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Federal Communications Commission

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Federal Communications Commission  
Washington, D.C. 20554

In the Matter of )  
 )  
Advanced Television Systems ) MM Docket No. 87-268  
and Their Impact Upon the )  
Existing Television Broadcast )  
Service )

**FOURTH REPORT AND ORDER**

**Adopted: December 24, 1996**

**Released: December 27, 1996**

By the Commission: Commissioners Ness and Chong issuing separate statements.

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## Appendix A

## Appendix B

I. Introduction

1. In this, the Fourth Report and Order in our digital television ("DTV") proceeding, we adopt a standard for the transmission of digital television.<sup>1</sup> This standard is a modification of the ATSC<sup>2</sup> DTV Standard proposed in the Fifth Further Notice of Proposed Rule Making and is consistent with a consensus agreement voluntarily developed by a broad cross-section of parties, including the broadcasting, consumer equipment manufacturing and computer industries.<sup>3</sup> As explained below, the Standard we adopt does not include requirements with respect to scanning formats, aspect ratios, and lines of resolution.<sup>4</sup> For clarity, we will refer to this modified standard as the "DTV Standard."

2. This proceeding demonstrates how competing industries, working together, can develop de facto industry selected standards that satisfy the interests of contending parties. We commend these industries for their efforts. We also commend the many dedicated individuals and entities who voluntarily contributed their talents and resources to the development of a world leading digital broadcast television technology.

3. We conclude that adoption of the DTV Standard will serve the public interest. It will bring many benefits to American consumers. By providing a requisite level of certainty to broadcasters, equipment manufacturers and consumers, the benefits of digital broadcasting will be realized more rapidly. The public will receive more choices in video programming with dramatically better visual and aural resolution. In addition, new and innovative services can be

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<sup>1</sup> This standard will apply only to terrestrial digital television broadcasting and not to other video delivery services.

<sup>2</sup> "ATSC" is the Advanced Television Systems Committee. When it adopted the ATSC DTV Standard, the ATSC had 54 members including television networks, motion picture and television program producers, trade associations, television and other electronic equipment manufacturers and segments of the academic community. It was formed by the member organizations of the Joint Committee on InterSociety Coordination ("JCIC") for the purpose of exploring the need for and, where appropriate, to coordinate development of the documentation of ATV systems. The JCIC is composed of the Electronic Industries Association, the Institute of Electrical and Electronics Engineers, the National Association of Broadcasters, the National Cable Television Association, and the Society of Motion Picture and Television Engineers. The membership of the ATSC when it adopted the ATSC DTV Standard is at Appendix C of the Fifth Further Notice of Proposed Rule Making in MM Docket No. 87-268, 11 FCC Rcd 6235, 6269 (1996) ("Fifth Further Notice").

<sup>3</sup> See letter of Broadcasters Caucus, Consumer Electronics Manufacturers Association and Computer Industry Coalition on Advanced Television Service, dated November 26, 1996 ("the Agreement"), at "(1)".

<sup>4</sup> According to the Agreement, id., the "ATSC DTV Standard, including the Table 3 video format constraints, remains unchanged."

made available by the data transmission capabilities of the DTV Standard. Further, the DTV Standard will permit interoperability with computers and encourage innovation and competition.

## II. Background

4. This proceeding began in 1987, when we issued our first inquiry into the potential for advanced television ("ATV") services. Subsequently, over the course of the past decade, we have issued a series of Notices concerning ATV and, based upon the comments received, have made a number of decisions.<sup>5</sup> In the fall of 1987, a few months after initiating this rulemaking proceeding, we established the Advisory Committee on Advanced Television Service ("Advisory Committee" or "ACATS") to provide recommendations concerning technical, economic and public policy issues associated with the introduction of ATV service.<sup>6</sup> Early in the process we decided that no additional spectrum would be allocated for television broadcasting, but that existing broadcasters should be permitted to upgrade their transmission technology so long as the public remains served throughout any transition period.<sup>7</sup> We later decided "that an ATV system that transmits the increased information of an ATV signal in a separate 6 MHz channel independent from an existing NTSC channel will allow for ATV introduction in the most non-disruptive and efficient manner."<sup>8</sup> As the proceeding progressed, all-digital advanced television systems were developed and we began to refer to advanced television as digital television ("DTV") in recognition that, with the development of the technology, it was decided any ATV system was certain to be digital. In February of 1993, the Advisory Committee reported that a digital HDTV system was achievable, but that all four competing digital systems then under consideration would benefit significantly from further development and none would be recommended over the others at that time.<sup>9</sup> In May of 1993, seven companies and institutions that had been proponents of the

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<sup>5</sup> Notice of Inquiry in MM Docket No. 87-268, 2 FCC Rcd 5127 (1987) ("First Inquiry"). See also Tentative Decision and Further Notice of Inquiry in MM Docket No. 87-268, 3 FCC Rcd 6520 (1988) ("Second Inquiry"); First Report and Order in MM Docket No. 87-268, 5 FCC Rcd 5627 (1990) ("First Order"); Notice of Proposed Rule Making in MM Docket No. 87-268, 6 FCC Rcd 7024 (1991) ("Notice"); Second Report and Order/Further Notice of Proposed Rule Making in MM Docket No. 87-268, 7 FCC Rcd 3340 (1992) ("Second Report/Further Notice"); Second Further Notice of Proposed Rule Making in MM Docket No. 87-268, 7 FCC Rcd 5376 (1992) ("Second Further Notice"); Memorandum Opinion and Order/Third Report and Order/Third Further Notice of Proposed Rule Making in MM Docket 87-268, 7 FCC Rcd 6924 (1992) ("Third Report/Further Notice"); Fourth Further Notice of Proposed Rule Making in MM Docket No. 87-268, 10 FCC Rcd 10540 (1995) ("Fourth Further Notice"); Fifth Further Notice, supra; Sixth Further Notice of Proposed Rule Making in MM Docket No. 87-268, 11 FCC Rcd 10968 (1996) ("Sixth Further Notice").

<sup>6</sup> The Advisory Committee, chaired by former FCC Chairman Richard Wiley, consisted of a twenty-five member parent committee, a Steering Committee, and three Subcommittees.

<sup>7</sup> Second Inquiry, supra at 6525 and 6530.

<sup>8</sup> Third Report/Further Notice, supra at 6926; see also First Order, supra at 5627-29.

<sup>9</sup> ATV System Recommendation of the FCC Advisory Committee on Advanced Television Service (February 24, 1993) ("ATV System Recommendation").

four tested digital ATV systems, joined together in a "Grand Alliance"<sup>10</sup> to develop a final digital ATV system for the standard. Over the next two-and-a-half years, that system was developed, extensively tested, and is documented in the ATSC DTV Standard. On November 28, 1995, the Advisory Committee voted to recommend the Commission's adoption of the ATSC DTV Standard.

5. The system described by the ATSC DTV Standard is generally recognized to represent a significant technological breakthrough. It includes discrete subsystem descriptions, or "layers," for video source coding and compression, audio source coding and compression, service multiplex and transport, and RF/transmission. In addition to being able to broadcast one, and under some circumstances two, high definition television ("HDTV") programs, the Standard allows for multiple streams, or "multicasting," of Standard Definition Television ("SDTV") programming at a visual quality better than the current analog signal.<sup>11</sup> Utilizing this Standard, broadcasters can transmit three, four, five, or more such program streams simultaneously.<sup>12</sup> The Standard allows for the broadcast of literally dozens of CD-quality audio signals. It permits the rapid delivery of large amounts of data: an entire edition of the local daily newspaper could be sent, for example, in less than two seconds. Other material, whether it be telephone directories, sports information, stock market updates, information requested concerning certain products featured in commercials, computer software distribution, interactive education materials, or virtually any other type of information access can also be provided. It allows broadcasters to send, video, voice and data simultaneously and to provide a range of services dynamically, switching easily and quickly from one type of service to another. For example, a broadcaster could transmit a news program consisting of four separate, simultaneous SDTV program streams for local news, national news, weather and sports; then transmit an HDTV commercial with embedded data about the product; then transmit a motion picture in an HDTV format simultaneously with unrelated data. As stated by the HDTV Grand Alliance:

The ATSC DTV Standard based on the Grand Alliance system represents by far the world's best digital broadcast television system, with unmatched flexibility and unprecedented ability to incorporate future improvements. Implementing this technology will dramatically increase the technical quality of broadcast television, helping to preserve for consumers and for our democratic society the benefits of

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<sup>10</sup> The members of the HDTV Grand Alliance are AT&T, General Instrument Corporation, Massachusetts Institute of Technology, Philips Electronics North America Corporation, Thomson Consumer Electronics, The David Sarnoff Research Center, and Zenith Electronics Corporation.

<sup>11</sup> High Definition Television offers approximately twice the vertical and horizontal resolution of current NTSC analog broadcasting, which is a picture quality approaching 35 millimeter film, and has sound quality approaching that of a compact disc.

<sup>12</sup> This is made possible through the use of digital compression technology and a packetized transport structure using packet headers and descriptors, which have been described as "a kind of translator to tell all digital devices what type of data is being transmitted." Advisory Committee Final Report and Recommendation, Advisory Committee on Advanced Television Service, November 28, 1995, p. 15.

a vibrant and healthy free over-the-air television service in the future. In addition, deploying this technology will give consumers access to a host of potential information services that can help meet pressing needs in health care, education and other areas....<sup>13</sup>

6. On May 9, 1996, we adopted the Fifth Further Notice, *supra*, recommending adoption of the ATSC DTV Standard, and seeking comment on additional issues. Comments in response to the Fifth Further Notice were received July 11, 1996. Reply comments were received August 12, 1996.

7. Several commenters to the May 9 Fifth Further Notice, including representatives of the computer industry and film makers, objected to adoption of the ATSC DTV Standard. After several efforts to reach consensus among the industry groups failed, the groups came together again. On November 25, 1996, representatives of a broad cross section of the broadcast, computer and receiver manufacturing industries reached an agreement ("the Agreement") and, the following day, submitted it to the Commission.<sup>14</sup> The Agreement stated that the FCC should adopt the voluntary ATSC DTV Standard, except for the video format constraints described in Table 3, including the aspect ratios. The parties also asked that any Report and Order adopting the ATSC DTV Standard, as modified, clarify that data broadcasting<sup>15</sup> is a permitted use under the standard. Finally, the parties agreed that the ATSC DTV Standard, as modified, would provide for extensibility of services and quoted the following language from the ATSC "Guide to the Use of the ATSC Digital Television Standard."

Because there will be possibilities for future services that we cannot anticipate today, it is extremely important that the transport architecture provide open-ended extensibility of services. New elementary bit streams could be handled at the transport layer without hardware modification by assigning new packet IDs ("PIDs") at the transmitter and filtering out these new PIDs in the bit stream at the receiver. Backward compatibility is assured when new bit streams are introduced into the transport system as existing decoders will automatically ignore new PIDs.<sup>16</sup>

On November 27, 1996, the Commission released a Public Notice soliciting comment on the

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<sup>13</sup> Comments of the Digital HDTV Grand Alliance at *i*.

<sup>14</sup> Film maker representatives, although party to the negotiations leading to the agreement, oppose the agreement because it does not require the transmission of motion pictures in their original aspect ratios. See letter of Larry Chernikoff on behalf of the Coalition of Film Makers, dated November 26, 1996.

<sup>15</sup> The parties defined data broadcasting as the transmission of any type of data other than real-time video and audio programming.

<sup>16</sup> ATSC A/54 (Guide to the use of the ATSC Digital Television Standard"), Section 8.1.1.3.

Agreement.<sup>17</sup> Comments were filed December 6, 1996.

### III. Comments<sup>18</sup>

8. Technical Standards for DTV. We received a broad range of comments regarding the Fifth Further Notice about whether and how to adopt technical standards for digital broadcast and the proper role of government in the standard setting process. There is widespread agreement among commenters that selection of a DTV standard should be analyzed in terms of network effects, that is the indirect benefits that accrue to other DTV users when any particular user adopts DTV.<sup>19</sup> Broadcasters, computer interests and cable interests agree that broadcasting is a network product; that issues surrounding selection of a DTV standard are influenced by network effects; and that in order to evaluate the various alternatives, it is important to understand how network effects will operate. While commenters agreed on a common analytical framework, they disagreed on the relative severity of the startup, coordination and potential splintering problems facing digital broadcast television.<sup>20</sup> Startup refers to the situation where everyone would be better off adopting DTV technology but no one has the incentive to move first.<sup>21</sup> Coordination is the collaborative effort by broadcasters, consumer equipment manufacturers, and program producers that is necessary to introduce DTV. Splintering refers to the breakdown of the consensus or agreement to use the DTV Standard.

9. Commenters also disagreed on the availability and effectiveness of market-based mechanisms to solve these problems and to facilitate the goals and objectives established in this proceeding. Broadcasters, equipment manufacturers and some consumer groups contend that DTV has startup, coordination and splintering problems that are more severe than those of other

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<sup>17</sup> Public Notice, "Technical Standard for Digital Television - MM Docket No. 87-268 - The Commission Seeks Comment on Digital TV Standards Agreement," FCC 96-465, 61 Fed. Reg. 64045 (December 3, 1996).

<sup>18</sup> This Section will first summarize the initial positions of parties. The extent to which their positions have changed since their initial filings is summarized in the subsection concerning the Agreement.

<sup>19</sup> In television broadcast systems, one user's adoption of DTV provides no direct benefit to other users, but may yield lagged, indirect benefits through the provision of new or improved programming. See comments of National Cable Television Association, "Declaration of Bruce M. Owen in Response to the Fifth Further Notice of Proposed Rule Making," at 4-11; comments of Broadcasters at 16; reply comments of Strategic Policy Research (on behalf of Cap Cities/ABC Inc., CBS Inc., Fox Television Stations, Inc., Association for Maximum Service Television ("MSTV"), National Association of Broadcasters ("NAB"), and the National Broadcasting Co., Inc.) at 4-8; and comments of the Computer Industry Coalition on Advanced Television, Volume 2, Exhibit D, at 3-4. For a discussion of network effects in broadcast television see Bruce M. Owen and Steven S. Wildman, Video Economics, (Harvard University Press, 1992): 260-313.

<sup>20</sup> See, comments of Broadcasters at 15-23, reply comments of Strategic Policy Research at 2-8, reply comments of National Cable Television Association at 10-17, and reply comments of Computer Industry Coalition on Advanced Television Service at 5-11.

<sup>21</sup> Startup is also referred to as the "chicken and egg problem" or "wait and see behavior."

network industries and that a DTV standard adopted by the Commission is needed to overcome these problems.<sup>22</sup> In contrast, cable and computer interests contend that all sectors of the broadcast industry have significant incentives to reach a consensus on transmission and reception standards without a government mandate.<sup>23</sup>

10. Broadcasters warn that a market-driven selection of a standard would result in barriers to the introduction of DTV if different incompatible systems develop.<sup>24</sup> Under a market-based approach, for example, broadcasters in the same community could select different and incompatible transmission systems so that consumers would only be able to obtain service from those television stations using the system that is compatible with the receiver they have purchased and be denied access to those using another transmission system. Broadcasters maintain that a government-mandated standard is essential to ensure a universally available, advertiser-supported over-the-air digital broadcast service in the future.<sup>25</sup> In contrast, cable interests do not agree that there are unique characteristics or public policy goals attendant to broadcast DTV, or that there would be a market failure unless a mandatory transmission standard is adopted.<sup>26</sup> They argue that the rationale for not adopting transmission standards for DBS, PCS, MMDS, and DARS applies to DTV.<sup>27</sup>

11. There is likewise a range of opinion on the merits of the ATSC DTV Standard. Broadcasters, equipment manufacturers, the Grand Alliance, and ATSC urge the Commission to adopt the complete ATSC DTV Standard.<sup>28</sup> They contend that only a Commission-adopted standard will supply the certainty needed by all parties to undertake the transition to DTV and that the ATSC DTV Standard is the best DTV standard in the world.<sup>29</sup> The Grand Alliance contends that "[t]he system's all-digital layered architecture, its packetized data transport structure, its use of headers and descriptors, its support of multiple picture formats and frame rates with a

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<sup>22</sup> See, e.g., comments of Mitsubishi Consumer Electronics America, Inc., ("MCEA") at 2-3; Philips Electronics North America Corporation ("Philips") at 4-8; comments of Broadcasters at 15-24.

<sup>23</sup> See, e.g., comments of Tele-Communications, Inc. ("TCI") at 6-8; comments of Compaq Computer Corporation at 6-14.

<sup>24</sup> See reply comments of Strategic Policy Research at 6.

<sup>25</sup> Id. at 14.

<sup>26</sup> See reply comments of National Cable Television Association, Inc., at 10-17.

<sup>27</sup> See, e.g., Comments of TCI at 2.

<sup>28</sup> See, e.g., comments of Broadcasters at 34; comments of ATSC at 9; comments of Zenith at 7; comments of Sony at 12; comments of Thomson Consumer Electronics ("Thomson") at 6; comments of Grand Alliance at 9.

<sup>29</sup> See, e.g., comments of Broadcasters at 18-19 and 34; comments of ATSC at 3, 6; Sony Electronics Inc. ("Sony") at 8.

heavy emphasis on progressive scan<sup>30</sup> and square pixels,<sup>31</sup> and its compliance with MPEG-2 international compression and transport standards, give it unprecedented and unmatched interoperability with computers and telecommunications."<sup>32</sup> (Footnotes added.)

12. Computer interests, lead by Computer Industry Coalition on Advanced Television Service ("CICATS"), urge us not to adopt a DTV standard but state that if we decide to the contrary we should only mandate a minimum base-line standard based exclusively on progressive scanning technology.<sup>33</sup> The National Telecommunications and Information Administration ("NTIA") stresses the need for a single mandatory DTV standard but recommends limiting a standard to only those elements necessary to provide certainty, encourage adoption, ensure the opportunity for technological developments, and promote evolution to an all-progressive scan system.<sup>34</sup> NTIA concludes that the best solution would be for interested parties to reach a consensus on disputed issues.<sup>35</sup>

13. While favoring a mandatory DTV standard, most commenting cinematographic and imaging interests (with the significant exception of the Motion Picture Association of America, Inc.<sup>36</sup>) oppose adoption of the ATSC DTV Standard in its current form because of its inclusion of interlaced scanning and other perceived deficiencies, particularly in its video and audio specifications.<sup>37</sup> MPAA, however, supports all aspects of the Standard including its use of both

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<sup>30</sup> In interlaced scanning, which is currently used in NTSC television, odd and even numbered lines of the picture are sent consecutively, as two separate fields. Alternate scans through the picture scan all even numbered, then all odd numbered lines. These two fields are superimposed to create one frame, or complete picture, at the receiver. In progressive scanning, instead of skipping rows as in interlaced scanning, each line is scanned in succession from the top of the picture to the bottom, with a complete image sent in each frame. This type scanning is commonly found in computer displays today.

<sup>31</sup> A pixel is an abbreviation for "picture element," the smallest distinguishable portion of a picture. "Square pixels" means that picture elements are equally spaced in the vertical and horizontal direction. This simplifies computer processing of images. Comments of the ATSC at 20, fn 12.

<sup>32</sup> Comments of HDTV Grand Alliance at 17-18. See also comments of ATSC at 3, and EIA at 9.

<sup>33</sup> Comments of CICATS at 31-37.7

<sup>34</sup> Comments of NTIA at 1-3.

<sup>35</sup> Reply comment of NTIA at 2.

<sup>36</sup> Motion Picture Association of America, Inc. ("MPAA") is a trade association representing seven of the largest U.S. producers, distributors, and exporters of theatrical motion pictures, television programming, and home video entertainment.

<sup>37</sup> See, e.g., Comments of Robert Primes, ASC, at 2 and 13; comments of the Coalition of Film Makers ("Film Makers") at 2, 5-9, and 11; comments of Harold Becker.

interlaced and progressive scanning and its 16:9 aspect ratio.<sup>38</sup> As noted above, the cable industry opposes adoption of mandatory standards. The National Cable Television Association ("NCTA") is not critical of the specific ATSC DTV Standard, but questions whether any standard should be dictated by government.<sup>39</sup> Nevertheless, it recognizes the need for performance standards for controlling interference.<sup>40</sup>

14. Public interest groups generally favor adoption of a single mandatory standard although they differ on what that standard should be.<sup>41</sup> For example, Consumer Federation of America and Media Access Project ("CFA/MAP") believes that the public interest will be served if the Commission adopts a digital television standard that 1) reduces the cost of digital receivers and converters and 2) permits the convergence of video and computer technologies.<sup>42</sup> In contrast, National Consumers League urges adoption because "[i]n the absence of a standard, consumers will be confused. The marketplace will send a number of conflicting messages as new products will diverge in purpose and application. Demand for HDTV and related products will not materialize, and we will not experience the dramatic price reductions normally associated with consumer electronics products. The market will simply not be able to function efficiently, and consumers will literally pay the price."<sup>43</sup> Citizens for HDTV contends that the Commission should adopt the Standard for several reasons, which include "the unique 'open' and 'universal' nature of the Nation's broadcasting system, as distinguished from other media; the appropriate role of government...in adopting and mandating this Standard; the certainty and confidence [it] affords for investments by consumers...; and the importance of the Standard to DTV compatibility with today's NTSC broadcast system and the Commission's planned recapture of part of the TV bands after the transition is completed."<sup>44</sup>

15. Alternatives to Standards. Little comment was received concerning the two alternative approaches to standards specifically mentioned in the Fifth Further Notice: that we authorize use of and prohibit interference to users of the ATSC DTV Standard, or adopt the ATSC DTV Standard for allocation and assignment purposes only. However, some commenters

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<sup>38</sup> Comments of MPAA at 2-8.

<sup>39</sup> Comments of NCTA at 2.

<sup>40</sup> Reply Comments of NCTA at 6-7.

<sup>41</sup> Citizens for HDTV Coalition and the National Consumers League urge adoption of the ATSC DTV Standard while the Benton Foundation ("Benton"), Consumer Federation of America and Media Access Project ("CFA/ MAP") recommend adoption of the CICATS standard. However, CFA/MAP contend that the public interest would be served by encouraging ATSC and CICATS to work out their technological differences.

<sup>42</sup> Comments of CFA/MAP at 1.

<sup>43</sup> Comments of National Consumers League.

<sup>44</sup> Comments of Citizens for HDTV at 6.

propose approaches consistent with these two alternatives. For example, equipment manufacturer Harris argues for mandating at least the RF/transmission layer and basing allotment and assignment principles on it in order to provide protection from objectionable interference.<sup>45</sup> Some, such as the Benton Foundation, urge the Commission to adopt no more than the minimal rules needed to protect spectrum users from interference.<sup>46</sup> Also, NCTA opposes adoption of a design standard and suggests that we use performance standards to control interference.<sup>47</sup> The many parties that support adoption of the complete standard generally believe that these less inclusive options would not provide the certainty necessary for the successful launch of DTV and would not provide an adequate basis for either the design or the purchase of DTV receivers. In addition, the Advanced Television Technology Center ("ATTC") asserts that a DTV table of allotments necessarily will depend on the extent to which DTV causes interference to itself and other signals and resists interference from other signals. Therefore, ATTC contends it is more realistic to mandate the Standard for actual operation than to attempt to predict the impact of hypothetical alternatives.<sup>48</sup> Zenith and others suggest that using the Standard only for allotment and assignment purposes would fail even to guarantee interference protection.<sup>49</sup>

16. The ATSC DTV Standard. Substantial comment was received concerning the merits of, and objections to, the ATSC DTV Standard. Broadcasters, equipment manufacturers, the Grand Alliance, ATSC, and the ATTC praise the Standard as representing the best digital television system in the world and one that is unmatched in terms of flexibility, extendibility, interoperability and headroom for growth.<sup>50</sup> They note it uses primarily progressive scan and square pixels, the latter being used in all HDTV formats. These features, they contend, make it the most computer-compatible digital television system in the world because computer monitors use these features. They argue that the Standard's inclusion of four interlaced formats will benefit broadcasters by allowing for the use of interlaced scan where broadcasters determine it desirable to do so, such as when broadcasting archived material that was filmed in interlaced scan or where interlaced scan may be superior, such as in low-light conditions often accompanying electronic news gathering ("ENG"). Additionally, they assert that the 16:9 wide-screen aspect ratio<sup>51</sup> is internationally recognized and accepted and with "letterboxing"<sup>52</sup> will allow the display

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<sup>45</sup> Reply comment of Harris Corporation at 5.

<sup>46</sup> Comments of Benton Foundation at 3.

<sup>47</sup> Reply Comments of NCTA at 6-7.

<sup>48</sup> Comments of ATTC at 4.

<sup>49</sup> Comments of Zenith Electronics Corp. ("Zenith") at 7.

<sup>50</sup> Comments of the Grand Alliance at 2-3; comments of ATSC at 3-4; comments of ATTC at 5-7; comments of Philips at 14-15; reply comments of Grand Alliance at 15-33; reply comments of ATSC at 15-32.

<sup>51</sup> "Aspect ratio" is the ratio of picture width to picture height.

of motion pictures in their original aspect ratio far better than is permitted by the current 4:3 aspect ratio.

17. Commenters representing computer interests, cinematographers, and some public interest groups generally oppose the standard.<sup>53</sup> Computer interests object to discrete features of the Standard, including the presence of interlaced scanning and the use of non-square pixels in some of the formats, as well as the maximum frame (or "refresh") rate of 60 Hz.<sup>54</sup> These features, when taken together, assertedly hinder the compatibility of the system with computer applications, drive up the cost of receiving equipment, and delay the convergence of computer and television technologies. CICATS recommends that the Commission adopt a standard consisting of a single video format with 480 lines of progressive scanning, a broadcaster determined picture aspect ratio, and the utilization of only square pixel spacing. Such a standard would allow for an enhancement layer that would permit, but not require, the transmission of high definition television by stations equipped to do so. This approach, it contends, would enable all consumers to receive, at a minimum, an SDTV picture on their digital equipment, at equal or better quality and significantly lower costs than under the ATSC DTV Standard. As mentioned above, most cinematographic and imaging interests oppose the inclusion of interlaced scanning as well because of its perceived deficiencies. Public interest groups such as CFA and MAP believe that the ATSC DTV Standard uses too many formats and that the baseline CICATS system will be cheaper, promoting both a more rapid and orderly transition to DTV (and the return of spectrum) and convergence of computer and television technologies.<sup>55</sup> Film interests maintain that the Standard's specification of only two aspect ratios (4:3 and 16:9) will lead to "pan and scan" of wide screen films, cropping significant portions of the original image and damaging the film makers' artistic vision.<sup>56</sup>

18. Supporters of the Standard respond that it is far more computer friendly than any other digital television system in use anywhere in the world, relying as it does primarily on

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<sup>52</sup> "Letterboxing" is a technique in which the aspect ratio of a film is preserved by blacking out portions of the screen, typically at the top and bottom. Material, however, is not cut from the frame. This is different than, so-called, "pan-and-scan" translation of widescreen movies to television in which moves and cuts never intended in the original are introduced to help make the action visible in a narrower frame. In pan-and-scan, less than the complete frame is transmitted and portions of the picture are left out.

<sup>53</sup> See, e.g., comments of CICATS, Coalition of Film Makers, and Consumer Federation of America/Media Access Project. While several film makers object to the Standard, the Motion Picture Association of America supports its adoption by the Commission.

<sup>54</sup> This is the number of frames transmitted per second.

<sup>55</sup> Comments of CFA/MAP at 1, 5 and 6.

<sup>56</sup> Comments of Film Makers Coalition at 5-7.

progressive scan and square pixels.<sup>57</sup> While these commenters assert that current technology prohibits the use of progressive scanning for images of more than 1000 lines in the 6 MHz channel, they concede that an all progressive system would be preferred once possible.<sup>58</sup> In the interim, convergence will not be hampered because the Standard enables consumers to choose the display formats they prefer, as interlaced programs may be displayed on progressive receivers (and vice versa). In any case, supporters of the Standard assert that interlaced source material will continue to be widely used for many years and progressive scan receivers such as those advocated by computer interests will have to include a deinterlacer even if only to display NTSC transmissions during the simulcast period.<sup>59</sup> Moreover, they contend that there are already PC/TV products on the market using analog NTSC technology, which relies on interlace scanning, thus proving that interlaced scanning is not incompatible with computers.<sup>60</sup> Therefore, they do not believe it credible that the introduction of the primarily progressive scan ATSC DTV Standard would somehow stymie further convergence, especially given its flexible design which permits future innovations to be accommodated.

19. Proponents of the Standard challenge as greatly overstated the cost estimates put forward by computer interests. For example, the Grand Alliance states that the cost of a CICATS' single format SDTV receiver would be only \$48.00 less than an ATSC DTV receiver which can decode all 18 formats afforded by the Standard, and that this differential will shrink to only \$3.00 by 2004.<sup>61</sup> With respect to opponents' complaints regarding the Standard's maximum frame rate, the Grand Alliance asserts that if the frame rate is increased to 72 Hz, as proposed by CICATS, more bits would have to be transmitted each second. In order to fit within the Standard's maximum bit rate of approximately 19 Mbps transmitted over a 6 MHz television channel, proponents contend that trade-offs in picture quality would have to be made if the

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<sup>57</sup> See, e.g., comments of the Grand Alliance at 3.

<sup>58</sup> See, e.g., comments of Matsushita Electric Corp. of America at 8. ("There is broad consensus among technical experts that all progressive HDTV production is the goal, the power and flexibility of the ATSC ATV (sic) standard has been crafted to provide it and MECA is investing its resources in achieving that goal.") See also comments of the Grand Alliance at 21. ("[T]he Grand Alliance generally agrees that progressive scan is the *preferred* mode for text and graphics material...")(Emphasis in original.)

<sup>59</sup> Reply comments of the Grand Alliance at 48.

<sup>60</sup> Id.

<sup>61</sup> Reply comments of the Grand Alliance, Appendix A at A-11. Grand Alliance also contends that in 1996 dollars, the incremental parts cost of a high-quality de-interlacer -- a cost which only all-progressive displays would have to bear and which some in the computer industry believe puts them at a competitive disadvantage versus interlaced receivers -- would be \$28 to support a high-end receiver with a high-resolution 720-line progressive scan display, and only \$2 to support a mid-line receiver with a 480-line progressive scan display. Reply Comments of the Grand Alliance at 48.

system were to operate at 72 Hz.<sup>62</sup> Proponents also argue that the specified aspect ratios are appropriate because 16:9 is already accepted worldwide, and 80% of motion pictures are shot at 1.85:1, which readily fits a 16:9 screen with negligible use of letterboxing. Even the widest films can be accommodated by letterboxing only on the order of 25% of the screen height.<sup>63</sup> Adopting the film makers' proposed 2:1 aspect ratio would still require letterboxing for films made in aspect ratios different than 2:1, which today includes most films, and would result in displays, for a given picture height, 12.5% larger in picture area, 30 - 50% heavier and correspondingly more expensive for consumers. Use of the CICATS proposal, which emphasizes SDTV, would further diminish a film maker's product by foregoing consumer access to resolution comparable to that found in a theater.

20. Review or Sunset of Standard. Most commenters addressing the issue advocate either proceeding under our current processes for regulatory change or reviewing the Standard at some definite future time. Broadcasters and equipment manufacturers, for instance, believe that we should consider modifications but should not establish a specific review date or a sunset.<sup>64</sup> They argue that doing so would inject an element of uncertainty into the transition process, discourage consumers, broadcasters and manufacturers from making investments, and be arbitrary because the transition timetable, the timing of production of DTV sets, and the timing of consumer acceptance of DTV sets is unknown at the present time.<sup>65</sup> These parties emphasize the inherent flexibility of the Standard and argue that this mitigates the need for a fixed review or sunset. Sony and Schreiber propose that the Commission name an Advisory Committee, consisting of experts, who would examine the Standard and recommend changes in accordance with the Commission's existing procedures.<sup>66</sup>

21. NTIA urges us to ensure that the industries involved develop a clearly defined plan to promote speedy migration to an all-progressive scan system that moves expeditiously and includes a target date for full transition.<sup>67</sup> NTIA suggests that we periodically review the migration to an all progressive system.

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<sup>62</sup> Reply comments of the Grand Alliance at 57; reply comments of ATSC at 55.

<sup>63</sup> Reply comments of the Grand Alliance at 59; reply comments of ATSC at 57-58.

<sup>64</sup> See, e.g., comments of Broadcasters at 24; comments of Sony at 36.

<sup>65</sup> See, e.g., comments of Broadcasters at 24; comments of Sony at 36; comments of MCEA at 4.

<sup>66</sup> Comments of Sony at 37 ("[T]he Commission could name an industry Advisory Committee comprised of the experts of that day who would examine the standard in light of the real imperatives of the future and, after thoughtful deliberation of the perceived need, recommend changes which would again be subject to public discourse and review.") and Schreiber, Part II at 8 ("A small panel, appointed by the Commission, and composed exclusively of persons with no financial interest in the outcome, would seem appropriate.").

<sup>67</sup> Comments of NTIA at 2-3.

22. Incorporation of Standard into Commission's Rules. Little in the way of comment was submitted on this issue. The Grand Alliance believes that the Commission should incorporate the Standard by reference, as it did in 1995 with an ATSC standard for ghost canceling in NTSC. The Standard, it adds, need not be incorporated in its entirety. It asks that the Commission incorporate by reference ATSC Doc. A/53 ("ATSC Digital Television Standard, 16 Sep 95") and ATSC Doc. A/52 ("ATSC Digital Audio Compression Standard (AC-3), 20 Dec. 95") but only mention and not incorporate ATSC Doc. A/54 ("Guide to the Use of the ATSC Digital Television Standard, 4 Oct 95").

23. Audio Standard. Audio system proponents Digital Theater Systems ("DTS") and Dolby Laboratories sharply differ on which is the superior technology and whether the standard we adopt should specify an audio format. DTS argues that its audio system is superior to the Dolby system embodied in the ATSC DTV Standard and that the standard we adopt should exclude audio formats.<sup>68</sup> Dolby responds that DTS has not demonstrated that its system is superior to the Dolby AC-3 system.<sup>69</sup> Dolby points out that its system has been widely tested, evaluated and accepted by numerous standards setting organizations and for numerous consumer electronics products. Dolby argues that the multiple audio decoding system proposed by DTS would burden products with unnecessary cost and complexity and that, while creating the ATSC DTV Standard document, the ATSC Specialist Group on Digital Services (T3/S3) discussed and rejected the approach suggested by DTS.<sup>70</sup>

24. Licensing Technology. Generally, commenting parties that addressed this issue agree to the reasonable licensing of their relevant patents, including pending patents and intellectual property necessary for the successful construction of DTV equipment.<sup>71</sup> ATSC indicates that it sought and obtained from each member of the Grand Alliance and from Dolby a written commitment to abide by this requirement.<sup>72</sup> ATSC and the other commenting parties suggest that no further Commission action is required.

25. Closed Captioning. Comments that addressed this issue, such as those of the Grand Alliance, ATSC and Zenith, indicate that they have worked closely with the affected communities to provide for closed captioning in the ATSC DTV Standard. They each suggest that the ATSC DTV Standard provides all the capability necessary for broadcasters and receiver manufacturers to provide closed captioning.<sup>73</sup>

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<sup>68</sup> See comments of DTS at 6.

<sup>69</sup> See reply comments of Dolby at 3.

<sup>70</sup> Id. at 5.

<sup>71</sup> See, e.g., comments of Grand Alliance at 29, Dolby at 4, Zenith at 15, Thomson at 16.

<sup>72</sup> See, e.g., comments of ATSC at 29.

<sup>73</sup> See, e.g., comments of Grand Alliance at 31, ATSC at 32, Zenith at 17.

26. November 26, 1996, Agreement. As noted above, some of the commenters have altered their positions since the initial round of comments. After further discussions and negotiations, the parties to the November 26, 1996, Agreement urge us to adopt the modified standard we are calling the DTV Standard. The Grand Alliance and ATSC view it as a way to resolve the controversy that has delayed adoption of a DTV standard.<sup>74</sup> They believe that reliance on voluntary industry standards for the formats to be used for digital television is preferable to the cost of the further delay that would result if we fail to act while the parties remain at an impasse.<sup>75</sup> Full service broadcasters endorse the Agreement for similar reasons. The Association for Maximum Service Television, Inc., ("MSTV") believes the Agreement is a "workable compromise" that will permit the compatible development of progressive technologies.<sup>76</sup> One low power television broadcaster, International Broadcasting Network, objects to the process that resulted in the Agreement and contends that low power television broadcasters were excluded.<sup>77</sup>

27. Equipment manufacturers endorse the Agreement as "an important step toward reducing reliance on Government-mandated standards," that makes it likely that "the industry standard becom[es] the vehicle around which the marketplace organizes."<sup>78</sup> They believe that the Agreement will provide sufficient certainty and that the video formats, although not mandated by the Commission, will remain viable nevertheless because there is a voluntary industry standard in place.<sup>79</sup>

28. Coalition of Film Makers objects to the Agreement for the same reasons it objected to the ATSC DTV Standard in its initial comments.<sup>80</sup> Most other commenters on this issue, except DemoGraFX and Venture, see the Agreement as addressing Film Maker's objections by

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<sup>74</sup> Further Comments of the Digital HDTV Grand Alliance at 2; Further Comments of the Advanced Television Systems Committee at 2.

<sup>75</sup> Further Comments of the Digital HDTV Grand Alliance at 2.

<sup>76</sup> Comments of the Association for Maximum Service Television, Inc. on the Digital Television Standard Agreement at 2.

<sup>77</sup> While not pointing to any specific prejudice it suffered, IBN contends that approval of a Standard during 1996, in accordance with the terms of the Agreement, could prejudice the outcome of issues raised in our Sixth Further Notice, reply comments on which are not due until January 10, 1997.

<sup>78</sup> Comment on the Agreement of General Instrument at 1; see also comments on the Agreement of EIA, Matsushita, Philips, Thomson and Zenith, all of which endorse the agreement.

<sup>79</sup> Comments on the Agreement of Philips Electronics North America Corporation and Thomson Consumer Electronics, Inc., at 2.

<sup>80</sup> Comments of the Coalition of Film Makers (in response to the Public Notice) at 4-6.

dropping any constraints on formats.<sup>81</sup> Beyond that, they believe that the question of how a film is broadcast is not appropriately part of this proceeding, is a contractual matter, and should be left to film owners and broadcasters, bargaining at arm's length. DemoGraFX, while stating that it is pleased with some aspects of the Agreement, recommends additional measures. It urges that the Standard require transmission of films in their original aspect ratio and colorimetry and prohibit cropping; it also objects to interlaced formats remaining in Table 3 of the ATSC DTV Standard. DemoGraFX also urges measures to require frame rates and horizontal resolutions not called for in the Standard and advocates requiring receivers to display films in their original aspect ratios.<sup>82</sup> Venture Technologies Group wants the DemoGraFX system incorporated into the Standard<sup>83</sup> and Digital Imaging General opposes the Agreement which it contends was without the full participation and knowledge of the public.<sup>84</sup>

29. Audio interests remain divided, as they were prior to the Agreement, for essentially the same reasons.<sup>85</sup> Department of Defense does not directly address the Agreement but voices its concern over any use of interlaced scanning and non-square pixels.<sup>86</sup> It strongly favors progressive scanning and square pixels because, it states, they result in operations that are cheaper, faster, and computer compatible for DOD information processing applications. William Schreiber opposes the Agreement on the ground that the process resulting in it may have violated the Federal Advisory Committee Act. He also believes that without mandated formats prospective purchasers will not know what they are buying and that the penetration of digital receivers will be slowed. In the public interest community, Benton Foundation urges quick adoption of the Agreement so that the Commission can turn to public interest standards<sup>87</sup> while the American Foundation for the Blind objects that the ATSC DTV Standard does not designate audio bandwidth capacity for delivering video descriptions, thereby depriving the blind of equal

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<sup>81</sup> See, e.g., Comments on the Agreement of Zenith Electronics Corporation, Electronics Industries Association, CBS, Inc., and the Broadcasters Caucus' "Response to Cinematographers' November 26 Fax to Vice President Gore Concerning DTV Standard."

<sup>82</sup> Comments of DemoGraFX in Response to the Commission Seeking Comments on Digital TV Standards Agreement Released 27 November 1996 at 2-7.

<sup>83</sup> Venture Technologies Group's Comments on the Digital Television Standards Agreement at 3.

<sup>84</sup> Digital Imaging General, DIMAGE Inc, Comments on Fifth Notice of Proposed Rule Making (NPRM) and on Public Notice FCC 96-465 at 2.

<sup>85</sup> See generally Comments on the Agreement of Dolby Laboratories, The Academy for the Advancement of High End Audio, and Widescreen Review.

<sup>86</sup> Comments of the Department of Defense. The Under Secretary of Defense in response to the Public Notice at 1.

<sup>87</sup> Comments of Benton Foundation in response to the Public Notice.

access to video programming.<sup>88</sup>

#### IV. The Digital Television Standard

30. Adoption of the Digital Standard. In the Fifth Further Notice, we listed four objectives regarding the authorization and implementation of a DTV standard: 1) to ensure that all affected parties have sufficient confidence and certainty in order to promote the smooth introduction of a free and universally available digital broadcast television service; 2) to increase the availability of new products and services to consumers through the introduction of digital broadcasting; 3) to ensure that our rules encourage technological innovation and competition; and 4) to minimize regulation and assure that any regulations we do adopt remain in effect no longer than necessary.<sup>89</sup> In addition to these objectives, we stated our intentions to consider how adoption of the DTV Standard would affect other goals enumerated in this proceeding including facilitating the provision of digital video services, spurring a rapid conversion from NTSC to DTV, and recovering the analog broadcast spectrum after conversion.<sup>90</sup>

31. In the Fifth Further Notice, we proposed to adopt the ATSC DTV Standard. In addition to requesting comment on our proposal, we requested comment on alternative approaches to requiring a standard and specifically mentioned two options previously identified by the Commission: 1) authorizing use of a standard and prohibiting interference to it, but not requiring the use of that standard;<sup>91</sup> and 2) adopting a standard for allocation and assignment purposes only.<sup>92</sup> We also sought comment on requiring use of some layers of the ATSC DTV Standard but making others optional. In this Report and Order, we decide to adopt this last alternative and to require the use of all layers of the ATSC DTV Standard, except the video format layer, which will remain optional.

32. Our decision today to adopt the ATSC DTV Standard, as modified, is based on a careful weighing and balancing of the various goals and objectives outlined in this proceeding. We conclude that adopting the DTV Standard will fulfill the four objectives set out in the Fifth Further Notice.<sup>93</sup>

33. First, we conclude that the DTV Standard will serve our goal of ensuring that all

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<sup>88</sup> Comments of the American Foundation for the Blind - December 6, 1996 at 1.

<sup>89</sup> Fifth Further Notice, *supra* at 6236.

<sup>90</sup> Fourth Further Notice, *supra* at 10541.

<sup>91</sup> Second Inquiry, *supra* at 6535.

<sup>92</sup> Id.

<sup>93</sup> By adopting a standard for the transmission of digital television, we are requiring its use by television licensees.

affected parties have sufficient confidence and certainty in order to promote the smooth introduction of a free and universally available digital broadcast television service. As we have recognized before, broadcast television is unique. It is free, available to nearly every American, and many Americans rely on broadcast television programming as a primary source of information and entertainment. Because of these characteristics, we stated that the goals of certainty and reliability take on special significance and strengthen the case for our adoption of a DTV standard.<sup>94</sup> The DTV Standard we adopt today will help ensure that broadcast television remains available to all Americans in the digital era.

34. Many commenters argued that startup, coordination and potential splintering problems are so severe in digital broadcast television that they cannot be adequately solved without the Commission adopting a single DTV standard. We recognize that these problems may be more troublesome for digital broadcast television than cable, DBS, MMDS and other subscription video services which have a greater degree of control over the equipment used by their customers. While we are not convinced that these problems are so severe that they would absolutely preclude us from allowing the market to operate without a set standard, we are concerned that market solutions may result in more than one sustainable transmission standard. Such an outcome might result in compatibility problems and increase the risk that consumer DTV equipment purchased in one city would not work well in another city; that a receiver would not display all the broadcast channels in a city; or that a digital television set purchased one year might not work several years later. Such results would hurt consumers and make it more difficult to preserve a universally available broadcast television service.

35. More than one transmission standard could also cause some consumers and licensees to postpone purchasing DTV equipment, because they do not wish to take the risk of investing in what may soon become obsolete technology, or because they believe better technologies will soon become available. This could slow investment during the early stages of the transition to DTV and, thereby, slow the transition to DTV.

36. In addition, more than one transmission standard would make it more difficult to facilitate an efficient allotment of broadcast channels and protect against interference. Determining interference performance becomes more complicated as the number of transmission systems increases, because each system's interference characteristics must be tested against every other system. This could complicate moving some licensees to new channels following the conversion to DTV and decrease the amount of spectrum recovered.

37. For all of these reasons, we believe that adopting the DTV Standard provides additional certainty that the public policy goals unique to broadcast DTV are realized. Simply protecting a standard, or using a standard for allocation purposes would not address our concerns with "wait-and-see" behavior and preserving a universally available broadcast television service. We also reject the argument that the Agreement is too restrictive and still includes too many

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<sup>94</sup> Fifth Further Notice, supra at 6249.

mandatory aspects of the DTV Standard.<sup>95</sup> As more fully explained below, we believe that the entire DTV Standard is needed to achieve our goals.

38. Second, we conclude that adopting the DTV Standard will increase the availability of new products and services for consumers. The DTV Standard is flexible and extensible and permits data broadcasting as well as new services. With respect to data broadcasting, the DTV Standard provides for multiple 19 Mega (Million) bits per second ("Mbps") digital pipelines directly into the home of every American. While we would anticipate that licensees would, at the very least, continue to provide tomorrow what consumers have come to expect today -- that is, at least one free program per 6 MHz channel -- we also expect to authorize its use to transmit, for example, newspapers, stock market or sports data and, perhaps of greatest significance, software applications directly to computing devices.<sup>96</sup>

39. Third, we conclude that incorporating the DTV Standard into our Rules will encourage technological innovation and competition. In particular, we conclude that our decision not to specify video formats will result in greater choice and diversity of equipment, allow computer equipment and software firms more opportunity to compete by promoting interoperability, and result in greater consumer benefits by allowing an increase in the availability of new products and services. By not adopting video formats, we are allowing consumers to choose which formats are most important to them. Thus, we avoid the possibility that we could inhibit development of services which might, in fact, draw consumers more readily to embrace digital broadcasting and thus, hasten its adoption. By not specifying video formats in this respect we foster competition among those aspects of the technology where we are least able to predict the outcome, choosing instead to rely upon the market and consumer demand.

40. Moreover, the DTV Standard itself is highly extensible. The DTV Standard remains fully digital and incorporates packet identifiers ("PIDs") which provide a large amount of "headroom" for further development without requiring changes to the DTV Standard. We note that ATSC is already at work on technical standards to facilitate data broadcasting with DTV systems. It has formed a new ATSC Specialist Group on Data Broadcasting to develop data broadcasting standards that "will provide the mechanism for distribution of computer files including programs (executable code) and data."<sup>97</sup>

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<sup>95</sup> See, e.g., comments of DemoGraFX and comments of The Academy for the Advancement of High End Audio (both in response to the Public Notice).

<sup>96</sup> By way of example, the transmission of one HDTV or several SDTV video programs may still leave millions of bits per second of system data capacity unused. This "opportunistic data" capability can be used for data transmission at the same time a viewer is watching a program. The extent of any limitations on nonbroadcast data transmission, in terms of the amount of time or system capacity that may be used for data transmission purposes, and the public interest obligations which will attach to DTV licensees irrespective of the use of the system for data transmission are issues that were raised in the Fourth Further Notice, supra, and will be resolved in a subsequent Report and Order.

<sup>97</sup> "ATSC Initiates Development of Data Broadcasting Standards," ATSC, July 22, 1996.

41. Furthermore, there is little risk in such extensibility making obsolete consumer investment in digital receivers or decoders. While not all receivers would be capable of interpreting new PIDs, we are satisfied that, "[b]ackward compatibility is assured when new bit streams are introduced into the transport system as existing decoders will automatically ignore new PIDs"<sup>98</sup> and continue to decode and display the intended material. The resultant conditions would be reminiscent of the introduction of color or stereo sound to the NTSC system. Earlier equipment continued to work unimpaired even as newer equipment provided additional or improved features.

42. Finally, we conclude that adopting this Standard provides for the minimum of regulation needed to provide for a smooth transition. At the same time, we provide the certainty needed for the transition. The DTV Standard eliminates an unnecessary government requirement by not specifying video formats. A key point of contention throughout this proceeding has been the migration to progressive scan transmission formats. While almost all parties agree that, ultimately, progressive scanning is superior to interlaced across a variety of dimensions, the record has been marked by dissent and contradiction about the desirability of allowing both interlaced and progressive scanning, given the over-the-air bandwidth limitation of 6 MHz. Adoption of the DTV Standard, which will allow video formats to be tested and decided by the market, avoids the risk of a mistaken government intervention in the market and is consistent with the deregulatory direction of the Telecommunications Act of 1996.<sup>99</sup>

43. The consensus among the broadcast, set manufacturing and computer industries gives us confidence that the DTV Standard we are adopting does not reflect overreaching or overregulation by government. The Agreement itself recognizes that the ATSC DTV Standard is a "voluntary" one, selected by private parties under the auspices of the ATSC, an American National Standards Institute ("ANSI")-accredited organization.<sup>100</sup> That parties representing major segments of such widely divergent industries have forged a consensus over the appropriate standard at once furthers our confidence in the DTV Standard itself and ameliorates concerns that adoption of a standard might retard competition and innovation.

44. We recognize that although there was substantial praise among members of the broadcasting, equipment manufacturing and computer industries, support for the Agreement was not unanimous. The Coalition of Film Makers was party to the negotiations that resulted in the Agreement, but did not join in its support and opposes the Agreement because it does not require the display of films in the films' original aspect ratios. We note, however, that consistent with the Agreement, we are not adopting Table 3 of the ATSC DTV Standard as part of the DTV Standard, and thus not adopting any particular aspect ratio. This goes far in meeting the Film Makers' initially expressed concerns that by adopting Table 3 we might prevent films from being

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<sup>98</sup> ATSC A/54, Section 8.1.1.3.

<sup>99</sup> See the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996).

<sup>100</sup> The Agreement at (1).

displayed in their original aspect ratio.<sup>101</sup> We are sensitive to the concerns of film makers but note that the standard we adopt will allow pass-through of films in whatever format they are provided to broadcasters by distributors. The DTV Standard we are adopting not only does not impose any impediment to the display of films in their original aspect ratios, but to the extent that resolution of displays is improved and a wide aspect ratio is adopted by consumers, the display of films in their original aspect ratios might be promoted.

45. International Broadcast Network, a low power broadcaster, expressed displeasure with the Agreement for not doing enough to protect their interests.<sup>102</sup> We disagree. As a general matter, it appears to be directed more toward the transition to digital television rather than the transmission standard itself. This portion of the proceeding is concerned with the adoption of such a standard. More wide ranging issues, many of which are of direct concern to LPTV broadcasters, will be dealt with in response to the Fourth and Sixth Further Notices, supra. Additionally, we note that the Commission has previously determined that it would not mandate LPTV service conversion to DTV by a date certain.<sup>103</sup> Accordingly, their interest in the transmission standard is more remote.

46. We are not persuaded by those who contend that not specifying video formats in the DTV Standard will inject uncertainty into the transition process and delay implementation of digital television.<sup>104</sup> As explained above, we believe that by adopting a transmission standard, we are providing the appropriate level of certainty that the digital television market will need to move forward. Our belief in this regard is supported by the fact that the major industries affected by this decision have reached an agreement that video formats need not be part of the DTV Standard. The confidence expressed by these parties gives us reasonable assurance it is not necessary to require video formats. We recognize that some parties contend that the Commission should not rely on the Agreement in considering an appropriate digital standard. As the analysis above shows, we are not relying solely on the fact that these parties reached agreement. Nevertheless, we believe the consensus flows from a sufficiently broad segment of the affected industries to warrant our recognition of the end result and factor it into our analysis.

47. Placing the ATSC DTV Standard in the Commission's Rules. In the Fifth Further Notice, we sought comment on whether, assuming we required use of the ATSC DTV Standard, we should place it into our Rules in its entirety or, instead, should incorporate it by reference.<sup>105</sup>

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<sup>101</sup> The Coalition also argues that the DTV Standard will contain a "pan and scan" feature of MPEG-2. Dec. 6 Comments at 4. However, this feature does not appear to affect or limit the transmitted aspect ratio. Dec. 8 Letter of Bob Rast to Arthur Cole, submitted by the Digital HDTV Grand Alliance.

<sup>102</sup> See International Broadcasting Network's Comments (in response to Public Notice).

<sup>103</sup> Third Report/Further Notice, supra at 6955.

<sup>104</sup> See, e.g., comments of MIT at 1-2; comments of Schreiber at 2-3.

<sup>105</sup> Fifth Further Notice, supra at p. 6250.

We also asked whether, alternatively, we should publish the Standard as an OET technical bulletin rather than putting it in our Rules either in its entirety or by reference. For the foregoing four reasons, we have decided to adopt the DTV Standard. We have also determined that we will incorporate into the Commission's Rules, by reference, ATSC Doc. A/53 ("ATSC Digital Television Standard, 16 Sep 95"), except for Section 5.1.2 ("Compression format constraints") including Table 3, "Compression Format Constraints," as contained in Annex A ("Video Systems Characteristics") and the references to that Table contained in the "Allowed Value" columns of Section 5.1.1 Table 2 and Section 5.1.3 Table 4. We will also incorporate by reference ATSC Doc. A/52 ("ATSC Digital Audio Compression Standard (AC-3), 20 Dec. 95") in its entirety. Incorporation into the Commission's Rules by reference has been done before<sup>106</sup> and, in this matter, is particularly warranted given the 194-page length of the Standard and its easy availability.<sup>107</sup>

48. Review. In the Fifth Further Notice, while proposing adoption of the ATSC DTV Standard, we also expressed our desire "to encourage further innovation by those who have devised the ATSC DTV Standard as well as new entrants."<sup>108</sup> To that end, we set forth three options that arguably could accomplish this goal. The three were: 1) to proceed under our current processes for regulatory evolution and change, which include consideration, as appropriate, of requests from parties to amend our rules or review of the Rules on the Commission's own initiative; 2) to commit ourselves to conduct a proceeding to review the Standard at some future time (either a specific date or upon the happening of an objective event); and 3) to establish a period of time after which the Standard no longer would be required or exclusive (i.e., "sunsetting" it) thereby allowing digital licensees freedom to use any technology that does not interfere with users of the Standard.

49. We believe that in view of the DTV Standard that we are adopting, a sunset is not necessary. Nonetheless, unforeseeable innovations eventually may require modification of this standard. We want to be sure that we do not inadvertently deter experimentation and innovation by adopting the DTV Standard. Our concern is lessened substantially by the broad range of parties who have agreed that deleting the video format constraints will permit experimentation and innovation and eliminate the need for either a sunset or a scheduled review. Moreover, the ATSC has committed to continue to review the ATSC DTV Standard and to implement compatible extensions of, and deviations from, the ATSC DTV Standard that evolve in the future.

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<sup>106</sup> See, e.g., Section 73.682(a)(21)(iv) ("ghost cancelling"), 73.682(c)(3) and 73.681("BTSC stereo sound"), 73.682(a)(14)("circular and elliptical polarization"), and 15.31(a)(6)("intentional and unintentional radiators"). Although they do not specifically incorporate material by reference, the ghost cancelling and stereo sound provisions reference Office of Engineering and Technology Bulletins which, in turn, incorporated ATSC and Broadcast Television Systems Committee ("BTSC") standards and recommendations. The polarization provision references an IEEE Standard and the radiator provision references an ANSI Standard.

<sup>107</sup> The Standard documents can be ordered through the Commission's contract copy service and the full text is available on the Internet at the ATSC site (<http://www.atsc.org>).

<sup>108</sup> Fifth Further Notice, supra at 6251.

We also have adopted a schedule of periodic reviews to monitor the progress of DTV implementation and have requested comment on updating that schedule.<sup>109</sup> We intend to keep abreast of developments and will review our rules as appropriate based upon technological developments and marketplace conditions.

#### V. Audio Standard

50. As indicated by the foregoing, we are adopting ATSC Document A/52 which pertains to audio standards. Although audio standards are not addressed in the Agreement, it implicitly supports adopting ATSC A/52 because it seeks adoption of ATSC DTV Standard A/53. Annex B of the ATSC DTV Standard A/53 includes extensive normative references to ATSC Document A/52. In comments, some parties have suggested that this DTV audio standard should not be adopted as a required audio standard.

51. We are not convinced that the approach suggested by DTS is desirable, so we are adopting the audio portion of ATSC DTV Standard. We note that DTS did not go through the extensive testing and evaluation where the Dolby system prevailed. While claims and testimonials were submitted in comments, there is no supporting, independent testing or analysis to form a basis for determining whether the DTS system represents a substantial improvement. We also note that the suggested changes could delay implementation as affected parties modify the documentation. Also, while there is disagreement about how significant it would be, it does appear that implementing the DTS proposal would involve additional costs.

52. We do not agree that the DTS proposal is consistent with the Agreement on excluding specifications of the video formats. The DTV video will still be coded and compressed as specified in the ATSC DTV Standard, generally required to conform to the MPEG-2 Video Standard. In contrast, the DTS proposal would exclude audio formats, coding and compression specifications. The suggested audio changes to the documentation are significantly more extensive than the accepted video changes. Furthermore, as noted by Dolby, the DTS downloading approach appears to present practical problems either with audio acquisition time delays or inefficient use of the spectrum.

53. Finally, the flexibility and extensibility of the ATSC DTV Standard does allow broadcasters to transmit DTS system audio data as ancillary data that could be recognized and used by suitable receiving equipment. The DTS system could be advanced as a possible subsequent extension to the ATSC standard for providing alternative DTV audio linked to the associated video or independent audio services. Contrary to the view expressed in the December 6, 1996, DTS comments, we believe this is consistent with the spirit expressed in paragraph 3 and Attachment A of the Agreement. Although some of the DTV signal would be devoted to the audio signal specified in the DTV Standard this does provide an avenue for the introduction of a new system that might offer a substantial improvement. A sufficiently superior system has

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<sup>109</sup> See Third Report/Further Notice, *supra* at 6964-6966 and Fourth Further Notice, *supra* at 10548-10549.

an opportunity to succeed in the marketplace. Under the rules we are adopting, such dual audio system transmissions are permitted consistent with the DTV Standard.

#### VI. Licensing Technology

54. In earlier phases of this proceeding we indicated that, in order for DTV to be successfully implemented, the patents on the technology would have to be licensed to other manufacturing companies on reasonable and nondiscriminatory terms.<sup>110</sup> We noted that the system proponents that participated in the Advisory Committee's competitive testing process were required to submit a statement that they would comply with the ANSI patent policies. The proponents agreed to make any relevant patents that they owned available either free of charge or on a reasonable, nondiscriminatory basis and we stated that we intended to condition selection of a DTV system on such commitments.<sup>111</sup> In the Fifth Further Notice, we sought additional comment on whether more detailed information on the specific terms of such patent licensing, how pending patents will be licensed, or any other intellectual property issues should be considered.<sup>112</sup>

55. It appears that licensing of the patents for DTV technology will not be an impediment to the development and deployment of DTV products for broadcasters and consumers. We reiterate that adoption of this standard is premised on reasonable and nondiscriminatory licensing of relevant patents, but believe that greater regulatory involvement is not necessary at this time. We remain committed to this principle and if a future problem is brought to our attention, we will consider it and take appropriate action.

#### VII. Closed Captioning

56. In the Fifth Further Notice, we noted that the requirement contained in Section 305 of the Telecommunications Act of 1996<sup>113</sup> for the Commission to assure that video programming is fully accessible through the provision of closed captions is being examined in MM Docket No. 95-176.<sup>114</sup> We also noted that the ATSC DTV Standard reserves a fixed 9600 bits per second data rate for closed captioning and that we understood an EIA subcommittee was considering the syntax for the data and how to include closed captioning information for multichannel SDTV transmissions. We sought additional comments concerning the ability of DTV to include

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<sup>110</sup> Notice, supra at 7035; Second Report/Further Notice, supra at 3358; and Third Report/Further Notice, supra at 6982.

<sup>111</sup> Third Report/Further Notice, supra at 6983.

<sup>112</sup> Fifth Further Notice, supra at 6261.

<sup>113</sup> Pub. L. No. 104-104, 110 Stat. 56 (1996).

<sup>114</sup> Notice of Inquiry in MM Docket No. 95-176, 11 FCC Rcd 4912 (1995) and Order in MM Docket No. 95-176, 11 FCC Rcd 5783 (1996).

captioning and how the Commission should implement captioning requirements for DTV in the event it does not adopt a mandatory DTV standard.<sup>115</sup>

57. The DTV Standard we are adopting includes the reserved 9600 bits-per-second of data for closed captioning. No comments suggested that this would be insufficient. We conclude that adequate provision has been made to allow closed captioning information to be carried by DTV stations using the standard we are adopting today. We expect the issues of receiver requirements and mandating transmission of closed captioning data will be subjects in a subsequent Report and Order in this proceeding or in MM Docket No. 95-176.

58. On the related topic of video descriptions, as raised in the comments filed by the American Foundation for the Blind in response to the November 26, 1996, Agreement, we note that the audio system of the DTV Standard allows data to be specifically identified as an associated audio service for the visually impaired. In addition, the DTV Standard allows a separate complete audio service that includes video description. However, while the Standard can accommodate video descriptions, unlike closed captioning there is no data capacity reserved exclusively for it. This treatment of video description in the ATSC DTV Standard is consistent with the current regulatory status of the two services. Closed-captioning capability is required by law and regulation while video description is not. In the context of adopting the DTV Standard we are satisfied that it provides a method of including video descriptions. Imposing requirements for video description is an appropriate subject for consideration in MM Docket No. 95-176. If, in the future, video description capability is required, we expect ATSC to consider appropriate changes to the ATSC DTV Standard and we will consider appropriate changes to the rules.

#### VIII. Miscellaneous Matter

59. William Schreiber, in his comments on the Agreement, alleges that the agreement was a result of an "apparent violation of the Federal Advisory Committee Act (FACA) in spirit, if not in letter." Professor Schreiber argues that, since the parties to the agreement met at the urging of the Commission, the "group" constituted an "advisory committee." International Broadcasting Network raises similar concerns in its comments on the Agreement arguing that the "ATSC standard was developed in a closed process which excluded the participation of low power television broadcasters." It is unclear whether International Broadcasting Network is referring to the ACATS process or the recent inter-industry meetings that lead to the Agreement. However, we will consider it to be in reference to the latter because the comment was filed in response to our Public Notice seeking comment only on the Agreement.

60. We disagree with such comments. Section 3(2) of the FACA defines an "advisory committee" subject to the Act as follows:

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<sup>115</sup> Fifth Further Notice, *supra* at 6261.