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Federal Communications Commission
Office of the Secretary

BRUCE H. TURNBULL
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November 18, 1987

Mr. William J. Tricarico
Secretary
Federal Communications Commission
Washington, D.C. 20554

Dear Mr. Tricarico:

Enclosed herewith are an original and eleven (11) copies of the Comments of Matsushita Electric Corporation of America on behalf of the Matsushita Electric Industrial Group Companies in response to the Federal Communications Commission's Notice of Inquiry in MM Docket No. 87-268.

Please address any questions concerning this filing to me or to M. Joel Bolstein.

Sincerely,

Bruce H. Turnbull
Bruce H. Turnbull

Enclosures

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Before the
Federal Communications Commission
Washington, D.C. 20554
Federal Communications Commission
Office of the Secretary

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 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 ✓

TO: The Commission

COMMENTS OF
MATSUSHITA ELECTRIC CORPORATION OF AMERICA
AND THE
MATSUSHITA ELECTRIC INDUSTRIAL GROUP COMPANIES

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Date: November 18, 1987

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SUMMARY

By these comments, Matsushita joins the growing chorus of voices calling for the Commission to authorize an advanced television service as soon as possible. While High Definition Television ("HDTV") and other improvements on the current NTSC technology both offer benefits over the present system, Matsushita believes that the new technologies should be considered separately because there are advantages and disadvantages for each.

Matsushita believes that Advanced Television ("ATV") offers substantial benefits to broadcasters, cablecasters, program producers, retailers, equipment manufacturers, but most of all, to American consumers. To help bring these benefits to fruition, we recommend that the Commission, being sensitive to the economic viability of the TV broadcast industry, choose a delivery standard whose performance will be as close to that of HDTV as possible. In this regard, Matsushita recognizes that there is a compelling need for the broadcast ATV service to occupy more than 6 MHz, and we believe that the optimum location is in the UHF/VHF bands.

In order to produce the best result for all affected parties, Matsushita proposes that the Commission

launch an expedited investigation to decide how much additional spectrum space is necessary to transmit the extra information required to provide ATV service, and how that added information should be packed in the spectrum space adjacent to the main channel to minimize interference to NTSC service on existing receivers.

It is important that in the process of bringing ATV to American consumers, the Commission continues to exert its technological expertise, particularly in the area of maintaining the integrity of the broadcast spectrum for use only by ATV and keeping it free of unwanted interference.

Matsushita wholeheartedly agrees with the Commission that the benefits of ATV must be available to all viewers. Although we have a strong bias favoring free markets, we believe that in order for a new ATV technology to be successfully launched, there must be some regulation to provide consistency and to make the business environment stable for all market participants.

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MM Docket No. 87-268

COMMENTS OF
 MATSUSHITA ELECTRIC CORPORATION OF AMERICA
 AND THE
MATSUSHITA ELECTRIC INDUSTRIAL GROUP COMPANIES

Matsushita Electric Corporation of America and the
 Matsushita Electric Industrial Group companies hereby submit
 the following comments to the Federal Communications
 Commission ("FCC" or "Commission") in response to the Notice
 of Inquiry ("NOI" or "Notice"), in MM Docket No. 87-268
 concerning Advanced Television Systems.¹

1. 2 FCC Rcd 5125 (1987).

INTRODUCTION

Matsushita Electric Corporation of America ("MECA") and the Matsushita Electric Industrial Group companies (collectively referred to as "Matsushita") appreciate this opportunity to comment on the technical and public policy issues surrounding the use of advanced television technologies by broadcasters. We welcome the Commission's attention to ATV, as evidenced by its Notice of Inquiry, as an essential step in the renovation of the present U.S. TV system. For the past two decades, Matsushita, which markets products in the U.S. under the Panasonic, Technics, and Quasar trade names, has played a leading role in the continuing evolution and expansion of the American consumer electronics market. In particular, we have remained at the forefront of the ongoing development of television technology. Thus, we recognize the Commission's NOI as an important and necessary step to ensuring that regulatory standards will continue to accommodate advances in television broadcast technology.

It is Matsushita's firm view that all elements of the television marketplace -- from equipment makers, to broadcasters and programmers, to television viewers -- will find the advent of HDTV to be beneficial. For television viewers, in particular, HDTV will mean vast improvements in

picture clarity, color resolution, and enhancement in sound quality. It represents the latest -- and possibly the most significant -- step in a technological evolutionary chain, which has seen television progress steadily from a display of simple black-and-white images, to the widespread availability of color in the 1960s, to the many advances in quality and uses that have come in the 1980s, e.g., stereo, digital, teletex data services, and closed-captioning for the hearing impaired.

Matsushita eagerly awaits the time when HDTV becomes a commercial reality, and we believe that the market and regulatory mechanisms are now functioning to allow this to happen within a reasonable period of time. We applaud the Commission and all others who have worked to bring us to this point, and pledge our full cooperation, on "both sides of the ocean" for the remaining effort to bring HDTV to market. In Japan, Matsushita has been participating in studies of HDTV and EDTV systems as a member of the Broadcast Technology Association ("BTA"). On the U.S. side, the Matsushita Technology Center ("M-TEC") in Secaucus, New Jersey, has been spearheading MECA's HDTV efforts through, among other things, its active participation in the Advanced Television Systems Committee ("ATSC") and various industry organizations, all of which are dedicated to contributing to the effort to

establish a new ATV system. We also feel privileged that Jack Pluckhan, President of Quasar Company, has been asked to serve on the joint FCC-industry HDTV Advisory Committee.

As our following Comments indicate, we recognize that conversion to an HDTV system may not be without its difficulties. However, it is Matsushita's belief that the system's ultimate performance should be worthwhile and capable of adapting to new developments, bringing greater benefits to all segments of the society.

Matsushita's Comments are in the specific form of answers to the questions as they were enumerated by the Commission in its NOI. Responses have been provided for the questions which we believed were the most appropriate for us to answer and for which our answers would be the most beneficial to the Commission.

We hope that the opinions expressed in these comments are helpful to the Commission in its consideration of ATV, as we wish to constructively cooperate with both the FCC and the BTA.

RESPONSES TO QUESTIONS
ENUMERATED IN THE NOI

QUESTION 1: What criteria, such as video/audio quality performance, transmission bandwidth, NTSC compatibility, etc., should the Commission use to evaluate and compare the various ATV technologies? What are the appropriate trade-offs between the various criteria?

Generally, we believe that, to insure the competitive position of the Broadcast TV industry, the focus of the Inquiry should be on identifying the amount of spectrum space available for the emission of ATV signals and the techniques available for maximizing the information to be placed in this space.

We recommend that HDTV and Improved NTSC ("INTSC") be considered separately in the evaluation of ATV technologies. With HDTV, extremely high picture quality (as defined by the ATSC T3 Technology Group) and sound quality (such as that produced by Compact Disks) can be expected. With INTSC, improvement of picture quality and sound quality can be achieved while maintaining compatibility with existing NTSC receivers and keeping the present 6MHz emission bandwidth. For instance, some increase of horizontal image resolution and a widening of the image aspect ratio,

(heretofore not considered as part of INTSC) can be considered.

In addition, we strongly recommend that means for the reduction of transmission multipath be included.

QUESTION 2: What changes in ATV technologies should be anticipated for the near future? For example, can ATV technologies be expected to develop so that the transmission bandwidth of a high resolution production source can be compressed to fit within 6 MHz channel without apparent loss of quality? At what stage is the development of an all-digital ATV system using digital signal processing and IC technologies?

The baseband signal bandwidth of an HDTV system will be 20-30 MHz. All of the techniques used to reduce the emission bandwidth of HDTV made public to date utilize digital signal processing in some form, but none of these achieve the goal of successfully compressing an HDTV-quality image into a 6 MHz channel. We do not expect the successful development of such in the near term.

On the other hand, it is considered very feasible to improve the image quality of the present NTSC system within the 6MHz bandwidth by making use, in part, of digital technologies while maintaining compatibility with present

NTSC receivers. However, such INTSC image quality falls short of that of HDTV.

We estimate that the successful development of an ATV system using digital emission techniques is many years away.

QUESTION 3: How quickly are developments of the various ATV technologies progressing? Which are now operational? Which are in prototype stage? Developmental stage? How long until these systems are realized?

The outline of the INTSC system which is currently under examination by the Broadcast Television Association ("BTA") in Japan will be the subject of Comments by the BTA (in Japan, such systems are called "Extended Definition Television" or "EDTV"). We will describe the EDTV system which Matsushita has proposed to the BTA and express our opinions on its feasibility.

We proposed to the BTA (1) a system to add new information to the current 6MHz band using quadrature modulation of the video carrier while maintaining compatibility, and (2) a scheme to remove multipath image degradation using a pseudo random signal train as a Ghost Cancelling Reference ("GCR") Signal, and a method to transmit identification signals in EDTV signals using this scheme.

1. QUADRATURE MODULATION OF THE VIDEO CARRIER

In this system, additional information is compatibly multiplexed into the NTSC signal by the use of an added quadrature component to the picture carrier of the NTSC signal. The detailed principle is described in Appendix 1 ("An Extended Definition Television System Using Quadrature Modulation of the Video Carrier with Inverse Nyquist Filter," IEEE Trans. Consumer Electronic, vol. CE-33, pp. 173-80, Aug. 1987). A number of options are created for improving an NTSC image using this new information channel:

- A. High frequency components of luminance & chroma signals.

We have successfully transmitted such improvement signals using experimental hardware in our laboratories. We conclude that it is possible to transmit high frequency components of the luminance signal beyond those transmitted by today's system. Interference to existing receivers is minor. The results of this effort were presented to the BTA in March, 1987.

- B. Transmission of side panels.

The present aspect ratio of the NTSC system is 4:3. It is possible to transmit an image with 16:9 aspect ratio by transmitting the extra information (called side panels, the extra image area on either side of the conventional image)

for increasing the aspect ratio. We have constructed prototypes of hardware to implement this concept, completed checks of basic operations, and are currently improving the details of its operation.

The transmission of side panel information, considered to be impossible with conventional analog technologies, is possible by making use of digital technologies. Since our technique is based on the current NTSC signals, it can be easily combined with other NTSC improvement technologies and, therefore, provides extendability. An increase in the aspect ratio will have a major impact on the video industry.

2. GHOST CANCELLER USING A PSEUDO RANDOM GCR SIGNAL.

A pseudo random signal is transmitted as a GCR signal, and ghosts are cancelled in the receiver by a transversal equalizer referencing this signal. The detailed principles of this technique are shown in Appendix 2 ("A Ghost Cancelling Using Pseudo Random Signal Train"). This technology has already been put into practical use in a ghost canceller for Teletext which is described in Appendix 3 ("Adaptive Equalizer for Teletext Receiver," IEEE Trans. Consumer Electronics, vol. CE-32, pp. 533-37, Aug. 1986). This signal can be used as a high performance GCR even when the signal-to-noise ratio is low. In addition, this system

is capable of transmitting digital data simultaneously, making it possible to transmit identification signals which are required for providing extendability to the EDTV system.

The BTA is currently examining 1A and 2, with the target of placing them in practical use in 1989. The technique in 1B is to be examined in the future.

* * * *

In Japan, HDTV will be put into full operation by use of the broadcasting satellite BS-3 in 1990-1991. This HDTV system has been extensively described in the technical literature. We are currently developing various HDTV products based on this service.

QUESTION 4: What are the relative costs of these new transmission systems for programming producers? For broadcasters? For consumers?

Particular attention must be paid to the receiver costs consumers will be asked to pay for improving performance. Receiver cost will have a strong influence on the growth rate of the new ATV service, as consumers balance their perception of the increase in image quality against cost.

Therefore, careful study is required because the receiver cost depends heavily on which ATV system is adopted. Further, seemingly minor variations in approach to the same ATV system can have major implications on cost.

QUESTION 5: From a technical perspective, what are the advantages and disadvantages of augmenting the channel capacity of existing television assignments? What is the appropriate bandwidth for the augmentation channel? Must it be contiguous to the main channel?

It is desirable to allow the TV broadcast industry the opportunity to deliver an image whose quality is as close to HDTV as possible. This is strongly needed for the future economic viability of the TV broadcast industry.

This will require the use of additional spectrum per TV station, in the form of an augmentation channel. The augmentation channel should be adjacent to the main channel, since the difference in transmission characteristics between two widely separated channels imposes restrictions on the system and leads to higher receiver cost.

QUESTION 8c: How much additional bandwidth could be made available for ATV, and what would be the interference implications if the Commission "repacked" the VHF and UHF

spectrum using adjusted protection criteria to accommodate (for example) 9, 10 or 12 MHz-wide channels?

We feel that this is a most important step towards a U.S. ATV service. At least two other media will be competing with TV broadcasting, so it is vitally important to the future health of the business segment that careful study is done to allow informed decisions so that TV broadcasting can compete in the area of image quality.

There appears to be no technology available for the next few years which will allow the delivery of an image of competitive quality to be delivered in a 6 MHz channel. Thus there is a compelling need for the broadcast ATV service to occupy more than 6 MHz.

At the present time, VHF and UHF appear to be the optimum spectral region for placement of the new ATV service. In order to proceed in an orderly fashion, two questions must be answered: 1) how much additional spectrum space is necessary to transmit the extra information required to provide ATV service to the home, and 2) how should that extra information be packed in spectrum space adjacent to the main channel without burdening the consumer with substantially degraded NTSC signals? Our view is that these answers can be obtained via a structured investigation described below.

- A. The first step is to assess the required baseband bandwidth needs by reviewing all the spectrum packing techniques developed by Matsushita, the New York Institute of Technology, SRI's David Sarnoff Laboratories, North American Philips Research Laboratories, and Hitachi. The goal of such a technology assessment should be the delivery to the home of an image with the resolution of HDTV. In this investigation, no limitation should be placed on baseband bandwidth required, only that the information be tightly packed and the receiver performance achieved.
- B. The next step is to investigate various strategies for spreading energy in the spectral space adjacent to the main NTSC channel. This requires the development of a tool which minimizes the effort required. The tool is a statistical, general case model of the response of existing TV receivers, now in consumer hands, to energy in adjacent spectral areas. A great deal of quantitative information now exists describing such performance when the energy in the spectral areas adjacent to the main channel is distributed as per an NTSC signal. But the model must be able to accommodate a variety of

spectral distributions to be useful as a research tool.

- C. The task in A above gives insight as to what information must be included in the extra spectral space. The results from B give guidance as to how that information, in modulated form, must be distributed in the extra space to avoid interference, in excess of predetermined levels, to viewers of NTSC across the nation. The converse of this answer is the amount of extra spectrum space needed to deliver an image of target resolution.

QUESTION 9: What would be the technical and economic impact on existing NTSC service if the Commission modified or eliminated the existing protection criteria?

It is important that control over interference to NTSC receivers be maintained. Using the plan outlined in Q.8, the basis for a new protection criteria could be generated which will give the broadcast TV industry access to increased bandwidth, while at the same time keeps control of interference.

QUESTION 14: What technical problems, such as propagation or equipment development, could impede implementation of a

terrestrial ATV service at 2.5 GHz, 12 GHz, 23 GHz, or other portions of the spectrum?

We believe that it is possible to establish an ATV service in this spectral region. Indeed, there is a major advantage in using this region, in that it would be likely that the entire ATV signal can be carried in one wider channel. This is in contrast to the VHF/UHF spectrum where it is quite possible that a single ATV signal must be divided into more than one channel.

Our understanding of the propagation characteristics of the spectrum above 1.0 GHz makes us believe that there will be a major problem in geographical coverage to overcome. Our assumption is that demographic coverage of the new ATV service must be about that of the present TV system to be financially viable. We then note that the propagation deficiencies of the microwave spectrum require compensation, which needs to be designed into the ATV system at a cost to the consumer. We refer specifically to two attributes of propagation in this spectral region:

1. Generally, the free space propagation losses at these bands will require higher transmitter power than at VHF/UHF.
2. Problems caused by shadowing (due to buildings, terrain, etc.) will require the use

of repeaters. This increases the required spectrum space needed for the service. In those areas where the number of broadcasters, or broadcasters plus repeaters, require bandwidth in excess of that available, the use of synchronous repeaters (i.e., phase-locked to the main transmitter) will be required.

Careful study will be needed to find solutions to these difficulties in a way to optimize the growth rate of the new ATV service.

QUESTION 16: The present taboos were adopted in 1952 and have remained unchanged since that time. What taboos should be eliminated or modified and what impact would this have on existing television service?

Where the adjacent channels are occupied by NTSC signal, it is difficult to modify UHF taboos.

QUESTION 20a: How might future improvements in television receivers affect susceptibility to taboo frequencies?

In 2 or 3 years, it would be possible to develop a tuner which allows reduction of UHF taboos, but its performance is less than a VHF tuner. However, careful study will be required for modifying UHF taboos, because there

exist many receivers with contentional tuners now used by consumers.

QUESTION 20c and d: Are changes in receiver designs likely to cost-effectively reduce the susceptibility of receivers to taboo frequencies for NTSC signals? What are the anticipated costs of taboo immune TV receivers and the time frame for significant market penetration?

Because of new technologies that are coming, the cost of an improved UHF tuner would be reduced to a competitive level in the near future.

QUESTION 22: What are the possible consequences, for terrestrial broadcasting, of the non-broadcast uses of advanced television?

The competition between media will cause market pressures to provide HDTV image quality and CD audio quality.

QUESTION 23: What is the expected effect of these consequences on the overall quality, quantity and value of video programming delivered to American viewers?

With respect to image quality, a market demonstration of the effects of competition between medias is now taking place: both cable and broadcast TV industries are examining their practices and technology as they contemplate competition from S-VHS VCRs. Similar effects should happen

in the future for ATV if the competitive nature of the consumer video marketplace is kept intact.

QUESTION 24: Under what circumstances would the public be disadvantaged under a regime, such as the plan discussed above, where television licensees were authorized some discretion in the deployment of any augmented spectrum capacity they might be assigned?

To protect the TV viewing audience the use of augmented spectrum space must be carefully regulated in application for ATV use only.

QUESTION 25: As compared to the plan offered above, what are the relative advantages and disadvantages of providing for "non-conforming" use on augmented channels in a manner similar to that used for such operations in the Direct Broadcast Satellite service?

In the mentioned DBS service example, the nature of DBS transmitters allowed systems with nationwide scope to be established. Because any new businesses created to work within these systems were nationwide as well, opportunity for growth was optimized.

In the case of hypothesized "non-conforming" use at the individual terrestrial transmitter level, a fragmented environment results that allows only local business

opportunities. This again leads back to increased uncertainty in all of the business sectors involved as to potential market size for the new service, with attendant growth problems.

QUESTION 26d: What are the public interest gains and losses of giving licensees greater discretion in determining the levels of interference they wish to tolerate? What is the possibility that contracts or negotiated agreements would result in the practice of excluding less desirable demographic areas from receiving service?

We think that there is a high probability that this will happen, and not limited to less desirable demographic areas. If not controlled by regulation, the additional spectrum space will be subject to "appropriation" by other market interests whose profit margins will support paying higher costs.

On balance, it would seem that if the goal of U.S. public policy is to gradually move the business of transmitting TV to consumers away from broadcast towards other (less public) media, it would seem that the policy of discretionary use of the additional spectrum space would create a market condition which would achieve that goal.

CONCLUSION

Matsushita respectfully requests that the Commission act expeditiously in this matter in order to bring the benefits of HDTV service to American consumers as soon as possible.

Respectfully submitted,

Matsushita Electric Industrial
Company, Ltd.

and

Matsushita Electric Corporation
of America

By:

Akiya Imura / s.m.

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President and Chief Executive Officer

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