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Intraplex Products

Application Note

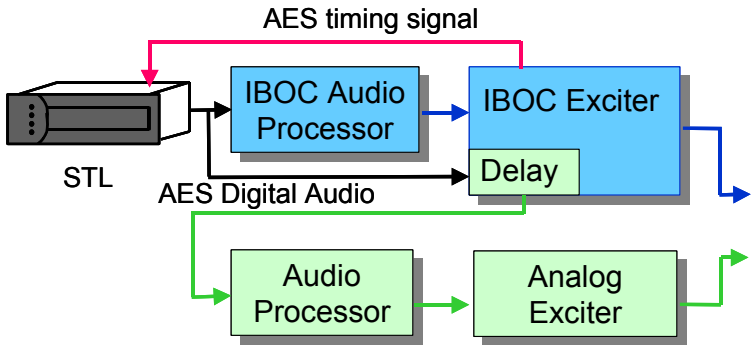
STL Considerations for HD Radio™

Choosing the STL to achieve best results from IBOC for your HD Radio conversion

In order to take full advantage of HD Radio™ conversion the IBOC (in band on channel) digital radio STL should be **digital**, have a **44.1 kHz sampling rate** and be **linear uncompressed**.

The STL is responsible for delivering 20 kHz digital audio to the IBOC transmitter and, simultaneously, a minimum 15 kHz audio feed to the existing analog transmitter. As long as listeners continue to use analog receivers, broadcasters should be unwilling to compromise the analog transmission and risk losing ratings to competing content providers like satellite radio or CDs.

In this hybrid mode of IBOC a single audio stream is split, processed seperately, time aligned and delivered to the IBOC and analog exciters.



Block diagram of IBOC audio signal flow at a typical FM site

STLs should be digital for IBOC
An all-digital air chain is recommended to take full advantage of IBOC conversion. A digital STL can deliver a nearly bit-for-bit copy of the input to the output so performance characteristics of the program audio are unaltered by the STL system.

An end-to-end all-digital system is best. Multiple analog to digital and digital to analog conversions in an air chain increase noise and distortion and reduce dynamic range and should be avoided.

Analog and composite STLs are non-digital paths. These units should be replaced with digital STLs to achieve the best quality HD Radio performance.

The Intraplex STL HD™

STL HD digital STL system is specifically tailored for HD Radio™ conversion. Audio modules with 44.1 kHz sampling provide 20 kHz audio bandwidth. A built-in data channel transports program associated data. An external clock input synchronizes the audio to the IBOC exciter. Both analog and digital audio inputs and outputs are particularly handy for testing and monitoring.

The STL HD transports pure crystal-clear digital audio over any distance and any terrain. It is inherent bi-directional operation provides the ability to transmit STL and TSL backhaul simultaneously over the same digital link.

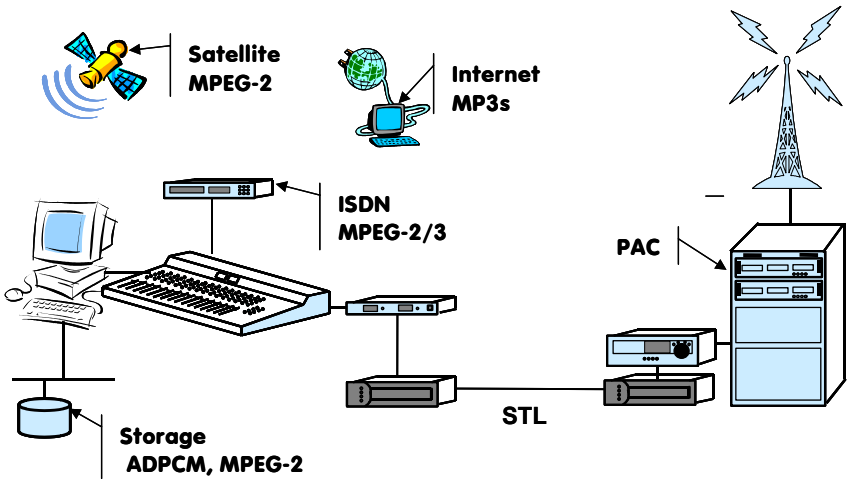
Optional add-on packages include stereo audio for TSL or additional program channels, two-wire voice for off-premise extensions and automatic ring-down phone circuits, four-wire voice for PBX tie lines between offices or FSK remote control, data packages for LAN/WAN, remote mirrored servers and control circuits. These other applications "ride for free" with the program audio increasing communications efficiency.

STL HD uses all types of T1 circuits including leased telco T1, microwave and spread spectrum radio and fiber links.

Intraplex STL HD

44.1 kHz sampling is desirable for FM IBOC
44.1 sampling rate is the native sampling rate of the IBOC transmission. In the STL it provides 20 kHz audio throughput and is a good compromise between audio performance and transport bandwidth. Digital STLs with 32 kHz sampling rates are only capable of 15 kHz audio which will limit the performance of the entire air chain, as in the weakest-link analogy. They should be upgraded or replaced by models having 44.1 kHz sampling for best results.

AM IBOC is limited to 15 kHz audio bandwidth which is achievable with an STL operating at 32 kHz sampling. Therefore existing 32 kHz digital STLs currently in FM use may be redeployed to AM service. Analog STL links should be upgraded to digital and to stereo for AM IBOC.



Sources of audio data compression in the digital air chain

Linear uncompressed STLs are recommended for IBOC
Uncompressed STL systems have been a long time performance favorite of U.S. broadcasters. STLs using audio data compression algorithms can degrade the audio performance. This is especially true when multiple instances of audio data compression are used in tandem through a broadcast air chain.

PAC coding used in the IBOC over the air transmission is a highly compressed psychoacoustic coding algorithm. Often source material has already been coded and decoded upstream using other types of psychoacoustic algorithms. An example of these would be MPEG-2 ISDN remotes, satellite delivered programs, and commercials distributed as MP3s.

The effects of these additional passes of a psychoacoustic algorithm can be compounded by tandem coding with the PAC algorithm. For this reason an uncompressed STL is best. If compression is required choose an ADPCM algorithm such as apt-X rather than an algorithm from the MPEG or AAC family and always use the highest data rates and lowest compression ratios possible.

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