ATV emission is its relationship with the NTSC 525 lines-per-frame and 59.94 Hz (fields-per-second) scanning requirements. For example, an ATV system based upon a 1125-line, 60 Hz format might conceivably be "decoded" to be compatible with 525-line, 59.94 Hz NTSC; however, the decoder (really a format converter) would likely be complex and expensive.23/ On the other hand, an ATV systembased upon 525 lines and 59.94 Hz, or some simple multiple of those numbers (e.g., 1050 lines) would be either compatible with, or readily transcodable into, NTSC. Standardizing a level of compatibility that would require an NTSC television viewer to invest in adaptive equipment in order to see a CATV or terrestrially broadcast picture from an ATV signal would not serve the public interest.24/ The public will enjoy the richest variety of program material and the broadcast industry can continue to serve mass audiences only if the Commission

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23/ Format conversion entails signal processing with modification of field rates. It is complex and expensive compared to format transcoding, which is signal processing without the need to modify the field rate.

24/ Similarly, DBS viewers should not have to invest in a complex and expensive converter because a satellite ATV signal is not easily transcodable into a viewable format.

ensures that ATV signals are compatible with NTSC receivers.[25]

Receiver compatibility means more than the capability of displaying an image on an NTSC television set. The ATV signal should be capable of displaying a broadcast-quality NTSC picture on all NTSC receivers. That is, an NTSC television set should receive pictures from an ATV signal that are at least equivalent in quality to the pictures received from an NTSC signal on the same set.[26]

In addition to receiver compatibility, an ATV emission system should be forward compatible. This is especially important for non-broadcast video-delivery

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25/ In order to compare the various advanced technologies, the Commission considers an ATV system to be compatible if its signal can be decoded and viewed on a conventional NTSC receiver. See Notice at ¶81. Within this structure, both the 1125-line and 525-line ATV systems described above, could be deemed compatible; however, we assume that the Commission's liberal definition of receiver compatibility is intended only as a way of determining what additional equipment is needed to decode the ATV signal for NTSC use. Throughout these comments, we have adopted the stricter meaning of "receiver compatibility" which does not include the concept of adaptive or decoding equipment with respect to terrestrial or CATV broadcast. For DBS, the meaning of receiver "compatibility" does not include the concept of format conversion, but only simple format transcoding.

26/ For a discussion of receiver compatibility and picture parity, See "The Concept of 'Compatibility' and 'Evolution'", Document 11, Rev. 1--8/6/87, CCIR Study Groups, Study Programs 27A/11 and 27B/11.

equipment. Products such as VCRs and videodisc players should be able to play back on all television sets both the NTSC pictures it records from an ATV signal and the pictures in current inventories of video cassettes and discs. This, too, should be accomplished without adaptive equipment.27/

Finally, without receiver compatibility in the transition to ATV, there does not appear to be any economically sound way to prevent viewer dislocations. Although simulcast may be a minor part of an HDTV solution, the extent of simulcast necessary to satisfy the needs of every terrestrial licensee desiring to take part in the new service would likely be impractical with the limited radio frequency spectrum available.28/ Simulcast also presupposes a substantial economic investment in transmission equipment which many smaller broadcasters might find restrictive. [¶85] The use of decoders to

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27/ As alternatives to forward compatibility based upon a common standard between the future generations of VCRs/video players and television sets, it has been suggested that: (a) a TV set have the capability of receiving more than one standard signal, or (b) there be a decoded output from an advanced picture VCR or video player to a TV set. See Notice at ¶¶86 and 88. For reasons related in these comments, we believe that these alternatives are impractical, overexpensive, and have a chilling effect on product innovation.

28/ In this context, simulcast means the emission of the same programming in two separate formats on different channels.

prevent viewer dislocation seems equally futile. Format conversion required because of incompatible or unfriendly parameter values with the values of NTSC is economically unsound at the consumer level. [¶87]

In sum, obsoleting the huge base of NTSC consumer equipment, or requiring the purchase of additional, adaptive equipment to interface with NTSC receivers can, and should, be avoided. The television industry and the Commission have a responsibility to preserve, and not neglect, the important economic interests of trusting consumers who have spent billions of dollars on NTSC TVs, VCRs, and other video products; neither can we neglect the educational, informational and entertainment needs of two hundred million viewers.29/

3.1.3 An evolution to HDTV

In general terms, evolution is the smooth, gradual change from an early form to a later form. As applied to ATV, the CCIR Study Group document on compatibility and evolution is precisely on point. It states:

29/ The economics of compatibility also affects business investments such as those referenced in note 30 at p. 23, below.

> "In broadcasting technology, [evolution] is used to denote a smooth and gradual transition between broadcasting service A and broadcasting service B, which follows it in time and is conceived to improve on it or replace it.
>
> "The transition can be smooth and gradual from the technical viewpoint, only if service B is compatible with service A, i.e., if service A receivers can receive and use the signals of service B 30/

We agree with the Study Group, and would add that if gradual evolution requires intermediate technologies, each technological step should be compatible with both the preceding step and the next succeeding step. The television industry (and the Commission) should define the country's HDTV goals and determine how to achieve them before adopting any intermediate (e.g., EDTV) format or taking any action that could prejudice implementation of HDTV. At the very least, a clear view of our ATV goals and their technological requirements (spectrum-wise and otherwise) is necessary so that each intermediate step in the evolution process leaves sufficient development room for both the next step and HDTV.31/

30/ CCIR Study Groups document, supra note 26, at p. 20.

31/ ATV evolution would not only bring some order and direction to video delivery system planning, it would also focus on the need for proper economic planning for the multi-billion dollar signal distribution and reception business. For example, many CATV system operators are currently planning for large investments in expanded-capacity systems. Without knowing the direction that ATV will take, it is difficult to imagine how these investment decisions can be made with a proper level of confidence.

To help assure an ATV evolution with developmental integrity, HDTV as a new standard should not be separate or distinct from the existing television broadcast standard. We agree with the Commission that the establishment of an HDTV standard should be fully integrated with NTSC and, over time, replace it. We believe, however, that NTSC should be supported with product development for many years to come and should be replaced with a new standard only as quickly as the marketplace demands. [¶43]

We estimate that the marketplace will demand retention of NTSC well into the 21st Century. Because the intended psycho-physical effects of HDTV are best realized when the receivers are large screen and are placed three or four picture heights away from the viewer, it is unlikely that smaller screen sizes (20-inch diagonal and below, used in kitchens, bedrooms, playrooms, bathrooms or other places where color TVs have become commonplace) will be HDTV. Moreover, given the higher prices that HDTV television sets are likely to command, compared to the substantially lower prices associated with smaller (non-HDTV) screen sizes, a broad consumer demand for HDTV is questionable. This will be especially true in the first

years after HDTV introduction and in light of IDTV advancements. For many years from the introduction of HDTV, NTSC will remain an efficient, effective and needed standard except for high end, large screen products which are ideal for HDTV.

3.1.4 The NTSC standard should not be relaxed

With respect to regulatory activity, we believe that the NTSC standard should not be relaxed. If the NTSC standard were relaxed or made voluntary, a profusion of formats and sub-formats would emerge, and the television industry would lose coherence. Moreover, a television receiver manufacturer could find it difficult to assure its customers that its products would work satisfactorily with varying signal formats. Without a firm NTSC standard, all manufacturers of NTSC equipment would be unable to exploit years of experience and investment, and would be unlikely to devote resources to develop the still-vigorous potential of the NTSC picture.

Even with technical specifications in the Commission's rules to ensure continued service to

viewers, it is not readily apparent what those specifications could be, other than the full NTSC format, to assure a non-degraded service. **[¶94]** We urge the Commission to adopt the view that if any relaxation or modification of the NTSC standard is warranted for a particular case, that determination should be made only in light of the specific proposal before it and not as a general proposition. **[¶83]**

3.2 Distribution Media Should Have Equal Opportunities to Participate in HDTV

The terrestrial broadcast, direct broadcast satellite and cable television segments of the television industry are each concerned that the proper environment be established to assure their participation in HDTV, both in terms of quality and timing.[32/] Their concerns are well

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32/ See, for example, the statements of Mr. Richard R. Green, Senior Vice President of Public Broadcasting Service; Mr. Fred Paxton, Chairman, the Association of Maximum Service Telecasters; Mr. Daniel Gold, President and Chief Executive Officer, Knight-Ridder and Chairman, HDTV Task Force for the National Association of Broadcasters; and Mr. Charles C. Hewitt, President, Satellite Broadcasting Communications Association, all filed with the House of Representatives, 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.

founded. No medium wishes to find itself transmitting pictures inferior to those of its competitors. As a guiding principle, we strongly believe that an ATV system for the United States must be equally useable by terrestrial broadcast licensees, CATV operators and DBS broadcasters. An advanced television system should not create a discernable advantage or disadvantage for any of the distribution media, and all media should have a practical opportunity to compete in the HDTV marketplace as it develops.

3.3 HDTV Viewing Experience Is the Proper Goal for ATV

In an evolution from NTSC to HDTV, each step forward should show a significantly better picture, compared to the previous step. However, the evolution should have an achievable goal. Although the path to the goal may have intermediate plateaus along the way, the goal for the United States should be nothing less than HDTV.[33/] We

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33/ Although the characteristics of an HDTV picture have not been defined as a term of art, current convention characterizes HDTV as having roughly twice the horizontal and vertical resolution of the current television picture, a 16:9 aspect ratio display, and CD-quality digital sound. The means for achieving these characteristics and their spectrum, picture-quality, and cost tradeoffs vary widely among the many HDTV proposals. Other differentiating technical characteristics among HDTV proposals include the scanning method, the field frequency and the processing of the luminance and chrominance signals.

believe that technology has progressed to the point that it is foreseeable that viewers will be able to enjoy a high-definition picture that is artifact-free at an affordable cost in terms of dollars and spectrum.[34/]

HDTV brings together all of the attributes that the industry has been discussing for years. In essence, all of the excitement of the movie theater is brought into the home with 35 mm movie fidelity, a cinemascopic-effect picture and the same quality sound played on the finest laser compact-disc players. This is the goal elsewhere in the world, and we believe that the American public should not be offered anything less as the ultimate in television development.

34/ The concept of HDTV as the goal of the evolution from NTSC is accepted even by many of the proponents of intermediate, EDTV systems. For example, see the Statement of Mr. Steven Bonica, Vice President of Engineering, NBC, filed before the House of Representatives, Committee on Energy and Commerce, Subcommittee on Telecommunications and Finance, in connection with Hearings on High Definition Television and Other Advanced Television Systems, on October 8, 1987.

3.4 More Than 6 MHz Will Be Required for HDTV

All of our knowledge of current and foreseeable technology indicates that rf spectrum in excess of 6 MHz will be needed for HDTV. **[¶40-Q2]** There are a number of frequency bands that might accommodate the additional spectrum, and the Notice touches on many of them. **[¶¶49-53]** In our own initial work, UHF taboo (and VHF guardband) frequencies have been of particular interest. We believe that with some increase in cost, future television sets could be designed to exploit UHF taboo and guardband frequencies. For example, TV sets might employ double conversion tuners that would eliminate the need for the Sound Image, Picture Image, Local Oscillator Radiation and Intermediate Frequency Beat taboos. In addition, improvements in tuner front-end linearity are likely to result in improved rejection characteristics for adjacent channels. **[¶78-Q20a]**

We are convinced that an HDTV system that is both NTSC compatible and equitable to all distribution media can be implemented without radical changes to the Commission's present channel allocation scheme. But

spectrum work has just begun. We join with Commissioner Quello in urging the Commission that it take no action that could foreclose the availability of additional spectrum for ATV use until an ATV system is selected.[35/] **[¶54 and 78-Q21]**

3.5 There Should Be a Single Integrated System of ATV Standards for the United States

All of our preceding comments lead to the conclusion that there should be one integrated set of ATV emission standards for all distribution media in North America. Competing standards within a particular distribution medium, either initially or after a short period of time (e.g., five years), would have a chilling effect on innovation and improvements in that medium subsequent to establishment of a standard. The AM stereo experience is instructive.

Since the first transmission of AM stereo in July of 1982, NAPC estimates that only 11% of all AM stations have decided to broadcast AM stereo. There have been a correspondingly small number of AM stereo radio sales. This is a direct consequence of first having five and then two

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35/ See Concurring statement of Commissioner Quello, Gen. Docket No. 85-172, FCC 87-327 (released October 21, 1987).

systems vie for acceptance in the marketplace. In contrast, a single standard for multi-channel TV sound was chosen through industry consensus and was first broadcast in 1984. As of August 1987, we estimate that 450 TV stations (28% of the total) covering 95% of the U.S. population are broadcasting stereo sound. About 10 million stereo television receivers have been sold to date, and during 1987, stereo sound will be featured in an estimated 25% of all TVs sold.

It follows that we would not encourage a requirement that ATV television receivers support multiple, non-integrated ATV transmission standards. A requirement of multiple non-integrated standards would produce chaos for television receiver manufacturers, and would likely result in manufacturers waiting until integrated standards were adopted by the marketplace, rather than designing receivers around several systems and duplicating investments in expensive electronic integrated circuits.

We do believe that multiple standards (and multi-standard receivers) have a proper role in an evolution to HDTV, and we draw a clear distinction between that role and the one just described. **[¶¶86 and 98]** For example, in an environment which serves the public interest, EDTV

signal and receivers would be forward compatible with a known HDTV standard, and an HDTV receiver would be designed to receive both HDTV and EDTV signals. For this multi-standard (multi-receiver) environment to become a reality, there must be only one integrated set of ATV emission standards which ultimately provide for HDTV. **[¶88]**

A systems approach would reduce the pressure on each segment of the television industry to foster an independent ATV proposal on its own without an overall plan for an evolution to HDTV. The television industry would not be fragmented, with each segment looking for ways to participate which could be antagonistic to participation by others. We believe that the industry and the American viewing public would suffer great injury from de facto standards that are incompatible with NTSC or which do not offer the even-handed access to all distribution media that would be offered by an integrated systems approach. Given a comprehensive emission system, equipment manufacturers could optimize development of both receiving devices and support equipment as constructive participants rather than as reluctant suppliers reacting to ad hoc standards.

4. NAPC PROPOSES A HIGH DEFINITION SYSTEM FOR NORTH AMERICA, CALLED "HDS-NA"

HDS-NA (short for "High Definition System for North America) is the North American Philips high definition television proposal for North America. It has two components. The first, called "HDMAC-60", is an HDTV satellite emission signal that carries information from a program source to a terrestrial broadcast station, a cable headend, or a viewer's home satellite receiver. The second component, which is derived from HDMAC-60 with a simple transcoder, is an HDTV distribution signal used to carry information from a terrestrial broadcast station or CATV headend to a viewer. This second component is called "high definition NTSC", or "HDNTSC."[36/] Although the Notice appears to treat HDMAC-60 and HDNTSC as separate approaches, they are components of a single system. **[¶¶28 and 37]**

4.1 HDMAC-60 Is the Satellite Emission Signal for HDS-NA

HDMAC-60 is a time-multiplexed analog component signal. It is a master feeder signal that carries information via satellite (or line-of-sight microwave, or fiber optics) from the program source to a terrestrial

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36/ During our April 1987 demonstrations, we referred to these components as "MAC-60" and "ENTSC", respectively. These names are no longer used.

broadcast station, a CATV headend, or, in the case of direct broadcast satellite, directly to a viewer's satellite signal receiver.[37]

HDMAC-60 conveys a 1050 line, 2:1 interlace scan, 59.94 Hz field-rate, 16:9 aspect ratio picture and supports digital CD-quality sound. The equivalent internal parameter values are 525 lines, 1:1 progressive (or sequential) scan, and 59.94 frames per second. Current HDMAC-60 transmits approximately 500 lines per picture height HDTV resolution (equivalent to MUSE) in both vertical and horizontal directions for both still and moving pictures. The signal has a base bandwidth of approximately 9.5 MHz. When frequency modulated, the radio frequency ("rf") bandwidth is 24 MHz and fits within the capacity of a single satellite transponder. The signal is designed to carry encrypted video, digital multichannel sound, and data using currently available equipment.

37/ See "Hierarchical High Definition Television System Compatible With the NTSC Environment," published by Philips Laboratories, North American Philips Corporation, Briarcliff Manor, New York (September 1987), a copy of which has been placed in the public record of this proceeding, for a more detailed description of HDMAC-60.

4.2 HDNTSC Is the Terrestrial Broadcast and CATV Distribution Signal for HDS-NA

HDNTSC is the signal used to distribute high definition television pictures from a terrestrial broadcast station or CATV headend to the viewer. HDNTSC carries all of the information contained in HDMAC-60, including the same resolution in both vertical and horizontal directions, and has signal parameter values identical to HDMAC-60. Because of this design relationship, HDNTSC can be derived from HDMAC-60 at the terrestrial broadcast station or the cable headend using an inexpensive transcoder.38/

When HDMAC-60 is received at a terrestrial broadcast station, it is demodulated and divided into two signals, each of which fits into a 6 MHz band. The first signal is, in fact, a common NTSC signal, 6 MHz wide at rf. It carries the conventional 4:3 aspect-ratio, 525-line, 2:1 interlace-scan television signal with a 59.94 Hz field rate, and retains normal NTSC analog stereo sound.

38/ In Section 3.1.2 of these comments, we have expanded upon the importance of a "friendly" relationship between signal formats for purposes of transcoding and compatibility.

For a more detailed description of HDNTSC, see the Philips Laboratories document referenced at note 37, p. 34, above.

The second (or augmentation) signal is also 6 MHz wide, and contains all the extra information needed to deliver high definition television, including the side panels to widen the standard picture, the extra HDTV picture resolution, improved color rendition, and the data to achieve CD-quality digital stereo sound. Together, the two 6 MHz signals of HDNTSC comprise HDS-NA. Several rf techniques may be developed to distribute the two HDNTSC signals from terrestrial broadcast stations to viewers. One technique uses the combination of an analog signal for the NTSC channel and a digital signal for the augmentation channel, while another is entirely analog. Both emission methods hold the potential for an attractive, efficient use of the rf spectrum.

4.3 Early Results Show That HDS-NA Has Promising Emission and Spectrum Characteristics

4.3.1 Emission and spectrum

HDS-NA requires the bandwidth of two 6 MHz channels. We believe that a comprehensive spectrum plan is possible that will permit VHF and UHF terrestrial broadcasters to use HDS-NA without a material change in the current rf spectrum assignments. The following is a brief description of some of the spectrum plans we have

examined in support of HDS-NA. Additional work is needed to refine these plans and to evaluate further their propagation and interference characteristics. [¶50-Q6]

-- Digital Modulation of Augmentation Signal with Analog Main Channel. One spectrum solution is to modulate the augmentation channel digitally and use analog modulation for the main channel. Digital modulation allows power to the augmentation signal 15-20 dB below the power needed for analog modulation of the main channel.39/ Digital modulation at low power allows the service area coverage of the augmentation channel to be equal to the coverage of a main NTSC channel at higher power. This result would not be possible if both channels used analog modulation.

While digital modulation is in many ways attractive, it does require sophisticated bit rate reduction techniques. However, the consequent digital signal processing is consistent with the expected evolution of digital receiver technology.

39/ The low power ratio of digital modulation (i.e., the ratio of signal power-to-noise) is possible for two reasons: (1) the reception of digital signals is less affected by noise than analog signals, and (2) sync pulses are not used.

At this stage of our work, we see two rf spectrum engineering implementations of a digitally modulated augmentation channel. The first involves channels adjacent to the main channel (i.e., channel n - 1 or n + 1 where "n" equals the channel to which the receiver is tuned), and the second involves spectrum in non-adjacent channels above the main channel (i.e., UHF channel n + 14 or n + 15).

o Digital Modulation Using Adjacent Channels. The radiated augmentation signal, without a carrier, could be placed in channel n - 1 or n + 1 in which case the augmentation signal would exhibit a flat energy denisty (i.e., energy would be spread throughout the channel.) As a result, interference at n would appear as only a slight increase in the random noise level, not as channel print through or as a beat pattern.

Using an adjacent channel scheme, all VHF and UHF licensees could participate in HDTV. However, all but three VHF channels (2, 5 and 7) and one UHF channel (38) have lower adjacent channels available, and all but three VHF channels (4, 6 and 13) and one UHF channel (36) have upper adjacent channels available. These exceptions would

require special treatment. An additional 18 MHz of VHF bandwidth would need to be assigned to accommodate the three VHF channels without available guardband space and an additional 6 MHz of UHF spectrum would be required to serve the UHF exception. This scheme presents the disadvantage of not treating all channels in an even-handed way--those channels without available guardband space would need to accept reassignment.

o Digital Modulation Using Channels n + 14 or n + 15. The radiated augmentation signal could also be placed in UHF channel n + 14 or n + 15. In this implementation, all VHF and UHF licensees would have the same even-handed opportunity to participate in HDTV. Below channel 55, all UHF channels have a channel n + 14 and n + 15. However, for UHF channels 56 and above, neither channel n + 14 nor n + 15 exists. Today, there are 168 UHF licensees at channel 56 or above. If those 168 UHF licensees were allowed to use either channel n + 14 or n + 15 of a UHF broadcaster who has both of those channels available, there would be 722 channels left for the augmentation signals of the 680 current VHF licensees. **[¶105]**

o Digital Modulation Using A Super Augmentation Band. Another alternative worthy of examination is

the use of a 42 MHz band, in either VHF or UHF, to be reserved in each local service area for the placement of VHF HDTV augmentation signals. To serve UHF licensees, a minimum additional 54 MHz would be required in each service area.[40/] The augmentation signals would be digitally modulated and time multiplexed. Because of the low power required for digital modulation, co-channel interference rejection characteristics of the band would be excellent, and spectrum could be reused in contiguous service areas. **[¶50-Q10]**

-- Analog Modulation Using Quadrature in Lower Adjacent Channel. Modulation of the visual carrier in phase quadrature with the augmentation channel radiated in the lower sideband (n - 1) permits an efficient use of rf spectrum. For example, using quadrature modulation, a 12 MHz band can support an 11.25 MHz bandwidth HDTV signal. Using conventional modulation techniques, the same 12 MHz band could support only an 8.4 MHz signal.

Quadrature modulation can have attractive interference characteristics. Because no carrier signal is transmitted in the lower adjacent channel, the

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40/ Each service area includes up to 7 VHF and up to 9 UHF stations.

potential for interference is greatly reduced. The quadrature carrier is attenuated 6 dB at the transmitter and the sidebands near the carrier are also attenuated, assisting the television receiver to reject unwanted information. Moreover, proper phase switching of the quadrature signal would result in minimally detectable interference with a same-channel NTSC signal on current NTSC sets.

However, use of a lower adjacent channel for analog modulation of the augmentation signal can result in interference on receivers between service areas where the lower adjacent channel in one area is the main channel in the other. Although this concern may be addressed using antennas with high directivity and gain (including circular polarization), in some instances interference may be a problem.41/

In addition, this alternative suffers from the same disadvantage described in the discussion of using channel n - 1 with digital modulation. Certain VHF and UHF licensees require reassignment owing to the unavailability of guardband space. **[¶¶45, 50-Q7, Q8a, Q8b and Q9]**

41/ This is not different from the environment today where sites equidistant from multiple service areas suffer from terrestrial signal interference problems.

4.3.2 Taboos

The HDS-NA spectrum plans discussed above introduce sideband energy into taboo channels n - 1, n + 1, n + 14 or n + 15.[42/] This sideband energy will be rejected by the rf selectivity characteristics of most existing television receivers in the case of n - 1. In the case of channels n + 14 and n + 15, the power characteristics of the digitally transmitted augmentation signal will prevent interference with the main channel on all existing sets. These results are preliminary. Once the industry has focused on specific options for ATV spectrum use, studies should be undertaken to determine precisely the effects of ATV signals in the n - 1, n + 14 and n + 15 taboos and the effects of these signals on NTSC receivers of all ages.

No UHF taboo or VHF guardband should be modified or eliminated until it has been examined in the light of yet unknown ATV interference considerations. **[¶¶72, 78-Q16]** However, the Commission should preserve its options and opportunities with respect to the assignment of spectrum currently taken by taboos and guardbands so that radio frequency spectrum can be used for providing HDTV services to the public. **[¶¶68, 78-Q19, Q21 and 79]**

42/ See Notice at ¶61, et seq.

4.4 HDS-NA Offers An HDTV-Quality Viewing Experience

As the Commission is well aware, the NTSC standard has limitations which adversely affect the quality of the picture.[43] HDS-NA is designed to eliminate cross-color and cross-luminance artifacts and improve significantly picture quality and sound.

(i) Cross color and cross luminance are non-existent in the HDMAC-60 satellite emission signal because of the way in which the luminance ("Y") component and the chrominance ("V" and "U") components are generated and then transmitted using time division multiplexing. In the case of the HDNTSC distribution signal, signal pre-processing (i.e., pre-combing) at the transmission station, together with adaptive post-combing in the HDTV television receiver, minimize these effects so that they are virtually invisible.[44]

(ii) Because HDMAC-60 and HDNTSC are based upon progressive scanning and use line differential techniques, all of the interlace artifacts of NTSC transmission are eliminated. Thus, the HDNTSC high definition picture has no line flicker, line crawl, vertical aliasing, temporal aliasing, or large area flicker.

43/ See Notice at ¶8, et seq.

44/ The HDNTSC signal, pre-processed at the terrestrial broadcast station or cable headend, will also reduce color quality defects on NTSC television sets with comb filters. Thus, HDNTSC has the potential to improve the viewing experience for consumers using those NTSC receivers.