

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)
)
Review of Technical and)
Operational Requirements:)
Part 73-E, Television Broadcast)
Stations)
)
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 NORTH AMERICAN PHILIPS CORPORATION

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SUMMARY

The time is ripe for a careful study of advanced television ("ATV") technologies and their regulatory implications. The Commission has acted wisely by initiating a wide-ranging inquiry and establishing a blue-ribbon advisory panel. North American Philips Corporation ("NAPC") is committing substantial resources to the development of ATV technology, and wishes to play a commensurate role in the formulation of ATV public policy.

Technology now permits significant improvements in the quality of the television viewing experience. Detail can be refined; color can be made more lifelike; picture dimensions can be extended; motion artifacts can be eliminated; and sound quality can be greatly enhanced. U.S. consumers should be able to enjoy these significant improvements in our most important medium of mass communications.

The advent of ATV presents important public policy issues. Will regulatory processes be directed to the objective of nothing less than a high-definition television system? Will spectrum allocations permit ATV to be available via terrestrial broadcasting as well as

cable, DBS, VCR, video player, etc.? Will consumers and broadcasters be permitted to adapt to the new environment at a deliberative pace, and without undue disruption or expense? Will agreement on a single long-term standard permit a rapid and orderly deployment of ATV systems? NAPC submits that each of these questions should be answered in the affirmative.

NAPC is actively engaged in the development of ATV technologies. Progress has been rapid and encouraging. Information about NAPC's progress has been widely shared with industry representatives and policymakers. This cooperation and candor will continue.

NAPC's systems approach is discussed in detail in these comments. The system has two components: a multiplexed analog component signal to serve as a master feeder and distribution signal for satellite transmission to terrestrial stations, CATV headends and DBS receivers, and a two-channel signal that will permit terrestrial broadcasters and cable systems to deliver non-degraded NTSC to NTSC receivers and high-definition television to ATV receivers. NAPC believes that its ATV system offers a viable and attractive technology consistent with sound public policy.

The current NTSC standard has served the public well and cannot responsibly be jettisoned. ATV can and should be introduced in an evolutionary manner that permits enjoyment by those who wish it, but does not cause hardship to those who are not prepared to purchase new receivers or cannot afford them. Compatibility with the NTSC standard should accordingly be an indispensable criterion of an acceptable ATV technology.

The ultimate goal of the evolutionary process should be a high definition television system. "Improved" NTSC and "enhanced" NTSC may be desirable intermediate steps, but only to the extent that they facilitate rather than impede the evolution to HDTV.

The Commission should also do its utmost to ensure that the benefits of ATV will be made available via terrestrial broadcasting, and not just to those who subscribe to cable or DBS services. Television broadcasting plays a vital role in news distribution as well as entertainment, and it is important that this role not be impaired by foreclosing broadcasters from offering quality improvements comparable to those that inevitably will be provided by other video distribution services.

It appears that terrestrial broadcasters will not have the opportunity fully to participate in advanced television if they remain confined to the 6 MHz channels currently assigned. It also appears that the VHF and UHF television spectrum can provide the additional bandwidth necessary to permit widespread deployment of high definition television ("HDTV"), while still satisfying the need for compatibility. Early decisions which reduce the availability of this spectrum must be avoided.

Ideally, spectrum issues should be resolved in conjunction with the designation of a single ATV system for use in all video distribution and display media. The contrasting experiences with AM stereo and multi-channel TV sound teach a compelling lesson: the competition to develop technology must at some point give way to the cooperation necessary to make that technology available to the consumer. Agreement on a single standard must not, of course preclude marketplace competition in associated hardware design and sales.

ATV can bring welcome benefits to the American public. The Commission's activities should be directed toward these ends. NAPC will assist in realizing these goals.

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COMMENTS OF NORTH AMERICAN PHILIPS CORPORATION

North American Philips Corporation ("NAPC") hereby submits its Comments in response to the Commission's Notice of Inquiry with respect to advanced television ("ATV") systems and technologies.^{1/} We believe that the Notice

1/ 2 FCC Rcd. 5125 (1987) (hereinafter cited as "Notice").

Whenever we refer to a specific paragraph of the Notice, the text will be followed by a reference to the applicable paragraph in brackets, e.g., [181]. When the text responds to a numbered inquiry in the Notice, the bracketed paragraph number will be followed by a dash and the inquiry number, e.g., [140-Q5].

establishes a solid foundation for the consideration of ATV issues. Just as important, the Commission appears willing to take positive, standards-setting action, commensurate with its responsibilities under the Communications Act, in a creative process that will focus some of the best minds in the country on the important matters identified by the Notice. We commend the Commission for this action, and we look forward to participating actively in this vital process.^{2/}

^{2/} In the past two years, NAPC has participated in several of the Commission's proceedings, calling attention to ATV issues. See Reply Comments of North American Philips Corporation, Gen. Docket No. 86-336 (November 10, 1986), the satellite scrambling proceeding; Reply Comments of North American Philips Corporation, Gen. Docket No. 85-172 (Aug. 29, 1986), the UHF-land mobile spectrum sharing proceeding, and Comments of North American Philips Corporation, Gen. Docket No. 80-741 (Jun. 22, 1986), the Space-WARC proceeding.

In addition, although omitted from Appendix A of the Notice, NAPC submitted comments to the Commission in support of the broadcasters' Petition for Notice of Inquiry. See RM-5811 (Mar. 6, 1987).

1. INTEREST OF NAPC IN ATV AND OVERVIEW OF COMMENTS

1.1 NAPC Has an Important Interest in ATV

There is no company in the United States with a greater interest in ATV than NAPC. It is among the 100 largest industrial companies in the United States, with over 42,000 U.S. employees, and its largest business is television. This year, NAPC will manufacture nearly two million color television sets in Greeneville, Tennessee. In Ottawa, Ohio, the Company will manufacture nearly three million color picture tubes for itself and for others in the U.S. television market. In all, NAPC has over 9,000 employees in its television-related businesses, and its Philips, Magnavox, Sylvania and Philco TV brands are among the most popular in the country.

Supporting its manufacturing activities, NAPC conducts significant research and development at its laboratories in Briarcliff Manor, New York. The laboratories employ more than 300 scientists and staff, and for more than three years, a preeminent team of NAPC scientists and engineers has been dedicated to the

development of a high definition television (HDTV) system for the United States.^{3/}

1.2 Overview of Comments

The scope of NAPC's development work in HDTV is defined by four criteria: (1) the need for compatibility with the NTSC standard; (2) the need to maintain the NTSC standard so that it may be fully exploited and developed, and can serve as a base from which to evolve gracefully to mass-market HDTV; (3) the need for efficient use of the radio frequency spectrum, accommodating the channel needs of HDTV without major changes to the Commission's channel

^{3/} NAPC is a subsidiary of Philips of the Netherlands which is a principal participant in the European, Eureka HDTV project. Eureka is a joint enterprise of European manufacturers, broadcasters, satellite operators, universities and governments which share a common interest in developing a HDTV transmission technology for the European environment. Eureka has focused upon a European solution, rather than a single worldwide approach to HDTV transmission, in order to develop a system that can provide a compatible evolution from its current, unique transmission technologies (called "PAL" and "SECAM") to HDTV. See "Status Report, High Definition Television System," EUREKA Project EU 95 HDTV (August 1987).

Similarly, NAPC has focused upon an HDTV transmission solution for the unique U.S. (or, more precisely, North American) environment.

allocation plan, and (4) the need to treat equally all emission media, broadcast and non-broadcast, so that each can participate in HDTV without a discernable advantage or disadvantage.^{4/} These criteria are the sine qua non for assuring the benefits of ATV for all viewers via all media, and we urge the Commission to adopt them as the principles on which to base an ATV system for the United States. [¶3]

In addition, we believe that the Commission must adopt HDTV as its goal. Intermediate steps may be desirable, but only if they are technologically compatible and timely steps to HDTV. More than 6 MHz will be required for an HDTV system governed by the above four criteria, and we would urge the Commission to assign the necessary additional spectrum. In the interim, because it is not possible to know the boundaries of HDTV spectrum needs, we would urge the Commission to defer any action that would prejudice the use of broadcast spectrum for HDTV until the parameters of that system are determined.

^{4/} "NTSC" refers to the technical standard for terrestrial broadcast of television in the United States. It was promulgated in 1941 for black-and-white, and was modified for color in 1953. Compatibility with NTSC is discussed at p.18, et seq., below.

Finally, to establish an orderly transition from NTSC to HDTV, we urge that the Commission not compromise the NTSC standard in a way that would jeopardize the tremendous potential for the continuing development of NTSC television receivers, and the economic investments in NTSC transmission and reception equipment.

We encourage the Commission to begin promptly to establish an integrated system of ATV standards, capable of HDTV, so that industry participants can begin to join resources in appropriate ways, to do necessary forward planning and to further ATV technical developments. Nothing would be more helpful to the American television industry at this juncture.

In the discussion that follows, we will develop a view of the television environment in the United States and then postulate an ATV system which addresses the needs of that environment. Finally, we will describe our own system proposal and, in doing so, we will

respond to many of the Commission's inquiries. We will reserve for Reply Comments comparisons with other systems, as may be appropriate.

2. THE DISPARATE ATV COMPETITIVE ENVIRONMENT STATES THE CASE FOR AN INTEGRATED SYSTEM OF ATV STANDARDS

The ATV environment is highly charged with activity. Each segment of the television industry is actively determining its role and opportunities. The forces driving this activity are technological in nature and have caused serious concerns among some broadcast media about unequal ATV opportunities vis a vis their broadcast competitors. Additional concerns have resulted from the market introduction of new, non-broadcast ATV delivery products. Other driving forces are the processes of standards-making bodies, primarily the Commission, but including the international standards-making process of the Consultative Committee for International Radio ("CCIR"). The effect of competitive pressures differs among the distribution media, but the factors generating those pressures, listed below, appear to be universal:

1. Terrestrial broadcast participation in HDTV will depend upon the practical availability of additional rf spectrum for each VHF and UHF licensee.
2. Super VHS ("S-VHS") improved resolution tape recorders have recently been introduced into the U.S. market. Other systems, e.g., Extended Definition Beta, could soon follow.
3. Closed-system HDTV-VCRs with TV monitors are likely to be introduced into the U.S. market in limited quantities in 1989 or 1990.
4. It is forecasted that a MUSE emission HDTV format will be broadcast in Japan by NHK via direct broadcast satellite in 1990.^{5/}

What these factors have made apparent to everyone in the industry is that ATV could drastically change the industry's competitive balance. The following paragraphs exemplify the competitive environment in several of the distribution media.

Terrestrial. Terrestrial broadcasters have led the industry in bringing the important issues of ATV to public light. The critical concern of terrestrial broadcasters is whether they can participate in HDTV if, as we believe, each VHF and UHF licensee will need an increase in its assigned rf spectrum. The resolution of that concern goes

^{5/} NHK is the Japanese government-supported national broadcaster, and MUSE is the non-NTSC compatible HDTV emission system developed by NHK, primarily for satellite transmission in Japan. See National Association of Broadcasters "NAB HDTV Project-Proposed Schedule," September 20, 1987.

to the very essence of the continued viability of terrestrial broadcast as a competitive video delivery service.

Cable. The cable industry sees the Video Cassette Recorder ("VCR") as a critical competitive threat in the short term.^{6/} CATV has always been able to transmit its basic and premium services with quality at least equivalent to terrestrial broadcast and VCR; however, premium channel CATV services such as pay-TV and Pay-Per-View will now face direct competition from the higher quality pictures of S-VHS and, eventually, HDTV transmitted via Direct Broadcast Satellite ("DBS"). To meet this challenge, the cable industry is engaged in the near-term evaluation of options that will match or exceed the quality of products such as S-VHS.^{7/} [188]

^{6/} The CATV industry is also subject to future obsolescence pressures from companies with the capability of providing HDTV service over a Broadband Integrated Services Digital Network ("B-ISDN"). To this end, fiber optics may begin to replace coaxial cable technology in the middle-to-late 1990s.

^{7/} For example, Home Box Office, Inc. recently held demonstrations for the cable industry and others showing the picture quality of HDTV and emphasizing the need for cable operators to meet the competitive challenge of HDTV home VCRs. See "Television Digest," Vol. 27, No. 43, p. 16 (October 26, 1987). At the same time, the National Cable Television Association has created a new task force to examine the potential of both an HDTV solution and an Enhanced Definition Television ("EDTV") solution, called "supercable," to meet the S-VHS challenge. See "Television Digest," Vol. 27, No. 41, pp. 10-11 (October 12, 1987).

Direct Broadcast Satellite. DBS hopes to play an important and active role in the ATV market. DBS industry participants view high-powered Ku-band satellite distribution as becoming a marketplace reality within the 12.2-12.7 GHz band reserved for its use. The satellite broadcasting industry projects an expansion of the two million homes now equipped for C-band television reception to 20-30 million homes equipped with DBS Ku-band receivers during the next 10 years.^{8/} DBS can become a driving force in the U.S. television business if it offers a high-quality broadcast service that can be distinguished by the average viewer from conventional terrestrial broadcast or CATV offerings. HDTV offers DBS that opportunity, possibly using the recently developed, non-compatible MUSE format, and satellite broadcasters and equipment makers appear determined to exploit the potential.^{9/}

Fiber Optics. The Broadband Integrated Services Digital Network ("B-ISDN") is still in its infancy, but rapid technological progress is likely to establish a

^{8/} See the statement of the Satellite Broadcasters and Communications Association, pp. 4-5, filed with the Committee on Energy and Commerce, Subcommittee on Telecommunications and Finance in connection with High Definition Television and Other Advanced Television Systems hearing held on October 8, 1987.

^{9/} Id., p. 3, et seq.

broadband fiber optic network beginning in the 1990s. High capacity transmission and multiplexing technologies are being developed primarily for telephony applications and, by 1995, most of the inter- and intra-city trunk systems are expected to be digital and fiber based. HDTV is a driving force for the implementation of a residential fiber-loop business competitive with the traditional methods of video delivery.^{10/}

Video Tape. VCR has had a significant impact on all conventional video delivery methods. Since 1985, VCR tape has become the dominant and fastest-growing revenue producer in video programming in the United States. Among the newest and most technologically advanced VCR systems is S-VHS, a high-quality EDTV product.^{11/}

S-VHS picture resolution is significantly better than both (non-S/VHS) VCR resolution and the picture from broadcast quality NTSC.^{12/} [¶88,101-22] For the first

^{10/} Due to the massive investment in the existing copper-based telecommunication system, the transition to fiber optics could last for 25 years or more.

^{11/} NAPC estimates 1988 S-VHS sales in the United States of approximately 600,000 units, increasing to 1.2 million units in 1989.

^{12/} S-VHS has about 420 lines of horizontal resolution, compared to about 250 lines for VHS. Broadcast quality NTSC has approximately 330 lines of horizontal resolution.

time, the picture resolution of a consumer tape product is better than the picture available at the end of a cable or from terrestrial broadcast. In addition to higher resolution, S-VHS is able to eliminate NTSC artifacts (e.g., cross luminance effects such as "dot crawl") because it processes luminance and chrominance separately.^{13/} [¶88]

S-VHS is clearly an intermediate step toward a compatible HDTV VCR, and is backward compatible with both NTSC and current-technology VCRs. The next step might be wide-aspect ratio S-VHS, and the following step, HDTV.^{14/} Because S-VHS is based upon the familiar 525 line,

^{13/} S-VHS has a video output in which luminance and chrominance are processed independently from standard rf output. Therefore, cross luminance effects are eliminated only when S-VHS tape records S-VHS program material and plays that program material on a high-end TV receiver with a Y (luminance) and C (chrominance) video input capability.

^{14/} Future HDTV VCRs will also likely be backward compatible with NTSC, VHS and S-VHS. They will probably have baseband component input and output for interconnections with HDTV television receivers. Nevertheless, compatibility with NTSC remains an important issue. If an HDTV VCR format is incompatible with NTSC, decoding would entail format conversion if the VCR output is to be useable on NTSC receivers. This decoding can be complex and, consequently, too expensive for consumer-level product. [¶88]

59.94 Hz (fields per second) scanning standard, it will be readily accommodated by a new generation of TV receivers.^{15/} [TT88,101-Q22, Q23]

3. THERE ARE CRITICAL REQUIREMENTS FOR AN INTEGRATED SYSTEM OF ATV STANDARDS FOR THE UNITED STATES

Our analysis of the terrestrial, cable, DBS and video tape environments, together with the many Enhanced Definition Television ("EDTV") and HDTV proposals being developed, leads us to the conclusion that the time window available to agree upon an integrated advanced television system for the United States is critically short. **We believe that a systems approach to HDTV is necessary. A systems approach would serve all signal carriers, including terrestrial broadcast, CATV, DBS, fiber optics, and stand-alone storage and play-back devices (VCR, and videodisc), with HDTV signals having consistent parameter values which support an integrated family of emission standards.**

^{15/} Conversely, we believe that any new VCR service which depends upon scanning standards different from NTSC will only be slowly accommodated, if at all, in the receiver marketplace.

We know the Commission will act deliberatively in its ATV proceedings; we encourage the Commission to act promptly to establish an HDTV format based upon an integrated systems approach. In doing so, we urge the Commission to consider the following requirements.

3.1 The NTSC Format Should Be Retained as a Standard and as a Vital Link to HDTV

When considering the retention of NTSC as a standard and as the base for ATV development, four inter-related matters must be considered: (1) the vitality of NTSC within the environments of both current and future NTSC receivers and future ATV television sets; (2) the need for ATV signals to be compatible with NTSC receivers; (3) the need for a smooth evolution from the NTSC standard to HDTV; and (4) the need to maintain the integrity of the NTSC standard. [¶83]

3.1.1 NTSC vitality

The Commission has pointed out that the NTSC standard "no longer represents the limits of the present and anticipated future technological possibilities in the home video delivery service."^{16/} We agree, but we also

^{16/} See Notice at ¶6.

observe that NTSC is an invaluable foundation for, not a limitation upon, future technological possibilities. NTSC has served the public well and can continue to serve as a vital base from which to evolve a system for HDTV. [¶6] Improved Definition Television ("IDTV") and EDTV exemplify this point.^{17/}

IDTV, representing compatible, incremental improvements to NTSC, has been developing rapidly in the past few years. For example, comb filters are now used in high-end receivers, helping to eliminate picture artifacts such as cross luminance and cross color.

EDTV, representing picture improvements more extensive than IDTV and requiring system changes beyond

^{17/} According to the terminology of the Advanced Television Systems Committee, IDTV refers to picture and sound improvements accomplished within the television receiver with signal post-processing and within the constraints of both receiver and channel (i.e., 6 MHz) compatibility. EDTV refers to such improvements using both signal pre- and post-processing and without compatibility restraints. Nevertheless, the distinctions between IDTV and EDTV as applied to some features, such as progressive scan (which can be accomplished at the receiver, or at both the broadcast station and the receiver) can be vague. Therefore, in these comments IDTV and EDTV are both considered as receiver compatible, but intermediate, advances in the gamut between NTSC and HDTV.

the receiver, has also been developing.^{18/} However, while backwards compatible with NTSC, EDTV creates new signal emission and receiver design plateaus which, if adopted, will need to be maintained into the future. The Commission should therefore look with favor upon an ATV system which not only provides high definition television but which also permits levels of EDTV technology.

Future improvements to the NTSC picture are certain. NTSC television sets will be introduced with digital signal processing circuitry at baseband and, in some cases, field memory. These receivers will feature progressive scanning and line/field combing that will significantly improve interline flicker, line crawl (most noticeable on large screens), line structure (i.e., static raster), cross luminance, cross chrominance and noise. Other improvements which broadcasters may implement include pre-combing of luminance and chrominance components in the signal encoder, and insertion of a vertical interval training signal for ghost reduction in receivers with suitable signal processing. These

^{18/} Examples of extended resolution and EDTV proposals include those of Dr. Fukinuki of Hitachi and the recent "ACTV" proposal of NBC and David Sarnoff Research Center, respectively. See Notice at ¶24.

techniques have been demonstrated either in simulation or hardware, and each can improve picture quality considerably.

The NTSC picture advancements already implemented or to be implemented in the future represent significant improvements, but they are only a harbinger of the IDTV/EDTV technology yet to come. For example, the Broadcasting Technology Association of Japan ("BTA") has selected the following improvements for inclusion in test broadcasts scheduled in Japan for 1988:^{19/}

- (i) Adaptive pre-emphasis for reduced noise visibility.
- (ii) Gamma compensation for improved luminance resolution in highly saturated color areas.
- (iii) Anti-ghosting (i.e., ghost cancellation) techniques.
- (iv) Wide-band quadrature transmission for improved color resolution.
- (v) Progressive scan at the camera, as well as at the receiver, for reduced interlace error.^{20/}

^{19/} In response to the government-sponsored efforts of the Japan Broadcasting Corporation ("NHK") to institute a country-wide satellite broadcast system, local broadcasters in Japan became determined to help preserve their status by improving the quality of local broadcast. To accomplish this, an association of television broadcasters, equipment manufacturers and others was formed to develop enhancements to NTSC that are both receiver and channel compatible.

^{20/} Progressive scanning in the TV receiver would substantially cure the artifacts presently caused by interlaced scanning in NTSC receivers. However, when limited to 6 MHz, the technique would involve field memory with some motion artifacts resulting.

All of these techniques are known and can provide demonstrable image resolution improvements.^{21/} Importantly, we believe that all of the improvements discussed above will be accomplished without violating the NTSC transmission standard which has served so well for more than 40 years and which can continue to serve with renewed vigor. [¶¶22-26]

3.1.2 Receiver compatibility with NTSC

An HDTV distribution signal should become a standard in the United States only if it is receiver-compatible with the 130 million NTSC color television sets currently in use in this country.^{22/} That is, an NTSC television receiver should display an NTSC picture using ATV signals, but without using adaptive equipment. The principal technical determinant of the level of compatibility of an

^{21/} The above-described activities of the BTA were reported at the meeting of the BTA in Tokyo, Japan on or about October 15, 1987.

^{22/} Throughout these comments, we use the terms "emission" and "distribution" interchangeably to mean the electronic conveyance of HDTV signals from a signal-emitting device (e.g., radio broadcast tower or cable headend) to a television receiver.