

ORIGINAL
FILE

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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NOV 18 1987

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)
)
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)

RM-5811

MM Docket No. 87-268

COMMENTS
OF
NATIONAL BROADCASTING COMPANY, INC.

TABLE OF CONTENTS

SUMMARY OF COMMENTS

	<u>PAGE</u>
I. <u>INTRODUCTION</u>	1
II. <u>ADVANCED TELEVISION SYSTEMS (ATV)</u>	3

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III. <u>ADVANCED COMPATIBLE TELEVISION (ACTV)</u>	6
IV. <u>SPECTRUM ALLOCATION ISSUES</u>	11
V. <u>"POLICY" ISSUES</u>	18
VI. <u>CONCLUSION</u>	21
APPENDIX I	

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SUMMARY OF COMMENTS
OF
NATIONAL BROADCASTING COMPANY, INC.

The television industry is poised on the brink of a profound change in television technology that will afford improvements in quality of a magnitude unimagined today by most viewers. Yet, although several ATV systems have been under development for many years, none has been introduced in the marketplace.

It is NBC's view that an orderly evolution to ATV is of paramount importance to the public interest. While the remarkable potential of ATV systems to deliver high-quality service should in no way be discounted, it is equally important that the public for whom, after all, these services are provided not be subjected to major dislocations as television technology progresses.

To a large extent such issues ultimately are settled in the marketplace; but we believe, nevertheless, that the Commission has a role to play in ensuring a smooth transition. In this manner, the television landscape can be radically transformed and improved for the better with a minimum of dislocation for all concerned. In these comments we urge the Commission to heed the experience of the past 50 years of television broadcasting and foster a smooth evolution to ATV.

NBC believes that this proceeding will elicit several clear criteria for any ATV system, based upon basic public interest considerations. Television broadcasters must be able to maintain their competitive position vis-a-vis other means of delivering video images to the home, or free service to the public of local broadcasting may become a second class service or disappear altogether. Broadcasters should have the ability to choose to transmit higher quality television images and consumers should have the ability to choose to receive higher quality television images.

To accomplish this, any ATV system offered should be NTSC receiver compatible, and it should have the capacity for growth. That is, even though the short-term quality improvements offered by a 6-MHz approach such as ACTV, the system proposed by NBC, may be considerable, ultimately, as display technology improves and other technological advances are made, the ATV system in place should be adaptable to offer further enhancement at minimal cost with minimal displacement. Accordingly, spectrum must be preserved to permit transition to a system with greater signal enhancement in the future. Although the existing data are inadequate for an early decision on spectrum allocation, these comments urge that a major study of the VHF and UHF bands be commenced as soon as practicably possible to determine how additional spectrum could be made available for ATV. Clearly, no spectrum should be made unavailable absent a comprehensive analysis of the present and future needs of broadcasting.

NBC's ACTV system is expected to provide a means for broadcasters and other video delivery services to deliver enhanced television signals to the public in the shortest possible time with the least dislocation in the industry. It will be able to be implemented within the existing 6-MHz channel allocation. It will be capable of providing images comparable to those that will be provided by other systems. It also will be compatible with the 140 million existing NTSC receivers. Moreover, the cost of a new ACTV widescreen receiver very likely will be less than for other proposed systems.

NBC believes that at this early stage the Commission has an important role to play. As the guardian of the public interest, the Commission can ensure that the public is not left behind in the process, by ensuring NTSC compatibility and orderly spectrum planning so that local broadcasters, who provide free television service, can participate. The public will reap the greatest benefits if advanced television systems, as remarkable as is their performance, are introduced in an evolutionary process, not by cataclysm.

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MM Docket No. 87-268

COMMENTS
OF
NATIONAL BROADCASTING COMPANY, INC.

National Broadcasting Company, Inc. (NBC) files the following comments in response to the Commission's Notice of Inquiry (Notice) in the above-referenced proceeding.

I. INTRODUCTION

A. NTSC. For more than 50 years, NBC, in collaboration with the Radio Corporation of America (RCA), its original parent company, has been a leader in advancing television technology. On April 30, 1939, a

telecast of President Franklin Delano Roosevelt speaking at the opening of the New York World's Fair inaugurated NBC's and the nation's first regular all-electronic television service to the public. The system used by NBC formed the basis of the 525-line/60 field-per-second system adopted by the National Television System Committee (NTSC) and the Federal Communications Commission (FCC) in 1941.

B. Color. In the late 1940's, a number of parties in the broadcasting and manufacturing industries were making progress in producing an all-electronic color television system. The FCC concluded in 1950 that the field-sequential system of color-television broadcasting developed by CBS was the only method that at the time had demonstrated the possibility of widespread viewer acceptance; and that method was adopted. However, the field-sequential system was incompatible with the existing monochrome transmission system. Over the next three years, the RCA/NBC team worked to promote a compatible TV system with NBC providing compatible colorcasts during regular broadcasting hours. On December 17, 1953, the FCC reversed its decision and adopted the compatible-color TV standard recommended by NBC, RCA and the NTSC.

C. Stereo. NBC also was the first major network to introduce fully compatible stereophonic sound in television broadcasting. We were among many urging the Commission to protect the stereo pilot tone so that the industry could develop a single system.

Overall, the history of NBC's participation in the introduction of new technology has taken the form of an evolutionary process designed to maintain compatibility with existing systems while also providing an opportunity for an enhanced experience for the public. This has been accomplished through the introduction of compatible equipment that is receptive to alternative services.

We believe that a similar evolutionary approach to ATV will best serve the public interest. These comments address many of the specific questions raised in the Notice while describing how NBC's proposed ATV system can accomplish a smooth transition to advanced television in this country without causing major dislocations in the provision of television services to the public.

II. ADVANCED TELEVISION SYSTEMS (ATV)

The Notice discusses various new television systems under development today that promise unprecedented improvements in picture and sound quality when compared to

the current NTSC transmission system. These new advanced television systems cover a broad range of improved features, methods of delivery to the end user and projected spectrum requirements.

Recognizing that certain tradeoffs, in particular "quality-for-bandwidth" tradeoffs, may have to be accepted in selecting among competing ATV technologies, the Notice asks a series of questions about the criteria to be used in evaluating and comparing the various ATV technologies. (Paragraph 40, questions 1-5).

NBC believes that the criteria mentioned in the Notice, i.e., video/audio quality, bandwidth required, NTSC compatibility, are important ones for consideration.

In NBC's view, NTSC receiver compatibility is vitally important in order that existing receivers not be made obsolete by the new technology. We also believe that signal compression into a 6-MHz transmission channel is extremely important because this could assure existing broadcasters the ability to deliver local programming to their entire public via enhanced systems in the quickest and most efficient form available.

Of course, video and audio quality performance, as well as affordable cost, are significant criteria that together will determine whether a system will be accepted by the public as an advanced television system. Indeed, consumer demand for better quality television and how it might best be provided are prominent among the motivating factors for this proceeding.

NBC believes that the public interest will best be served if the Commission allows for an orderly evolution to advanced or enhanced television systems. Such an approach will minimize the costly dislocations in the marketplace that inevitably accompany major technological advances. Under such an approach, ATV system development, in the initial phase of laboratory experimentation and then actual field testing, can continue apace throughout the industry, having recently been brought under the aegis of the Commission's recently-created Advisory Committee on Advanced Television Systems and its working subcommittees. Only as such projects produce research data will the Commission be in a position to establish meaningful criteria for evaluating ATV systems and then set standards and make implementation decisions, including those regarding the commitment of additional spectrum to ATV.

III. ADVANCED COMPATIBLE TELEVISION (ACTV)

NBC recently announced a proposed system that we call Advanced Compatible Television (ACTV), a single-channel, NTSC-compatible, extended-definition, wide-screen television system. A paper describing this system in detail, prepared at the David Sarnoff Research Center, is attached hereto as APPENDIX I. The David Sarnoff Research Center (formerly a part of RCA) has been conducting research on ATV for over a decade.

Question 3 at paragraph 40 of the Notice inquires into the status of ATV systems currently in development. NBC's ACTV system has been modeled on a Digital Video Facility. Work has progressed to a point where a high probability of success with the technology has been projected. To date, \$45 million have been invested in system development, and it is estimated that it will cost another \$30 million to achieve a proven system.

Prototypes of ACTV are in development. Of course, until prototypes have been lab and field tested, it would be premature to establish system parameters. For this reason, and because the same is true for other ATV systems currently in development, we reiterate our plea that the

Commission not make the setting of standards or the determination of spectrum allocations with regard to ATV until there are enough data on which to base sound decisions.

Nevertheless, developmental work to date gives us every indication that ACTV will fulfill its promise and meet the criteria that NBC has set for its advanced television system.

ACTV embodies an evolutionary approach to offering advanced television signals to viewers. In developing ACTV, NBC expects to achieve the following goals:

- 1) ACTV will fit within a single, 6 MHz channel. We believe that the improvements afforded by ACTV will be particularly remarkable in light of the small amount of spectrum required to deliver ACTV. While delivery of other ATV systems will require additional bandwidth, it is expected that the enhanced-definition signal of ACTV will be able to be compressed into a single 6-MHz channel. Thus, ACTV should be capable of delivery to viewers by existing broadcast licensees without additional spectrum, which

means that broadcasters could provide an enhanced image in the shortest possible time with the least dislocation.

- 2) ACTV will be NTSC compatible. The ACTV television signal would be seen as an NTSC signal on the 140 million existing NTSC receivers. New wide-screen receivers would display the enhanced-definition ACTV signal. There would be no perceptible degradation of the picture delivered to NTSC receivers via the ACTV system; indeed, the picture quality on NTSC receivers may even show some improvement.

- 3) ACTV will provide a vastly improved quality image. Improvements include a wider aspect ratio (NTSC - 4:3 v. ACTV - 5:3 or 16:9). Additionally, the ACTV picture would be quieter, free from inter-line flicker. The ACTV picture would be cleaner, virtually free from crawling dots, hanging dots and bizarre rainbow effects. Resolution would be noticeably increased in both spatial dimensions. Line structure would not be visible because of the increased line density.

In moving portions of the picture, there would be no annoying beat between moving horizontal edges and the scanning structure.

- 4) ACTV is by design an open-ended, augmentable system. As display technologies allow for the effective use of even greater resolution, ACTV could be enhanced through the use of an augmentation channel. Provided spectrum is made available, the performance of ACTV could be readily upgraded through the addition of contiguous or non-contiguous spectrum while maintaining the all-important compatibility with NTSC receivers.

It is NBC's expectation that no existing television broadcaster or television viewer need be "disenfranchised" by the introduction of ACTV and no existing NTSC receiver rendered obsolete. NBC places a high premium on the value of being able to introduce an enhanced service with a minimum amount of dislocation in the marketplace, and we urge the Commission not to overlook this important public interest factor in evaluating all proposed advanced television systems.

Because ACTV is still in development, it is would be unrealistic to estimate cost figures, as question 4 asks. However, a few general observations are possible. ACTV being NTSC compatible, consumers need not spend anything to receive on their NTSC receivers signals delivered on an ACTV system. To receive enhanced resolution, a wide-screen receiver would have to be purchased. We believe that the cost of a new wide-screen receiver for ACTV will very likely be less than for other proposed systems.

Broadcasters would require new or modified transmitters to deliver ACTV, although they would not require additional bandwidth. Moreover, these transmitter modifications could well cost less than the new equipment for systems that would utilize more than 6 MHz. New production equipment, including cameras and switchers, would be required to produce ACTV programming.

We believe it critical to achieving advanced television systems that existing terrestrial broadcasters be able to deliver to their viewers local programming, as well as national and syndicated programs, in whatever enhanced mode the Commission, the marketplace and consumers ultimately agree upon. We believe that ACTV will provide a spectrally-efficient solution to this issue.

IV. SPECTRUM ALLOCATION ISSUES

This inquiry and, undoubtedly, the related proceedings that will follow it, are infused with questions regarding the amount of spectrum that will be necessary to deliver ATV on a per-channel basis and also industry-wide. Moreover, the issue of where any additional requisite spectrum will come from appears equally pressing. NBC does not dispute the view of many in the industry that additional spectrum may be necessary in the future for all broadcasters to be able to deliver ATV signals. Indeed, we recognize that as viewer expectation develops it may become evident that additional spectrum will be necessary to provide greater quality enhancements. The appearance of urgency notwithstanding, NBC joins other industry commenters in urging careful consideration and even patience on this front.

There are two general reasons why the Commission should not make the spectrum allocation decisions prematurely or in haste. In the near term, it would be wise to allow the 6-MHz compression approach proposed by NBC and several other ATV system proponents to prove itself through field tests before concluding that no additional spectrum may be necessary to deliver ATV. Taking a longer-term perspective, even if 6 MHz prove

adequate for ATV now as promised by our work to date, technological improvements are certain to be made in the future, and additional spectrum may well be necessary to assure that terrestrial broadcasters can provide the benefit of these future developments to the public.

If spectrum allocation decisions made in the framework of this proceeding are to remain viable into the future, a long-range view is necessary. It would be judicious to await the development of evidence that will be forthcoming as a result of intensive efforts throughout the industry to achieve ATV. It is imperative that the Commission allow the industry sufficient time to develop both theoretical, experimental and experiential data as to broadcasters' additional spectrum needs to deliver ATV and to make informed policy decisions regarding spectrum allocations that will serve the public interest into the future.

While we believe that further study will be necessary to illuminate many of the issues raised in paragraphs 50-79 of the Notice, we can provide our preliminary assessment of some of the matters addressed. To the extent that ATV can be delivered using existing 6-MHz channels, such as is anticipated with ACTV, existing licensees in both bands might wish to do so. Therefore,

in answer to question 6, we believe that ATV should be implemented in both VHF and UHF bands. Although new or modified transmission equipment would be necessary, it seems unnecessarily complicated to require channel and band changes where they are not absolutely necessary.

If spectrum augmentation proves to be necessary at a later date, this could be accomplished with minimal administrative confusion if ATV were implemented in both VHF and UHF. Particularly if additional spectrum proves necessary, using only UHF for ATV would severely strain the available UHF spectrum. Even with the inclusion of VHF spectrum, there probably would be congestion problems in major markets.

Augmentation of the channel capacity of existing TV assignments could permit fully-compatible NTSC transmission and additional HDTV information. For flexibility, and to minimize the need for major frequency reallocation, non-contiguous augmentation spectrum would be more desirable than contiguous; however, more experimentation and experience in the field are necessary to determine the interference effects of provision of a single ATV signal using non-contiguous channels.

In questions 8 and 9 at paragraph 50, the Notice considers the possibility of finding additional bandwidth for ATV by adjusting downward the existing interference protection criteria.

Additional research and testing would be necessary to determine with any semblance of reliability the in-field ramifications of modifying various interference protection ratios and standards and of the major reallocation that would result from "repacking" both VHF and UHF bands. Most particularly, it may be unwarranted even to assume that any available bandwidth could be obtained by reducing interference criteria. For, while it is true that additional bandwidth might be available if co-channel and adjacent channel protection ratios were reduced, it is quite possible that, to accommodate viewers' objections to impairment of the higher quality image, the desired-to-undesired signal ratios might need to be adjusted upward for ATV service rather than downward.

To provide answers to the questions listed in paragraph 78 of the Notice, we propose that the Commission undertake a major study on the implications of removing any or all of the VHF and/or UHF taboos. Although the 1952 studies on which the taboos were based may be subject to criticism on account of their age, they should not be discarded as outdated until a comprehensive evaluation is

performed, particularly because the effects on spectrum efficiency of taboo removal or revision would be more complicated today than in 1952 on account of the many new variables in television transmission.

Co-channel interference is the major constraint in station planning. Nevertheless, without resorting to major reallocation of channels, we believe that usable spectrum could be found with the elimination of some or all of the UHF taboos.

Questions 10-15 raise issues regarding implementation of ATV in portions of the spectrum not now allocated for broadcasting. Implementation of ATV in bands not now allocated for terrestrial broadcasting may be a viable possibility for the future, but as the Notice recognizes, innumerable uncertainties, both technical and practical, exist in this regard today. Accordingly, evaluation of the future possibility of allocating to ATV spectrum not now allocated for terrestrial broadcasting should be undertaken only with the recognition that uncertainties abound as to the very feasibility of this proposition. The dislocations this would cause in the marketplace likely would be more severe than those that would accompany use of the currently-allocated VHF and UHF bands

for ATV. Moreover, many technical questions exist that would require further study before implementation of higher frequency bands for ATV.

Therefore, NBC encourages the Commission to pursue ATV at VHF and UHF, even if it also implements ATV outside the conventional TV bands. Because there already exist studies on signal propagation, ATV may be more easily implemented in the conventional TV bands. Moreover, if ATV is not pursued at UHF, it is unlikely that ATV could be implemented by all existing broadcasters desiring to do so. Clearly, it would be useful to conduct comparative studies between VHF and UHF ATV systems on the one hand and microwave ATV systems on the other in order to determine and assess the differences between the two possibilities.

There are many unanswered questions regarding the use of microwave frequencies for terrestrial broadcasting. Propagation factors at these higher frequencies would seriously limit broadcast coverage, particularly in more heavily built-up areas. The use of multiple transmitters could be explored, but this would almost certainly increase the expense of ATV transmission. Sharing at 2.5 GHz (ITFS/MDS), 12 GHz (DBS) or 23 GHz (private microwave) would affect the implementation of terrestrial ATV at

these bands. More research is necessary to determine the impact on sharing non-broadcast spectrum with ATV, both on the non-broadcast services and the broadcast service. Until such work is accomplished, it is difficult to predict whether such sharing would be at all practicable.

We are more confident in predicting that certain UHF taboos could be eliminated or modified without significant impact on existing television service. Because of improvements in receiver design, the intermodulation, IF beat and oscillator radiation taboos probably could be eliminated with little or no impact on existing television service. Image taboos should be reviewed to determine appropriate minimum separations. It also may be possible, as the Notice suggests in paragraphs 75 and 76, to eliminate the sound image taboo as a result of improved receivers and lower sound-radiated power levels.

We do believe, however, that it is in the overall public interest to protect service to all present viewers. Realistically speaking, looked at from the individual viewer's point of view, it is probably unacceptable to eliminate present service. Yet, so long as care is taken, modification of the taboos may be reasonable.

In answer to question 19a, we can only posit that further research would be necessary to determine the extent to which "gaps" in the present allocation table may be used by ATV systems. However, given the distinct possibility of this approach bearing fruit, no additional new TV station assignments should be made until ATV needs for this spectrum are fully explored (question 19b). Certainly, it would be unwise to use the spectrum for "other purposes" until its usefulness for ATV operations has been determined.

In answer to question 20, future improvements in TV receivers probably would reduce susceptibility to taboo interference, at least for NTSC receivers. Whether this would extend to ATV receivers of course would depend on the transmission system.

V. "POLICY" ISSUES

In questions 22 and 23 at paragraph 100, the Notice raises questions about the possible consequences, for terrestrial broadcasting, of the non-broadcast uses of advanced television and the expected effect of these consequences on the overall quality, quantity and value of video programming delivered to American viewers.

While answers at this time to questions such as these may be considered speculative and largely unquantifiable, these are important issues that must be considered. In recent times, broadcasters have faced unprecedented competition from novel, growing video delivery services. While this competition may have had a quantifiable negative impact on broadcasters' audience share, it also has spurred broadcasters to improve their product to meet this competition. However, broadcasters' improvement of their product is limited, in an absolute sense, to the improvements possible within the allocated bandwidth. Indeed, while NBC's ACTV signal would require only 6-MHz to provide an enhanced picture of vastly superior quality to that which NTSC provides in 6-MHz, there may be a limit to the amount of information that can be compressed into 6-MHz.

The quality-for-bandwidth tradeoff is an issue about which the Commission should be concerned because broadcasters may not in the future be able to compete in terms of quality with enhanced, higher-definition video service providers if they are limited to one 6-MHz channel at a time when competitors are serving the public using additional bandwidth. At some point, assuming the public can and does move in significant numbers to a greater-than-6-MHz video service, this will cause the

erosion of the television audience base which in turn will produce revenue reductions so great that broadcasters no longer will be able to provide the local service that has been uniquely their province and that has been provided to the public at no cost to it.

Over-the-air broadcast television provides the majority of the public with the majority of its viewing hours today. Loss of free, over-the-air terrestrial broadcasting as a public information and entertainment service is not an idle concern. The television broadcaster depends upon his or her ability to attract as broad an audience base as possible. If television broadcasters are not afforded sufficient spectrum to provide competitive enhanced TV service, their service will be relegated to second-class status among viewers and ultimately may be lost altogether.

Among the other public policy issues raised are possibilities of "non-conforming" or discretionary use of additional spectrum allocated for ATV and negotiated interference protection. (Questions 24 and 25 at paragraph 108.) NBC already has commented on these issues in General Docket No. 85-172 and RM 5532, and to the extent that those comments are responsive to the questions raised here, we incorporate them by reference herein. In

general, we cannot envision how the Commission would discharge its current statutory spectrum management responsibilities if private parties are permitted to modify their coverage and interference areas for private purposes and by private agreement. Moreover, and more importantly, in light of the many complex and controversial issues to be addressed regarding ATV alone, the matters raised in questions 24 through 29 of the Notice might better be considered in a separate proceeding.

VI. CONCLUSION

The industry is poised on the brink of a profound change in television technology that will afford improvements in quality of a magnitude unimagined today by most viewers. Yet, although several systems have been under development for many years, none has been introduced in the marketplace.

It is NBC's view that an orderly evolution to ATV is of paramount importance to the public interest. While the remarkable potential of ATV systems to deliver high-quality service should in no way be discounted, it is equally important that the public for whom, after all, these services are provided not be subjected to major dislocations as television technology progresses.