

Before the
Federal Communications Commission
Washington, D.C. 20554

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In The Matter of]
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Advanced Television Systems]
and Their Impact on the]
Existing Television Broadcast]
Service]]
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Review of the Technical and]
Operating Requirements]
Part 73-E, Television]
Broadcast Stations]]
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Reevaluation of the UHF]
Television Channel and]
Distance Separation]
Requirements of Part 73 of]
the Commission's Rules]]

MM Docket No. 87-268

RM-5811

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Federal Communications Commission
Office of the Secretary

**COMMENTS OF THE
NATIONAL ASSOCIATION OF BROADCASTERS**

NATIONAL ASSOCIATION OF BROADCASTERS
1771 N Street, N.W.
Washington, D.C. 20036

November 18, 1987

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EXECUTIVE SUMMARY

It is the purpose of the Notice of Inquiry ("Notice") in this proceeding to "initiate a wide-ranging inquiry to consider the technical and public policy issues surrounding the use of advanced television technologies by television broadcast licensees."¹ The scope, detail and analyses presented in the Notice reveal, a comprehensive examination and understanding of high-definition television ("HDTV") and advanced television ("ATV") issues² and we commend the Commission for its action and for its thoroughness. This document and the comments to be filed in response reflect the monumental effort that the industry and the Commission have begun. We are setting a course that will dramatically change the way that the American public enjoys news, information and entertainment video programming services delivered to the home via over the air free broadcasting.

NAB's Comments set the stage and point the direction for what will and must be an arduous, extended, expensive, but ultimately rewarding, revamping of the entire system of television production, transmission and reception. It is the delivery systems and the technical quality of the service that will be reworked and to some extent replaced. But these changes will so dramatically affect what the viewing public sees, that it, the public, will feel they are being given an entirely new viewing experience.

It is to this end that we embark on the tasks before us. NAB's Comments lay out the enormity and the importance of challenges broadcast television (and the Commission) face to insure that the American public does in fact continue to have available universal free, high quality television programming. To this end, it is necessary that the broadcast television industry, in conjunction with the greater video industry and with the Commission, develop, in an ordered and careful way, a new transmission and reception system that produces a picture quality comparable to that soon to be available via non-broadcast video systems, here and in other countries. "Comparable" quality is the key to continued competitiveness of broadcast television and thus to the continuation of high quality, universal free television in this country.

NAB's Comments present the magnitude of the challenge and the tasks facing the industry and then describe in detail how NAB and the industry are mobilizing to accomplish these goals. We also discuss the critical role of the FCC and its Advisory

¹See Notice Id. at para. 3

² We use the terms HDTV and ATV throughout these comments as generic references -- "HDTV" being the generic reference commonly used in the industry and "ATV" being the term used in the Notice.

Committee in (1) advising and being advised by the Advanced Television Systems Committee ("ATSC"), the industry-wide standards setting group, as we sort through the very complicated tasks and tests ahead, (2) understanding the critical importance to the success of HDTV of setting a single broadcast transmission standard, and (3) continuing to reserve additional spectrum to broadcast HDTV, recognizing that there now is no way to know what those spectrum needs might be. This is so because actual testing of various systems has not yet been done, although detailed plans for tests are in progress. Until we know how well the various systems work and with what trade-offs, no projections can be made as to technical parameters, systems or spectrum. That is perhaps the overriding point of NAB's Comments: that we are at the beginning of a long and involved process which, to be ultimately successful, requires careful planning, ordered testing, reasoned decision-making and clear government action. We cannot rush to judgments. The stakes are too big. The payoff, however, will be worth the long endeavor -- for the industry, for the Commission, and above all, for the American public.

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COMMENTS OF THE
NATIONAL ASSOCIATION OF BROADCASTERS

The National Association of Broadcasters ("NAB")¹ submits herewith, in accordance with Section 1.430 of the Commission's Rules, its comments in response to the Notice of Inquiry issued by the Commission in the above-captioned proceeding.²

¹NAB is a nonprofit incorporated association of radio and television broadcast stations and networks. NAB membership includes more than 900 television stations plus the major commercial broadcast networks.

²Notice of Inquiry, MM Docket No. 87-268, FCC 87-246, adopted July 16, 1987, released August 20, 1987 ("Notice").

I. INTRODUCTION AND EXECUTIVE SUMMARY.

It is the purpose of the Notice of Inquiry ("Notice") in this proceeding to "initiate a wide-ranging inquiry to consider the technical and public policy issues surrounding the use of advanced television technologies by television broadcast licensees."³ The scope, detail and analyses presented in the Notice reveal, a comprehensive examination and understanding of high-definition television ("HDTV") and advanced television ("ATV") issues⁴ and we commend the Commission for its action and for its thoroughness. This document and the comments to be filed in response reflect the monumental effort that the industry and the Commission have begun. We are setting a course that will dramatically change the way that the American public enjoys news, information and entertainment video programming services delivered to the home via over the air free broadcasting.

NAB's Comments set the stage and point the direction for what will and must be an arduous, extended, expensive, but ultimately rewarding, revamping of the entire system of television production, transmission and reception. It is the delivery systems and the technical quality of the service that will be reworked and to some extent replaced. But these changes will so dramatically affect what the viewing public sees, that it, the public, will feel they are being given an entirely new viewing experience.

It is to this end that we embark on the tasks before us. NAB's Comments lay out the enormity and the importance of challenges broadcast television (and the Commission) face to insure that the American public does in fact continue to have available universal free, high quality television programming. To this end, it is necessary that the broadcast television industry, in conjunction with the greater video industry and with the Commission, develop, in an ordered and careful way, a new transmission and reception system that produces a picture quality comparable to that soon to be available via non-broadcast video systems, here and in other countries. "Comparable" quality is the key to continued competitiveness of broadcast television and thus to the continuation of high quality, universal free television in this country.

³See Notice Id. at para. 3

⁴ We use the terms HDTV and ATV throughout these comments as generic references -- "HDTV" being the generic reference commonly used in the industry and "ATV" being the term used in the Notice.

NAB's Comments present the magnitude of the challenge and the tasks facing the industry and then describe in detail how NAB and the industry are mobilizing to accomplish these goals. We also discuss the critical role of the FCC and its Advisory Committee in (1) advising and being advised by the Advanced Television Systems Committee ("ATSC"), the industry-wide standards setting group, as we sort through the very complicated tasks and tests ahead, (2) understanding the critical importance to the success of HDTV of setting a single broadcast transmission standard, and (3) continuing to reserve additional spectrum to broadcast HDTV, recognizing that there now is no way to know what those spectrum needs might be. This is so because actual testing of various systems has not yet been done, although detailed plans for tests are in progress. Until we know how well the various systems work and with what trade-offs, no projections can be made as to technical parameters, systems or spectrum. That is perhaps the overriding point of NAB's Comments: that we are at the beginning of a long and involved process which, to be ultimately successful, requires careful planning, ordered testing, reasoned decision-making and clear government action. We cannot rush to judgments. The stakes are too big. The payoff, however, will be worth the long endeavor -- for the industry, for the Commission, and above all, for the American public.

II. THE EMERGENCE OF HDTV PRESENTS THE TV BROADCASTING INDUSTRY WITH A CHALLENGE OF MAJOR PROPORTIONS THAT IT MUST MEET IN ORDER TO COMPETE EFFECTIVELY WITH ALTERNATIVE VIDEO MEDIA AND THEREBY CONTINUE TO PROVIDE UNIVERSAL, FREE TELEVISION PROGRAMMING TO THE PUBLIC.

Competition within the American television broadcast industry has driven it to produce the finest and most sophisticated television broadcast service in the world today. This competition has not been limited to the programming alternatives in news, information and entertainment, but has also involved competition in signal quality. The industry has increasingly focused attention on the technical performance of production, distribution, transmission and reception equipment and facilities. And, while many believe that the technical limitations of our current NTSC⁵ television system are about to be reached, if they have not been already, virtually all agree that true HDTV cannot be provided to the public without creating an entirely new transmission standard.

Competition by the television broadcast industry with other forms of video programming delivery, however, is at a critical crossroads. As described in our Petition

⁵The National Television Systems Committee established the technical standards for the transmission system used in the U.S.

for Notice of Inquiry, jointly filed on February 13, 1987 by 58 broadcast organizations and companies ("Joint Petition"), the emergence of HDTV will, in a very few years, present the American public with an alternative picture and sound quality so superior to that attainable with the current NTSC system that a predictable viewer preference (and hence viewer choice) for HDTV is certain to occur.⁶ Should broadcasters not be able to employ HDTV, then other media such as videocassette, videodisc, direct broadcast satellite and, notably, cable television that can employ HDTV will garner an increasing share of the video programming audience. The result will be a competitive imbalance with free, universally-available broadcast television audience revenues steadily declining.

Today, each segment of the video delivery world is financially healthy. However, should the television broadcast service not be able to employ HDTV as these other media will, the results would be catastrophic for the broadcast industry. The broadcast industry's experience with listenership of AM and FM radio is illustrative of what will likely occur. FM broadcasting now has 72% of the radio audience, leaving only 28% of the audience to AM -- which at one time had 100% of the audience.⁷ Non-existent before 1951, FM broadcasting (which is, in a very real sense, "high definition radio" in comparison to the technical sound quality that has characterized AM broadcasting) increasingly has captured audience share. Put simply, and of no surprise to the commission, AM radio is, and has been, in trouble.⁸ Should television broadcasting of the future experience a similarly decreasing share of the video audience, it would see severe decreases in advertising revenues. A real decrease in revenues inevitably would result in a reduction in the amount of money spent on equipment and personnel to produce local news and other public interest programming, as well as in the quality and quantity of the general news, information and entertainment programming enjoyed and expected, today.

The erosion of a non-HDTV television broadcast industry's financial base would

⁶See also in Gen. Docket No. 85-172, Comments of NAB at 33-42, Reply Comments of NAB at 21-27 and Appendices B,C,D,E and F and Further Reply Comments of NAB at 21-24. In the absence of HDTV product currently in the consumer market, comprehensive studies of this expected viewer preference have not yet been conducted, though some are planned under the aegis of ATSC for the near future.

⁷ Average of Spring and Fall, 1986 RADAR report, Statistical Research, Inc.

⁸While serious and major efforts are now underway to overhaul the technical quality of AM service, AM's decline has been devastating to a once-thriving industry, which simply cannot "compete" with FM service and has been relegated to small and specific program slots.

directly result from the competitive advantage such a vast improvement in technical quality would give competing media employing HDTV. In NAB's opinion, the quality difference between today's NTSC and tomorrow's HDTV is many times greater than that between AM broadcasting and FM broadcasting.⁹ The historical AM/FM example above well may understate the impact on the television broadcast service (and on its audiences) of not implementing a competitive HDTV service. The point here, of course, is that other media will, and that enough of the audiences will follow to undermine the viability of free, universal broadcast television. The Japan Broadcasting Corporation (Nippon Hoso Kyokai, "NHK") plans to begin its direct broadcast satellite service in 1990 in HDTV employing the MUSE bandwidth compression transmission format.¹⁰ As described in the Notice, NHK intends to have MUSE home receivers and videocassette recorders ready for mass production at the same time. NAB understands that the sizeable North American market for HDTV consumer equipment has not gone unnoticed, and that NHK estimates that 100,000 MUSE receivers/recorders will be sold in the U.S. in 1990, 500,000 in 1991 and 1.5 million by 1992. At that rate the NHK system, which is not compatible with NTSC television receivers, could easily become the defacto standard without the factoring in of U.S. needs or U.S. planning.

The U.S. broadcast industry has been aware of these developments for some time, and, more recently, of the relatively new development work of other transmission systems. The industry has been looking to the Advanced Television Systems Committee¹¹ process to provide a framework and to chart a course for evaluating the technical characteristics of these systems and of their implementation and to, lay out in the end the trade-offs of each so that the greater video industry can select a single system for a wholesale transition to a new television technology. If free, over-the-air television broadcasting is to maintain its competitive stance, and maintain its viability and universality, it must receive the aid and support of the Commission in devising how best to employ HDTV for broadcasting. This Notice of Inquiry is a major step in this

⁹ Significant improvement of the technical sound quality of AM broadcasting will be possible as stations begin adopting the new transmission standards developed by the National Radio Systems Committee.

¹⁰ See Notice supra at para. 32.

¹¹ The Advanced Television Systems Committee ("ATSC") was formed in 1983 by the cooperative effort of the NAB along with the Electronics Industries Association, the Society of Motion Picture and Television Engineers, the National Cable Television Association, and the Institute of Electrical and Electronic Engineers.

direction, as is the formation of the FCC's Advisory Committee. NAB views this all-industry effort to implement HDTV as a major technical standards development process whose focal point must be the Advanced Television Systems Committee.

III. NAB HAS MOBILIZED ITS RESOURCES AND FORMED A BROADCAST TECHNOLOGY CENTER SPECIFICALLY TO ASSIST IN THE DEVELOPMENT OF HDTV.

NAB is dedicating substantial resources to assist the ATSC in its studies. To help the industry chart a path to HDTV, NAB formed its HDTV Task Force in early 1987 to advise the Association and its members on how best to develop an HDTV broadcast system. The Task Force membership and objectives are attached to these comments as Appendix A. In an unprecedented commitment of resources NAB has formed the Broadcast Technology Center, a new facility devoted and funded initially to assist the ATSC and the industry in the development of an HDTV broadcast transmission standard.

NAB has, in addition to supporting the ATSC and creating the Broadcast Technology Center, spent considerable time and resources developing a master plan in concert with the ATSC and other industry associations, for the orderly study, testing and implementation of a new television broadcast standard. Appendix B presents the NAB HDTV Project Schedule for these activities. This schedule has as its target objective the acceptance of a new television broadcast standard by the end of 1991. We estimate that up to 200,000 broadcast HDTV receivers will be in the U.S. consumer marketplace by the end of 1992 receiving HDTV broadcasts. This, NAB believes, is the latest an HDTV broadcast system can be implemented to avoid an adverse competitive impact on the broadcast industry from other media employing HDTV technology. As described, in the NAB HDTV Project Schedule, these efforts encompass: market studies, assumptions regarding Commission actions and the ATV Advisory Committee, establishment of the NAB HDTV Project Office and the Broadcast Technology Center, propagation tests (in coordination with ATSC), demonstrations, spectrum studies (in coordination with the Association of Maximum Service Telecasters) and, the bottom line in the schedule, the critical ATSC standards development effort that is expected to involve: 1) designing and equipping a suitable testing laboratory, 2) evaluating potential HDTV transmission systems for the technical, subjective, transmission impairment and inter-operability characteristics of each system and 3) reaching a decision on a single system, documenting and presenting a recommended standard to the Commission for its consideration. A description of the draft plan proposed to ATSC is given in Appendix C.

To date, NAB has committed \$700,000 to initiate these efforts and its Broadcast Technology Center anticipates a multi-million dollar budget for the development of an HDTV broadcast system. The ATSC standards development alone is expected to take 3-1/2 years to complete. The comments of other broadcasting organizations and companies will address the degree of their commitment to meet the challenge of HDTV. NAB urges the Commission to recognize that the massive scale on which the television broadcast industry is mobilizing its resources is indicative of its real and pressing need to be able to compete successfully in this new era of television. It must also recognize that on this ability to compete hinges universal, free television in the U.S.

IV. SUCCESSFUL IMPLEMENTATION OF NATIONAL BROADCAST HDTV IS DEPENDENT UPON THE COMMISSION'S RECOGNIZING A SINGLE STANDARD.

Historically, all aspects of the broadcast industry, broadcasters, and receiver manufacturers have not responded well when permitted to use any one of several non-compatible (with each other) transmission systems. A "marketplace approach" to technical standards for broadcasting has never served the public interest in seeing a new service widely implemented! To the contrary, marketplace approach to technical systems has bred receiver manufacturing and broadcast station uncertainty which has resulted in serious delay in eventual implementation of new services. The FM quadrasonic sound, teletext and AM stereo experiences stand as the measure of this approach. Nor can the marketplace be relied on to "select" the best quality technical system.

NAB believes that it is now widely accepted that technical standards foster competition among service and product providers. When UHF was introduced, receiver manufacturers were not required to include UHF tuners on all receivers. While not providing such tuners enabled makers to keep costs low and more competitive, it also relegated UHF to a less accepted class. Adaptor boxes worked only for that portion of the population willing and able to install them. Only after the Commission wisely adopted rules requiring that all television receivers include UHF tuners, were UHF television stations able to attract audiences on the basis of competitive programming rather than be subject to the whims of receiver manufacturers. But, because it took an act of Congress to require receiver manufacturers to include a UHF tuner as standard equipment, UHF has never achieved viewer acceptance competitive with VHF service.

When color television was introduced, it was as a single standard, not left to the marketplace to decide. Without a single standard, neither the broadcaster nor the public would have been willing to invest in such costly equipment (significantly more than black

and white) which could be made obsolete by the sway of the market.

Yet another example is the indecision of the Commission on selecting a national teletext standard. Again, while some small number of broadcasters use both of the two leading systems for teletext, receiver manufacturers have yet to introduce even one model of the system to the marketplace because of the relatively high costs of development which could be lost if a different system were eventually to be more used by broadcasters. Thus, because of a lack of a single standard, there is no significant teletext service offered in the United States.

Another example of the consequence of the failure to institute standards was shown by the quadraphonic FM sound experience. The service simply died, with the "marketplace" not able to succeed with multiple transmission standards and multi-system receivers.

And of course the best (or worst) examples of the inability of the marketplace to establish communication systems standards is the AM stereo debacle where, five years after the FCC permitted stations to use any of the systems they wished, AM stereo has not achieved a significant position in the marketplace.

The evidence is crystal clear. It is simply not realistic to expect the "marketplace" -- broadcasters, receiver manufacturers, and consumers -- to make a choice. And, while the private industry standards-setting has and can be successful, the proponents that are not selected can tie up the process and even kill it by time consuming litigation threats. Standardization can best be effectuated by a government regulatory body endorsing an industry standards process and its final selection. Then the service can itself proceed to enjoy the fruits of marketplace competition between various service and product providers -- using the same basic technical systems, but varying other characteristics.

In contrast to the failed services cited above, stereophonic and multichannel sound for television, a system which is protected by the Commission's rules, is enjoying a high degree of success. Station conversions and receiver sales have exceeded expectations. In only three years, nearly half the television stations offer stereo and virtually all receiver manufacturers offer several models with stereo.

It can be said with certainty that all proposed new broadcast services that were not introduced as a single standard have not succeeded in the marketplace. Therefore, NAB strongly urges that the Commission consider that the best service to the public interest is attained by the development of technical standards for a single HDTV broadcasting system, recommended by an industry standards process for Commission

adoption.

V. THE SPECTRUM REQUIREMENTS FOR BROADCAST HDTV CAN BE DETERMINED ONLY AFTER CAREFUL, DELIBERATIVE TESTING AND EVALUATION OF THE VARIOUS SYSTEMS IS COMPLETED AND THE OPTIONS FOR IMPLEMENTATION ARE KNOWN.

As presented in the Joint Petition and discussed in the Notice, some of the most important and decisive issues facing the Commission in this proceeding relate to the spectrum requirements of broadcasting HDTV.¹² An unavailability of adequate spectrum simply would limit the television broadcast service's ability to employ HDTV. The amount of spectrum needed to accommodate terrestrial broadcast of HDTV exceeds, as far as is known today, the current 6 MHz television channel bandwidth. This is due to the increased amount of transmitted information required to produce a minimally acceptable improvement in picture quality over that provided by the NTSC system.

An HDTV broadcast system has yet to be demonstrated which satisfies picture quality objectives, and operates within a 6 MHz channeling plan. This will be a central issue of a study by the ATSC in its systems evaluations. Absent scientifically conducted subjective assessments of picture quality provided by various ATV systems, and absent actual evidence of how each system works in operation, it is impossible to meaningfully evaluate the tradeoffs of the various ATV systems in light of each's spectrum efficiencies. Consequently, it is not possible at this time to project with any degree of certainty the spectrum requirements for HDTV broadcasting. This issue needs the careful deliberative development expected from the ATSC studies.

NAB supports the Commission's inclination that an ATV system should be provided "as a service integrated fully with the existing television broadcast service which over time would replace entirely the NTSC service".¹³ That would mean "compatibility" as well as the design of an ATV system with sufficient technical "overhead" to incorporate further improvements in the years to come.

NAB cannot see how it is not premature to speculate on the spectrum requirements for broadcasting HDTV until such time that serious comparative ATV systems analyses have been conducted. There is simply not enough information to date to reasonably make such projections.

NAB understands that the Commission desires expeditious resolution of the spectrum issue, and that it has instructed the ATV Advisory Committee to submit an

¹²See Notice supra at para. 41-79

¹³See Notice at para. 43

"Interim Report" by May 17, 1988 on spectrum requirements for broadcasting ATV. However, because there has been testing of only one HDTV system and only one system actually demonstrated, it is simply not possible even to take a stab at determining spectrum requirements at this time. Any suggestion made now by NAB or anyone else for spectrum requirements would be out of a hat and could risk great understatement of spectrum requirements - a risk which holds enormous adverse competitive implications if true.

Once a complete understanding of the spectrum requirements for broadcasting HDTV is developed, and those requirements evaluated against other characteristics of the systems, a projection as to spectrum needs, or at least as to a range, can be made. The next step is determining where and how that spectrum is available for use. Of the various spectrum options presented in the Notice, NAB believes that the existing UHF-TV band is considered the most promising because: 1) no spectrum reallocation or dislocation of other services is required, 2) there may be adequate capacity in this band for at least some ATV use, 3) and it holds greater attractiveness for implementation.¹⁴ As the propagation tests and spectrum studies expected of the ATSC are completed, further objective information will show the utility of the UHF-TV, 2.5 GHz and 12 GHz bands for HDTV broadcasting options. It is NAB's initial view, however, that the goals of equivalent coverage and ease of implementation argue strongly for employment of whatever additional capacity there may be within the UHF-TV band to broadcast HDTV. NAB is encouraged by the Commission's recent freezing of new and vacant television allotments and staying action in Gen. Docket No. 85-172, as a necessary step to preserving its options with respect to implementing HDTV broadcasting within the UHF band.¹⁵

The Notice also presents the Commission's intentions to:

"reexamine the extent to which the UHF taboos continue to be necessary for the protection of existing service; focus on the effects the taboos may have on the implementation of advanced television systems; and consider what effect the development of improved receivers (those associated with

¹⁴See Notice supra at para 46-58

¹⁵See order, RM-5811, 4074, adopted July 16, 1987, released July 17, 1987, and order, Gen. Docket No. 85-172, RM-3975, RM-4829, FCC 87-327, adopted October 13, 1987, released October 21, 1987, respectively.

advanced TV systems) may have on the need for maintaining the current UHF taboos or introducing new taboos."¹⁶

NAB supports this effort to reexamine the UHF taboos particularly with respect to the spectrum needs of HDTV broadcasting. However, since Commission efforts to reevaluate the taboos have continued for over 13 years, developing numerous reports and technical studies in two docketed proceedings, and since the relationship of the current UHF taboos to the interference susceptibility of HDTV broadcast receivers is unknown, NAB urges the Commission to consider providing a stage in this proceeding to focus separately on these issues.¹⁷ The meaningful assimilation of all this material, and formulation of substantive proposals to eliminate some taboos, as appropriate in the context of this proceeding, simply can not be accomplished within the brief period of 90 days afforded for comments.

VI. THE MOST IMPORTANT ASPECT OF COMPATIBILITY IS THE NEED FOR IMPLEMENTATION OF AN HDTV SERVICE IN A MANNER WHICH DOES NOT DEGRADE SERVICE TO THE PUBLIC.

The ideal compatible advanced television system would be one that allowed broadcasters to deliver to their audiences pictures comparable to HDTV studio quality and sound comparable to that of digital compact discs, with no increase in channel bandwidth and with no degradation to the pictures and sound on existing receivers. To transmit HDTV in this ideal world, broadcasters would continue to use current channel assignments and transmitters, changing only their studio equipment. Viewers could continue to use existing receivers until availability of programming, costs and other factors motivated them to move to high definition.

The introduction of color to monochrome NTSC came close to this ideal. There was some degradation due to cross-color and cross-luminance effects, but essentially there was a smooth transition to the new system.

In this proceeding, the concept of "compatibility" is more difficult to deal with. As the Commission describes in its Notice, there is channel compatibility and there is receiver compatibility. Some broadcasters have also expressed concern over transmitter compatibility. Since the transmitter, its associated input processing, output filtering and matching, and radiating equipment represent a substantial capital investment, the question

¹⁶See Notice supra at para. 59.

¹⁷See Notice supra at para. 39-45.

of replacing or modifying it is also a factor. But it is less important than, for example, receiver compatibility or channel compatibility.

HDTV studio standards, as defined by the Society of Motion Picture and Television Engineers (SMPTE), use bandwidths as high as 90 MHz¹⁸, and recording equipment bandwidths are currently in the range of 20 MHz to 30 MHz. Broadcasting such signals without some compression would take far too much spectrum. All of the systems already proposed offer some degree of bandwidth reduction.

So far, the only advanced television delivery system for which there is working, if prototype, equipment is the NHK MUSE. This system is not compatible in either sense of compatibility (channel or receiver), nor would it be transmitter compatible. It is, however, the system which will be used for HDTV delivery in Japan by Japan's national broadcasting network, NHK. It will be used for direct satellite broadcasting, videocassette, and videodisc. All this equipment has been demonstrated, and consumer versions are now being designed, to be available to the Japanese public in 1990. NHK officials have indicated that they expect the equipment to be sold in the U.S. and other countries to reduce the cost for their viewers.

Several delivery systems have been proposed that offer some degree of channel or receiver compatibility. Some of these systems have been simulated or "emulated" using computers and special circuitry, but NAB believes that none has actually been demonstrated to be capable of either, a) delivering video and sound quality perceived by viewers as being competitive with MUSE or, b) being receivable on existing receivers without noticeable degradation from current NTSC quality.

NAB believes that theoretical calculations and computer simulations have not pointed to any known technology that can achieve both NTSC receiver and 6 MHz channel compatibility and be competitive quality-wise with MUSE. All systems represent some significant compromises in one or more areas.¹⁹

NAB has committed considerable resources to studying and developing a system for broadcast delivery of HDTV which offers the highest degree of compatibility. The NAB

¹⁸ "Draft Signal Parameters of the 1125/60 High Definition Television Production System", Society of Motion Picture and Television Engineers Doc. N15.4/6, Ref 26 Rev 1, 23 April 1987.

¹⁹ Robert Hopkins, "Advanced Television Systems," National Association of Broadcasters, 1987 Engineering Conference Proceedings.

HDTV Task Force has issued a statement of broadcaster preferences, as we currently see them.²⁰ Concerning compatibility, NAB's Task Force noted that,

"It is clear that the existing NTSC broadcasting service must continue for some years. It is not clear at this time what type of compatibility is possible; however, it is important that the new system should permit broadcasters to continue NTSC service to all their current viewers (including CATV) with no degradation in service. In addition, the system should permit broadcasters to add HDTV service to at least 90 per cent of their viewers (including CATV), and it should be as efficient in its use of spectrum as possible."

The authors of this statement recognized, in particular, that an emphasis on compatibility with the existing NTSC system has the potential of reducing the later improvement and expansion of the broadcast system as new HDTV technologies are developed or existing ones improved. At the same time, NAB recognizes the need for the Commission to adopt a single system to provide a stabilizing framework for future development. The improvements made to the current system were in large part fostered by the stability of the NTSC standard and the confidence that this gave to equipment manufacturers, broadcasters and the public that hardware investments would be long-term. NAB supports the work of the Advanced Television Systems Committee to study and recommend HDTV delivery standards which meet the criteria described above. If the proposals of systems developers are not found to be adequate, NAB will support ATSC in developing a synthesis of technologies and implementation scenarios which will best serve the public and the industry.

VII. THE PICTURE QUALITY PROVIDED BY HDTV BROADCAST SYSTEMS MUST BE "SUBJECTIVELY" COMPARABLE TO THAT PROVIDED BY NON-BROADCAST MEDIA.

The ability of an HDTV broadcast system to produce a sound and picture quality comparable to that provided by the MUSE HDTV system (the only HDTV system developed to the point of readiness for market) is of critical importance to the future competitiveness of the broadcast industry and therefore to the viability of free, universal television in the U.S. Since MUSE is expected to be the only system used in the consumer HDTV products available in 1990, it will become the point of comparison by which consumers will judge other media employing HDTV.

The MUSE system itself represents a necessary compromise in picture quality from

²⁰ See Appendix A, NAB High Definition Television Task Force.

that of the HDTV production standard as a result of bandwidth reduction techniques employed to more efficiently use transmission spectrum. NAB understands that NHK compressed the bandwidth of the MUSE signal to no more than just under 9 MHz because they believed that at lesser bandwidths, the picture quality would be degraded below that necessary to maintain its market appeal.

In the end it is the viewer, of course, who will judge the value of improved picture quality. There is little question that viewers will strongly prefer the higher quality pictures presented to them -- in the testing room or in their homes. It is already known that viewers today have much higher expectations of picture quality than in the past.²¹ But critical and extensive "subjective" assessments of the sound and picture quality of various ATV systems are needed. They are needed to be able to compare the various ATV systems as to this "quality" characteristic and to then be able to evaluate the trade-offs each system makes among a variety of characteristics, for example, picture quality vs. bandwidth. These tests are being planned by the ATSC and the results will be essential to the system decision making process. The International Radio Consultative Committee ("CCIR") as well has requested its Interim Working Party (IWP)

11/4 (HDTV Subjective Assessment) to urgently begin studying the means for developing subjective test methodology and viewing conditions for subjective assessments of HDTV picture quality.²²

Specific issues to be studied in these ATSC tests include: degree of compatibility, protection ratios, picture quality comparisons, number of channels and quality of audio, and the effect of multipath. Test methodology issues include: evaluation scales to be used, viewers' and listeners' demographics, methods for presentation of results, and the viewing conditions -- which themselves require decisions such as peak luminance levels of display devices, viewing room ambient illuminance levels, viewer-to-display ratio, picture size, and others. The hardware, software and technical support necessary to conduct such assessments will require significant time and effort on the part of broadcasters and equipment manufacturers.

²¹ Jones, B. L. (April 23, 1986) "Subjective Assessment of Protection Ratios for UHF Broadcast Signals", CBS Technology Center Report 4/86.

²² The CCIR accepted a new draft document on November 13, 1987 Doc 11/76, on Subjective Assessment in which it states "as the need for appropriate assessments of HDTV is urgent and uncertainty exists about appropriate viewing conditions for such tests, IWP 11/4 is encouraged to further consider issues of HDTV assessments and to arrive at recommendations as quickly as possible."

NAB pointedly emphasizes the importance of subjective picture quality tests as well as the enormity of the tasks involved in this testing. We note that the issue of subjective testing was conspicuously absent from the Notice. Yet subjective testing is essential to the comparison of ATV systems. This is particularly so because of the wide range of sophisticated technologies employed by the various ATV systems which "take advantage" of certain physiological aspects of the human visual and auditory systems.

To reiterate, NAB believes that the continued competitiveness, and therefore the continued health, of the television broadcast service is dependent upon terrestrial broadcasting delivering HDTV with a picture quality "subjectively" comparable to, if not exceeding that of MUSE. This must remain the bottom line. We must continue to investigate ways to reduce the spectrum apparently now needed to accomplish this.²³ But we must find a way to transmit this degree of picture quality.

VIII. HDTV BROADCASTING WILL REQUIRE SUBSTANTIAL, BUT NECESSARY INVESTMENTS BY BROADCASTERS SINCE CONSUMERS WILL DEMAND HDTV SERVICE FROM OVER-THE-AIR BROADCASTING

A. Costs to the Broadcasting Industry

There is no question that the implementation of HDTV broadcasting will involve substantial investment by the industry as well by consumers. When an HDTV broadcasting system is adopted, television broadcast stations will be faced with the prospect of eventual conversion of most, if not all, of their production and transmission facilities to accommodate HDTV. The magnitude of this conversion process, and the steps needed to accomplish it, will of course depend to some extent upon the system used to transmit HDTV. But, NAB understands, and we believe most broadcasters understand, that these costs substantial as they are bound to be -- are a necessary investment in the future viability of the television broadcast service. Without this investment television broadcasting cannot remain competitive with non-broadcast media that will provide HDTV.

The cost to broadcasters for modification to transmission facilities depends entirely upon the transmission system selected for broadcast HDTV. (It will not be

²³We note that it appears today that, to have both 6 MHz channeling and NTSC receiver "compatibility", picture quality would be sacrificed and would be noticeably inferior to, and hence non-competitive with, that provided by MUSE. This view of course must await the critical comparisons of ATV systems by the ATSC to be confirmed.

affected by the production format finally selected as it is not feasible to transmit an HDTV production format, as today is done with NTSC, without substantial bandwidth compression techniques.) It is not known at this time which transmission system will be employed and thus it is not possible now to determine the cost of modifying transmission facilities. For example, a transmission technique that required only modifications to existing transmitters would be less costly than a system which required a separate augmentation channel and far less costly than replacing the entire transmitter with one capable of transmitting wideband, non-compatible HDTV. Depending upon the bandwidth involved and the channel allocated, antennas, transmission line and other RF equipment might have to be modified or changed as well. Substantial modifications are not unlike the construction of a new transmission facility, which many stations have undertaken during the lifetime of their facilities.

Broadcasters, however, are not likely to hesitate long in adopting whatever HDTV transmission system becomes the choice of the industry. The rate of conversion will depend upon several factors including but not limited to the cost of conversion, the position of the station in the marketplace, the attitudes of management, and the station's perception of the consumer's interest in HDTV.

Historically, the costs to both the industry and consumers presented by a new service are significantly reduced when the appropriate technical standards for the service are established at the outset. This would be particularly true for the introduction of an HDTV broadcasting service. Without the adoption of standards for HDTV broadcasting, manufacturers of transmission and reception equipment for television stations and consumers will face uncertainty over what HDTV options to offer -- uncertainly, which if persistent, could threaten the introduction of HDTV broadcasting with significant, if not terminal, delays. And, since economies of scale would not be realized without standards, NAB believes that the introduction of HDTV broadcasting would become unnecessarily and substantially more costly - particularly to the public.

The Commission has before suggested that the adoption of technical standards - can stifle innovation and impede technological improvements.²⁴ NAB believes that with a broadcasting service -- where the costs to the consumer are intentionally minimized to encourage maximum possible availability of the service -- the adoption of technical standards is mandatory. Technical standards provide the foundation for expeditious and

²⁴ See, eg., the Commission's Notices in the multi-channel sound proceeding, Docket 21323. (But, see Second Report and Order in that docket.)

less costly introduction of a broadcast service -- as well as a common ground on which competition can flourish. Where such standards may "stifle innovation", NAB believes that this is far offset by the timely provision of an economical service to the American public.

B. Costs to Consumers

The availability of HDTV broadcasting will present consumers with the choice of purchasing HDTV receivers that initially may be costly. This is not unusual. The cost of the introduction of almost any new consumer device that represents a substantial improvement over existing devices is almost always high. Once the improvement is accepted by a segment of consumers and economies of scale in production and marketing are realized, lower prices at levels affordable by most consumers will follow. Nearly every advance in broadcast receiver performance has followed this scenario. For example, FM stereo receivers were, at first, only available in the top-of-the-line models. As more stations began transmitting stereo the cost of stereo receivers dropped dramatically to the point where even the most inexpensive FM receiver is stereo. As manufacturers see a market developing (usually as the result of an industry standard), designers use the newest and most cost efficient technology to lower unit costs and increase performance in the hotly competitive consumer electronics environment.

With the introduction of multichannel sound for television, for which a single transmission system was protected from interference by the Commission²⁵, within months the first stereo sound television receivers were available in the top of the line models which sold for \$700 to \$1,000. Only a fraction of this cost represented the stereo portion of the receiver. After only a couple of years the sales of television receivers with multichannel sound is in the millions²⁶ and the cost of receivers with stereo sound has been reduced to a reasonable \$329.²⁷

Yet, the same scenario cannot be made for the development of AM stereo. Without an industry agreed upon standard the receiver manufacturers have introduced stereo AM receivers only in the high end model lines. Few AM stations converted to stereo because of uncertainty about which system to use. As a result receiver manufacturers, also uncertain about the direction of the broadcasters, have not

²⁵ Second Report and Order in Docket 21323, adopted March 29, 1984.

²⁶ TV Digest, November 2, 1987, p. 10.

²⁷ General Electric 20 inch stereo remote color television for \$329, Luskin's advertisement supplement, "Washington Post," Sunday November 15, 1987.

introduced stereo in lower model lines of AM receivers. This, years after AM stereo was introduced. The consumer, therefore, does not have ready access to low cost AM stereo receivers available for the mass market. As a consequence the AM stereo service is not having the success it could had there been a standard.

With an FCC approved HDTV standard, we expect the decreasing price scenario to occur over time. For many, the expected introduction price of an HDTV receiver at \$3,000 to \$4,000 may be too costly. As more of these receivers are made, however, these prices will surely drop significantly. Receiver manufacturers will soon realize economies of scale in production and marketing, and, forced by the pressure of competition, will pass on these cost savings to consumers in the form of lower prices. In Appendix D, this process can easily be seen in the examples mentioned above as well as with other video products.²⁸ For example, after accounting for inflation, the price of an average color television in 1986 is only 25% of the price 25 years ago.²⁹ This dramatic price decrease has occurred even while the quality of color television sets was being improved.

There is absolutely no reason to believe that this decreasing price scenario should not occur with the introduction of HDTV receivers in the U.S. In fact, the price decline should develop even more rapidly since those sets will begin to be produced for Japanese viewers before their introduction into the United States.

C. Consumer Acceptance

The trend of consumer investment in order to receive a quality service is well established. While a new quality service takes a few years to achieve a "foothold" once that foothold is realized, rapidly increasing consumer acceptance soon follows. This acceptance is seen in all the major introductions of new services such as color television, cable television service, VCRs, and stereo television. Of course, this acceptance is determined in large part by the price levels of these new products. But, as evidenced by the price history of the services discussed above, prices tend to drop significantly soon after introduction.

In Appendix D, we detail the consumer acceptance of these various video services. One interesting point to note in these examples is that consumer acceptance of new quality services may be occurring at a faster rate in recent years. The acceptance of stereo television receivers appears to be faster than that of color television and cable services. We would also expect the same to occur with respect to a new HDTV service.

²⁸See Appendix D, pp. 4-7.

²⁹Ibid., p.4.

IX. THERE IS AMPLE OPPORTUNITY UNDER THE COMMISSION'S RULES FOR EXPERIMENTATION WITH ADVANCED TELEVISION SYSTEMS WITHOUT RELAXING THE NTSC BROADCAST TRANSMISSION STANDARD.

The Notice raises the idea of converting the rules that describe the NTSC transmission system into voluntary guidelines to "remove constraints that might hinder development and implementation of advanced television systems".³⁰ Three reasons are advanced in the Notice in favor of relaxing the NTSC rules: 1) this could facilitate the introduction of some ATV systems 2) receiver improvements reduce the need for strict adherence to the NTSC format, and 3) broadcasters have strong incentives to maintain compatibility with existing receivers. NAB believes that this proposal is premature at best and greatly disserves the public interest for the following reasons.

First, the introduction of "some ATV systems", facilitated by voluntary NTSC standards or otherwise, is not, NAB hopes, the Commission's objective.³¹ If it were, this would suggest that the Commission appears inclined to adopt a "marketplace approach" to technical standards for terrestrial broadcasting of HDTV. That, in NAB's opinion would greatly dis-serve the American public and the television industry that serves it by encouraging different transmission systems and therefore different types of receivers. It is hard to imagine what purpose is served by a group of stations transmitting different systems -- each receivable only on certain types of receivers. Not only would the potential audience for those stations be reduced but the availability of receivers would be hampered by the higher prices inevitable with more than one receiving standard. Indeed multiple systems could serve only to drive viewers to other video delivery systems, those able to be properly displayed on existing receivers. Permitting any station at any time to modify its transmission standard would cause consumer confusion and create chaos in an otherwise well ordered industry. Ample opportunity, through experimental authorizations (see Part 74) and special temporary authority, is afforded to experiment with new or variations of transmission systems, without the need for modifying the Rules.

Second, the Notice suggests that a station transmitting non-NTSC signals would maintain equivalent interference protection to other stations, requiring a demonstration of equivalent protection and Commission's approval of the non-NTSC system interference

³⁰See Notice supra at paras. 89-96.

³¹ID at para 91 (emphasis added)

criteria.³² NAB submits that amendment of the NTSC transmission standard, as needed, to accommodate the implementation of an HDTV broadcast system is far less intrusive on both the industry's and the Commission's resources and would provide for a more orderly, efficient and expeditious transition to a HDTV broadcast service.

The parameters of the NTSC standard that might hinder the development and implementation of ATV systems are unknown at this time and are more meaningfully addressed when system evaluations are conducted by the ATSC.

NAB urges the Commission to abandon its proposal to convert the NTSC standards to voluntary guidelines at this, or any near, time.

X. PROPOSALS FOR "FLEXIBLE" SPECTRUM USE AND NEGOTIATED INTERFERENCE RIGHTS WOULD APPEAR TO POSE MORE DANGERS THAN BENEFITS TO THE INTEGRITY AND QUALITY OF TV BROADCASTING AND THEREFORE SHOULD NOT BE TESTED WITHIN A NEW ATV SERVICE.

As NAB has previously expressed ³³ there are many and serious technical, legal and policy questions concerning the "flexible" spectrum use concept. Because we view these concerns so seriously, we can only oppose the application of so risky a concept to the broadcast spectrum and to the service that the public relies on for local, and national, news and information, and of course for much of its entertainment programming. As detailed below, we are concerned -- for a number of reasons -- about flexible allocations as well as about privately negotiated interference rights.

NAB's two most important concerns come down to: one, the surety of interference protection and two, the adequacy of spectrum for U.S. television service including that for HDTV.

One, we do not believe that any "flexible private" system, no matter how carefully crafted, can provide the surety of protection against interference to television reception that today's system of clear and easily enforceable interference rules provides. Interference protection is simply not something that can be left to private parties. The actual implementation of an agreement between two broadcasters, or between a broadcaster and another service-type, could easily and perhaps unidentifiably, though

³²See Notice at n. 51.

³³See Comments of the NAB In the Matter of Further Sharing of the UHF Television Band by Private Land Mobile Radio Services, Gen. Docket No. 85-172, (April 11, 1986).