VERTICAL RADIATION PATTERN

ADC Alan Dick & Co Ltd

STATION HDTV

Channel USA 60

Frequency 746/752 MHz.

Type UHF BROADBAND PANEL ARRAY

Aperture 12 TIERS

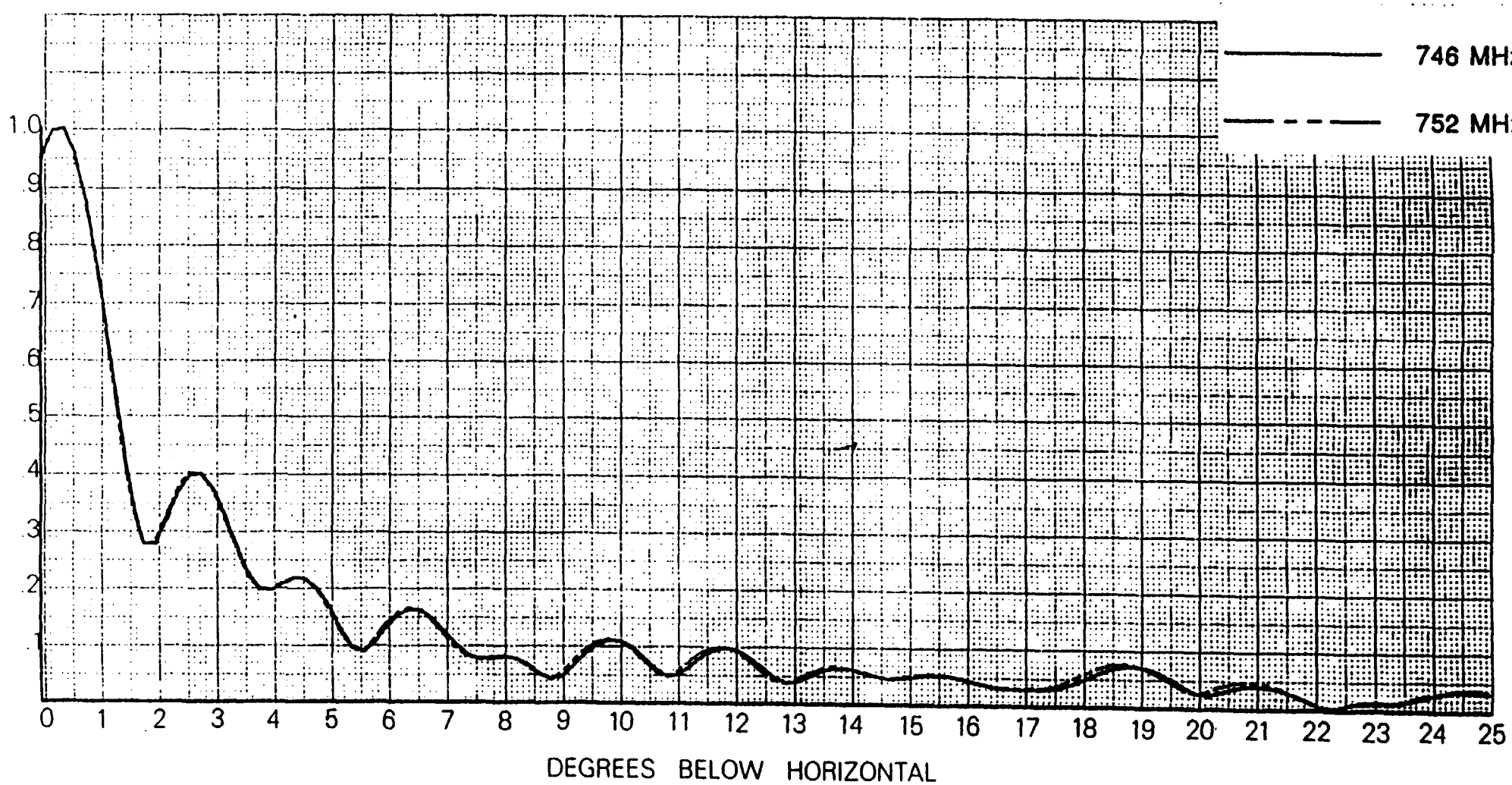
Beam Tilt 0.4 Deg.

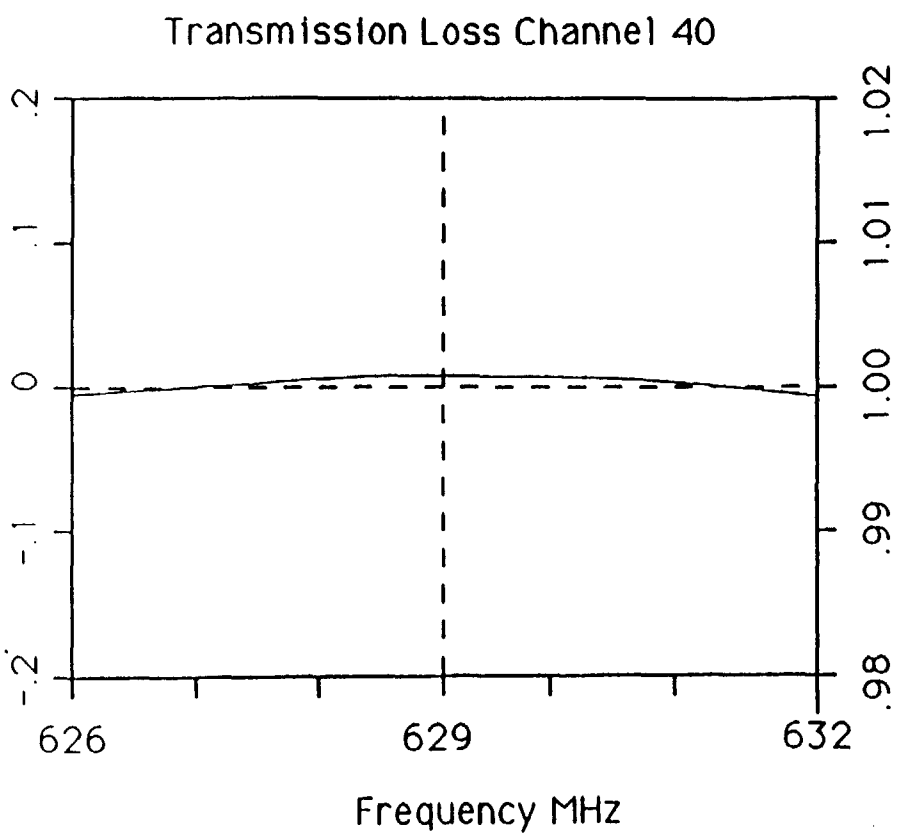
Null Fill Loss 1.2 dB.

Face

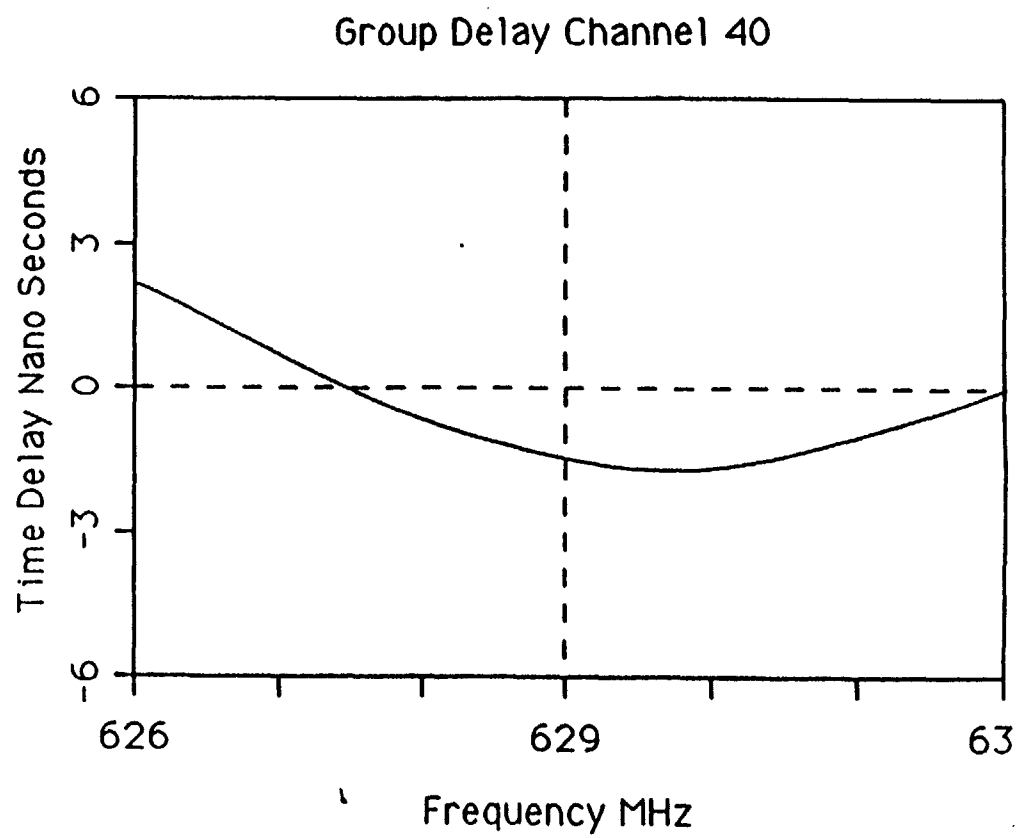
Engineer SD

Date June 1992





TYPICAL CHANNEL COMBINING UNIT PERFORMANCE



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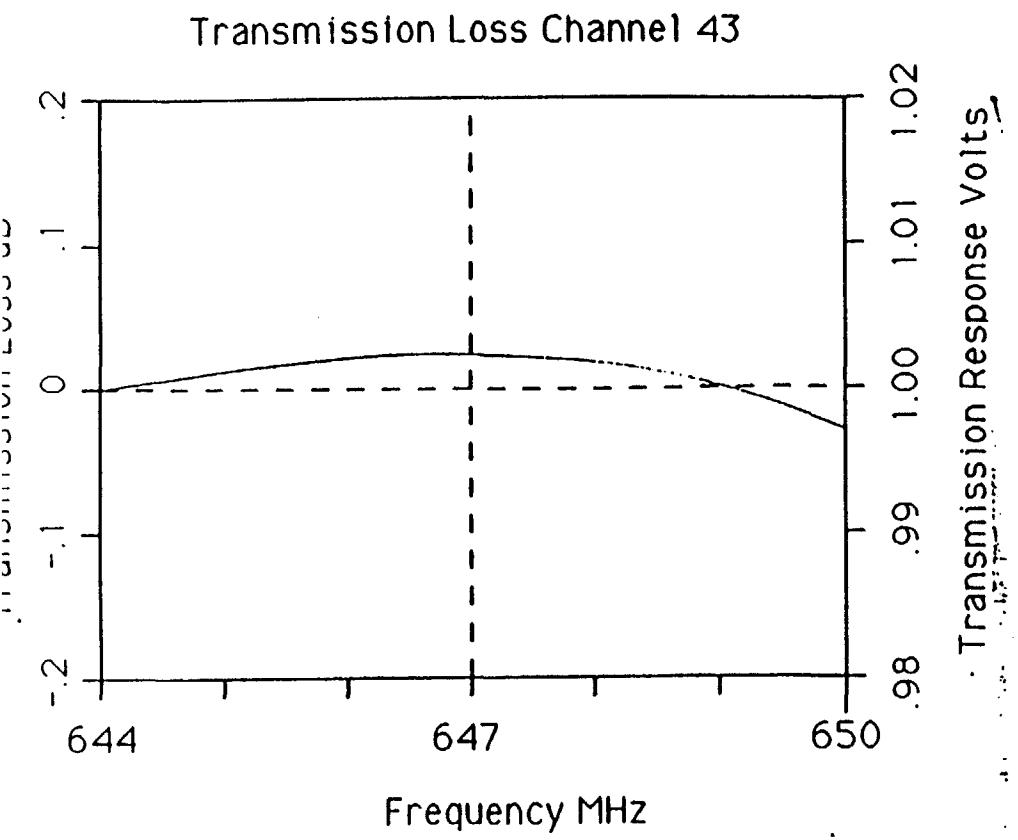

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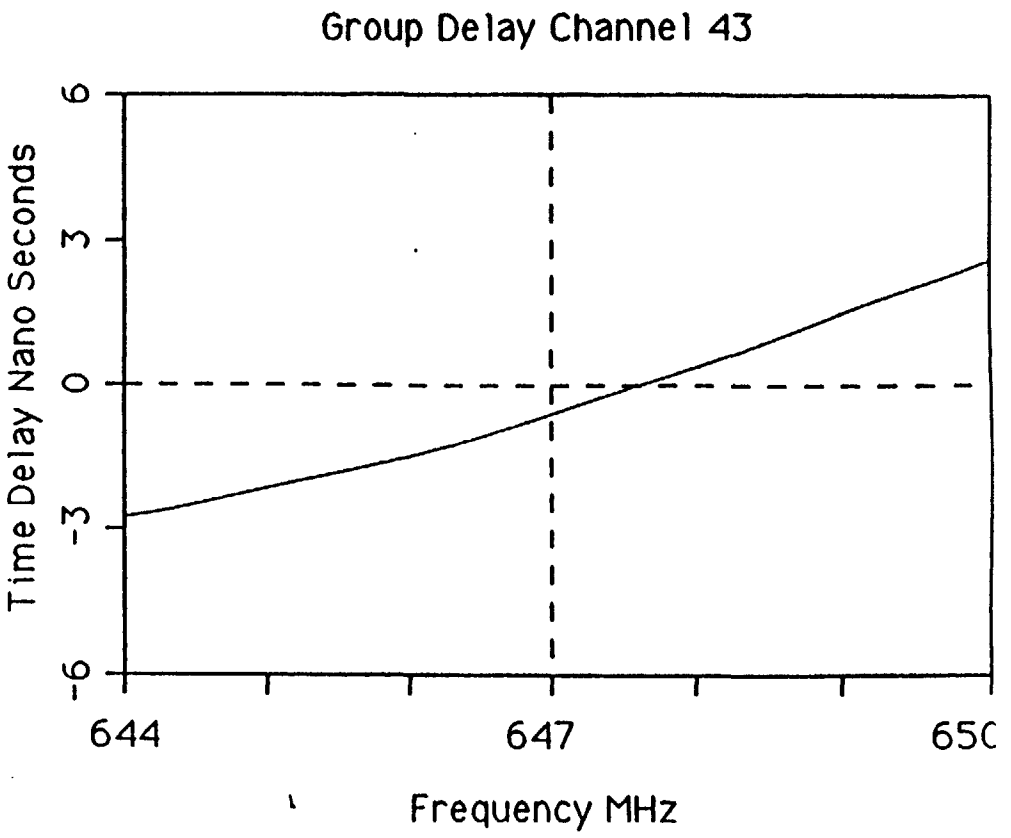

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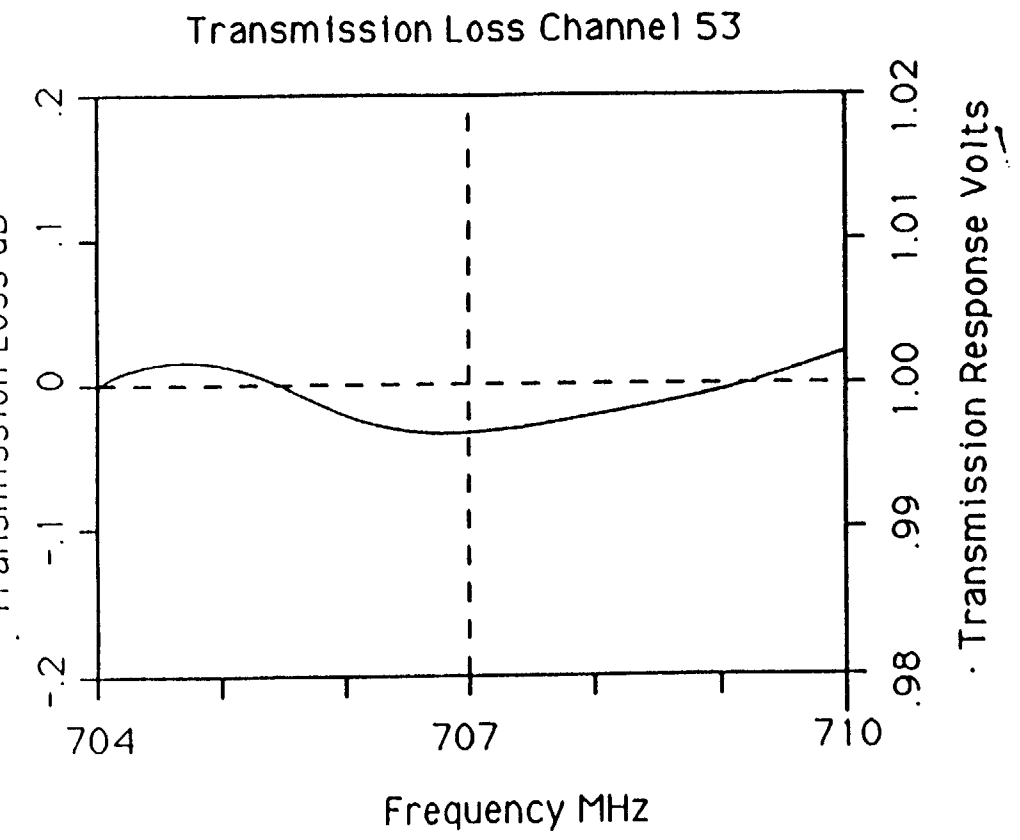

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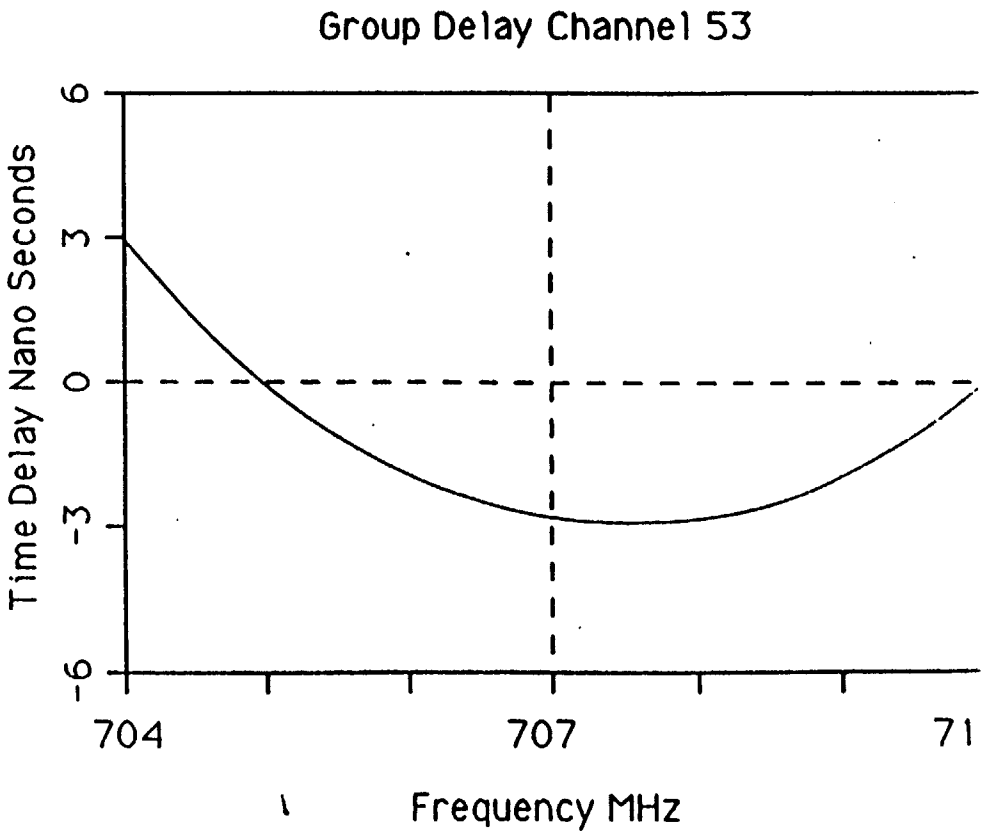

TYPICAL CHANNEL COMBINING UNIT PERFORMANCE

IS/WP2-0231
20 AUG 92

Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

Communications
Research Centre

Centre de recherches
sur les communications

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Your file Votre référence

Our file Notre référence

13 August 1992

Mr. Jules Cohen
Chairman
Field Testing Task Force, SS/WP2, ACATS
Jules Cohen & Associates
Suite 600
1725 DeSales Street, N.W.
Washington, DC 2036-4406

Dear Mr. Cohen

Following the meeting between J. Tremblay of Larcan Communications Equipment and B. Caron of Communications Research Centre (CRC) on 29 June 1992, some work has been done at CRC to characterize the Distribution of envelop to Average Power Ratio (dB) for Proposed HDTV Systems. The computer simulation results are tabulated in Table 1. The simulations are conducted using Signal Processing WorkSystem, a powerful simulation software package developed by COMDISCO Systems Inc. for communications system simulation. Comments on the simulation results are welcomed.

From Table 1, because of the proposed Digital HDTV systems implemented different (raised cosine) filter roll-off factors, the distributions of Envelop to Average Power Ratio are different. For each proposed system using QAM modulation, simulations show that there are almost no difference between the distributions of Envelop to Average Power Ratio for 32QAM system and for 16QAM system.

For ATRC's ADTV system, the distribution listed in Table 1 is for HP or SP carrier.

For DSC-HDTV system proposed by Zenith/AT&T, the distributions are quite different between the two transmission modes, 4-VSB and 2-VSB. The reason is that: (1) the two transmission modes have different levels of pilot injection, which results in different average power level. Simulation shows that the 4-VSB mode average power is about 1.4 dB lower than that of the 2-VSB mode' and (2) the two modes used different constellations which have different Peak Envelop Power. The 4-VSB mode peak power is about 1.1 dB higher than that of the 2-VSB mode.

Sincerely

Yiyan Wu

Dr. Yiyan Wu
Broadcast Technologies Research
Tel: 613-998-2870

Attach
co:A. Vincent
B. Caron
DCN

Canada

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P.O. Box 11490, Station H
Ottawa, Ontario
K2H 8S2

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CP 11490, Succ. H
Ottawa (Ontario)
K2H 8S2

TABLE 1: Distribution of Envelop to Average Power Ratio (dB) for Proposed HDTV Systems

	GI Digiphor 32/16 QAM 21% Roll-Off	ATRC ADTV 17% Roll-Off	MIT/GI (CDC-HDTV) 10% Roll-Off	Zenith-AT&T DSC-HDTV 11.5% Roll-Off	
				4-VSB	2-VSB
99.999%	9.3 dB	9.6 dB	9.9 dB	10.1 dB	7.6 dB
99.99%	8.7 dB	8.8 dB	9.3 dB	9.2 dB	7.5 dB
99.9%	7.8 dB	8.0 dB	8.3 dB	8.6 dB	7.2 dB
99.5%	6.9 dB	7.0 dB	7.2 dB	7.8 dB	6.8 dB
99%	6.6 dB	6.6 dB	6.7 dB	7.4 dB	6.6 dB
98%	6.2 dB	6.2 dB	6.3 dB	6.9 dB	6.3 dB
97%	5.8 dB	5.9 dB	5.9 dB	6.5 dB	6.1 dB
96%	5.5 dB	5.6 dB	5.6 dB	6.2 dB	5.9 dB
95%	5.3 dB	5.4 dB	5.4 dB	5.9 dB	5.7 dB

IS/WP2-0232
20 AUG 92

(Typical Letter to Additional Local Area Group Cities)

Eric Bergman, Director of Engineering
WHAS-TV
520 West Chestnut St.
Louisville, Kentucky 40202

August 12, 1992

Dear Eric,

Thank you for agreeing to be the facilitator for the Louisville Local Area Group of the FCC Advisory Committee for Advanced Television Service (ACATS), Implementation Subcommittee, Working Party 2 on Transition Scenarios.

As you may already know, the ACATS was established by the FCC in 1987 to investigate and advise the FCC on any technological and public policy issues in regard to the emerging Advanced Television technologies. To accomplish that goal, this Committee established a series of three Subcommittees to investigate Planning, Systems and Implementation issues in regard to adoption and implementation of an Advanced Television transmission standard. Furthermore, within these Subcommittees are a series of Working Parties that do the specific investigative work deemed necessary by their parent Subcommittee. Specifically, the Implementation Subcommittee, Working Party 2's mandate is to investigate those technological and public policy issues associated with the transition from the present NTSC transmission system to one involving Advanced Television. Additionally, IS/WP-2 is looking at the various proponents' ATV systems to see if any of the differences in the systems would have an impact on this transition.

As part of this overall ACATS system selection process, the five finalist Advanced Television design proponents have submitted their systems for testing by the Advanced Television Testing Center. The Center's results in turn will be

submitted to the full Advisory Committee and will become part of the overall ACATS final report to the FCC early next year.

You can provide very valuable input to this overall process by convening a Local Area Group of the Chief Engineers and other interested parties in your market. This Group should discuss the issues surrounding the ATV transition that the Group feels should be reported to the FCC as part of this decision making and regulatory process.

As a result IS/WP-2's inquiries to the present ATV system proponents, a table of anticipated transmitter power levels has been created and is included with this letter for your Group's information. As you study these power levels, you should consider in your subsequent discussions, always, a worst case situation or requirement for all of the broadcasters in your area who would want to transmit Advanced Television. The precise power level that will be required will not be known until the completion of field testing the selected system early next year.

Also included with this letter is a functional diagram of a theoretical transitional television station that has been used as part of the Working Party's discussions and may also spark discussions within your Group.

As you have no doubt heard or have read, earlier this year the FCC issued the Second Report and Order / Further Notice of Proposed Rule Making regarding the future Advanced Television system transmission. Included were issues that also ought to be made part of your discussions. Specifically, the following issues were covered :

- Limiting initial ADTV license eligibility to present broadcasters
- Two year deadline for eligibility and three year for construction
- Use of vacant non-commercial channel allotments only when necessary
- There will be a fixed time conversion (prop.15 years) to ADTV
- A 100% simulcasting requirement (prop. 9 years) for licensees
- Proposal to rank initial eligibility broadcasters for ADTV licenses
- Proposal for a negotiation period for market channel assignments
- Proposal for dual network rule suspension to allow for simulcast
- Proposal for LPTV stations to convert to ADTV

Have someone at your meeting(s) act as a reporter and provide the Working Party a summary of your discussions. Although a formal agenda might be advisable, do not limit the group's discussions to that of tower space and transmitter locations only. Consider all of the foreseeable transition problems and possible solutions (including regulatory).

Even though there has been a delay in our formal request to you to convene your Local Area Group, your participation will be vital to the work of the whole Advisory Committee. IS/WP-2 will soon be drafting a portion of the final determination and recommendation to the FCC by the Advisory Committee early next year of a system that we as broadcasters will live with for many years. Your identification of potential engineering, financial and local regulatory problems and solutions needs to be included in Working Party 2's portion of the final report and recommendation to the Commission. Your Group's input will make a real difference.

You can reach me at anytime at (704) 329-3632 or FAX (704) 357-4980.

Sincerely,

David Folsom
Director of Engineering
WCNC-TV
Providence Journal Broadcasting

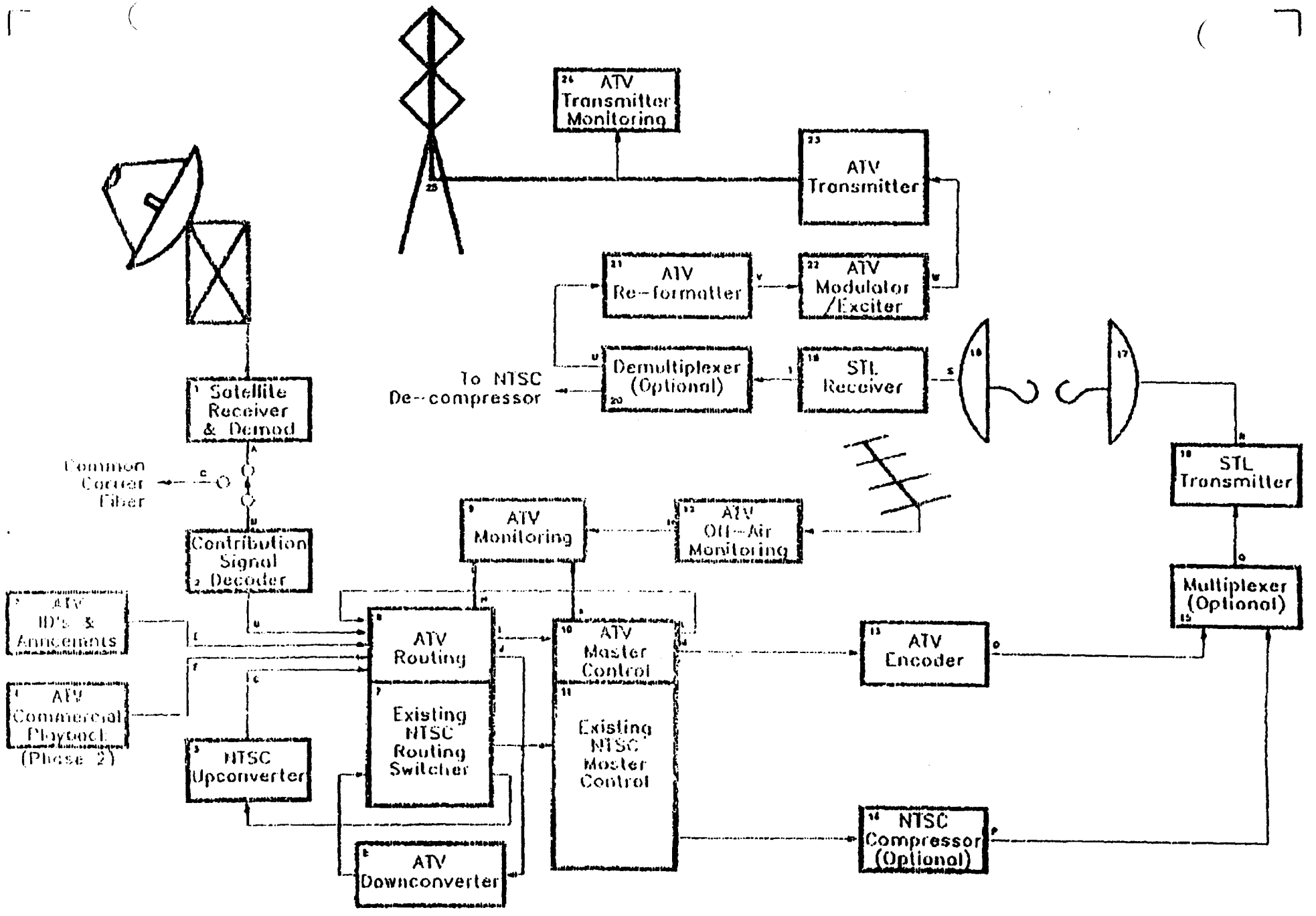
HDTV PROPONENT PREDICTED TRANSMITTER POWER LEVELS

AS OF 3/3/92

	AVERAGE POWER			PEAK POWER		
	Lo V	Hi V	UHF	Lo V	Hi V	UHF
G.I.	-15 dB	-15dB	-10 dB	<-10 dB	<-10 dB	<-5 dB
NHK	<-12.6 dB	<-12.6 dB	<-12.6 dB	-6 dB	-6 dB	-6 dB
Zenith	-12dB to -15 dB			-6 dB to -9 dB		
A.T.R.C	-12dB	-15 dB	-12dB	-2dB	-5 dB	-2dB
M.I.T.	-15 dB	- 15dB	-10 dB	<-10 dB	<-10 dB	<-5 dB

ALL REFERENCE: NTSC PEAK Channels 6 = 20 dBk or 100kW
13 = 25 dBk or 316 kW
36 = 37 dBk or 5000kW

ACATS IS/WP-2



ATV Transitional Television Station

IS/WP2-0233
20 AUG 92

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios

To: Birney Dayton - SS/WP-1

From: Merrill Weiss

Date: August 4, 1992

Re: Analysis of Distributed Transmission Concept

As we discussed on the telephone, IS/WP-2 has begun looking into the concept of distributed transmission (sometimes called a cellular approach) for Advanced Television. The investigation began as a direct result of the inclusion of this concept in the system submission on the Channel Compatible DigiCipher system.

As we both know, the concept of multiple-transmitter operation for broadcasters has been informally discussed both within and outside the Advisory Committee for some time. Given that it has been raised by a proponent, now is a good time to examine it sufficiently to decide whether it is a workable technique that should be recommended to the FCC or whether it is a nice concept that is impractical for implementation.

IS/WP-2 has held several discussions of the implementation of a distributed transmission approach and has recognized that it could be a good solution in a small number of cases where it might avoid other constraints that a broadcaster would otherwise face. Thus it might help some broadcasters get on the air who otherwise would not.

As a result of IS/WP-2's discussions, it was decided to seek a technical analysis of the system configuration that would be required to implement a distributed transmission system and of any limitations receiver designs, in particular, might place on the transmission system design. Thus I am writing to you to request that SS/WP-1 undertake such a study and report its findings back to IS/WP-2. It is expected that the SS/WP-1 work could be accomplished through the mechanism of a conference call of Bob Keeler's Analysis Task Force.

There are two forms of multiple transmitter operation that should be examined. First is the case with a small number of transmitters (perhaps 7 or 8) widely dispersed so that they fully cover a normal station's coverage area. This approach has one transmitter in the center and one ring of transmitters around it. From an operational point of view, this is the only arrangement that appears workable to the broadcasters who have looked at the concept.

The second form is the use of additional transmitters to cover relatively small areas. These might be used to fill in gaps in coverage caused by particular terrain or environmental conditions. These are the kinds of situations in which translators are used for NTSC today.

For each form of operation, IS/WP-2 requests a determination of the characteristics and configurations of the transmission systems that will be required. Thus, for example, regarding the first type there would be a number of transmitters specified, with effective radiated powers, antenna heights, special timing requirements, and other items determined. Any particular receiver characteristics needed to work with such a transmitter configuration should also be ascertained. Then, the proposed systems should be measured against the required receiver characteristics to see whether those characteristics can be relatively easily accommodated. A similar analysis should be conducted with respect the second distributed system approach.

I hope this is sufficient information for undertaking the examination we request. Since I participate in Bob Keeler's task force, I will be happy to elaborate for the members of the group. This will avoid the need to define the problem in too much detail in writing, thereby possibly stifling innovative thinking in the task force.

Thank you for your support in this investigation. Your Working Party was established with the resources and the assignment to deal with exactly these sorts of issues. IS/WP-2 is being very careful not to overstep its bounds and wishes to draw upon the very great expertise you have within your membership.

IS/WP2-0225
21 JUL 92
20 AUG 92

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios

Summary of Responses to Questions for Proponents

Following are the questions posed originally to proponents with a summary of the answers from each arranged following the original question. Supplementary questions were posed to each proponent based upon an original set of responses. The answers to the follow-up questions are included in the summaries where the follow-up questions have so far elicited responses. In the interest of keeping this document from becoming any longer than necessary, the follow-up questions are not repeated herein. They are available upon request from IS/WP-2.

General

Q1. Is extensibility built into your system? If so, are there extensions to your system that require particular consideration during the initial (full, but not extended) implementation? What are the considerations that must be addressed as part of the initial implementation?

NHK

1. Future improvement of dynamic resolution by adding motion vectors (all MUSE family members use only one currently).

   - Give up (reserve) data space — 60 kb/s for 140 vectors/field.

   - New receiver with additional 6 line memories and control circuits; original receivers can ignore new information.

2. Alternate media can use full MUSE quality if desired.

   - N-MUSE and MUSE use same algorithm, share same chip set.

   - Full-band MUSE digital input port can be provided in N-MUSE receiver to accept MUSE from some other service.

GI

1. Flexibility in compression/decompression supports various data rates from NTSC to HDTV and higher. Protocol and data structure are also flexible and can accommodate data from other services. Believe in concept of improved performance over time.

2. No answer yet to Specifics. Information on data/signalling, etc., soon to be released. No indication of how an initial DigiCipher receiver should be prepared to anticipate any particular extension(s).

   Present data structure is proprietary, not viewed as a "standard." Will be further defining protocol and willing to work with appropriate industry group to do so. Could incorporate aspects of SMPTE proposals.

Zenith/ATT

1. Possible extensions of performance of video and audio television services are discussed, variously implementable at the transmitter or the receiver, without impacting or making special provision in early receivers.

2. Data structure is particular to DSC-HDTV, not designed as a general communication system, but no particular ancillary data partitioning has been proposed. If the initial implementation of DSC-HDTV defines ancillary data as flexible packets with headers, new ancillary data services can be introduced later.

3. Headers/descriptors of the sort currently under consideration by SMPTE can be incorporated into DSC-HDTV global data packets with slight modification to the global data format. This would have to become part of the standardized system.

ATRC

1. Extensibility achieved by assigning a service code byte to each transport cell. New services, data (properly coded) can be added to digital stream at any time, for use only by receivers that recognize the particular code. Provides flexibility in mix of video, audio, and data for HDTV and in mix of services. There is no backward compatibility problem – early receivers ignore new services.

2. Have not identified any existing standard covering assignment of service types (ST). Those currently used arbitrarily selected, with additional types reserved for future use. Changing service type indicators is trivial. Headers/descriptors of type under consideration by SMPTE can be readily accommodated by assigning service type for such global headers. MPEG itself contains headers/descriptors to provide for video format flexibility. Transport cell format is fully described in System Description document.

3. Anticipate working with industry to finalize number and assignment of service types. If any standard is identified, will strongly consider its use.

1. Extensibility is provided by source-adaptive processing and the concept of headers.

2. Each image frame has a header containing information required or useful for interpretting the frame. Receiver can interpret header, properly decode, and ignore irrelevant information.

3. Current header protocols and data structures are proprietary, but flexible data structure permits adaptation to a reasonable industry standard.

4. Source adaptation sends source images in their native formats with any required format conversion done at the display. This is more efficient method in utilizing available bits than traditional approach of converting to a single format prior to transmission.

5. It is possible to use headers to select different encoding/decoding processes based on source format. CC-DC uses single encoding/decoding method with only the effective coding rate changed for the specific source.

Q2. How long following an Advisory Committee recommendation of your system will the detailed technical information necessary for the setting of standards and for the design and manufacture of both professional and consumer products be available?

NHK

1. The SS/WP-1 submission is a satisfactory introductory explanation. Standards setting information will be available after Advisory Committee recommendation for field test, before NPRM. Design/manufacturing information available during field test period. Part of coding is already in public domain in Japan.

GI

1. 0-3 months, for both standards setting and for design and manufacture.

Zenith/ATT

1. Both Zenith and AT&T have been responsive to this need in past standardization activities and will be for HDTV.

2. Development of standards and providing technical information for designers are separate issues. It is believed the proponent information for either or both will probably require 3 months to compile. Standards development may take an additional 3 months of effort by industry experts aided by the proponent.

ATRC

1. Much info is now available through ACATS documents, including SS/WP-1 submission, and through ISO-MPEG documentation.

2. Upon Advisory Committee recommendation (of ATRC system) detailed information will be available as quickly as possible given the scope of the task. Anticipate Advisory Committee and proponent(s) will agree on a timetable.

3. Anticipated time required to prepare final documentation on the order of 6 months including time to work in collaboration with industry experts and FCC officials.

MIT

1. A maximum of 4 months will be needed to supply technical information sufficient to begin the writing of both FCC Rules and industry technical standards. The information supplied during this period will be sufficient to permit start of IC and product design by manufacturers unrelated to system development program.

2. Personnel resources for development of necessary documentation will come from MIT's Advanced Television & Signal Processing Group and GI's VideoCipher division.

Q3. What provisions have you made for communicating information sufficient for design and manufacture to manufacturers of consumer and professional equipment? Do you have a program planned for providing direct support to help get such organizations up and running with your system?

NHK

1. NHK Engineering Services can provide all at any time under reasonable terms and conditions. Applies to any or all of proprietary info licensing, design diagrams, manufacturing know-how, and prototype evaluation.

2. Any proprietary information and manufacturing know-how necessary to commercial equipment, e.g. schematic diagrams, values of tap coefficients of digital filters, various kinds of parameters, will be subjects of doscussion of terms and conditions. Prototype evaluation service is included in technology transfer program but also available separately.

3. Information necessary to standards writing will be provided to any standardization organization without any restriction.

GI

1. Some internal discussions have taken place. GI has relevant experience in licensing and technical support. Such a function will be established for HDTV.

2. During remainder of 1992, GI will be exchanging information with a limited number of manufacturers. By the end of the year, GI will have developed a package for industry support.

Zenith/ATT

1. Nothing in place but intends to be responsive at the appropriate time. Both companies are experienced in this, and business interests are best served by rapid deployment of all hardware, hence by rapid information dissemination.

2. Plan will include, but not be limited to, detailed technical information and diagrams, seminars as appropriate. The establishement of a program for direct support is premature until there is an unambiguous system selection.

ATRC

1. ATRC member companies are leading manufacturers of consumer and professional equipment and all experienced in launching new standards. Have a record of effectivley supporting technology transfer.

2. Effective technology transfer must include manufacturers of broadcast equipment, consumer electronics, displays, and semiconductors. ATRC has required technical base and business presence in all these areas to ensure effective transfer across all industry segments.

3. It is premature to discuss details of a technology transfer plan prior to selection of a system for field testing.

MIT

1. Both MIT and GI have experience in licensing and technical support and are communicating with manufacturers.

2. A specific plan for technology transfer has not yet been developed. MIT is working with GI to develop such a plan. The plan will involve technology transfer to both IC and product manufacturers.

Q4. What arrangements have you made with integrated circuit vendors for supplying chips for your system? What availability of ICs do you anticipate for other manufacturers of both consumer and professional equipment?

NHK

1. No specific arrangements. MUSE chips already commercially available, second generation due this spring. Specifically, no plans or arrangements to develop the N-MUSE-specific chips required.

2. Decoder should be built using and augmenting full-MUSE IC's. There is no economic advantage to a complete kit of dedicated N-MUSE IC's. Use of MUSE IC kit for part of the N-MUSE decoder saves time and development money, offers extensibility.

3. Use of Full MUSE chips for N-MUSE has little cost penalty since the MUSE chips and N-MUSE chips are of almost the same size and complexity. There might be slight memory savings for N-MUSE chips *vs.* MUSE but this is negligible. Some additional chips are necessary to interface MUSE IC's to N-MUSE system, but they are uncomplicated and would cost relatively little.

GI

1. GI has in-house capability and experience in VLSI for NTSC DigiCipher. Partitioning and estimation have been done for HDTV. Negotiating with vendors for HDTV IC development. Development time will be 18-24 months to availability to equipment manufacturers. (Presumed starting point from Q5: selection of system for field test will trigger hardware implementation.) (Also stated components and hardware may be available by the end of 1994.)

2. May make available 1st cut IC's, which will not necessarily conform to the final standards, for use in preliminary development of equipment.

3. On follow-up, expects to initiate serious IC development by mid-year 1992, and thus expects to have first IC's available by mid-year 1994.

Zenith/ATT

1. AT&T Microelectronics intends to be an industry supplier.

2. AT&T Microelectronics will provide production chip sets to support DSC-HDTV system introduction. In AT&T/ME business interests to make complete receiver chipsets available on a timely basis to other consumer electronics manufacturers and provide appropriate IC's to professional equipment manufacturers.

3. No response to follow-up question on how long following FCC decision chips will be made available to other manufacturers. Restatement of "timely" availability.

ATRC

1. MPEG-based compression is an advantage; some manufacturers are familiar with concept. HDTV MPEG expected sooner and lower cost than a proprietary scheme. (This HDTV MPEG content is about 50% of the IC kit — but not in existence with respect to either complexity or speed required.) IC development forecast at 18-24 months, except MPEG part may be quicker.

2. Various competing sources are expected; ATRC members will produce "appropriate" IC's for the open market. ATRC members (Thomson-ST and Philips-Signetics) are already large consumer electronics industry suppliers and will continue to be for AD-HDTV components. Each is experienced in multiple sourcing agreements with other manufacturers. No specific arrangements for sourcing discussed.

3. IC design efforts at many companies will be triggered by an Advisory Committee recommendation and will be paced by a final FCC decision and timetable for implementation.

MIT

1. GI has in-house VLSI design capability. MIT/GI negotiating with IC vendors; expect chips to be widely available.

2. IC's are expected to be available within 18 months from the trigger point.

Q5. What is your expectation for the time of introduction of your system following the FCC decision? What point in the decision-making process (e.g. Advisory Committee Final Report, FCC Report & Order, completion of Field Test) will be the trigger for you to begin implementation in earnest? Do you have any suggestions for possible head starts in any areas to shorten the time to introduction?

NHK

1. Full service introduction (including alternate media) within 3 years of FCC decision.

2. Broadcast transmitter facility is critical path, including RF filter at the output.

3. Availability of MUSE receiver IC's and SMPTE 240M broadcast equipment can shorten time for certain equipment listed (but time not specified).

GI

1. System can be introduced within a year following Report & Order setting standard.

2. Selection of system for field test will trigger hardware development. Custom VLSI for encoder and decoder development will be the critical path.

3. Assuming FCC Report & Order by year-end 1993 and estimated IC availability by mid-year 1994, first receivers are estimated to be commercially available by year-end 1994.

4. Degree to which selected system is modified during FCC comment period preceding Report & Order constitutes risk for times estimated.

Zenith/ATT

1. Trigger for implementation will be an unambiguous selection of the DSC-HDTV system. This may be as early as an umambiguous selection for field testing.

2. Current timing estimate, based on system selection by FCC in mid-1993, indicates HDTV receivers and broadcast equipment beginning to be available by late 1995. Household penetration of 1 per cent is expected 2-3 years later.

ATRC

1. Implementation plans are underway. Display manufacturing facilities, requiring very long lead times and very large investments are already established.

2. On the Advisory Committee recommendation to the FCC, ATRC companies will begin product design cycles on remaining components (and presumably products).

3. PERT/Gantt chart times are aggressive but achievable. But choice of system may have a significant impact because of 2:1 raster and MPEG relationship.

4. Product design efforts will also be triggered by Advisory Committee recommendation and will be paced by final FCC decision and timetable for implementation.

MIT

1. Trigger will be the earlier of:
   - ATTC test results show CC-DC system is better than the others
   - System is chosen for field testing

2. Suggest all test results be made available as soon as possible.

3. Concept of system introduction is seen as commercial availability of transmitters and receivers. This is expected within 18 months from the FCC's decision.

Broadcast

Q1. What are the transmission power levels (ERP) required for the system for coverage equal to NTSC? Please specify for both low and high VHF and for UHF. Are there any power variations across the UHF band? Are any special transmitter or antenna characteristics required?

Power Levels of Proposed Systems

HDTV Proponent Predicted Transmitted Power Levels

	Average Power			Peak Power		
	Lo V	Hi V	UHF	Lo V	Hi V	UHF
Narrow MUSE	<-12.6 dB	<-12.6 dB	<-12.6 dB	-6 dB	-6 dB	-6 dB
DigiCipher	-18 dB	-18 dB	-13 dB	-11 dB	-11 dB	-6 dB
DSC-HDTV	-15 dB	-15 dB	-12 dB	-6 dB	-6 dB	-3 dB
AD-HDTV	-12 dB	-15 dB	-11 dB	-2 dB	-5 dB	-1 dB
CC-DigiCipher	-18 dB	-18 dB	-13 dB	-11 dB	-11 dB	-6 dB

All Reference: NTSC Peak Power Channels 6 = 20 dBk = 100 kW
13 = 25 dBk = 316 kW
36 = 37 dBk = 5000 kW

Based on Proponent Estimates as of 8/5/92

NHK

1. Noise figure of Narrow MUSE receiver will be 4-7 dB improved over NTSC receivers. This is all allocated to improving the noise performance of the receiver rather than extending the service area. Noise figure of current receivers is assumed to be 12 dB for VHF and 15 dB for UHF.

2. Relationship between peak and average power is important only for digital systems. In analog systems such as N-MUSE the average power is picture dependent. Average power of N-MUSE has been provided nonetheless for comparison's sake.

3. There are no power variations across the UHF band.

4. Required transmitter and antenna charateristics are described in a supplementary document (copy of a letter to chairman of SS/WP-2 Field Test Task Force).

ATRC

1. The different average power level for Hi V band is a result of different planning factors required for different bands as differences in conversion from FCC(50,50) to FCC(50,90) data in the bands. These differences have apparently not yet been included by other proponents in their estimates.