Processing in the Digital Airchain

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The digital airchain has eliminated a number of quality-limiting elements that formerly prevented FM stations from transmitting the best possible audio. In particular, RF STL's were typically the weakest link in the chain, adding both noise and distortion to the signal. Nevertheless, you will only obtain the best results from a digital airchain if you are aware of potential pitfalls.

Orban's Optimod-FM 8200 and 2200 digital processors provide a very tightly peak controlled signal from their AES/EBU digital outputs. If this is accurately passed on to a digital exciter (like Harris' "Digit") through its digital input, then the resulting on-air signal will be overshoot-free and maximally loud. However, if the link between the Optimod and the exciter introduces overshoot, it becomes necessary to remove the overshoot in the exciter's protection limiter. This can only reduce quality, so it should be avoided.

There are several types of digital STLs available. For our purposes, they can be divided into two categories—*compressed* and *uncompressed*. *Compressed* STL use various data reduction schemes to reduce the bit rate of the audio. *All* of these schemes introduce overshoot. In some cases, the overshoot can exceed 3dB, which, if not removed by the exciter's protection limiter, will cause large on-air loudness loss.

A new generation of STLs (like Harris' "CD Link") use advanced modulation schemes to transmit an uncompressed bitstream. If they are not forced to remove high frequency energy from the audio, they will not overshoot and will pass the tightly peak controlled output of the Optimod directly to the FM exciter, maximizing on-air loudness. A 32kHz sample rate provides the best RF spectral efficiency with these STLs. This means that the output of the audio processor driving them must be *strictly bandlimited to 15kHz.* Optimod-FM 8200 and 2200 meet this criterion perfectly. Certain other audio processors don't, and will overshoot when connected through an uncompressed STL with 32kHz sample frequency.

Another pitfall is headroom in the analog-to-digital converter (A/D) ahead of the audio processor. When you adjust operating levels in the program chain, you must be sure that the A/D never clips, even with the highest foreseeable levels out of the console. If the A/D clips, it will cause distortion that can be drastically exaggerated by the downstream processing. Orban's 8200 has a "Quick Setup" procedure that helps you make this adjustment; both the 8200 and 2200 have absolute peak reading INPUT LEVEL meters that clearly show any clipping in the A/D. It's up to the installing engineer to make sure that the processor is set up so that these meters never indicate clipping.

The future of sound broadcasting appears to be digital emission. Although most of the world has adopted the Eureka-147 system (which requires new spectrum), the United States is currently holding out for an "in-band on-channel" system, where the digital signal is shoehorned into the existing FM allocations and shares spectrum with the FM modulation. A similar system has been proposed for AM.

Some of these proposed systems bridge through dropouts in digital reception by cross-fading the receiver to the analog signal. Orban's new Optimod-DAB 6200 is designed to deal with this easily. Its presets are named identically to their counterparts in Optimod-FM 8200 version 3.0, and are designed to have a very similar sound texture. The LESS/MORE gamuts available in each preset track as well. Therefore, by setting an 8200 and 6200 to the same preset and same LESS/MORE setting, one can automatically set up an IBOC system that cross-fades smoothly between analog and digital.

Despite this feature, the 6200 is not just a clone of the 8200. It uses 20kHz audio bandwidth, phase-linear crossovers and non-clipping peak limiters to achieve the highest possible quality in the digital channel, which, unlike FM, does not use pre-emphasis. Further, its non-clipping "look-ahead" peak limiter puts minimal strain on the perceptual coders used in all digital radio systems, maximizing on-air quality for a given bit rate.