Advanced Television Systems

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Abstract

The United States Advanced Television Systems Committee (ATSC) was formed in 1983 to coordinate the development of national technical standards for advanced television systems and to develop proposed national positions for presentation to the Department of State for purposes of developing United States positions with international organizations.

Composed of fifty members, the ATSC has three technical groups, the Technology Group on Improved NTSC, the Technology Group on Enhanced 525-Line Systems, and the Technology Group on High Definition Television.

The paper gives an overview of the activities of the Technology Groups of the ATSC related to advanced television systems. Included are comments on the deliberations of the International Radio Consultative Committee (CCIR) Study Group 11 in October 1985 on the subject of worldwide standards for high definition television studios.

Introduction

There have been two previous national committees for television standards with which I am sure you are familiar. Both committees were called the National Television System Committee (NTSC). The first NTSC served from July 1940 to March 1941 and developed the standards for black and white television used in the United States. The basic parameters specified were 525 lines, 60 fields per second, 2:1 interlace scanning, and 4:3 aspect ratio.

The second NTSC served from January 1950 to February 1953. The committee developed the standards for color television in the United States maintaining the basic parameters established in 1941 for black and white television.

There is now a third committee, the Advanced Television Systems Committee (ATSC). The Joint Committee on Inter-Society Coordination (JCIC), composed of the Electronics Industry Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE), formed this new organization in 1983. The JCIC organizations are charter members of the ATSC.

The ATSC was formed to coordinate the development of United States national technical standards for advanced television systems and to develop proposed national positions for presentation to the Department of State for purposes of developing United States positions with international standards organizations such as the International Radio Consultative Committee (CCIR).

The ATSC is composed of fifty members, all of which are involved in the television industry in the United States. The members are broadcasters, cable companies, program producers, professional and consumer equipment manufacturers, and satellite companies, all well known names in the United States.

The ATSC is organized into three technical groups, the Technology Group on Improved NTSC, the Technology Group on Enhanced 525-Line Systems, and the Technology Group on High Definition Television.

Improved NTSC

The Technology Group on Improved NTSC is addressing the ongoing and evolutionary improvements being made in the present NTSC system involving no incompatible changes to the present radiated signal standards. The system retains the 525-line scanning standard and the 4:3 aspect ratio. Improvements could be made, for example, in home receivers, studio cameras and television plant distribution and processing.

Members interested in composite signal transmission by satellite have suggested that the terms of reference should be expanded to include composite systems not limited to the present radiated signal standards, thus allowing wider bandwidth and a different method for handling sound. A subcommittee was established at the last meeting to address this question.

The Technology Group has had some difficulties in finding their niche. What, precisely, should they be doing. Many topics which would seem to be candidates for discussion would not appear to require a standard since, for example, receiver manufacturers could incorporate such improvements in receiver design without the need for any documented standards. Indeed, any specific manufacturer may prefer such a route in order to protect proprietary interests throughout the development stage. Recently, interest has been raised in combing the luminance and color difference signals prior to NTSC encoding to permit better decoding in a receiver. This interest was prompted by a demonstration at the 1985 SMPTE Fall Conference.

There is a Specialist Group, Compatible Improvements in NTSC Transmission, that is collecting the various proposals for improvements that have been made in the past to determine which proposals are worthy of further study.

Enhanced 525-Line Systems

The second group, the Technology Group on Enhanced 525-Line Systems has the responsibility to develop and recommend voluntary national standards involving improvements through changes in the production, transmission and reception of the presently utilized 525-line signal format. Improvements may be gained by employing wider signal bandwidths for chrominance and luminance signals as well as separate transmission of these signals. As appropriate, multiple-channel sound, potential extensibility of the system, and conditional access through addressing, scrambling and encryption may be considered.

This group has spent most of their time discussing MAC type systems. They wrote a strawman proposal for component systems that incorporated three separate proposed systems. The strawman was written broad enough to include each.

Two of the three proposals have been withdrawn from consideration leaving only the B-MAC system, proposed by Scientific Atlanta. At the next meeting of this group, a proposal will be considered to adopt B-MAC as a standard for DBS transmission in the United States.

The technology group has called for proposals for enhanced 525 systems that would be applicable for terrestrial television broadcasting and for cable.

High Definition Television

The third group is the Technology Group on High Definition Television. This group is to develop and recommend voluntary national standards for high definition television which is characterized by an improvement in both horizontal and vertical resolution of approximately 2:1, a wide aspect ratio of at least 5:3 and multi-channel audio. Improvements may be achieved by using even wider chrominance and luminance bandwidths than enhanced or composite systems and through separate transmission of chrominance and luminance signals.

In March 1985, the group approved a document for transmittal to the Department of State as their proposal for the United States position on a single worldwide high definition television studio standard. The proposal was in the form of a CCIR Draft Recommendation proposing a system utilizing 1125 total lines, 1035 active lines, 60 Hz field rate, 2:1 interlace scanning and 16:9 (or 5 1/3 to 3) aspect ratio. The document also proposed that a sampled representation of the picture have 1920 samples per line for the luminance and half that number for each chrominance signal. Several other parameters, such as sampling frequency, were specified as well. Note that the number of samples per line is directly related to CCIR Recommendation 601 since twice the number of samples specified by CCIR Recommendation 601, 720, adjusted by the ratio of the aspect ratios yields 1920 samples. The aspect ratio for HDTV, 16:9, was widened over that proposed by NHK to permit a shoot and protect scheme to cover any released aspect ratio between 4:3 and 2.35:1.

CCIR Meetings

High definition television is not a new topic in the CCIR, documents have been placed before the CCIR for more than ten years. Decision 58 in 1983 established the Interim Working Party 11/6 with specific terms of reference:

> 1. to encourage administrations to participate in a coordinated way in the study of a high definition television standard for the studio for international program exchange and for broadcasting
>
> 2. to prepare, within the present study period, a Draft Recommendation for a single worldwide high definition television standard for the studio and for international program exchange, to be submitted to Study Group 11
>
> 3. subsequently to prepare a Draft Recommendation on the processing of the HDTV studio signal to adapt it, as may be required, to the specific constraints of transmission, distribution and broadcasting, as these constraints become more clearly identified.

The CCIR study periods are four years in length. The current study period concludes with the meeting of the CCIR Plenary Assembly in May.

Similar decisions were taken by the World Broadcasting Unions, meeting in Algiers in 1983, by recommending:

> 1. that the Broadcasting Unions should encourage their members to carry out studies on the preferred characteristics of a uniform world standard for a high definition television system
>
> 2. that the Broadcasting Unions should coordinate their studies on high definition television systems
>
> 3. that the Broadcasting Unions should concentrate these studies at first on a single HDTV production standard extending them later to broadcast and transmission.

Many different organizations around the world have been conducting studies on high definition systems attempting to meet the challenges noted above. It was with these events in mind that the ATSC, after due consideration, reached its decision in the March 1985 meeting. Members felt that the year 1985 represented a brief window of opportunity for HDTV standards development, fearing that the CCIR would never recommend a worldwide HDTV studio standard if it failed to do so during the current study period.

The ATSC proposal worked its way through the US National Study Group 10 and 11 and was submitted to both the CCIR Interim Working Party 11/6 and to the CCIR Study Group 11 by the United States.

The Interim Working Party met in late September and agreed to submit a Draft Recommendation to Study Group 11 which was to meet two weeks later. The parameters specified in the document were identical to the numbers listed above. It was agreed to list only the basic picture geometry parameters. There are various parameters which must yet be specified, for example, those parameters relating to colorimetry. It is anticipated that this area will become the highest priority of the IWP in future meetings.

It should be pointed out that there was a footnote attached to the Draft Recommendation, stating that some of the 50 Hz countries had reservations about the parameter values and more studies were being conducted urgently.

The process for handling input documents in the Study Group meeting was to first separate the papers into four different categories:

> 1) Characteristics of Monochrome and Color Television Systems, International Exchange of Television Programs, Picture Quality, Monitoring and Measuring;
>
> 2) Additional Television Services;
>
> 3) Planning of Television Broadcasting Networks, Television Receivers and Antennas; and
>
> 4) Digital Methods for Transmission of Television Information.

Each category of documents was assigned, then, to four different Working Groups.

Each Working Group was divided into another four sub groups. The Working Group of interest in this paper, the first group listed above, was divided as follows:

> 1) Television Picture Quality,
>
> 2) Television Systems and Program Exchange,

3) High Definition Television, and

4) Enhanced Television Systems and New Systems.

Within the sub group, papers where then still further divided into drafting groups. Each drafting group was to take the input documents, present them, discuss them, and then write, as necessary, an output document. The output documents were then pushed back up to higher levels, one level at a time, for final approval.

The Draft Recommendation on high definition television went through these processes with great debate at the various levels. After approval at the Working Group level, it was presented to the full Study Group 11 for final approval with a modified footnote. Two countries had, overnight, received instructions that they were to disapprove, thus blocking the document – the documents must be approved unanimously. The Draft Recommendation was resubmitted to the Working Group which modified its form to be a "Proposal for a New Recommendation" rather than a "Draft Recommendation." This procedure, although not considered the norm, has been used before when unanimous approval could not be reached on a document. On the last day of the 17 day meeting, this document, also with a footnote, was approved by Study Group 11.

The final step in the overall process will occur in May at the Plenary Assembly of the CCIR in Yugoslavia. The document will be considered at that time. Our goal is to have the Plenary Assembly approve the document as a CCIR Recommendation.

Why Standardization? Why Worldwide Standardization?

There was an incident in 1904 that truly underscored the need for product standards. A fire alarm went off in a warehouse in Baltimore. Within ten minutes, an explosion spread the fire to neighboring buildings. A telegram was sent to the Washington fire department indicating that help was needed desperately. The Washington firemen made the journey in a record 38 minutes, but, upon arrival, found that their fire hoses would not fit the nozzles on the Baltimore fire hydrants. Several other fire departments made the trip to Baltimore, but they, too, found that they could not use their hoses. Extensive damage was suffered from the 30 hour blaze. There was no shortage of water to fight the fire – only a shortage of hoses that fit the nozzles.

While 35 mm film is the international standard for high quality images and for international program exchange, all the new media outlets are electronic. VCRs, cable systems, and satellite systems are growing at a rapid pace. Most television programs are produced with film, not television. In 1986, it is anticipated that the motion picture producers will receive more revenues from television releases than they will from cinema releases. Many of these programs service a worldwide audience.

When our standards were written for black and white television and color television, the work was done in the context of a local transmission standard to the home. Studios generated the images using the same format as the transmission standard. Today, many complex processes, like digital video effects, are performed using components, not the composite transmission standard. In 1982, CCIR Recommendation 601 established a worldwide agreement on the digital representation of component television signals.

With the proliferation of electronic outlets and the international exchange of television programs by satellite and video tape, the time has arrived for the international television industry to establish a

single high quality worldwide television standard, similar to the quality attained with 35mm film. Such an agreement is within our grasp, but we must do it now because several *defacto* standards from various countries will undoubtedly develop, each based on different perceptions of optimum technology and market place self interest.

While it is always tempting to postpone standards decisions in order to incorporate the very latest idea on the engineers' drawing boards, the problem is that these drawing boards are never blank, there is always one new concept just about to bloom. We all know this, we only have to look at past failures to gain a single standard rather than the more common multiplicity of standards.

Howard Jones of the BBC presented a paper at the International Broadcasting Conference in 1980 which I found very interesting. He was discussing the concept of standardization being too early or too late. He said that often the technical community will argue that standardization is coming too early and not enough technical details are known or understood. He pointed out that, unfortunately, too late often occurs because the political community has made its decision and has become committed to a specific set of parameter values and cannot compromise.

We must be very careful that we do not reach the stage Howard called "too late." Standardizing too late means documenting the chaos of multiple standards. We must not repeat our failure, 20 years ago, when we were unable to agree on a single worldwide color television standard.