service; and (iv) the almost-complete universality of local broadcast service. Other systems that are free to exploit HDTV technologies without allocation restraints do not share these attributes.

B. Regulatory Action

In anticipation that the record will establish that some sort of regulatory response is indeed required, the Commission should seek comment on the options available to it. These would appear to fall into two general categories: 1) direct intervention in the marketplace and 2) structural intervention in the marketplace.

1. Direct Intervention

By direct intervention we mean measures which are intended to directly affect the relative market shares of the home video competitors. At one extreme, for example, the Commission could, leaving jurisdictional issues aside, bar the sale of television receivers capable of receiving any transmissions other than NTSC signals. Another direct intervention approach would be to directly subsidize, either with direct expenditures or through the use of Commission research facilities, the development of advanced television technologies which are compatible with both existing NTSC receivers and existing 6 MHz channels. (This system of centrally-funded research and subsidies is, of course, the mechanism employed by Japan in developing HDTV, though the

Japanese did not make compatibility with local broadcast systems a significant priority.)

The costs of direct intervention would be generally quite high and the benefits uncertain. Barring the introduction of HDTV equipment, for example, could result in both substantial short-term losses of consumer welfare and long-term counterproductive disincentives for investment in advanced television systems. Direct expenditures not only could be quite large but would embroil the Commission in investment decisions requiring expertise which the Commission might find difficult to obtain. Moreover, there are significant questions as to whether the Commission has sufficient jurisdiction over the manufacture, importation and sale of the equipment or sufficient authority to engage in direct subsidies.

Thus, while the Commission may seek comment on whether the benefits would exceed the likely costs of direct regulatory intervention in the home video marketplace and include these options in its inquiry, we believe it unlikely that direct intervention will be desirable.

2. Structural Intervention

By structural intervention we mean intervening to remedy or counteract identified market failures and, at the least, to ensure that the public receives the full benefits of an efficiently functioning home video marketplace.

Here, the principal market imperfection which must be addressed is the limited spectrum allocated to local broadcasting. The Commission should investigate the means by which sufficient additional spectrum could be made available to local broadcasters to ensure them an opportunity to implement such advanced television technologies as the marketplace dictates. It would seem useful to solicit comment on the benefits and costs of several specific possibilities:

a. More intensive use of existing local broadcast allocations

There is still unoccupied spectrum in the UHF television band. Outside the major markets, full 6 MHz allotments exist or could be granted employing existing interference protection criteria. Even in the most crowded markets, portions of channels could be made available without diluting existing interference protection standards. Cf. Comments of MST, General Docket No. 85-172 (July 11, 1986) at 17-21. Comment should be solicited on how much of this spectrum is available and how it might be used for the provision of advanced television services.

The Commission might request comment on the extent to which additional spectrum in the UHF band could be obtained for advanced television services through the

adjustment of existing broadcast-to-broadcast interference protection standards with little or no loss of actual service.[10/]

* * *

There are other options which the Commission may want to consider. We list them here for the sake of completeness only, though each carries with it very severe disadvantages. The undersigned emphatically do not endorse these options. Indeed, all or most of the undersigned might well oppose these options.[11/]

Although it is a radical measure which clearly would entail enormous disruption and expenditures, the Commission could also explore the facts and benefits of partial or total "repacking" of the VHF and UHF bands, i.e., reshuffling existing channel assignments, to accommodate either wider contiguous channels or non-adjacent spectrum for supplementary transmissions. It could also explore the

---

10/ A great deal of work with respect to land mobile-to-broadcast interference protection standards has also been performed recently in connection with the proposal to reallocate UHF spectrum to private radio users. UHF TV Band, 101 F.C.C. 2d 854 (1985) (General Docket No. 85-172). Comment should be solicited on the pertinence of this work to more intensive broadcast use of the television bands.

11/ But the fact that these options should be contemplated at all is an indication of the seriousness of the threat that local broadcast service will be precluded from participating in the new video technologies.

potential additional spectrum which would be made available, and, of course, the losses of diversity, which would result from dividing up some existing stations to permit the remainder to carry HDTV. Because of the tremendous costs entailed by these possibilities, the undersigned believe that at most they should be considered only after all other options have been found wanting.

* * *

Each of these possible adjustments in the use of existing broadcast spectrum could entail a substantial number of ancillary alterations in the Commission's broadcast ownership rules, e.g., the duopoly rule. Comment should be sought as to these issues as well.

b. Reallocation of additional spectrum from non-broadcast bands

The Commission may also need to ascertain whether additional spectrum should be obtained from that currently allocated to other services.

One such possibility is a reallocation of a part or all of the 12.2 to 12.7 GHz band, though this band presently has drastic and possibly insurmountable shortcomings. Internationally, terrestrial broadcasting has a co-primary allocation for these frequencies. 47 C.F.R. § 2.106. Domestically, the Commission allocated this spectrum entirely

to DBS. Direct Broadcast Satellites, 90 F.C.C 2d 676 (1982). The Commission declined to allocate any of this spectrum to terrestrial broadcasting because it concluded that all 500 MHz would be required for satellite use. Id. at 704-05. Five years later, it now appears that the demand for DBS services will be much less substantial. See, e.g., Report and Order in FCC Report No. MM220 86-359 (January 7, 1987) (CPs for three DBS applicants cancelled for failure to begin construction). Consequently, a reallocation of part of the band to terrestrial broadcasting for HDTV may now be possible[12/] without precluding any bona fide prospective DBS operators from taking their chances with that service.

The undersigned wish to emphasize that many broadcasters feel that it will never be technically feasible to use the 12 GHz band for terrestrial broadcasting. Signals in this band have an extremely limited range. For example, even assuming a signal-radius of 20 miles, it could require as many as ten transmitters to cover the service area now covered by a single VHF or UHF transmitter and the problems of frequency coordination and mutual interference might be too expensive or even impossible to overcome.

12/ Thus, an allocation of half the DBS band to local broadcasters would provide over forty 3 MHz-wide channels and fourteen 8.1-MHz wide channels for local broadcasting, while still leaving 250 MHz for DBS operations.

Moreover, this service would be vulnerable to terrain and foliage blockage and rain attenuation. At best, substantial technical breakthroughs would be required to make this band usable for terrestrial broadcasting, and even then cost considerations might make this option wholly unfeasible. Nevertheless, the severity of the potential impact upon the local broadcast system of the Commission's failure to provide it any additional spectrum requires inclusion of this option. The Commission should expressly solicit comment on the technical and practical feasibility of using this band.

V. CONCLUSION

For the foregoing reasons, the Commission should immediately initiate an inquiry into the nature and likely consequences of this country's transition from an NTSC home video system to an HDTV system and what responsive action should be taken by the Commission.

February 13, 1987

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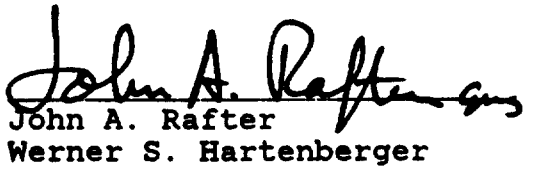

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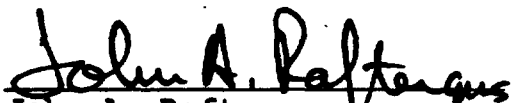

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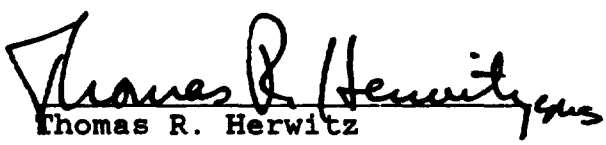

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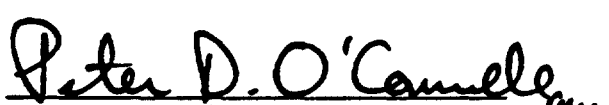

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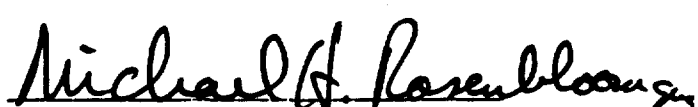

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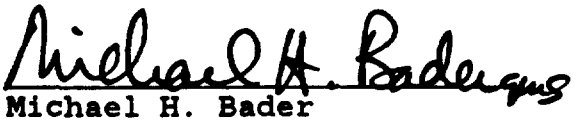

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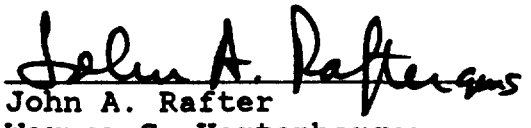

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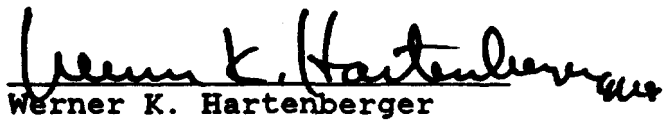

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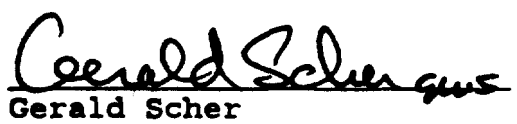

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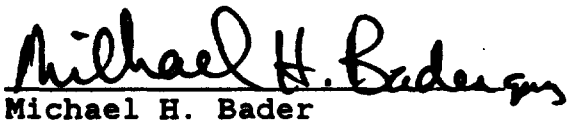

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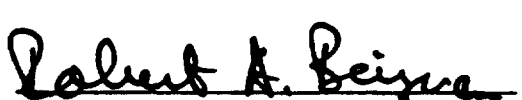

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Appendix A

ADVANCED TELEVISION TECHNOLOGIES OTHER THAN HIGH DEFINITION TELEVISION

I. IMPROVED NTSC SYSTEMS

These systems seek to improve upon television image quality, and in some cases sound quality as well, while operating wholly within the NTSC broadcast standards. Proposals of this nature which are under development include:

-- "Combing" the interspersed luminance and chrominance signals at the transmitter and the receiver, so as to reduce artifacts;

-- Conversion from interlaced to progressive scan,[1/] whether in the display only, or in both the camera and the display, both retaining interlaced transmissions. Through the

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1/ Inside an NTSC television set, the electron guns "scan" 525 horizontal lines on the surface of the picture tube to produce each "frame," or complete picture. The NTSC system uses "interlaced" scanning, in which first the odd, then the even lines are scanned in succession. Since only half of the lines constituting the frame are scanned in each "field," interlaced scanning doubles the scan frequency to 60 fields/second, thereby vastly reducing "flicker." However, due to the 1/60 second time difference between odd and even fields, moving contours are displayed with jagged edges.

Progressive scanning eliminates this effect by scanning each line of the field in sequence. Field stores and motion adapter circuity must be used to retain the 60/fields per second scan rate and thereby avoid perceptible flicker.

use of line and field stores in the receiver,[2/] this makes possible a doubling of the number of horizontal lines, thereby eliminating the appearance of the raster and improving the perceived degree of resolution; and

-- Making better use of the video bandwidth by interspersing additional, higher definition luminance information.

The net effect of these improvements is to approximately double the amount of displayed information and significantly reduce image imperfections. Most of these techniques can also be used to improve the more radical advanced television systems described below.

By definition, these improvements are compatible with current local broadcast channels and existing home receivers. They are also, of course, compatible with all other home video delivery mechanisms.

The above list of necessity is only partial and incomplete. Other efforts are also being made, some of which

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2/ Line and field stores are microprocessor memory devices contained in the television receiver reduce the perceptibility of certain picture defects. These devices average picture elements from the preceding and succeeding fields, allowing the apparent scan rate (frequency) or resolution (picture detail) to be increased without the need for additional information transmission capacity.

are proprietary and unpublicized.[3/] Clearly, the Commission should solicit further information as to all possible techniques for exploiting the full potential of the existing system in a compatible manner.

II. ENHANCED 525-LINE SYSTEMS

A second group of proposals retains the existing display format of a 4:3 aspect ratio and 525 horizontal lines, but alters the current NTSC transmission standards in an effort to improve clarity and color fidelity. These systems in effect "repeal" the engineering compromises which facilitated the compatible conversion to color, instead

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3/ In Japan, the Broadcasting Technology Association (BTA) is now evaluating at least three different improved NTSC-compatible (sometimes referred to as extended definition television, or EDTV) systems, including systems developed by Asahi Television Corporation, Hitachi and NHK. The BTA intends to select one of these systems for implementation by local broadcasters in Japan.

According to news reports, RCA Laboratories is now developing NTSC receivers with quality-enhancing frame store capabilities. Similar work is being funded in this country by the Center for Advanced Television Studies (CATS), a research consortium formed by ten U.S. companies, including ABC, NBC, PBS, HBO and several manufacturers of video recording and broadcasting equipment. The mission of CATS is to sponsor research by independent academic institutions into improving in the U.S. television system. Projects will focus upon increasing the efficiency of television signal transmission and enhancing picture and sound quality for optimum viewer satisfaction. The first such project is the Advanced Television Research Project at the Massachusetts Institute of Technology, which has been conducting research since 1983 into the perceptual and technological basis for improved television systems.

employing luminance and chrominance information in non-overlapping components or "packets," separated in time. Such component transmissions permit the use of greater luminance and chrominance bandwidths and eliminate cross-modulation artifacts. At least one such system, the B-MAC (a type of multiplexed analog component system) is now being marketed by Scientific Atlanta. Other MAC variants are apparently being developed.

The problem is that the Scientific Atlanta B-MAC system, intended primarily for use in satellite transmissions, has a bandwidth of slightly more than 6 MHz. While it is possible to compress a component transmission system into a 6 MHz-wide channel, this will require some reduction in clarity and color fidelity. Regardless of their bandwidths, the Scientific Atlanta and other proposed component systems can be carried by all other home delivery media, including satellite, cable and videocassettes and discs.

Even if compressed to 6 MHz, component systems are not compatible with current receivers. For existing sets to receive such signals, they must employ a converter or black box.

Component systems carry the potential for substantial improvement over the NTSC system, though it appears that such improvements could not be compatible with existing receivers even if compressed to fit existing channels.

III. DEVELOPMENTAL STATUS

Most of the described advancements in the NTSC system will be implemented within the next five years. Indeed, some set manufacturers are already marketing receivers with comb filters and progressive scanning. In any event, since each of these improvements is an advancement in the receiver's ability to process and display information already being made available to it, all home video transmission media will benefit equally from these advancements.

Of the enhanced 525-line systems, only Scientific Atlanta's B-MAC system is certain to be commercially marketed. The B-MAC system was designed and intended to be used for the delivery of satellite programming to cable systems and other retransmitters. It is already being used to deliver satellite programming in Australia.

In Japan, the Broadcast Technology Association (BTA) will soon recommend a choice of an Extended Definition Television (EDTV) system to the Ministry of Posts and Telecommunications, which will then adopt it by 1988 as the standard for terrestrial broadcasters. Implementation is predicted by 1992.

The status of HDTV is described in the text of the Petition at pp. 16-18.

Appendix B

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