Digital Transition Challenges: Cable's Must-Carry Conundrum

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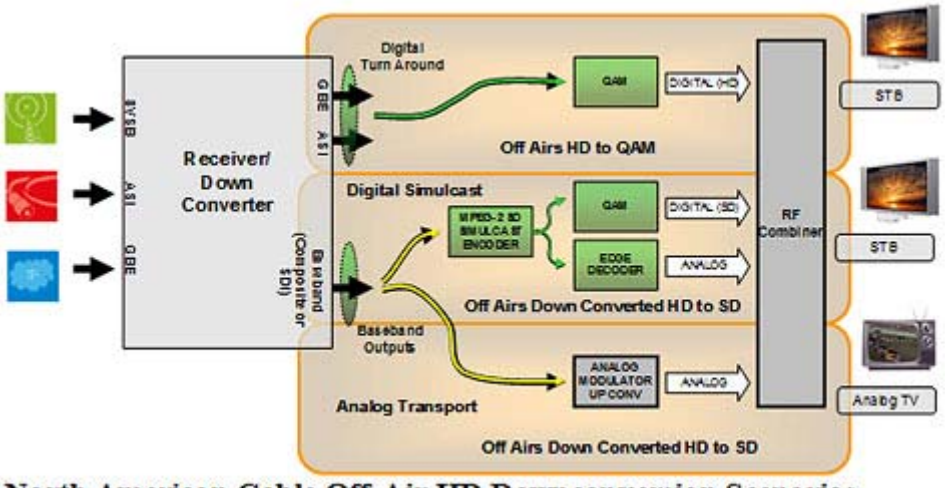
As the February 2009 deadline for transitioning to digital TV broadcasts comes ever nearer, cable operators are preparing for a very different challenge: recreating the analog signal after the DTV shift takes place. Even as broadcasters shut down analog broadcasts to free up spectrum for reuse, as mandated by U.S. regulatory authorities, many cable operators are bound by "must-carry" agreements for providing broadcast channels in both digital and analog NTSC formats through 2012. These operators are in the midst of implementing cost-effective strategies for continued provision of analog service.

For numerous practical and financial reasons, it's simply not feasible to abandon analog altogether, go all-digital and place the burden of downconverting digital ATSC signals to analog NTSC signals on the subscriber's equipment. So, to ensure that those viewers with analog sets can continue to watch "must-carry" channels, cable operators are planning to perform HD downconversion of off-air ATSC broadcasts for delivery in analog form. Downconversion of the digital signal is complicated not only by the different parameters of analog video, requiring renewed attention to the 4:3 aspect ratio and the "area of interest" within converted images, but also by the sheer number of signals requiring conversion and the need to manage attendant metadata correctly.



North American Cable Off-Air HD Downconversion Scenarios

The more than 1,000 discrete off-air feeds around the United States have given rise to a new compatibility and robustness challenge: the reception and downconversion components deployed by a given operator must conform to a signal, whether in the east, west or center of the country. Although the ATSC standard defines the different modes of video encoding across this vast number of sources, the multiple encoding vendors and the stations working with different settings have led to implementation of a massive number and variety of MPEG-2 HD encoding schemes. An operator looking to deploy gear for downconversion, or a vendor looking to propose such a product, must physically test that equipment with actual stream captures from many U.S. locations in order to validate correct functionality.

A Wealth of Challenges

Existing SD set-top box (STB) infrastructures bring new challenges to the mix, such as dual carriage of SCTE 21 and SCTE 20. Operators starting to test real systems have discovered that legacy SD STBs, deployed in mass quantities, may not support critical standards, such as SCTE 21 for closed captioning. SCTE 21 is an enhancement of SCTE 20 metadata carriage, including closed captioning. Because most stations today use SCTE 21, operators with deployed STBs, some supporting both standards and some supporting only SCTE 20, will need to translate the incoming SCTE 21 to SCTE 20 and carry both.

If downconverted video is not processed properly, operators can wind up with the unpopular "postage stamp" look, caused by the presence of both a center cut and letterbox. This problem can occur when ATSC content is upconverted to HD at the station and subsequently downconverted back to NTSC at the operator headend, yielding a viewable image that is smaller than the original ATSC image. Because the issue is caused by unsynchronized station-operator processing of the signal, effective processing with Active Format Description (AFD) support addresses this issue and enables the receiver to determine the area of interest and dynamically apply the appropriate aspect ratio to the video signal.

Audio issues also crop up when multiple conversion processes take place. Operators must ensure that their receivers maintain the integrity of the primary and SAP channels throughout conversion. Likewise, the receiver being implemented should demonstrate reliability in handling and providing closed captions, program guide information, automated measurement of lineups (AMOL) and XDS data for V-Chip.

Crucial Home-Stretch Issues

While cable operators must be aware of all these issues, the key home-stretch concern for engineers - particularly those working in decentralized operations - is the fundamental matter of getting receivers into place and tested with actual signals from their broadcast counterparts. While the cable operator's receiver of choice may have been carefully evaluated and tested in an experimental setting or lab, there is no way the operator can launch real-world tests if local broadcast stations have not yet begun any testing of their over-the-air signals. This issue is a legitimate source of concern because cable operators are dependent on broadcasters to get digital

signals to air in a timely fashion and to resolve network configuration issues in order to support added digital channels.

As cable operators get ready to receive, process, multiplex, decode and perform HD downconversion and aspect ratio adaptation of off-air ATSC broadcasts, another concern is the strength of the 8VSB signals the cable headend receives from fringe-area stations. The problem gets more intense in cases relying on analog repeaters. When the transition to digital-only takes place, stations that decided not to invest in a repeater will lose coverage and, as a result, the cable hub and headends will not receive the same signals as they did prior to the transition. Operators' interests are best served if they look specifically at getting the 8VSB signals into their plants at the highest possible quality. The focus on 8VSB signals is necessary because they will comprise the bulk of the signals being processed, and downconverted to analog, across the United States. Large metropolitan operators have IP-based infrastructures at their disposal and can take advantage of ASI and IP inputs and outputs, but taken as a whole, processing largely will involve 8VSB downconversion to analog NTSC signals.

The larger the market, the greater the volume of channels and signals requiring downconversion. Some receivers handle just one channel, while others can downconvert as many as four channels. In any case, operators are adding significant processing power to their plants, and they must have the means to manage these new systems. Integration of new receivers into the cable plant can be simplified through adoption of open, scalable network management systems, which can support IP and ASI routing to provide flexibility in signal processing, management and delivery.

As the dust settles, cable operators establish successful provision of digital and analog services, and a few years go by, companies that have invested in robust receiver systems will be equipped to adapt their investment to other areas of their business. Receivers that incorporate advanced decoding and powerful stream processing, multiplexing functionality will support grooming and PSIP aggregation of multiple HD and SD programs for digital content distribution, thus providing valuable utility beyond their deployment for operators' current "must-carry" commitment.

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