David Sarnoff Research Center
201 Washington Road
Princeton, New Jersey 08540
July 21, 1995

Mr. Thomas Gurley
Advanced Television Test Center
1330 Braddock Place, Suite 200
Alexandria, Virginia 22314

Dear Mr. Gurley

On July 19 1995 you requested a written explanation of the Grand Alliance Transport Encoder operation for certain tests related to Video Quality / Auxiliary Data Tradeoff. Later that day I gave you a Draft explanation before I left the ATTC building. That Draft explanation has since been reviewed by Mr. Terry Smith and Mr. Paul Lyons here at the David Sarnoff Research Center. They have indicated that the explanation looks fine, so I'm sending you a final copy attached to this cover letter.

Sincerely yours

Rick Bunting
Grand Alliance

David Sarnoff Research Center
201 Washington Road
Princeton, New Jersey 08540
July 21, 1995

Mr. Thomas Gurley
Advanced Television Test Center
1330 Braddock Place, Suite 200
Alexandria, Virginia 22314

Dear Mr. Gurley

The Video Quality / Auxiliary Data Tradeoff - Constant (Forced) Data Rate test, 2.10., was done as follows. The GA Transport Encoder configuration of services was set for Video, Audio A, and Aux 1. The computer which generates the Schedule sent to the GA Transport Encoder gives Aux 1 service a higher priority than Video in the Schedule. The Aux 1 Data rate was controlled by one of the function generators, and was set at each of the five data rates listed in step 2.10.3., of the test procedure. Since the Aux 1 service has higher priority, as the Aux 1 Data rate goes up the lower priority (Video) service gets less access to the channel. This forces the Video Data rate down.

The Video Quality / Auxiliary Data Tradeoff - Opportunistic Data Capability test, 2.11., was done as follows. The GA Transport Encoder configuration of services was set for Video, Audio A, and Aux 3. The computer which generates the Schedule sent to the GA Transport Encoder gives Video service a higher priority than Aux 3 in the Schedule. The Video Data rate is image dependent, and is determined by the Video Encoder. Since the Video service has higher priority, as the Video Data rate goes up the lower priority (Aux 3) service gets less access to the channel, thus forcing the Aux 3 rate down. In the same fashion if the Video Data rate goes down, due to ease of Video compression, than the Aux 3 Data rate can increase.

Sincerely yours

Rick Bunting
Grand Alliance

cc. Paul Lyons
Terry Smith

SWP2-1462
25 July 95

ADVANCED TELEVISION TEST CENTER, INC.

1330 BRADDOCK PLACE SUITE 200 ALEXANDRIA, VIRGINIA 22314-1650
703/739-3850 FAX 703/739-3230

July 25, 1995

Mr. Mark Richer
SS/WP-2 Chairman, FCC Advisory
Committee on Advanced Television Service
c/o Public Broadcasting Service
1320 Braddock Place
Alexandria, Virginia 22314

Dear Mark:

This letter is to advise you of an anomaly in the test results for Upper Adjacent Channel ATV-into-NTSC interference, which we noted at the time of the original test and investigated further at the end of the Grand Alliance test period, and for which we now offer a recommendation to SS/WP-2.

A disparity exists between the median CCIR Grade 3 level determined by expert viewers at ATTC and the Grade 3 level resulting from the non-expert assessment at ATEL. At the Strong (-25 dBm) level of the desired NTSC signal, the ATEL Grade 3 occurs at a 3.5-dB lower level of interference than the ATTC Grade 3. At the Weak (-55 dBm) level of the NTSC signal, the ATEL Grade 3 occurs at a 6.8-dB lower level. In both cases, the CCIR 3 level voted by the experts as the median for the 24 receivers was beyond the range of levels they selected, using a single "median" receiver, for non-expert viewing at ATEL. Therefore, the ATEL results could not possibly have matched the ATTC results. In both cases, however, the individual CCIR 3 levels voted by the experts for that receiver ("B5") were in close agreement with the ATEL results, which were based upon recordings made from that receiver. At the Strong NTSC level, the two results were 0.5 dB apart; at the Weak level, the results were 1.8 dB apart. Based upon this analysis of the data, we hypothesized that the disparity was most likely due to the fact that the selected "median" receiver was not sufficiently representative of the bank of 24 receivers.

Last week, at the conclusion of Grand Alliance testing, we set up the test conditions again in order to investigate our hypothesis. A representative of the Grand Alliance was present during this investigation. We confirmed, by "live-versus-tape" A/B comparison, that the recordings used in the ATEL testing had correctly captured the performance of the "median" receiver (B5) at each of the selected ranging levels. We also noted that, especially at the Weak level, the performance of this receiver was not representative of the median performance of the bank of 24 receivers over the full range from Threshold of Visibility (TOV) to Point of Unusability (POU). This

observation was confirmed by further analysis of the expert voting results. Specifically, at Weak, the TOV for Receiver B5 was nearly 3 dB better than the median TOV, while at POU, the TOV for B5 was 3 dB worse than the median TOV. At the CCIR 3 level, that receiver was 5 dB worse than the median. However, given the constraints involved in selecting a "median" receiver, we found that B5 had been the best choice available. (One constraint is that only six receivers have baseband video outputs available for recording. Also, on several of these receivers, under the upper-adjacent channel interference condition, the appearance of the impairment on the screen differs significantly from the appearance of the baseband output as displayed on the large-screen NTSC monitor—*i.e.* one matching the monitor used at ATEL—thus further limiting the number of receivers suitable for recording.)

After discussion of this finding with ATEL and with representatives of the Grand Alliance, it is our recommendation that the ATEL results for this test be set aside in favor of the experts' results.

In a separate letter to you this date, I have reported results of supplemental testing for degradation of BTSC audio in the presence of Upper Adjacent Channel ATV interference. Those results show that the audio impairment precedes the CCIR 3 video impairment, thereby rendering the subjective video test results of less importance to the spectrum planning process.

Sincerely,

Tom

Thomas M. Gurley
Director of Testing

cc: Richard Citta, Zenith/Grand Alliance
Metin Akgun, ATEL
Robert Bromery, FCC

SSWP2-1464
25 July 95

ADVANCED TELEVISION TEST CENTER, INC.

1330 BRADDOCK PLACE SUITE 200 ALEXANDRIA, VIRGINIA 22314-1650
703/739-3850 FAX 703/739-3230

July 25, 1995

rk Richer
an, SS/WP-2
dvisory Committee on
nced Television Service
blic Broadcasting Service
raddock Place
ndria, Virginia 22314

Mark:

The Grand Alliance Test Plan provided for limited testing for degradation of audio in the presence of a co-channel or upper-adjacent channel ATV signal. tests were to determine, on six receivers, whether any audio impairment was "more than slightly annoying" (*i.e.* CCIR Grade 3 or worse) at the video 3 level determined for each of the receivers during the corresponding ATV-NTSC video test.

Based upon the results of this limited testing, you authorized supplemental during the Grand Alliance testing period. These supplemental tests sought the wing data:

1. Audio CCIR 3 for the remaining 18 receivers for upper-adjacent channel interference at the Weak Desired level.

2. Audio CCIR 3 and CCIR 4 (including SAP CCIR 4) for upper-adjacent channel interference at Moderate Desired level.

3. Audio CCIR 3 and CCIR 4 (including SAP CCIR 4) for upper-adjacent channel interference at Strong (-25 dBm) Desired level.

4. Audio CCIR 3 (including SAP CCIR 3) for N+14 UHF taboo channel interference at Weak Desired level.

Two other tests were authorized, time permitting. One of these was to be a repeat of number 3, above, at a -15 dBm Desired level, as was used in the first round of testing (1991-92). The other was a repeat of number 3 with the ATV signal shifted upward by 0.5 MHz from the normal channel position. These were conducted only as limited experiments by ATTC and Grand Alliance staff, and did not utilize outside expert observers.

For each test, the video CCIR 3 levels for each receiver were determined first, as starting points for the audio tests.

The results are summarized as follows:

1. For co-channel interference and for N+14 UHF taboo channel interference, the CCIR 3 impairment level for video occurred at a lower interference level than the CCIR 3 impairment level for the audio.
   Therefore, the spectrum planning is properly based upon video impairment considerations.

2. For upper-adjacent channel interference, at all three levels of the Desired NTSC signal, the critical impairment level for audio was reached at a lower interference level than the CCIR 3 impairment level for the video. At the Weak Desired level, the CCIR 3 impairment level was deemed critical for audio; at the Moderate and Strong Desired levels, the CCIR 4 impairment level was the critical level for audio.
   Therefore, spectrum planning for upper-adjacent channel interference must be based upon audio impairment.

The delta interference levels, with respect to the Video CCIR 3 level, are as follows:

At Weak, Audio CCIR 3 precedes by 5 dB;

At Moderate, Audio CCIR 4 precedes by 2.25 dB, and SAP CCIR 4 precedes by 7.5 dB;

At Strong, Audio CCIR 4 precedes by 0.7 dB, and SAP CCIR 4 precedes by 1.7 dB.

Details of each test and a chronology (in draft form) are enclosed for the record.

Sincerely,

Tom

Thomas M. Gurley
Director of Testing

cc: Richard Citta & Carl Eilers, Zenith/Grand Alliance
Robert Bromery, OET/FCC
Dale Hatfield & Jules Cohen, PS/WP-3
Victor Tawil, MSTV

Enclosure

August 25, 1995

DRAFT

Details of Each Test and Chronology for Supplemental Testing for Degradation of BTSC Audio.

Introduction
The Grand Alliance System Test Procedures describe the testing of ATV into NTSC video interference in Section 3.7 and some corresponding tests for interference into BTSC audio in Section 4. The Test Procedure required that six of the 24 NTSC receivers (the six with video and audio baseband outputs) should be used to compare whether at the interference level necessary to produce CCIR3 video performance, the audio performance was also degraded, and if so, was the impairment greater than CCIR3, (slightly annoying). This test was conducted as specified in the Test Procedure for Co-Channel and Upper Adjacent channel at Weak Desired Power.

Co-Channel BTSC Audio Impairment Comparison to Video at Weak Desired Power
For Co-Channel the test showed that video was impaired before audio for all six receivers tested, and so no further tests were considered necessary.

Upper Adjacent Channel BTSC Audio Impairment Comparison to Video at Weak Desired Power
For Upper Adjacent channel it was found that for four of the six receivers tested the audio was impaired before the video.

As a result, this issue was discussed between the ATTC and the Grand Alliance at a review meeting on April 28, 1995. It was decided that it would be prudent to test the remaining 18 receivers and to try to determine a CCIR3 median for audio in addition to that for video for Upper Adjacent channel at Weak Desired Power. It was also decided to test a few receivers using 7dB visual to aural ratio instead of the usual 13dB ratio. The testing was conducted in accordance with the 5/15/95 Draft Procedure, which is appended to this document.

Prior to the audio tests, the CCIR3 video level for the remaining receivers which had not been determined previously was measured. The same audio procedure was followed as in the Test Procedures for the other 18 receivers, except that as there were no audio outputs available from the other receivers, the internal speakers of each receiver were used for the listening test of that receiver. The same three audio sounds were used. The experts were asked to sit or stand at the same distance from each receiver as they had used for the viewing tests, when making their judgement. The experts were asked to judge what level of interference produced CCIR3 (slightly annoying) audio impairment.

The result of this testing showed that the CCIR3 median audio for the 24 receivers required less interference than for the CCIR3 median video for the 24 receivers.

Upper Adjacent Channel BTSC Audio & SAP Impairment Comparison to Video at Moderate Desired Power

At a meeting between the ATTC and the Grand Alliance with the Chairman of SS/WP2 present, on May 25, 1995, the results of this test were discussed, and it was decided that it would be desirable to repeat the test for the Moderate Desired Power level, to determine if the effect was repeated at that power level. It was also decided to conduct CCIR3 audio tests on the SAP (mono) channel as well as the BTSC stereo output channels.

Lower Adjacent Channel BTSC Audio & SAP Impairment Comparison to Video at Weak & Moderate Desired Power

Also at this meeting, testing of ATV into NTSC interference for Lower Adjacent channel CCIR3 audio impairment was discussed. Some effects of colored noise had been noticed by ATTC staff and reported in expert comments for Lower Adjacent channel. It was felt that this was an unexpected result, and that it might indicate that this audio channel could also be affected. It was decided to test ATV into NTSC audio (BTSC stereo and SAP) impairment performance of Lower Adjacent channel at Weak and Moderate Desired Power level. The six receivers with baseband audio outputs would be tested as in the first Upper Adjacent and Co-Channel tests, but using the internal speakers of the receivers, and Weak Power would be tested first. A decision whether to proceed to test all 24 receivers and whether to test at Moderate Desired Power would depend on the result of testing the first six receivers.

Upper Adjacent Channel BTSC Audio & SAP Impairment Comparison to Video at Moderate Desired Power - Tests

Six receivers (those with baseband video and audio outputs) were tested for Upper Adjacent channel CCIR3 audio impairment at Moderate Desired Power, using the same testing methods used for Weak Desired Power. The results showed that audio impairment appeared at a lower interference level than for video impairment. Because of this result, all of the remaining receivers were then tested for Upper Adjacent channel CCIR3 audio impairment at Moderate Desired Power. Again, data was gathered for CCIR3 video level for all of the 24 receivers. In addition, all 24 receivers were tested for CCIR4 audio impairment at Moderate Desired Power (requested by the FCC), and for the 15 receivers with SAP at CCIR4. The results confirmed that audio impairment appeared at a lower interference level than for video.

Lower Adjacent Channel BTSC Audio & SAP Impairment Comparison to Video at Weak Desired Power - Tests

Tests were made of ATV into NTSC Interference for Lower Adjacent channel at Weak Desired Power, using the same testing methods as in the Test Procedures. Six receivers, (those with video and audio baseband outputs) were tested, and the results showed that audio (BTSC stereo and SAP) impairment appeared at a higher interference level than video impairment. Consequently no further Lower Adjacent channel testing was undertaken.

Upper Adjacent Channel at Strong Desired Power (-25dBm & -15dBm), Frequency Shifted by 0.5MHz and N+14 Taboo at Weak Desired Power, BTSC Audio & SAP Impairment Comparison to Video

Following the above tests, analysis of the effects for Upper Adjacent channel was undertaken by Carl Eilers, and the issues were discussed in writing and verbally by Charles Rhodes, Rich Citta, and Carl Eilers. During the final meeting of the ATTC and Grand Alliance to review all testing, a discussion on this subject was held by Rich Citta, Charles Rhodes, and Dennis Wallace, and a recommendation was made to the meeting and accepted to conduct four further tests. These were: ATV into NTSC, Upper Adjacent channel audio (BTSC stereo and SAP) performance at Strong Power (-25dBm); If this test showed audio impairment to then test ATV into NTSC, Upper Adjacent channel audio (BTSC stereo and SAP) performance at Strong Power (-15dBm) as in the first round of testing; ATV into NTSC, Upper Adjacent channel with the frequency for the Upper Adjacent channel shifted upwards by 0.5MHz, (BTSC stereo and SAP audio and video CCIR3 level of impairment to be noted); ATV into NTSC, N+14 Taboo audio (BTSC stereo and SAP) performance at Weak Desired Power, as many receivers as necessary to be tested.

The plan for these tests was reviewed by the Chairman of SS/WP2 and he gave approval to do the tests provided testing did not run beyond Friday, July 21st, 1995.

N+14 Taboo at Weak Desired Power, BTSC Audio & SAP Impairment Comparison to Video - Tests

ATV into NTSC for N+14 taboo channel was tested for audio (BTSC stereo and SAP) impairment at Weak Desired Power. Thirteen receivers were tested for CCIR3 audio (BTSC stereo and SAP) impairment level and in none of the receivers was the interference level found to be less for audio than for video. Testing was therefore discontinued at that point.

Upper Adjacent Channel at Strong Desired Power (-25dBm), BTSC Audio & SAP Impairment Comparison to Video - Tests
ATV into NTSC Upper Adjacent channel was tested for audio (BTSC stereo and SAP) impairment at Strong Desired Power. All 24 receivers were tested for CCIR3 and CCIR4 for the stereo channel and the 15 receivers with SAP channels were tested at CCIR4. Audio impairment was found to occur at lower interference levels than for video impairment, though with not as great a difference as for Weak or Moderate Desired Power.

Upper Adjacent Channel at Strong Desired Power (-15dBm), and (-25dBm) Frequency Shifted by 0.5MHz, BTSC Audio & SAP Impairment Comparison to Video
There was no time remaining to conduct the Upper Adjacent channel audio impairment tests at Strong (-15dBm) power, or for the Upper Adjacent channel test shifting the Upper Adjacent channel upwards by 0.5MHz with Experts. These two tests had been tested briefly during an experiment between ATTC and the Grand Alliance, and those results will be reported.

Upper Adjacent Channel at Strong Desired Power (-15dBm), BTSC Audio & SAP Impairment Comparison to Video - Tests
A few receivers were tested briefly during the Dry Run, and in the test of Upper Adjacent channel audio impairment tests at Strong (-15dBm) Desired Power it was found that the trend of BTSC audio being more sensitive to interference than the video continued.

Upper Adjacent Channel at Strong Desired Power (-25dBm), Frequency Shifted by 0.5MHz, BTSC Audio & SAP Impairment Comparison to Video - Tests
When the Upper Adjacent channel was shifted upward in frequency by 0.5MHz, a number of receivers showed improved BTSC stereo/SAP and improved video. Some receivers which at the standard frequency had poor sound but quite good video, (indicating that the tuner was not overloading) also showed significant improvement in BTSC stereo/SAP at the shifted Upper Adjacent channel frequency.

SSWP2-1465
25 July 95

ADVANCED TELEVISION TEST CENTER, INC.

1330 BRADDOCK PLACE SUITE 200 ALEXANDRIA, VIRGINIA 22314-1650
703/739-3850 FAX 703/739-3230

July 25, 1995

Mr. Mark Richer
Chairman, SS/WP-2
FCC Advisory Committee on
Advanced Television Service
c/o Public Broadcasting Service
1320 Braddock Place
Alexandria, Virginia 22314

Dear Mark:

This letter provides a description of the matter involving six of the twenty-six images used as the 'reference' in the Basic Quality testing of the progressive format of the Grand Alliance HDTV System. Actions were taken to address the matter before the tests were conducted, and those actions are detailed below. For background please recall that these tests are conducted by the Advanced Television Evaluation Laboratory (ATEL) with non-expert viewers who are asked to compare a 'reference' image (1035-active line studio source) with a 'test' image of the same picture. The tests use 'randomized' video tapes supplied by ATTC, which provide a series of 'reference *vs.* test' images for this comparison.

In reviewing the video tapes prepared by ATTC before this testing began, it was determined that these six images, which are in the interlaced format, had incorrect colorimetry and, therefore, did not match the colorimetry of the same images in the progressive format which were the source for creating the progressive test picture. These six 'still' images are those generated via the PIXAR computer imaging device, whose analog output is recorded onto digital high definition video tape for use in the tests. It appears that, in the primary recording process of one tape, the color shift occurred either in the A/D conversion between out- and inputs of the PIXAR and the HD-DVTR, and/or in a misadjusted format convertor between the two machines.

In creating the 'master' tape of all reference images to be used in this test, these six images were derived from this wrong tape source—one made in 1991, at approximately the same time as when the correct source tape was made. The correct source tape is the 'interlaced format master' tape from 1991, which was used in the original round of testing, and which has the proper colorimetry matching the contemporaneously created progressive scan version of these same images. The wrong tape was used to assemble the master tape because its longer (30-second) sequences made the assembly editing easier, but in the mistaken belief that its colorimetry was correct.

Upon discovery of the situation, when the color mismatch was noted between the reference and the test images, discussions among Grand Alliance, ATTC and ATEL representatives, and then with your review, determined that ATTC should attempt to 'extract' the incorrect colorimetry by trying to reverse the color shift process using the adjustments (Y, Pr, Pb) on the format converter. Efforts over nearly a day did not succeed in establishing common criteria for doing this for all six images; so, it is believed that the problem arose from a combination of sources in the original recording of that one tape. At the proposal of the Grand Alliance, an attempt was also made to pass the incorrect, color-shifted interlaced image through the Grand Alliance system's receiver scan-converter

(interlaced in/progressive out), thereby seeking a new, 'color matched' progressive image which could replace the already correct, but not matched progressive source image. This did not succeed as the system hardware--which was built to manage this scan conversion in the all-digital mode--could not readily be re-configured to accept an R, G, B baseband input of the interlaced image.

Therefore, after further discussion among the parties, and with your approval, it was determined that the six incorrect reference images on the tapes to be used at ATEL should be replaced with the correct ones (*i.e.* with proper colorimetry), and that the correct progressive scan versions of these images be re-recorded through the Grand Alliance system and also be used. (Note: These progressive scan images were those used in the first round of testing; and they replaced ones which, while properly color matched to the correct ones, had been taken from another 1991 version of the progressive test materials.) Therefore, these corrections were made to the sets (reference and test) of the six images wherever they occurred on the randomized tapes for use at ATEL.

It should be noted that this solution means that these six images now used in the progressive scan Basic Quality test are not the same as those (incorrect colorimetry) ones used as reference and as source in the interlaced scan Basic Quality test. While it is not believed by the parties that this will affect the respective test results in either format's Basic Quality--inasmuch as all input images are, in fact, now properly color matched--this fact must be noted in a review and comparison of the two formats' results. Although not a comparison contemplated by the Test Plan, this distinction will be noted by ATTC and ATEL in their respective reports; and it should be noted in any later presentation of the results.

Sincerely,

Tom

Thomas M. Gurley
Director of Testing

cc: Paul Hearty, GI/Grand Alliance
Metin Akgun, ATEL

Sarnoff Research Center · Subsidiary of SRI International · CN 5300 · PRINCETON NJ 08543-5300 | 609-734-2281
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SSWP2-1466
24 JUL 95

July 24, 1995

Mark Richer
Chairman, SS/WP-2
c/o Public Broadcasting Service
1320 Braddock Road
Alexandria, Virginia

Dear Mark,

At your recent working party meeting, the issue of comparability of the multiple copies of the digital HDTV Grand Alliance prototype. This issue is of particular interest given that multiple copies will be used to expedite the field testing. Obviously there is concern that a copy of the hardware used to document field conditions is "identical" to the hardware used in the laboratory tests. At that recent meeting, you requested that the Grand Alliance document that the multiple copies support this concern.

To review, the Grand Alliance undertook an effort to construct prototype hardware for testing and evaluation by the Advisory Committee. The effort to construct this hardware was spread among seven different companies at seven different locations. To support our ongoing efforts, and to speed the integration tasks, we determined early on to build three "identical" copies of the hardware. (When the need to support standards conversion arose, two copies of that hardware element were constructed.)

As you have observed, the hardware implementation is quite large and complex, and relies on a great deal of software and firmware elements to provide the necessary functionality. While this could lead to differences between the copies of the hardware, we instituted a tracking procedure designed to keep all hardware copies in official use up to current revision. As a matter of fact, there were several occasions during the course of testing at ATTC where copies of individual boards and subsystems were replaced due to hardware failures. These occurences have been documented by both the Grand Alliance and the ATTC, as has been our general practice. While it is possible that an unintentional difference may exist in one of the copies, we believe that for all intents and purposes these systems are "identical".

As I have noted in a previous communication, the transmission prototype hardware used in the field tests will be modified to accurately represent the system as documented (i.e. segment sync levels). This is the only

difference that I am aware of between the prototypes as used in the field, relative to the prototypes tested at the ATTC.

I hope this memo meets the needs you specified. I look forward to reviewing this matter at the upcoming meeting of your working party.

Best Regards,

Terrence R. Smith
Director, Television Research

cc: John Henderson
Peter Fannon
Brian James
Jules Cohen
GA TOG

8VSB Modem problem of June 14, 1995

8:30AM Ran normal morning calibrations and checks. Dynamic range test failed. Instead of -80 dBm as receiver input level at threshold of errors, -70 dBm was measured.

This suggests AGC system failure. AGC signals originate on the sync recovery board and control the IF gain on the demod board, and the RF gain in the tuner.

Signal strengths were confirmed. Noise floor purity was confirmed. Data levels and system indicators were checked. Computer diagnostic programs were run.

Between original 8VSB system and backup 8VSB system:

- swapped demod (Dynamic range test still failed at -70 dBm)
- swapped tuner (still failed)
- swapped sync recovery board (still failed)
- swapped transmitter (still failed)
- swapped receiver (Dynamic range test passes at -81 dBm)
- returned to origninal transmitter (still passes)
- physically replaced original reciever with backup receiver (still passes)

Re-ran AM calibrations and checks.
Completed analog adjustments

White noise threshold test fails - 15.9 dB signal to noise ratio instead of 14.9, and errors exhibit burst-type characteristic.

Turned phase tracker off - burst characteristic ceases.
Swapped phase tracker board.
11:45 AM: White noise threshold test passes at 14.89 dB S/N.

THE RECEIVER NOW IN USE HAS . . .
the original tuner, demodulator, sync recovery board, and phase tracker AND the backup rack, power supply, and remaining boards

THE TRANSMITTER NOW IN USE IS THE ORIGINAL UNMODIFIED TRANSMITTER

Leif Otto
Engineer Zenith/Grand Alliance

8VSB Modem problem of June 15, 1995

8:20 AM Ran normal morning calibrations and checks. Dynamic range test failed. Instead of -80 dBm as receiver input level at threshold of errors, -71 dBm was measured.

The backup rack which failed yesterday passed today and was swapped in.

10:30 AM All system checks pass. Signature test starts.

THE RECEIVER NOW IN USE HAS . . .
the backup tuner, demodulator, sync recovery board
AND the original phase tracker, rack, power supply, and remaining boards

THE TRANSMITTER NOW IN USE IS THE ORIGINAL TRANSMITTER

. . . where the "original" refers to the equipment used for test, and "backup" refers to the duplicate equipment held in reserve at the beginning of Monday morning.

Leif Otto
Engineer Zenith/Grand Alliance

ADVANCED TELEVISION TEST CENTER, INC.

1330 BRADDOCK PLACE SUITE 200 ALEXANDRIA, VIRGINIA 22314-1650
703/739-3850 FAX 703/739-3230

May 12, 1995

To: File

From: Charles Rhodes, ATTC
Gary Sgrignoli, Zenith/Grand Alliance

Subject: Comparing Original and VSA Measurements of Grand Alliance HDTV System

At the direction of Mark Richer (SS/WP-2), based on a request from Richard Citta (Zenith), on April 27, 1995, Zenith and ATTC staff jointly measured average signal ("Desired") and noise ("Undesired") power using two methods, as a one-time comparison, in conjunction with the determination of the TOV for Random Noise impairment of ATV.

First, the measurements were taken using the ATTC computer-automated system, the same instrumentation and methodology used throughout the first round of testing (1991-92) and in the transmission subsystem "bake-off" testing (1994). As described in the Grand Alliance System Test Procedures, this technique takes measurements of the maximum available power levels, using a Boonton Model 4200 RF Microwattmeter, and then sets the required levels for the test using precision attenuators.

Then, the measurements were repeated using a Hewlett-Packard Model 89441A Vector Signal Analyzer (VSA) belonging to ATTC.

The results of these measurements are as follows:

1. Maximum available average power (ATTC method):
   ATV signal -12.61 dBm
   Noise -18.81 dBm

2. Measurements at noise level slightly higher than TOV:
   (3 consecutive BER readings of 3.48 E-5, 3.29 E-5, and 3.90 E-5)

	ATTC Method	VSA	Δ (ATTC—VSA)
Desired (D)	D = -28.11	D = -28.27 dBm	+0.16 dB
Undesired (U)	U = -43.06	U = 42.95 dBm	-0.11 dB
D/U Ratio	D/U = 14.95 dB	D/U = 14.68 dB	+0.27 dB

3. Measurements at noise level slightly lower than TOV:
(3 consecutive BER readings of 3.69 E-7, 4.50 E-7, and 4.82 E-7)

	ATTC Method	VSA	Δ (ATTC—VSA)
Desired (D)	D = -28.11	D = -28.28 dBm	+0.17 dB
Undesired (U)	U = -43.31	U = 43.22 dBm	-0.09 dB
D/U Ratio	D/U = 15.20 dB	D/U = 14.94 dB	+0.26 dB

* * *

By our initials above, we affirm that these results are true and correct. A copy of the original worksheet for this comparison is attached.

Attachment

Special test to compare ATTC Noise Pw. against VSA values at the input to Demod. as directed by M. Richen today.

5

Bit Error Rate

1) 3.483×10^{-5}
2) 3.294×10^{-5}
3) 3.900×10^{-5}

15.21

ATTC: D = −12.61 $\frac{D}{U}$ = 14.95 dB
(MAX) U = −18.81

D_0 −28.11 dBm ΔU = .25 dB
U_0 −43.06

VSA: (ATTC's) INST.

500 D_0 = −28.27 dBm
U_0 = −42.95 dBm

3.69 E^{-7}

1. ~~[illegible]~~ ATTC D_1 −28.11 $\frac{D}{U}$ 15.20 dB
2. 4.5 E^{-7} U_1 −43.31
3. 4.82 E^{-7} VSA D_1 −28.28
U_1 −43.22

14.94 14.94

1 ATTC D_2 U_2

2 VSA D_2 U_2

3

Δ VSA trial A D0.01 dBm 5-12-95
U0.02 dBm
CWR
GJS 5-12-95

on ZENITH D_x 28.28
VSA: U_x 42.97 dBm
wrt U_0, D_0

CWR (Rhodes)
Gary (Sgrignoli)

recd 4/28/95

AT&T Bell Laboratories

Subject: Step Response of the GA HDTV system

From: Siu-Wai Wu (Tel: 908-582-7804, Fax: 908-582-3662)

To: Charles Rhodes, ATTC

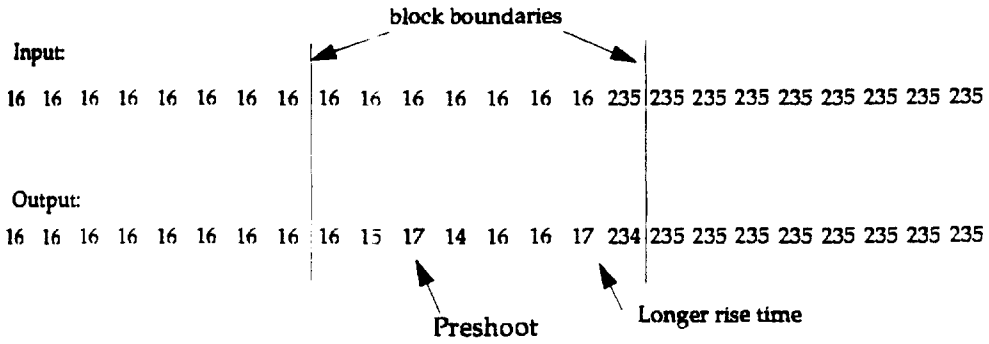
CC: John Mailhot, Terry Smith, Aldo Cugnini

Date: June 19, 1995

The discrepancy between the chroma step response measured on 6-13-95 AM Signature test and that measured on 5-23-95 can be explained as follows.

Since the video signal is processed by block transform (DCT) coding which quantizes high frequency coefficients coarsely, the step response of the system is not spatially invariant. If the rising edge of the step is aligned with an 8x8 block boundary, the AC energy of the blocks will be minimal. In this case, the rise time and the Gibb's ringing of the signal at the output of the coder are minimal. However, a small amount of misalignment can result in a significant amount of AC energy in the block where the step occurs, therefore increasing the rise time and the amplitude of the ringing.

Consider the following example. Suppose the input to the DCT coder is an ideal step function that transit from pixel value of 16 to 235, and the transition is one sample off from the block boundary. Assuming the signal is intra coded with the MPEG default quantization matrix and quantizer scale 8, the coded pixels values are shown in the following figure.



It is obvious that with 8 bits of DC precision, the output pixels would have exactly the same values as the input if the 16 to 235 transition aligns with the block boundary.

The one pixel (or less) drift in the alignment of the step function in the 5-23 measurement versus the 6-13 measurement are well within the tolerable range of the sync timing accuracy and measurement accuracy.

Please let me know if you have any further questions.

John N. Mailhot
Technical Manager
Advanced Video Technology Dept.
AT&T Bell Laboratories

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June 28, 1995

Charles Rhodes - ATTC
(703) 739-3230

Re: Scene change detection in GA encoder

Charlie -

This is my lead software engineer's description of how the scene change detection affects I frame placement in the GA-HDTV encoder.

Refresh is normally accomplished by inserting periodic intra frames, at a provisioned rate. This behaviour is altered for scene changes. Superior video quality may be attained by synchronising intra frames with scene changes. The HFILM board contains hardware and software to accomplish this.

Based on statistical metrics, frames may be identified as scene changes. These frames become candidates for conversion to intra frames. If a candidate frame is found in the lookahead pipeline, periodic intra frame conversion is disabled. When the candidate reaches the HFILM output stage, it is converted to intra.

If multiple candidate frames exist in the pipeline, then a holdoff mechanism is employed; only the last candidate will be converted to intra. If, due to a continuous sequence of candidate frames, holdoff persists for longer than twice the provisioned refresh rate, then a frame will be converted to intra at the first opportunity.

The holdoff window is determined by the length of the pipeline, which is a maximum of 5 frames (interlaced) or 10 frames (progressive). The pipeline will in some cases appear to be shorter than 5 frames, due to reordering of B pictures. There are some additional constraints and complications introduced by 3:2 pulldown when film is present.

Scene change detection can be disabled by the frontpanel, in which case the encoder defaults to a fixed GOP. Also, the decoder is capable of freeze-framing the I frame.

John Mailhot

PHILIPS

Philips Laboratories - Briarcliff

July 21, 1995

Mr. Charles Rhodes
Advanced Television Test Center
1330 Braddock Place, Suite 200
Alexandria, VA 22314

Dear Mr. Rhodes:

This is in reference to the questions raised to William O' Grady regarding aberrations on a horizontal sweep signal observed on a waveform monitoring scope.

Experiments (and analysis) performed by me and colleagues at Briarcliff indicate that if a sufficiently large amplitude horizontal sweep signal (0-30 MHz) is encoded, decoded, postprocessed, and displayed, the peaking circuit located in the postprocessor can drive the signal into overflow and underflow, thus causing the observed aberrations in the waveform monitor. The peaking circuits are located after the circuits that convert MPEG data to raster-format video data. Peaking is not specified in the transmitted bitstream in any way, and hence does not affect it.

If you have further questions, please feel free to contact me.

Sincerely,

Kiran S. Challapali
Sr. Member of the Research Staff
Video Communications Department

cc: Ralph Cerbone, AT&T
Robert Rast, GI
Jae Lim, MIT
Carlo Basile, Aldo Cugnini and William O' Grady, Philips
Glenn Reitmeier, David Sarnoff Research Center
Bill Beyers, Thomson
Wayne Luplow, Zenith.

Philips Laboratories
North American Philips Corporation

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Briarcliff Manor, New York 10510

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RESULTS OF OFFSITE VIEWING OF LONG-FORM ENTERTAINMENT PROGRAM

MEMORANDUM

TO: Mark Richer, SSWP2, Jim Gaspar, PSWP6, Karen Pitts, GA
FROM: Bronwen Jones
DATE: Oct. 25, 1995
RE: Long-form Viewing Test results (questionnaire)

Approximately 75 people attended the long-form viewing sessions in groups of two to 25, October 16, 17 and 18, 1995, in the beautiful THX/HDTV theater at the National Cable Television Association. While not everyone filled in the questionnaire, sixty-six answered most of the questions. In general, the comments were enthusiastically positive in all regards, including rave reviews about the editing of the audio and video test material. It is interesting that only 20 of 76 responses ticked any ACATS committee membership (56 responded "other" and "FCC", evenly split).

Few people mentioned artifacts except when asked directly, and then quantization noise was mentioned most often, and mentioned in a way suggesting that it was a challenge to find, but not that it was a problem. All comments on this topic pertained to video; no audio artifacts were mentioned.

Every comment on the prospect of this system becoming a US (and possibly a North American) standard was positive and expediency was enthusiastically urged. Two or three questions were found regarding the implementation costs involved.

In comparing the projected image versus the CRT, most said the projector looked softer and had less contrast which we all agreed was true. The direct view display was preferred by almost all observers.

Fifty-two of sixty-two responses said "same" or "better" in comparing the Red October film clip to a typical film projection. The few comments on this topic were "less jitter", "poor contrast ratio" and "projector not as good as film"

Attached are copies of the questionnaire with the summarized responses and recorded comments, and also a memo from J. Gaspar, software editor and producer.

LONG FORM VIEWING
EXPERT OBSERVER QUESTIONNAIRE

NAME: _____
TECHNICAL EXPERTISE/BACKGROUND: _____
ACATS ASSOC.: PSWP6 SSWP2 TECH SUB GP FCC OTHER

Overall audio quality comments:

_____

_____

Overall video quality comments:

_____

_____

Overall audio with video quality comments:

_____

_____

Did the Red October film clip seem **better ... worse ...** or the **same** as a typical film projection? Any specific reason?

_____

_____

Any comments on differences between the projection versus direct view images?

_____

_____

This is to be the US and possibly North American high definition television standard; please comment:

_____

_____

General Expert Observation & Commentary (EO&C):

_____

_____

_____

Attached is a table of potential digital audio artifacts, most can be applied to video. It can be used as a guide, if you wish, for general EO&C comments. Please describe any errors noticed over the entire viewing and listening session.

_____

_____

_____

POPCORN WAS: EXCELLENT GOOD FAIR POOR BAD