d. Single transmitter coverage.

If at all possible, any ATV system adopted for local broadcasters should require only a single transmitter with coverage comparable to that of current station service areas, even if two separate channels are required. Multiple transmitter systems would limit spectrum efficiency, would be difficult to integrate with the present system of allocations, and would create severe and probably insurmountable practical and economic hurdles in major markets. As discussed below, the feasibility of such systems will depend on an analysis of the spectrum available for ATV augmentation channels and on the total required bandwidth of each such ATV system.

e. Rugged transmission signal.

Critical to the success of any broadcast ATV system will be the ability of the signal to withstand the peculiar stresses of the broadcast environment. Virtually every ATV system now known to be in development will require a more intensive use of the spectrum than the current NTSC system. As a consequence, most if not all, of these systems will be more vulnerable to interference from other broadcast and non-broadcast signals than NTSC signals and more susceptible to propagation phenomena such as ghosting. Actual over-the-air evaluation of the proposed ATV systems will be essential to the recommendations of the Advisory Committee.

f. Potential for improvement of signal quality.

As discussed above, it is all-but-certain that further improvements will be required in local broadcast quality beyond those contemplated today. It is essential, therefore, that candidate ATV systems be evaluated in terms of their capability to accept additional improvements in an economical, spectrum-efficient manner.

g. Universal availability.

The opportunity to implement whatever ATV service is adopted should be available to all current broadcasters, commercial and public. The competitiveness and economic viability of ATV service may well depend on its ability to achieve the same nationwide, universal service offered today.

h. Multi-Media compatibility.

The ATV system adopted for local broadcasters should also be readily available and appropriate for other media delivery systems, including cable and satellites.[20/] The Commission has long recognized the special relationship

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20/ The Commission has long recognized the special relationship between broadcasting and cable; cable subscribers generally depend on cable services for access to over-the-air broadcast signals; Carriage of Television Broadcast Signals by Cable Television Systems, 1 FCC Rcd. 864, 880 (1986); and cable broadcasters depend on local broadcast signals and local broadcast programming for their programming. Multichannel News, June 8, 1987, at p. 24

(Footnote Continued)

between broadcasting and cable; cable subscribers generally depend on cable services for access to over-the-air broadcast signals; and cable broadcasters depend on local broadcast signals and local broadcast programming for their programming. The inter-service compatibility of the NTSC system has reduced the cost of obtaining programming, ensured universal coverage, and enhanced competition. Producers, delivery systems, and the public all have an interest in developing an ATV system that will not require costly conversions of program that may degrade program quality, or impose barriers to carriage.[21/]

B. The Status Of Existing Developments.

The principal ATV systems of which MST is aware and which may provide the competitive level of performance described above are described in Appendix A. ATSC, MST, NAB and other industry organizations are actively involved in evaluating the prospects for these systems.

Several general observations should be made regarding these proposed systems in response to the questions posed by the NOI. First, each of the systems

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(Footnote Continued)

(showing 76% of weekly viewing in all cable households is of broadcast stations).

21/ Developers are already emphasizing the importance of developing systems that can easily be transferred from one delivery system to another. See Philips Laboratories, White Paper: "Hierarchical High Definition Television Systems Compatible With the NTSC Environment" (September, 1987).

proposes a substantially different approach to terrestrial delivery of ATV. Behind the obvious differences between NTSC-compatible and incompatible systems and single and two-channel systems are fundamentally different technological approaches to delivery of high-quality HDTV service in the most practical, spectrum-efficient manner. None of these approaches (with the exception of MUSE) has been tested, and experts disagree on the feasibility and merits of each. Consequently, it is impossible at this point to characterize or assume the specific characteristics that the successful broadcast ATV system (or systems) will have.

Second, many of the proposed systems are expected to be ready for initial testing and evaluation of the trade-offs involved in various display, transmission and sampling techniques over the course of the next two to three years. All of the systems, with the exception of NHK's MUSE system, are presently still being prepared for testing. The systems that have been in development for the longest period of time, the NBC/RCA/Sarnoff Laboratories system, the New York Institute of Technology (Glenn) system, and the North American Phillips system, are expected to begin testing of the first hardware-prototypes during the next six to twelve months.

Third, the broadcast industry is already making plans for the operational testing and subjective evaluation of these systems as soon as they become available. Under

the auspices of the Advisory Committee, ATSC, and in conjunction with the NAB, the proposed systems will be tested, evaluated and compared as soon as each system's equipment is available. This will involve construction of the necessary laboratories and test beds, operational testing to identify any impairments created by broadcasting or cable transmission, and tests to determine the interference characteristics and ruggedness of the signals. The NAB has already proposed at least two demonstrations of prototype systems as the equipment becomes available over the next twelve months, with over-the-air system demonstrations by mid-1989, in addition to ongoing laboratory evaluations.

Fourth, new approaches continue to emerge. For example, researchers at MIT have suggested techniques for developing a 6 MHz incompatible ATV system based on a combination of currently proposed ATV technologies.[22/] Other approaches, or recombinations of the existing approaches, may already be in development and should be expected to arise out of the testing and evaluation process now underway.

Finally, some ATV experts anticipate that a two, or possibly multi-stage process for implementing HDTV may be the most economical and efficient means of implementing

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22/ W.F. Schreiber, "6-MHz Single-Channel HDTV Systems," Proceedings of the Ottawa HDTV Symposium, October, 1987.

advancements in television quality over the long-term. These developers have suggested that an HDTV system using the technologies now under development should be implemented in the near future. This first-stage would not represent the ultimate improvement in television quality, but would introduce new advanced receivers that would not only be able to display the near-term advancements, but could continue to be upgraded to implement long-term technological advancements. Adopting a two-stage approach would avoid the risk that receivers purchased to receive the near-term advancements might be rendered totally obsolescent by subsequent developments.[23/]

C. The Overall Evaluation Of Systems And The Trade-Offs In Performance And Implementation Criteria.

Although many discrete criteria for evaluating HDTV systems can be articulated at this stage, the variations among the systems under development make clear that the evaluation process cannot treat each particular criterion in isolation, but must be based on an overall evaluation of each system. System performance, spectrum requirements, interference characteristics and implementation costs are all interrelated and inseparable:

23/ Both MIT and NBC/RCA/Sarnoff Laboratories have suggested two-stage approaches with these features. See W.F. Schrieber, "6 MHz Single-Channel HDTV Systems," supra.

spectrum availability affects performance; spectrum use also affects the susceptibility of the system to interference; interference in turn affects the quality of the system; and the remedies for each of these considerations will affect compatibility, receiver costs, transmitter costs, and other implementation costs.

The trade-offs between these criteria cannot be evaluated in the abstract or in advance of testing the overall performance of systems being proposed. Since each system employs significantly different approaches to these trade-offs, it is impossible to assume a particular relationship between the criteria until the feasibility and performance of the systems are tested. For example, the ultimate evaluation of these trade-offs will depend heavily on psychophysical testing of the systems and the artifacts which may be introduced by various bandwidth-compression techniques. Many of these artifacts will be unique to the particular systems and cannot be defined or compared in advance of the completion and demonstration of the system, e.g., it is impossible in the abstract to compare the impact of the motion artifacts of the MUSE system with limited resolution or defects that may appear in other systems when they are tested. Even for artifacts that may be common among different systems, the effect of the artifact will depend on the degree of the artifact, the artifact's

relationship to other artifacts created by the system, and the system's other features.

Plans are already underway to prepare for an ultimate evaluation of the systems under development and analyze the interdependent trade-offs involved. The final stage of ATV standards development will be to assemble the results of the operational, psychophysical and interference tests conducted on various systems as they become available in order to identify the systems that are feasible and analyze the trade-offs of spectrum, interference, performance and costs. The product of this overall evaluation process will be a final recommended standard for ATV.

III. SPECTRUM ALLOCATION ISSUES.

A. Additional Spectrum May Be Necessary to Implement ATV.

The NOI notes that spectrum-allocation issues are "[t]he most important issues the Commission will address in this proceeding . . . ." NOI, at ¶41. Yet the NOI also notes that the Commission intends to resolve these issues "as quickly as possible ...", id., and the ATV Advisory Committee has been instructed to report on spectrum requirements within six months of the Committee's initial session. FCC, "Formation of Advisory Committee on Advanced Television Service and Announcement of First Meeting," 52 Fed. Reg. 38523 at ¶ D (October 16, 1987).

MST agrees that the spectrum-allocation issues are the most important issues presented in this proceeding and concurs with the judgment that they must be resolved expeditiously. Broadcasters, too, have a vital stake in determining their precise ATV spectrum needs at the earliest possible juncture. The imminent introduction of ATV via VCRs and then by cable and other media provide a sufficient spur to broadcasters to test and evaluate ATV systems as promptly as possible. Artificial deadlines to stimulate action are unnecessary.

But MST strongly disagrees with the implication of the NOI and the instructions to the Advisory Committee that the spectrum-allocation issues can be resolved well in advance of the other system-evaluation and planning issues presented in the NOI. Such questions as the additional bandwidth required, if any, and the appropriate spectrum location of augmentation channels cannot be answered with any assurance until the proposed ATV systems have been identified, their relative quality established, their feasibility and off-air ruggedness demonstrated and their interference characteristics determined.

A premature decision on spectrum will not provide an added incentive to further reduce advanced television signals to "fit" within the 6 MHz bandwidth. See NOI, at ¶ 47. The numerous advantages to such a 6 MHz solution already provide overwhelming incentives to develop such a

system if it proves possible. To fail to preserve additional spectrum, on the other hand, may foreclose the possibility of ever developing an ATV system that will be compatible with consumers' existing receivers; may significantly increase the cost of ATV to consumers by requiring the use of spectrum with poorer propagation or necessitating the use of more expensive receivers; or, at worst, may totally preclude local broadcasters from delivering ATV.

Most ATV system developmental efforts have focused on systems requiring more than 6 MHz of spectrum on the assumption that a 6 MHz ATV system of a quality competitive with that of wideband systems that will be available to non-broadcast media is not feasible. NHK, the developer of the MUSE system, has steadfastly maintained that it is impossible to deliver an NTSC-compatible ATV system with quality comparable to that of its 8.1 MHz ATV system using broadcasters' present channels. The researchers developing the North American Phillips and New York Institute of Technology (Glenn) system have come to the same conclusion.

Nevertheless, exciting proposals for utilizing ATV transmissions have also surfaced. Chief among such proposals are NBC/RCA/Sarnoff Laboratories Advanced Compatible Television (ACTV) and Matsushita systems. The ACTV system proposes to use "holes" in the current NTSC signal and quadrature modulation to provide a wide aspect

ratio and improved resolution. The Matsushita proposal offers the capability to extend the aspect ratio or increase resolution. Similar EDTV systems have already been developed in Japan and NHK and the Japanese Broadcasting Technology Association (BTA) plan to implement these EDTV systems for terrestrial broadcasters in Japan.

Whether such systems will be fully competitive with MUSE and other wideband ATV systems must await further system development and testing. The proponents of the NBC/RCA/Sarnoff Laboratories system have already acknowledged that, even if it is successful in operation, it is offered only as an EDTV system that will provide an intermediate level of improvement short of full HDTV-quality.[24/] The developers of the ACTV system anticipate that even if it achieves the full-quality expected by the proposal, additional upgrading will be necessary in the future, upgrading which will require additional spectrum.

Long-term improvements in television quality will probably involve advancements in both transmission and receiver technologies that will push the standard of quality even beyond that of current systems. As a result, augmented

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24/ See M.A. Isnardi, J.S. Fuhrer, T.R. Smith, J.L. Koslov, B.J. Roeden, W.F. Wedam, "A Single Channel, NTSC Compatible Widescreen EDTV System" (1987).

channel capacity will remain an important potential source of additional improvement, regardless of the outcome of present proposals. Due to the complex relationship between performance, bandwidth and interference protection, spectrum requirements are destined to become a crucial consideration in the ultimate evaluation of performance, cost, and interference trade-offs, and potential for additional enhancements.

As described below, the present industry development and evaluation effort is designed to survey all possible sources of spectrum while simultaneously conducting the testing necessary to determine what types of spectrum allocations are feasible. This effort shares the Commission's desire that spectrum allocation and other ATV issues be resolved "expeditiously." NOI, at ¶ 41. But thorough and responsible evaluation of the spectrum-related issues cannot be conducted until the capabilities of the technologies proposed has been carefully analyzed.

B. Utilization of Already-Allocated Broadcast Spectrum.

1. The Optimality of Utilizing the VHF and UHF Broadcast Bands.

As the NOI observed, the most promising source of additional spectrum for the implementation of ATV is the existing VHF and UHF television allocation. NOI, at ¶ 55. Use of the broadcast spectrum would make it easier to implement an NTSC-receiver-compatible system. Use of these

frequencies would also make it possible for broadcasters to cover all or most of their current service area without multiple transmitters or cumbersome receiving antennae. These advantages would significantly increase feasibility and reduce the cost of implementation to both broadcasters and consumers.

MST strongly believes that, if at all possible, any ATV system implemented should be modeled around the existing system of NTSC service with the same or similar technical criteria. The system implemented should be fully "channel-compatible" in the sense that it will provide all existing broadcasters with the opportunity to implement ATV without rearrangement of the existing allocations system. No action should be taken based on any other assumption unless it were to become clear that the trade-offs in sacrificed quality or costs connected with preserving the existing system are too severe.

In particular, MST regards any partial or total "repacking" of the VHF or UHF band as an extremely undesirable option that should be considered only as a last resort.[25/] Even the shift of a single television station to another channel is an extremely disruptive action that should be undertaken only if there are extraordinary public

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25/ See Statement of MST and NAB (filed September 4, 1987).

interest benefits. See, e.g. Table of Allotments, TV Broadcast Stations (North Los Vegas, Los Vegas and Goldfield, Nevada and Cedar City, Utah), 2 FCC Rcd. 5114 (1987). Any type of repacking would be an enormously costly and disruptive undertaking that would require overwhelming countervailing benefits to justify.

2. The Spectrum Available in the VHF and UHF Broadcast Bands

A major part of the industry development and evaluation effort is directed at selecting systems that are both NTSC-receiver and channel-compatible so that they can be implemented in the current broadcast spectrum. Several of these systems are expected to become available for testing in the near future.

In addition, the industry has been trying to identify how much broadcast spectrum is available, and how it might be used so that this information is available to system developers to answer the questions posed by the Commission in the NOI concerning the use of existing broadcast bands. NOI, Quests. 6-9. A major part of this effort consists of surveys and analyses of the available broadcast spectrum. MST, in cooperation with ATSC, NAB and others, intends to play a major role in this process.

An early analysis, the "Preliminary and Partial Study of the Use of the UHF Band to Accommodate Local High Definition Television," was submitted by MST to the Commission in March in support of the Broadcast Petition. A

copy of this study has also been attached as Appendix B to these comments. That study examined whether, given certain assumptions about the signal characteristics of an ATV augmentation channel, sufficient spectrum was available in six of the most congested television markets to allow each broadcast station in those markets to implement an ATV system using 3 MHz augmentation channels and the station's existing NTSC channel. The survey found that there would be sufficient spectrum for each of the television stations in these markets to provide wideband ATV television, but that there would be a shortage of channels if UHF spectrum were reallocated to land mobile as proposed in General Docket No. 85-172. These results are apparently consistent with the encouraging results of the Commission's own study, alluded to in the NOI. NOI, at ¶ 57.

MST has also conducted an additional preliminary analysis of the same six markets assessing the prospects for implementing a two-channel ATV system employing a 6 MHz augmentation channel in the UHF band. This study is attached as Appendix C. This study is relevant to the feasibility of both two-channel systems such as that being developed by North American Philips Corporation and the New York Institute of Technology, and to systems such as that

proposed by Dr. William Schreiber,[26/] which envision simultaneous broadcast of NTSC and a 6 MHz ATV system which is not NTSC-receiver compatible. The study employed the same assumptions as those used in the 3 MHz study. The study indicates that there is not enough spectrum in the UHF broadcasting band for each of the stations in the six studied markets to be allotted an additional 6 MHz of spectrum. In New York and Philadelphia, only eleven of the twenty stations could receive an additional 6 MHz allotment. Los Angeles and Baltimore-Washington fall seven and three channels short, respectively. Only Chicago has sufficient spectrum for each of the existing stations. As the study indicates, the shortfalls would be more severe if UHF sharing proposed in Docket 85-172 were implemented.

MST is currently planning further spectrum studies which it anticipates will be conducted in conjunction with the work of the ATV Advisory Committee. ATSC and NAB are planning tests to obtain preliminary data on the appropriate desired-to-undesired signal ratios between present NTSC signals and augmentation channels of the type being proposed by current system developers. Based on these preliminary measurements, MST plans to revise the assumptions in its current studies and extend the studies to cover a broader

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26/ W.F. Schreiber, "6-MHz Single-Channel HDTV Systems," Proceedings of the Ottawa HDTV Symposium, October, 1987.

area of potential spectrum. As interference and coverage data on various systems become available, these studies will be further expanded to address the trade-offs between coverage and spectrum, the appropriate co-channel and adjacent-channel interference protections, and other issues, in order to answer the questions posed in the NOI and provide a basis for establishing standards for ATV.

3. Efforts to Determine the Technical Advantages And Disadvantages Of Implementing ATV in the Existing Broadcast Spectrum.

The interrelated problems of the technical requirements for implementing ATV in the existing broadcast spectrum are the focus of tests currently being conducted by ATSC. As the NOI notes, there are a number of possible approaches to implementing ATV in the existing VHF and UHF bands: use of a single 6 MHz channel; use of existing channels plus augmentation channels; and use of single channels greater than 6 MHz. NOI, at ¶ 56. Each of these approaches present technical problems that are not adequately addressed by the existing research on signal propagation.

The first phase of the spectrum studies to be conducted by ATSC, NAB, MST and others involves propagation tests to address what might be described as "generic" questions presented by these approaches, so that the results will be immediately available to guide system developers and the Commission. The first set of tests involves two-channel

"dual band" tests to examine the feasibility and propagation problems that would be involved in the use of non-contiguous augmentation channels. Many experts believe that the use of two channels to transmit ATV will create severe ghosting problems that may be difficult and costly, if not impossible to correct. A test to study delay, multipath and other propagation problems by simultaneously broadcasting the signal of Channel 9 in Washington, D.C., over a co-located UHF transmitter has already been designed and test equipment has been set up. Operational testing to gather data is expected to begin within the next few months, to be followed by further field testing and analysis of the results.

A second set of tests to be conducted by ATSC and NAB will study the propagation characteristics of broadband UHF signals to identify coverage characteristics, multipath effects and other propagation problems that might accompany the use of single-channel ATV systems of greater than 6 MHz.

Beyond these generic problems, the propagation characteristics of specific systems must be examined. These include the coverage areas of each system, multipath effects, taboo characteristics, and interference-protection ratios for NTSC-to-ATV, ATV-to-NTSC and ATV-to-land mobile and other services. The second phase of the studies will involve tests of individual systems as they become available.

The results of these tests, in conjunction with the information on system performance, spectrum surveys and implementation cost information will permit an overall evaluation of the systems developed and recommendations on ATV standards.

C. Allocation Of Non-Broadcast Spectrum For ATV

1. The Need To Examine And Preserve the Possibility Of Accommodating ATV In Non-Broadcast Spectrum.

There are significant technical and economic disadvantages to the use of frequencies other than the VHF and UHF broadcasting bands for ATV which have already been enumerated by MST and others. See, e.g., Broadcast Petition at 30-31. As noted in the NOI, accommodating ATV in non-broadcast spectrum might require the relocation of existing users. NOI, at ¶ 51. Even if ATV were accommodated in presently vacant frequencies or by sharing frequencies now allocated to other services, difficult interference-protection and compatibility problems might arise. Finally, the propagation characteristics of the frequencies above 1 GHz would make it more difficult for broadcasters to provide coverage to their present service areas. Indeed, use of the 12 GHz or higher frequencies would appear to require major technological breakthroughs.

These disadvantages highlight the necessity of preserving the VHF and UHF broadcasting bands. But until more is known about the performance of the ATV systems under

development, the possibility of using non-broadcast frequencies must be preserved. As discussed above, if 6 MHz augmentation channels are necessary to implement a receiver-compatible ATV system, the existing vacant UHF spectrum may be inadequate to permit universal implementation of ATV.[27/] If contiguous augmentation spectrum is necessary, spectrum from other bands could well be necessary.

The testing and evaluation being conducted by ATSC and others will address the questions raised by the NOI NOI, Quests. 11-15, and eventually resolve whether ATV should be accommodated in non-broadcast allocations. In the meantime, the broadcast industry is actively assessing all reasonable possibilities for upgrading the quality of existing television using spectrum above and below 1 GHz.

2. Possible Sources Of Non-Broadcast Spectrum.

MST will be actively involved in the industry efforts to conduct a comprehensive spectrum survey to identify possible non-broadcast spectrum allocations. At this point, MST has identified several bands have been identified as possible candidates:

27/ Moreover, there may not be adequate spectrum to implement 3 MHz augmentation channel systems if the coverage and taboo characteristics of these systems turn out to be different from those assumed in the Preliminary and Partial Spectrum Study.

a. 225-420 MHz (Government)

b. 2 GHz (Broadcast Auxiliary)

c. 2.5 GHz (ITFS/MMDS)

d. 12 GHz (Direct Broadcast Satellite)

e. 23 GHz (Point-to-Point)

Each of these bands has serious practical, economic and technical drawbacks which will require imaginative solutions. MST will conduct further investigation of these and other candidate bands will be conducted as more information on system development and propagation characteristics becomes available.[28/]

3. Efforts To Determine The Technical Advantages And Disadvantages Of Implementing ATV In The Non-Broadcast Spectrum.

As in the case of broadcast spectrum, MST's spectrum surveys will be complemented by tests to evaluate the propagation problems associated with use of these bands. For example, the current testing plan calls for 12 GHz propagation tests during the next year. As more information

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28/ The Commission has now denied broadcasters' request that the Commission refrain from granting additional licenses in the 12 GHz band and take action to make part of the spectrum available for terrestrial HDTV. Nevertheless, MST urges the Commission to retain the flexibility to make the 12 GHz band available for the implementation of ATV service by local broadcasters, if necessary. The Commission should continue to strictly enforce deadlines for construction and launching of DBS systems and should deny any requests for extensions of time on these deadlines.

on specific systems becomes available, tests of other bands may be conducted. These tests will include examination of the feasibility and impact of specific ATV systems sharing non-broadcast spectrum with other services.

D. UHF Taboo Reevaluation.

1. Reexamination Of UHF Taboos And Other Interference Characteristics Must Await Further System Development.

Many of the ATV systems currently under development may have interference characteristics that differ dramatically from the characteristics of the current NTSC system. For example, systems using augmentation channels to increase the quality of existing NTSC signals may not contain a synchronizing pulse in the augmenting signal. In theory, this may make it possible to reduce the co-channel and adjacent-channel separations for these channels below those required for NTSC without sacrificing the quality of service. See Appendix B, at 10-12. By the same token, systems that compress more information into the present 6 MHz channels by adding additional subcarriers and altering the scanning techniques (e.g., ACTV system) may be more susceptible to interference and require greater levels of protection.

The uncertainty over the appropriate protection criteria for these developing systems is particularly acute in the case of UHF "taboos." Consequently, the reevaluation of UHF taboos discussed in the NOI (Quests. 16-21) is

premature. As with other interference considerations, the susceptibility of ATV systems to taboos is dependent on system design. There is reason to believe that, in theory, it may be possible to ignore some or all of the taboos for some ATV systems (although different conclusions may be reached for NTSC channels). See id., at 12-14. But at present, taboo characteristics for the ATV systems under development are speculative, may vary from system to system, and ultimately cannot be resolved until systems are tested.

Moreover, spectrum allocation and taboo issues are closely intertwined. As the spectrum surveys described above indicate, the applicability of UHF taboos may determine whether or not there is sufficient spectrum to implement particular ATV proposals in existing broadcasting spectrum. Likewise, relaxation of taboos may be a necessary trade-off to make sufficient spectrum available. It is not productive to examine whether these taboos should be retained for NTSC allocations if ATV systems require allocation of this spectrum for augmentation channels or modification of the standards for NTSC transmissions. Instead, reevaluation of the taboos should be addressed as part of the development and evaluation process now underway.

2. General Considerations In Reevaluation Of Taboos.

Although the questions posed by the NOI cannot be answered or meaningfully pursued until more is known about

ATV modulation characteristics and spectrum requirements, the information already assembled in this and previous Dockets[29/] permits some preliminary conclusions. These conclusions only reinforce the need to incorporate the re-evaluation of taboos into the overall evaluation of ATV systems.

First, relaxation of the taboos will not provide a significant opportunity for additional NTSC allotments. Previous surveys have shown that in most of the markets that are saturated, i.e., where all of the channels that can be allotted under the existing separation requirements, without regard to UHF taboos, have been assigned, virtually all of the channels which are assignable under co-channel and adjacent channel separation requirements have already been allotted by the Commission. See Docket No. 20485, Comments of the Association of Maximum Service Telecasters, Inc. (filed October 31, 1975). In these markets, virtually all of the allotments that are precluded by the UHF taboos would have to be in the same market as the stations which the taboos protect, and often, more than one taboo is involved. Unless the taboos were totally eliminated, few, if any additional NTSC broadcasting channels could be made

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29/ The materials submitted in response to the Commission's Notice of Inquiry, in Docket No. 20485, 53 F.C.C.2d 411 (1975), and Gen. Docket No. 78-392 (1978), have been incorporated as part of this proceeding. NOI, at note 42.

available. On the other hand, in those markets that are not saturated, i.e., where there are channels which can be allotted without violating the existing taboos, the taboos do not present any barrier to the creation of additional NTSC stations. Id.

Nevertheless, it is possible that unallotted channels may provide an important source of additional spectrum for ATV. Evaluation of systems currently under development may reveal that augmentation channels do not require the full protection of the NTSC-UHF taboos, and may also involve less potential for interference to NTSC channels. Augmentation channels may also permit reduced co-channel and adjacent-channel separations.

Second, the Commission's last two efforts to explore new receiver designs found that the improvements were too limited to yield meaningful benefits. See NOI, at ¶¶ 70, 71. Before they could be relied upon as a basis for altering the taboos, any receiver improvements would have to be tested and proven. Such state-of-the-art receivers are likely to involve substantial costs that will not be justified by the resulting benefits. Moreover, the Commission would have to continue to protect the 196 million receivers now in use until the vast majority of them had been replaced by more advanced NTSC receivers.

ATV technologies may offer a more efficient means of improving receiver performance. ATV receivers may be