OPEN ISSUES

- Details for Support of Local Program Insertion and "Live Edits"
- Relation of Audio, Video and System Clocks
- Program Guide Implementation

Grand Alliance
Summary of Specialist Group Activities

- Subjective Testing
- Receiver Implementation Costs

Receiver Implementation Costs

- Block Diagrams Used
- Analyzed to the Gate-Count and Memory Level
- Three Modes
  - 5.1 Loudspeaker Reproduction
  - 2 Loudspeaker Reproduction
  - 1 Loudspeaker Reproduction

Subjective Testing Activities

- Acquisition of Surround Sound Test Materials
- Tape Recording of Encoded/Decoded Cascade
  - Original, MIT, Dolby, Philips
  - Done at Zenith, July 22-23
  - Test Modes
    - » 6 Channel Umimpaired and Impaired
    - » 2 Channel Umimpaired and Impaired
- Expert Listeners Acquired

Activities to be Completed

- Analysis of Subjective Test Results
- Summary of Receiver IC Cost Studies
- Comparison of Advocate Systems to ATSC T3/186 Recommendation

Subjective Testing Activities (cont.)

- Material Presented in Following Order:
  - Reference
  - Randomized Unknown
- Identity of Unknown Concealed from Listeners and Testers
- Listening Tests Conducted at Lucasfilm, July 26-30
- Analysis of Results In-Process

Advanced TV

Advisory Committee on Advanced Television (ATV) Service

July 22, 1993

Mr. Richard E. Wiley
Chairman, FCC Advisory Committee on
Advanced Television Service
c/o Wiley, Rein & Fielding
1776 K Street, N.W.
Washington, D.C. 20006

Dear Mr. Chairman:

Enclosed is a copy of the survey which our group on "Production & Receiver/VCR Impact" has sent to some 263 individuals representing program production and post-production, professional and consumer equipment manufacturing, and broadcast and cable distribution. Also enclosed for your background is a list of those to whom we have so far sent this request for help. We have publicized the effort through the trade press, and we will give the survey to any others who call or who are suggested.

Our group worked for several days organizing this questionnaire. I expect we will meet to review the responses we have by late this month. As requested by the Technical Subgroup, we plan to provide a preliminary report on results at the August 11 meeting of the Technical Subgroup.

By copy of this letter to the Subgroup co-chairs, and the FCC's staff liaison, I would ask that the survey be put in the public record now so that others who may wish to comment have the chance to do so as soon as possible.

I look forward to seeing you next month, and I hope this effort will contribute to the important work ahead for the FCC Advisory Committee.

Very truly yours,

George Vradenburg

George Vradenburg III
Chairman, Experts Group on Production
& Receiver/VCR Impact

Enclosures

cc: Joseph Flaherty, Co-Chair, Technical Subgroup
Irwin Dorros, Co-Chair, Technical Subgroup
William Hassinger, FCC
Robert Rast, General Instrument Corporation (Grand Alliance liaison)

Advisory Committee on
Advanced Television (ATV) Service

July 14, 1993

Dear SIR or MADAM:

I am writing on behalf of the Advisory Committee on Advanced Television Service (ACATS), the official body which will recommend to the Federal Communications Commission (FCC) a terrestrial HDTV transmission standard for the United States. This letter is to seek your comments on certain design elements of the newly proposed HDTV transmission system now under final consideration for use in North America.

As you may know, the four all-digital HDTV systems earlier proposed have now joined together in a single, "merged" system dubbed the "Grand Alliance."

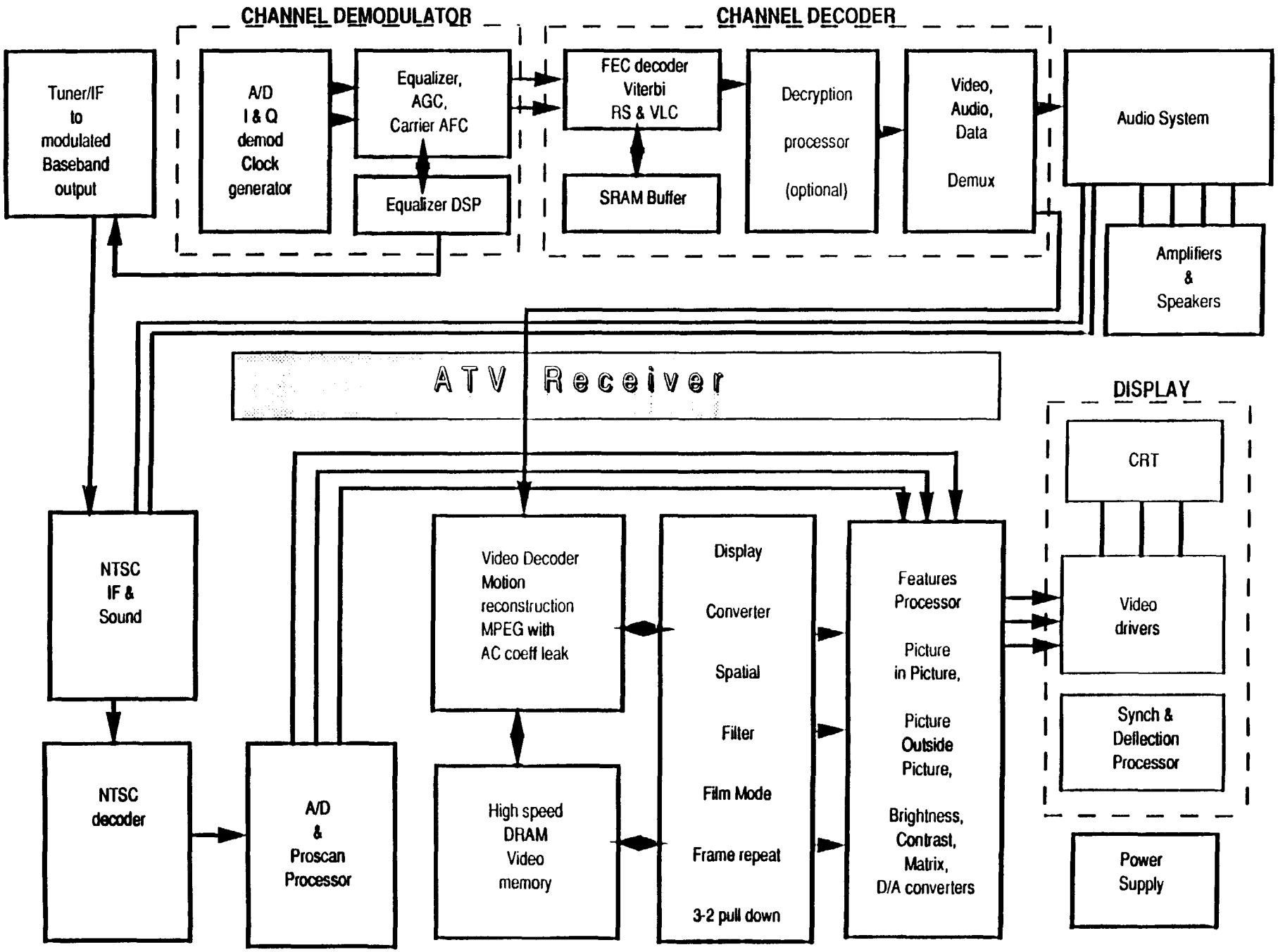
The Advisory Committee has designated a Technical Subgroup to evaluate the Alliance proposal and to make recommendations regarding its adoption as a United States standard. As part of that effort, an Experts Group on Production & Receiver/VCR Impact has been formed to evaluate the cost, operational and timing impacts of two design elements of the Alliance's proposal.

First. The Alliance has recommended that the HDTV terrestrial transmission standard contain multiple scanning formats; for example, both a 787.5 progressive scan format and a 1050 interlace scan format. We want your comments on the cost, operational and timing impact on HDTV studio origination equipment and on consumer HDTV equipment of the use of multiple scanning formats as opposed to a single scanning format.

Second. The Alliance has recommended that today's HDTV transmission standard incorporate a migration path to a future, higher line rate, progressively scanned transmission system. We want your comments on the feasibility, cost and timing impacts of designing HDTV studio origination equipment and HDTV consumer equipment now, in order to avoid the obsolescence which may be caused by planned future transmission system improvements.

I have attached a Memorandum discussing these questions in greater detail. Our group invites your questions and/or comments on this letter and the attached Memorandum at your earliest convenience. Please direct any questions—and your response—to Mr. Peter Fannon (Executive Director, ATTC, Suite 200, 1330 Braddock Place, Alexandria, Virginia 22314-1650, USA; telephone 703/739-3850 FAX 703/739-3230). If he cannot answer your questions, he will direct you to someone in our group who can.

We recognize that the questions posed in this letter and the attached Memorandum are complex and that definitive, detailed answers will require time. Nevertheless, we ask you to give us your best preliminary or tentative response by



WFW - 7/8/93

Attachment 6

6.) Given the various transmission scan format scenarios (e.g. start with 7260P and 960I and finish with 960P), discuss the CRT raster format which you believe would be the most appropriate. Factors to consider are complexity of the receivers's scan conversion scheme, the complexity of display drives, size of display, possible artifacts caused by the conversion, and the use of sources adaptive coding (i.e, 24, 30 and 60Hz frame rate will be transmitted, depending on the source material).

7.) Given that the final transmission format is a higher bit rate, either 960P at 60Hz or 1080P at 60Hz, discuss how the early receivers would be compatible with the chosen higher bit rate transmission format. For example, the higher bit rate format may require additional compression to fit within the 6 MHz broadcast channel bandwidth. The compression may not be completely determined when the first receivers are built. How can this flexibility in receivers be provided for the high bit rate transmission format? If the receivers do not provide compatibility, they may not be able to reproduce a picture. How might the receivers still be made usable?

8.) If the high speed data rate is completely specified, but not yet practical, can early receivers be made compatible using, for example, a hierarchial scheme?

5. HD LCD or other light valve projector technology.

Format	Cost	Complexity	Implementation Time
720P			
960I			
1080I			
720P and 960I			
720P and 1080I			

Now reassess the above assuming that forward compatibility is added, specifically:

720P and 960P			
960I and 960P			
1080I and 1080P			
720P,960I,and 960P			
720P,1080I, and 1080P			

4. Cable Converters. These units will also be required to decompress the digital 525 format which cable operators will use for premium near video on demand.

Format	Cost	Complexity	Implementation Time
720P			
960I			
1080I			
720P and 960I			
720P and 1080I			

Now reassess the above assuming that forward compatibility is added, specifically:

720P and 960P			
960I and 960P			
1080I and 1080P			
720P,960I,and 960P			
720P,1080I, and 1080P			

3. HD Laser disc players. We ask you to make the same assumptions as for VCR's unless you indicate otherwise.

Format	Cost	Complexity	Implementation Time
720P			
960I			
1080I			
720P and 960I			
720P and 1080I			

Now reassess the above assuming that forward compatibility is added, specifically:

720P and 960P			
960I and 960P			
1080I and 1080P			
720P,960I,and 960P			
720P,1080I, and 1080P			

2. HD VCR. We will assume that the compressed code needs minimal reformatting so as not to impact the VCR and that the HD receiver will do scan format conversion if necessary. Please indicate if your assumptions are different.

Format	Cost	Complexity	Implementation Time
720P			
960I			
1080I			
720P and 960I			
720P and 1080I			

Now reassess the above assuming that forward compatibility is added, specifically:

720P and 960P			
960I and 960P			
1080I and 1080P			
720P,960I,and 960P			
720P,1080I, and 1080P			

1. HD Receivers

The HD receiver will do scan format conversion if necessary. Please indicate if your assumptions are different.

Format	Cost	Complexity	Implementation Time
720P			
960I			
1080I			
720P and 960I			
720P and 1080I			

Now reassess the above assuming that forward compatibility is added, specifically:

720P and 960P			
960I and 960P			
1080I and 1080P			
720P,960I,and 960P			
720P,1080I, and 1080P			

transmitting 24 frame movies. Please assume this block diagram in your assessment. We believe that it will also be useful in considering the other kinds of CE equipment.

Please note that the receiver uses a single display format. The questionnaire requests information about this.

Please enter your estimates into the following tables, selecting one of the indicated formats as a reference.

Please indicate, the percentage difference in cost and complexity (+/-%) of the other receivers using your indicated referenced format. In 1992 the ACATS specialist group on cost assumed second generation receivers manufactured in 1 million quantities in a single year. Please use this assumption for implementation time.

Please indicate the time you believe it will take for CE to initially become available to consumers from the time the FCC releases its final order.

Example:

Format	Cost	Complexity	Implementation Time
720P	*+5%*	*0%*	*1 3/4 years*
960I	*ref*	*ref*	*2 years*

Finally, please remark on any impact consideration which you believe needs elaboration on a separate sheet.

FCC Advisory Committee
Experts Group on Production
& Receiver/VCR Impact

QUESTIONNAIRE
on
HDTV Consumer Equipment

The Experts group will consider the various types of HD consumer equipment (CE) such as receivers, VCR's, disc players, cable converters and future equipment, such as CD's and flat panel displays.

For CE, our Experts group has two goals:

1) To assess and compare the impact of single format CE with multiformat CE.

It is possible that a single scan form transmission scheme may be selected or two formats may be allowed in the initial phase of HDTV transmission. The questionnaire asks to evaluate the proposed single format to understand their differences and to form a reference to compare the proposed multiformat combinations. The questionnaire also asks to compare the proposed multiformat with all others.

2) To assess and compare the impact of various migration paths to a single higher bit rate format.

It is possible that a different, higher bit rate transmission scan format will be used when practical in the future, CE designers may want to take this into account for forward compatibility. The questionnaire asks to what extent this will impact CE design assuming that interim CE is desirable. There are also specific questions dealing with the compatibility issue.

***

In assessing impact, please consider cost, complexity and implementation time. Compatibility among various CE products should also be considered.

To help make your assessment, we have attached a block diagram of an HD receiver which also includes the necessary functions to receive and display NTSC signals and do the format-conversion. It also handles 24, 30, and 60Hz transmission frame rates since the proposed system will do source adaptive coding to avoid transmitting redundant bits when, for example,

LIST OF PRODUCTION EQUIPMENT

Cameras
Telecine
VTR
Routing Switcher
Production Switcher
DVE
Paint/Graphic Systems
Distribution Equipment (serialisers, deserialisers)

Downconverters to 525 television
Downconverters to 625 television
Upconverters from 525/625 television

Possible HDTV Production Formats as Recommended by the ATSC

	Production Format(s)	With Migration Path To:
OPTION 1	720 Progressive →	1080 Progressive
OPTION 2	1080 Interlace →	1080 Progressive
OPTION 3	720 Progressive AND 1080 Interlace (Requires Dual Format Production Equipment)	1080 Progressive

Attachment 3

Possible Grand Alliance ATV Transmission Formats

	Transmission Format(s)	With Migration Path To:
OPTION 1	720 Progressive →	960 Progressive
OPTION 2	960 Interlace →	960 Progressive
OPTION 3	720 Progressive AND 960 Interlace (Requires Dual Format Production Equipment)	960 Progressive
OPTION 4	720 Progressive →	1080 Progressive
OPTION 5	1080 Interlace →	1080 Progressive
OPTION 6	720 Progressive AND 1080 Interlace (Requires Dual Format Production Equipment)	1080 Progressive

Attachment 2

Grand Alliance entities agree to support the Alliance's proposed HDTV compression system in the International Standards Organization as the MPEG-2 HDTV profile.

Over the next few weeks, Advisory Committee participants will review the technical merits of the Grand Alliance proposal, which includes procedures for deciding on a few remaining component designs based on the results of specific tests. Various subgroups of the Advisory Committee will work with the Grand Alliance members as their merged system concept is finalized and, eventually, will oversee the testing of the completed system. Based on the results of those tests, the Committee may recommend the system to the FCC as the basis for a high definition television standard for our country. The FCC, of course, has the ultimate authority to adopt transmission standards.

best elements of the four systems and acceleration of HDTV service implementation. The FCC's Advisory Committee endorsed the Alliance concept at a meeting in February.

Important aspects of the Grand Alliance technical proposal submitted today include the employment of progressive scan transmission (where entire picture frames are transmitted sequentially) and the use of so-called "square pixels" (where the dots on a television screen are arranged in equally spaced rows and columns). Both of these design aspects are important for the interoperability of HDTV with computers, telecommunications, and other media and applications. Interlaced scan transmission (as deployed in today's TV systems) would also be accommodated in the initial deployment.[1]

Specifically, the proponents agree that all large-screen HDTV receivers (34 inches in diagonal and above) will incorporate a 60 frame per second 787.5 line or higher progressive scan display mode. Progressive display would be optional initially for smaller screen receivers. The proponents also concur that all transmission of film material will be in a progressive scan format beginning immediately upon the commencement of HDTV service. Finally, the Grand Alliance proponents unanimously endorse the objective of migrating the standard to a high line number (i.e. thousand-line plus) progressive scan transmission as soon as feasible, and will work together to eliminate interlaced scanning format from the transmission path in the future.

To support multiple transmission formats, the merged system will feature source adaptive processing. Moreover, to promote system flexibility and extensibility, the merged system also will feature a prioritized, packetized data transport structure. Additionally, the

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[1] MIT believes that a digital video broadcast standard that exclusively utilizes progressive scan transmission, from the beginning, is in the best interests of the United States.

Advisory Committee on Advanced Television Service

FOR IMMEDIATE RELEASE: May 24, 1993

HDTV "Grand Alliance" Proposal
Will Be Considered by FCC Advisory Committee

Washington, D.C. The Federal Communications Commission's Advisory Committee on Advanced Television Service (established by the Commission in 1987) will review a single digital high definition television (HDTV) system proposed today by a "Grand Alliance" of entities that, until now, had sponsored the four remaining competitive HDTV systems. These entities (AT&T, the David Sarnoff Research Center, General Instrument, Massachusetts Institute of Technology (MIT), North American Philips, Thomson Consumer Electronics, and Zenith Electronics) today reached a business and technical agreement and submitted to the Committee a merged system proposal.

The proposed system, if recommended by the Advisory Committee and adopted by the FCC, could place the U.S. in the forefront of high definition video technology. An all-digital standard, which would facilitate interoperability among broadcasting, cable, computer, and telecommunications technologies, has worldwide potential.

Advisory Committee Chairman Richard E. Wiley, who had encouraged the complex negotiations leading to the agreement, said "I believe the Grand Alliance proposal, subject to Advisory Committee and ultimate FCC approval, will help to conclude a process that has fostered the development of highly advanced digital HDTV technology. The members of the Alliance should be commended for their accomplishments." Wiley added that the benefits of the Grand Alliance include development of a digital system incorporating the

For example, please respond by providing your estimation in the following form:

Reference System	Cost	Operational Complexity	Implementation Time
720 p	±%	±%	_____ years
960 i	±%	±%	_____ years

Finally, please comment on any assumption or consideration which you believe needs elaboration.

4.0 FRAME RATE

A recent ATSC analysis recognized that the HDTV broadcasting infrastructure should operate at 59.94 Hz (in order to ensure a simplified HDTV/NTSC simulcast operation) while, at the same time, independent production and post-production facilities would prefer to operate at 60.00 Hz. Thus ATSC recommended that:

- Broadcasters operate HDTV at 59.94 Hz for the "simulcast period" (approximately 15 years during which both NTSC and HDTV would be operating).
- When NTSC shuts down, broadcasters switch to 60.00 Hz.
- HDTV production equipment be switchable between 60.00 and 59.94 Hz.
- HDTV receivers be capable of 60.00/59.94 operation from the outset.

Based upon this recommendation, can you comment on the following:

(a) What are the cost implications of dual frame rate capability in HDTV production equipment, versus a choice of one single rate?

(b) What are the cost implications of dual frame rate on HDTV receivers, versus a single rate?

* * *

Attachments:

(1) ACATS press release announcing formation of the Grand Alliance, May 24, 1993
(2) "Possible Grand Alliance ATV Transmission Formats"
(3) "Possible HDTV Production Formats as Recommended by the ATSC"
(4) "List of Production Equipment"
(5) "Questionnaire on HDTV Consumer Equipment"
(6) Block Diagram of "ATV Receiver"

(a) Transmission Format Assumptions

Please note that the questions regarding consumer equipment (*Attachment 5*, Questionnaire on HDTV Consumer Equipment") assume that the transmission formats to be analyzed are those six scenarios set forth in paragraph 1.0 above.

The questionnaire seeks to evaluate each proposed single-scan format in order to understand their differences and to form a reference against which to compare the proposed multiple-scan formats. The questionnaire also seeks to evaluate each of the different proposed multiple-scan formats.

Finally, the questionnaire seeks to evaluate the cost and timing impacts of forward compatibility for the two potential migration paths. Compatibility among the different consumer equipment products should also be taken into account.

To help you make your assessment, we have attached a block diagram (*Attachment 6*, "ATV Receiver") of an HD receiver which includes the necessary functions to receive and display NTSC signals and to do format conversion. The receiver also must handle 24, 30, and 60 Hz transmission frame rates since the proposed Alliance system will do source adaptive coding to avoid transmitting redundant bits when, for example, transmitting 24-frame per second movies. Please assume this block diagram in your assessment. You may also find it useful in considering other kinds of consumer electronics equipment (VCRs, etc.).

Please note that the receiver is a single display format. The questionnaire requests information about this.

(b) Questionnaire for Consumer Equipment Makers

Using the attached questionnaire (*Attachment 5*), please indicate, relative to an identified reference system, the percentage difference in cost and operational complexity (±%).

Please note that, in 1992, the ACATS Systems Subcommittee Working Party 3 (Economic Assessment) Receiver Costs Task Force assumed second generation receivers manufactured in quantities of one million in a single year (1998). Please use this assumption.

For delivery dates, please indicate for the reference system you select and for other systems cited in the questionnaire the time you believe it will take for consumer electronics equipment initially to become available to consumers from the time the FCC releases its Final Order on the HDTV transmission standard.