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Advanced Television Systems Committee



Advanced Television Systems Committee Standards Work Update

Jerry C. Whitaker, Advanced Television Systems Committee

This article summarizes some of the significant work undertaken by the Advanced Television Systems Committee (ATSC) in the current reporting period relating to technical standards for digital television (DTV). The driving force behind this work has been the ATSC Strategic Plan.

STRATEGIC PLAN—GUIDING NEW WORK ON DTV

In July 2009 the ATSC Board of Directors reviewed and updated the ATSC Strategic Plan, a comprehensive roadmap for future work of the organization that reflects the evolution of technology over the next two to five years. The Board developed the Plan taking into account both the likely progression of technology and the importance of backwards compatibility with existing DTV consumer receivers. Ongoing efforts are focused on comprehensive solutions that enable compelling services and products. Major projects already under way include the following:

- **ATSC Mobile DTV**—Development of a standard to provide services to mobile and hand-held receiving devices.
- **NRT**—Development of a standard for nonrealtime (NRT) delivery of services that leverage the low cost of storage and provide consumers with content they want, when and where they want it.
- **ATSC 2.0**—New services for the conventional fixed DTV receiving environment.

Although not directly related to new technologies, the current state of DTV audio implementation was identified early on in development of the Strategic Plan as an important issue needing further study in coordination with other industry organization. Although the AC-3 Digital Audio Standard (document A/52) has been on the books for many years, implementations in the field have varied, in particular with regard to lip-sync and sound levels. Dealing with audio loudness variations has been a top priority of work within ATSC during the past year.

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MOBILE DTV

ATSC MOBILE DTV

ATSC Mobile DTV is being developed to support a variety of services including free (advertiser-supported) television and interactive services delivered in realtime, subscription-based TV, and file-based content download for playback at a later time. The standard can also be used for transmission of new data broadcasting services.

ATSC Mobile DTV is built around a highly robust transmission system based on vestigial sideband (VSB) modulation, with enhanced error correction and other techniques to improve robustness and

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reduce power consumption in portable receivers, coupled with a flexible and extensible Internet Protocol (IP) based transport system, efficient MPEG AVC (ISO/IEC 14496-10 or ITU H.264) video, and HE AAC v2 audio (ISO/IEC 14496-3) coding. ATSC Mobile DTV services are carried in existing digital broadcast channels along with current DTV services without any adverse impact on legacy receiving equipment.

In addition to live television, the ATSC Mobile DTV system provides a flexible *application framework* to enable new receiver capabilities. Receivers that make use of an optional Internet connection will enable new interactive television services, ranging from simple audience voting to the integration of Internet-based applications and transactions with television content.

Development of the ATSC Mobile DTV system began in May 2007 with the issuance of a request for proposals (RFP). Since that time, enormous progress has been made.

Project Status

At this writing, the ATSC Mobile DTV standardization effort had reached a significant milestone—approval from the Technology and Standards Group (TSG) as a Proposed Standard. Before advancing to this point, the document set describing ATSC Mobile DTV (known as “A/153”) had been a Candidate Standard (CS). Advancement of a document to CS status is an explicit call to those outside of the related specialist group for implementation and technical feedback. This is the phase at which the specialist group is responsible for formally acquiring that experience or at least defining the expectations of implementation.

During the CS phase, considerable input was provided by member organizations. Implementations ranged from complete mobile DTV systems to individual elements of the system. During the seven-month CS period, four updates to the A/153 specification were issued. During this time, comprehensive demonstrations of ATSC Mobile DTV were held at the Consumer Electronics Show and the National Association of Broadcasters Convention, both held in Las Vegas.

During the TSG ballot, comments were received from member companies. Those comments were being addressed as this article went to press. Following completion of the comment resolution process, any substantive changes will be sent to TSG for approval.

The final approval step for the A/153 document set is a ballot of the full ATSC membership. If all goes as expected, the ATSC Mobile DTV standard could be finalized and approved in Q3 or Q4 of this year.

About the Process

Work on the ATSC Mobile DTV system has been done within the Specialist Group on ATSC Mobile DTV (TSG/S4), which is led by Mark Aitken of Sinclair Broadcast Group as Chair and Dan Borowicz of Ion Media as Vice-Chair. TSG/S4 divided the task of developing the standard into four primary elements, with most of the detailed work taking place in those sub-groups, specifically:

S4-1, Physical Layer Group. Led by Michael Doerr of Coherent Logix as Chair and Bruce Franca of MSTV as Vice-Chair; the Physical Layer Group is focusing on the RF, forward-error-correction, and legacy transport elements.

S4-2, Management Layer Group. Led by Rich Chernock of Triveni Digital as Chair and Alan Moskowitz of MobiTV as Vice-Chair, the Management Layer Group is focusing on transport, signaling, announcement, streaming and file delivery, service protection, and content protection.

S4-3, Presentation Layer. Led by Brett Jenkins of ION Media as Chair, the Presentation Layer Group is focusing on audio coding, video coding, and image formats.

S4-4, Systems. Led by Art Allison of NAB as Chair, the Systems Group is focusing on interface and project management issues.

Documentation

In a tip of the hat to the core ATSC DTV Standard—document A/53—the final ATSC Mobile DTV standard will be known as A/153. Like A/53, A/153 is modular in concept, with the specifications for each of the modules contained in separate parts. The major parts are as follows:

- **Part 1**—Mobile/Handheld Digital Television System
- **Part 2**—RF/Transmission System Characteristics
- **Part 3**—Service Multiplex and Transport Subsystem Characteristics
- **Part 4**—Announcement
- **Part 5**—Application Framework
- **Part 6**—Service Protection
- **Part 7**—Video System Characteristics
- **Part 8**—Audio System Characteristics

Part 1 describes the overall ATSC Mobile DTV system and explains the organization of the standard.

These documents remain available on the ATSC website during the ballot process. See www.atsc.org/standards/candidate_standards.php.

New Work on a Scalable Full-Channel Option

Work has begun on an extension of the ATSC Mobile DTV system described in A/153 that enables use of the full channel bandwidth for mobile services. The New Work Item, “Enabling Scalable Full-Channel Use for Mobile DTV Services,” was approved by the ATSC Board of Directors in June and assigned to TSG.

This work is intended to add increased capacity in a scalable manner up to complete channel bandwidth usage. The Scalable Full-Channel Mobile Mode (SFCMM) technology will provide additional operational options for use of A/153. The existing A/153 (Core Mobile Mode, or CMM) requires a minimum of 4.7 Mbits/sec to be transmitted as conventional 8-VSB. SFCMM, on the other hand, could scale capacity up to the total available from the channel.

Requirements and compatibility with existing devices and systems include the following:

- The emitted SFCMM signal must be compatible with the A/153 (CMM) emitted signal so as to allow receivers designed for SFCMM reception to be able to also receive A/153 (CMM) signals.
- A CMM-compatible portion of the emitted signal from a SFCMM system must be capable of being received and decoded on a CMM receiver.



- Like the current A/153 (CMM), emission of the SFCMM must not have any adverse impact on existing and future receivers deployed to receive ATSC A/53 DTV.

Work on the scalable full-channel system is under way on a new sub-group of TSG/S4, known as S4-5. This group is led by Jordan Cookman of Auvitek.

Evolving the ATSC Mobile DTV System

The experts in TSG/S4 recognize that technology will continue to move forward. As such, a mechanism to evolve the ATSC Mobile DTV system over time is important. This capability has been built into the System Configuration Signaling architecture. The goal of this system is to support a configuration change of the protocol stack used by the broadcaster. Key considerations include the following:

- The system must provide information about each piece of content and how it is transmitted.
- A receiving device must be able to determine if it can support such a content before the content is exposed to the user.

As designed, the signaling is multilayer and will support two types of changes:

- **Major Version Change:** A non-backward-compatible level of change.
- **Minor Version Change:** A backward-compatible level of change, provided the major version level remains the same. Decoders/receivers can assume a minor change does not prevent them from rendering content.

NRT

Work is well under way within the ATSC Specialist Group on Data Broadcast (TSG/S13) to develop a comprehensive standard for nonrealtime services. As envisioned in the ATSC Strategic Plan, the increasing desire for “everything-on-demand” has changed customer expectations in the media industry. NRT capabilities are expected to cover a wide spectrum—some are similar to traditional television, such as clip services (news, sports, weather) and long-form content (push video-on-demand movies and personalized TV channels)—whereas others are relatively new to the broadcast space (music distribution, games, interactive applications, and reference material). Some NRT-enabled services may be totally invisible to the viewer (such as in-receiver targeted ad insertion).

Development of a Working Draft standard is under way within a sub-group of TSG/S13, the Specialist Group on Data Broadcast. The group, S13-1, is led by Rich Chernock of Triveni Digital. The NRT document continues to evolve, with key sections close to completion at this writing.

ATSC 2.0

ATSC 2.0 is defined in the ATSC Strategic Plan as a “complete suite of ‘next generation’ services for the conventional fixed DTV receiver viewing environment.” The goal of the ATSC 2.0 effort is to provide a set of compelling system capabilities that can be simply and effectively marketed by retailers to the consumer. Following extensive study by the Planning Committee, under the chairmanship of Graham Jones of NAB, the Board considered recommendations as to what features and capabilities should be included in this new initiative.

At present, the Board envisions ATSC 2.0 (a working title) to include the following:

- NRT services
- Minimal interactive layer
- Advanced codecs
- Support for Internet connectivity (when present)
- Viewer data collection to support audience measurement
- Service protection and DRM
- Triggers and related metadata
- Capability to carry 3D files within NRT

Implementation of ATSC 2.0 is likely to be based on a combination of existing ATSC standards and new or revised ATSC standards. Work continues to define the scope of this project and identify a path forward.

AUDIO ISSUES

As noted in the ATSC Strategic Plan, some areas of DTV audio implementation continue to be problematic, in particular loudness variations and audio synchronization with video. Because these issues can be corrected only throughout the broadcast system with a cross-industry effort, the ATSC established two groups within the Specialist Group on Video and Audio Coding (TSG/S6), led by Pat Waddell of Harmonic, to focus on audio, as follows:

- **Audio Loudness Group** (S6-3), led by Jim Starzynski of NBC Universal.
- **Audio Synchronization Group** (S6-4), led by John Henderson of CEA.

The first order of business for each group was to identify the scope of the problem and what elements in the signal chain from the studio to the receiver in the consumer’s home contribute to it. It was determined that initial work on the synchronization issue, with respect to receivers, should be undertaken by the Consumer Electronics Association (CEA). Accordingly, CEA developed CEB-20, a Recommended Practice on “A/V Synchronization Processing,” which was published in July.

Study within S6-3 on the audio loudness issue led to development of a Recommended Practice on audio loudness.

Loudness

It is important for the DTV system to provide uniform subjective loudness for all audio content. Consumers find it annoying when audio levels vary when changing channels, and when watching a single channel. Dialog, the spoken word, has been identified as the element to which audiences typically adjust their volume. Achieving an approximate level match for average dialog level from all content is a desirable goal. Although the AC-3 audio specifications in ATSC Standard A/52, "Digital Audio Compression (AC-3, E-AC3) Standard," provide syntax that makes this goal achievable, system implementation in the real world has proved more difficult than expected.

The digital audio coding system is greatly different than analog, and it can provide a significant increase in dynamic range with no technical reason for dialog to be encoded near 100%, a common NTSC practice. Even so, there is no assurance that all digital program channels, or all content on a given DTV channel, will have dialog encoded at the same level. Without a uniform loudness level for dialog or the proper use of DTV audio metadata components, there will be inevitable audio-level fluctuations between channels across the dial and between programs and commercials on a single channel.

Addressing the loudness issue encompasses a number of elements, which include mixing, monitoring, and proper encoding of local and network programs, commercials, promos, and other content. The S6-3 study group has explored all facets of DTV loudness, with the goal to identify problem areas and recommend practical solutions.

At this writing, S6-3 and its parent specialist group (TSG/S6) were finalizing a Recommended Practice on "Techniques for Establishing and Maintaining Audio Loudness for Digital Television." The RP provides guidance for broadcasters and content creators. The document recommends production, distribution, and transmission practices needed to provide the highest quality audio soundtracks to the DTV audience. Specifically, the document does the following:

- Provides guidance on production and post-production monitoring techniques
- Recommends methods to effectively control loudness for content delivery or exchange
- Recommends methods to effectively control program-to-interstitial loudness
- Discusses metadata systems and use
- Describes modern dynamic range control
- Provides specific information on loudness management at the boundaries of programs and interstitial content

The RP still has to pass through the ATSC ballot process, but if all goes well, publication is expected in fall 2009.

NEW INITIATIVES

In addition to the work outlined earlier, two new projects have been launched recently within ATSC, focusing on transmission infrastructure and on the Programming Metadata Communication Protocol (PMCP).

Transmission Infrastructure

In an effort to address certain infrastructure issues relating to ATSC Mobile DTV implementation, the ATSC has formed a Specialist Group on Transmission Infrastructure (TSG/S5), led by Art Allison of NAB. TSG/S5 is working to develop a broadcast station infrastructure communications standard and related informational documents (as needed). The work will be coordinated with SMPTE whenever the possibility of overlapping responsibilities warrants such liaison.

Current efforts are focused on developing appropriate documentation to facilitate transport of standardized ATSC Mobile DTV data and metadata across various studio-to-transmitter links (STL). Because of the pending roll-out of ATSC Mobile DTV services, this program is on a fast-track to completion.

PMCP Recommended Practice

Last year the ATSC Planning Committee established a working group to study PMCP implementation issues. The group (PC-7), led by Chris Lennon of Harris, was composed of broadcasters and vendors who were implementing (or planned to implement) dynamic PSIP by way of PMCP interfaces among systems such as listing services, program management, traffic, automation, and PSIP generators. PMCP, ATSC Standard A/76, is the Programming Metadata Communication Protocol. It provides a standardized means of communicating PSIP-related data among the systems that manage it.

The PC-7 Working Group decided that a Recommended Practice on PMCP is needed. The project was subsequently assigned to the Specialist Group on Data Multiplex and Transport (TSG/S8), led by Mark Eyer of Sony. Initial work on this project is being done in the S8-8 sub-group, led by Chris Lennon.

ACTIVE GROUPS AND COMMITTEES

Table 1 lists the current active specialist groups and committees within ATSC. Work in ATSC is open to all with a direct and material interest in the work. If you are interested in participating in any of the ongoing work of the organization, please contact the author. All ATSC standards and recommended practices can be downloaded at no charge from the ATSC website at www.atsc.org.



Group Number	Group Name	Chair
TSG	Technology and Standards Group	John Henderson, CEA
TSG/S4	ATSC Mobile DTV	Mark Aitken, Sinclair
S4-1	Physical Layer	Michael Doerr, Coherent Logix
S4-2	Management Layer	Rich Chernock, Triveni Digital
S4-3	Presentation Layer	Brett Jenkins, Ion Media
S4-4	Systems Layer	Art Allison, NAB
S4-5	Scalable Full Channel Mobile DTV	Jordan Cookman, Auvitek
TSG/S5	Specialist Group on Transmission Infrastructure	Art Allison, NAB
TSG/S6	Video and Audio Coding	Pat Waddell, Harmonic
S6-3	Loudness Issues	Jim Starzynski, NBC Universal
TSG/S8	Data Multiplex/Transport	Mark Eyer, Sony
S8-8	PMCP Recommended Practice AHG	Chris Lennon, Harris
TSG/S9	RF Transmission	Charles Einolf, CBS
TSG/S10	Receivers	John Henderson, CEA
TSG/S13	Data Broadcasting	Mike Dolan, Nielsen
S13-1	NRT Services	Rich Chernock, Triveni Digital
PC	Planning Committee	Graham Jones, NAB
PC-4	ATSC 2.0	
PC-6	Education and Training	Jerry Whitaker, ATSC

Table 1. Active ATSC Specialist Groups and Committees.