bundle the analog and digital signals with data: weather, traffic, artist name, song title, name of the talk show host, etc. Note that the data stream presents exciting opportunities for sales tie-ins.

2. The digital signal is simultaneously transmitted along with your analog signal.

3. Important to note: Your listeners use their current antenna to receive both your analog signal and your digital HD Radio signal.

4. HD Radio receivers already on the market are designed to sort through reflected (multipath) signals with crystal clear reception.

5. Important to note: The simultaneous transmission of analog and digital is compatible with today's radios and new digital HD Radio receivers.

Do I need a new receiver in order to enjoy HD Radio broadcasts?

Yes, you'll need an HD Radio receiver to enjoy HD Radio broadcasts. This receiver will be able to pull in radio stations broadcasting in digital and analog, and it can display text data sent by the station. A number of high-profile receiver manufacturers are launching and delivering HD Radio receivers.

Does HD Radio increase a station's coverage area?

HD Radio does not increase a station's coverage area but it does greatly improve its reception characteristics within its coverage area. Distortion, static and hiss are virtually eliminated with HD Radio.

Who is developing HD Radio, and who is behind it?

HD Radio is being developed by iBiquity Digital Corporation. iBiquity Digital is partnered with the nation's leading consumer electronics manufacturers, semiconductor companies, automakers, radio equipment manufacturers and data application and service providers. About 15 of the largest U.S. broadcast groups have an equity stake in iBiquity. .

How does HD Radio sound compared to other digital technologies such as MP3 players or satellite radio?

HD Radio uses the latest data technologies to provide audio quality that is superior to MP3 players or satellite radio. Bit for bit, HD Radio sounds twice as good as MP3 or satellite.

4MX 50

Getting Started

Broadcasters do not need a new broadcast frequency to embark on this new digital world, although they will need a way to generate HD Radio signals on their existing licensed frequency. If they plan to multicast several program channels or add text data to HD Radio, they also will need a way to generate, multiplex and transmit these additional services. Broadcasters pay an HD Radio usage fee to iBiquity Digital for use of the technology.

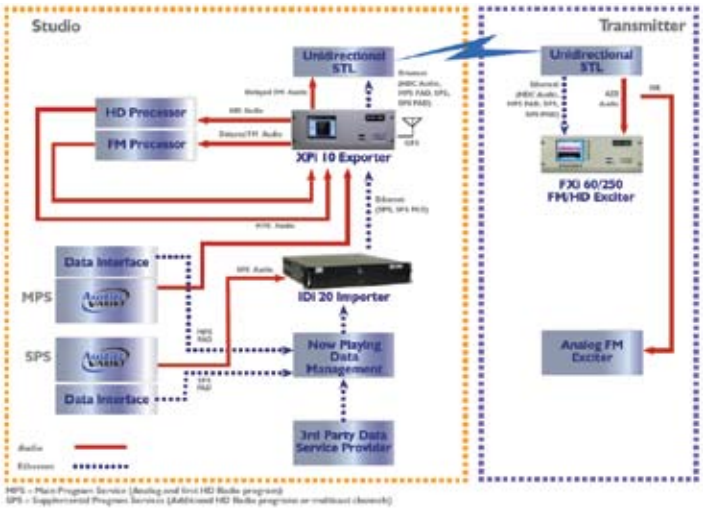
Transmitting HD Radio: For FM stations, power and placement of the system will depend on existing equipment.

Most existing BE AM transmitters will require a simple field modification and, with the addition of BE's ASi 10 AM HD Radio signal generator unit, can begin transmitting HD Radio immediately. For more information on specific products for HD Radio for FM and AM, contact BE.

Multicasting HD Radio: BE HD Radio FM transmission systems in production today are multicast-capable. To begin multicasting two or more program channels, all that's needed is a way to insert the digital radio and data bits into the broadcast signal. BE's IDi 10/20 Data Exporter serves this purpose.

Data and Text over HD Radio: If you have a Broadcast Electronics AudioVAULT studio system and a BE HD Radio transmission system, little else is needed to begin sending "now playing" song title and artist text for display on the HD Radio tuner. BE's AudioVAULT integrated with Now Playing software generates the text from scheduled songs, and BE's transmission system sends out the right text message in real-time with the song's transmission. (Ask a BE rep or your chief engineer about the XPi 10 Data Exporter unit.)

BE also has available its more advanced software package, Now Playing Plus, for adding more text messages and other data applications to the HD Radio broadcast.



HD Radio System Architecture Capable of Multicasting and Data Services

About Broadcast Electronics

Broadcast Electronics™ (BE) is the premier provider of mission-critical solutions for over-the-air and Internet radio. Our products encompass program generation, audio and data management, interfacility transport, and analog and digital transmission. For more than four decades, our pioneering developments have set industry standards for innovation and reliability, while providing broadcasters with new options for operational productivity and income generation.

BE is a complete system HD Radio provider and an iBiquity Digital HD Radio partner manufacturer. BE products for HD Radio include everything from audio and text integration at the studio to analog and digital signal generation at the transmitter site.

For the studio, BE makes its HD Radio-capable AudioVAULT digital audio system, along with Now Playing software for generating text and synchronizing audio and text. The company is the only manufacturer to make a fully integrated text and audio system for all major delivery platforms: HD Radio and analog broadcasts, RDS, and for transmission on the Internet. BE designs and delivers transmitters for analog FM and AM, as well as for HD Radio, at a variety of power levels.

BE's approach to HD Radio operation extends from the studio to the transmitter for unsurpassed reliability and compatibility with emerging and future technologies.

BE is headquartered in Quincy, Illinois and is represented worldwide by our network of local representatives.

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