A System Overview of Advanced Digital Television

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ABSTRACT

Advanced Digital Television is the digital HDTV system developed by the Advanced Television Research Consortium (Sarnoff, Thomson, Philips, NBC and CLI). This paper gives an overview of ADTV by describing its video compression, data transport and digital transmission approaches and explaining how they operate in unison as an effective simulcast HDTV system.

SUMMARY

ADTV consists of video and audio compression, data transport and digital transmission - integrated to operate in unison as an effective simulcast system. ADTV consists of four major subsystems:

- MPEG++ video compression
- MUSICAM audio compression
- Prioritized Data Transport format
- Spectrally-Shaped Quadrature Amplitude Modulation

This paper provides a high-level technical overview of ADTV by explaining the key aspects of these subsystems and their integration into a complete simulcast HDTV system.

MPEG++ Compression

ADTV's MPEG++ compression simultaneously provides high-quality HDTV pictures and forms the basis of ADTV's reliable and robust performance as a simulcast system. MPEG is an ISO standard for compressed video on digital storage media. It has achieved a great degree of worldwide consensus and is an important standard for many emerging computer and consumer electronics applications. ADTV's MPEG++ is the result of ATRC performance and robustness improvements to the basic MPEG approach. To overcome the serious effects of transmission

errors occurring in critically important bits, MPEG++ prioritizes an MPEG codeword stream, dividing it into two separate video data streams:

1) high-priority data that is essential to make viewable pictures
2) standard-priority data that is additionally required for high-quality HDTV pictures.

Prioritized Data Transport

ADTV's Prioritized Data Transport format is specifically designed to carry, synchronize and protect MPEG++ high-priority and standard-priority data through a two-tier (prioritized) transmission system that has two separate data channels. It provides several layers of "safety nets" that allow ADTV receivers to continue decoding useful video data even under very high bit error rate conditions. ADTV's data transport system also offers the flexibility to allocate its data capacity among video, audio and auxiliary data services. The Prioritized Data Transport format includes a special service type byte in each cell header. This means that the mix of video, audio and auxiliary data is completely flexible, enabling broadcasters to address special market needs or to innovate new service opportunities.

Spectrally Shaped Quadrature Amplitude Modulation

ADTV's Spectrally Shaped Quadrature Amplitude Modulation (SS-QAM) provides two-tier simulcast transmission for prioritized MPEG++ data. The SS-QAM signal is the key to simultaneously providing good coverage area, reliable and robust service, immunity to NTSC interference and NTSC-friendly simulcast signals. SS-QAM consists of two separate QAM carriers — a High-Priority carrier and a Standard-Priority carrier. Both carriers provide the high data rate and excellent performance of QAM transmission, and the High-Priority carrier is transmitted at an increased power level. This ensures that the High-Priority carrier will be reliably received over the entire ADTV coverage area, even under severely impaired transmission conditions that might momentarily incapacitate the Standard-priority carrier.

ADTV as a Simulcast System

ADTV's MPEG++, Prioritized Data Transport and SS-QAM subsystems operate in unison, as shown in Figure 1. ADTV delivers full high-quality HDTV pictures to its coverage area, which is defined by the reception of its Standard-Priority data. Extra reliability and robustness is provided by transmitting synchronization and control information, sound, and the important MPEG++ data constituting a viewable picture on the separate High-Priority carrier with additional power. The High-Priority carrier is reliably available over the entire ADTV coverage area, including the fringes, under virtually all transmission conditions. The result of this is that ADTV provides a reliable and robust television service to its audience, over a large coverage area. Thus, MPEG++

maintains MPEG data compatibility within the ADTV system, while making strong provisions for robustness in terrestrial broadcasting.

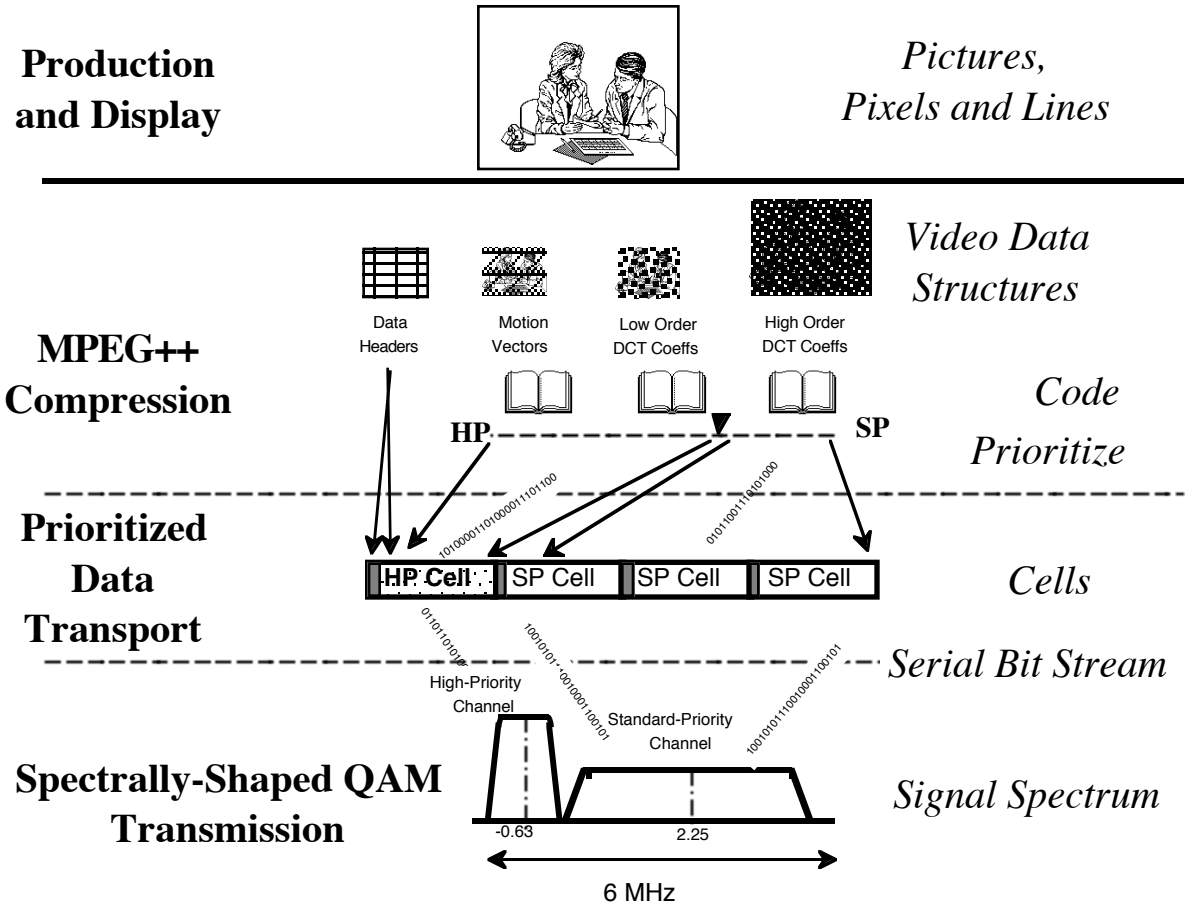

Figure 1 - A conceptual overview of the ADTV system.