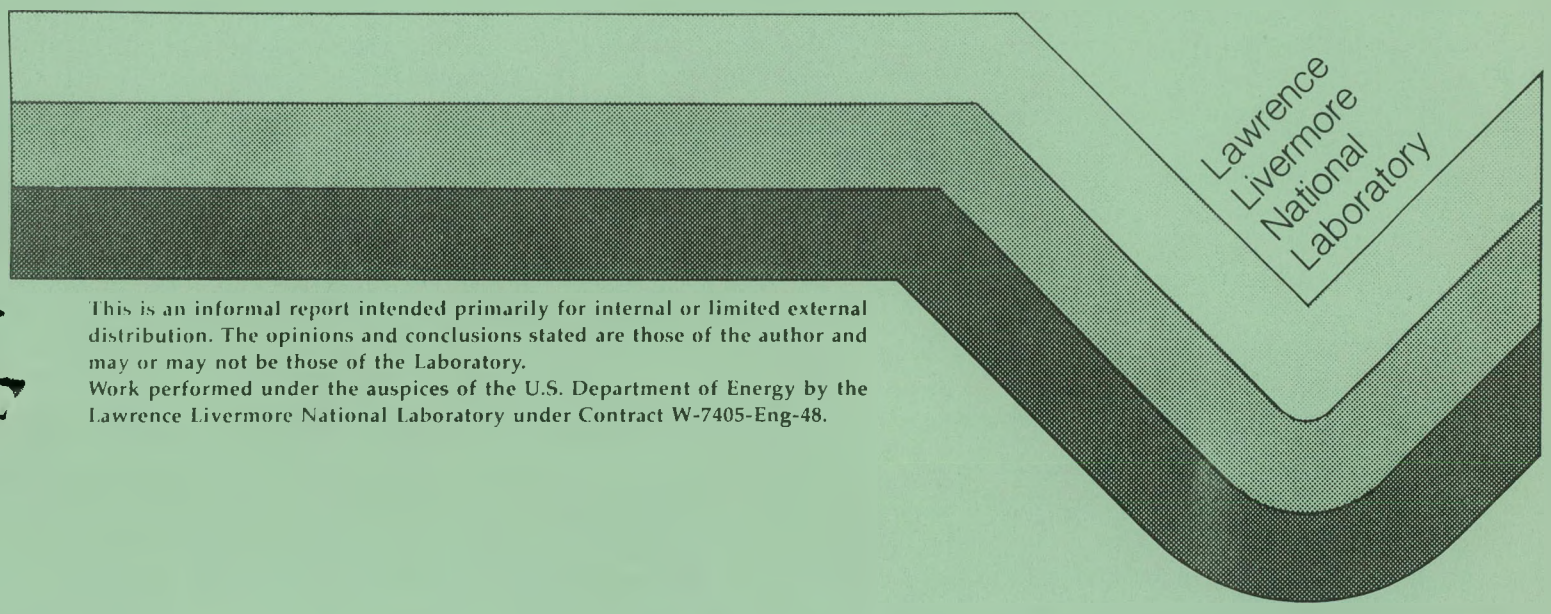
UCID- 21938

UCD-LLNL-SNL TV Link System Proof-of-Performance

David H. Dirks
John Baptista

February 1990



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A25	576-600
A99	601 & UP

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Abstract

This report contains the results of proof-of-performance tests of the TV link from University of California at Davis (UCD) to Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratory (SNL). These tests involve the measurement of a calibrated test signal originating in the TV classrooms in Bainer Hall at the UCD campus and received at various locations at LLNL and SNL. Proof of the TV link from LLNL to UCD involves the measurement of a calibrated test signal originating at the University Monitoring (UM) racks in B131, Room 1282B, and received at the Link 1B classroom, RM 1122, Bainer Hall, UCD.

GENERAL OBJECTIVES

The objective of the proof-of-performance is to demonstrate proper system performance and operation on a regular basis. Any discrepancies in the performance of the system or variance in measurements from proof to proof will show problem areas which require attention.

TESTING OBJECTIVES

The proof-of-performance is designed to proof the entire transmission chain. Both subjective and objective measurements are performed on the entire system. Measurements of separate sections of the transmission path such as the microwave are performed independently. The proof-of-performance of the TV link from University of California at Davis (UCD) to Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratory (SNL) involves the measurement of a calibrated test signal that originates in the TV classrooms in Bainer Hall at the UCD campus and is received at various locations at LLNL and SNL. Proof of the TV link from LLNL to UCD involves the measurement of a calibrated test signal that originates at the University Monitoring (UM) racks in B131, Room 1282B, and is received at the Link 1B classroom, RM 1122, Bainer Hall, UCD.

REFERENCES

The working document for the test is derived from the *NTC REPORT NO. 7* (National Transmission Committee) and the *NAB ENGINEERING HANDBOOK.*

SYSTEM TESTS

(Numbers in parenthesis refer to related sections in the *NTC REPORT NO. 7*)

I. Luminance Tests
   - A. Insertion Gain (3.2)
   - B. Gain Linearity (3.9)
   - C. Field Distortion (3.3)
   - D. Line Distortion (3.4)
   - E. Short Time Response (3.5)
   - F. Short Time Bar (3.5)
   - G. Frequency Response (3.8)

H. Random Noise (3.16)

II. Chroma Tests
- A. Chroma Gain Linearity (3.10)
- B. Chroma Phase Linearity (3.11)
- C. Chroma Noise

III. Chroma to Luminance Tests
- A. Gain Inequality (3.6)
- B. Delay Inequality (3.7)
- C. Differential Gain (3.13)
- D. Differential Phase (3.14)
- E. Chroma Intermodulation (3.15)

IV. Others
- A. Dynamic Gain Distortion [Bounce] (3.12)
- B. Non-Useful DC (4.5)

TEST SIGNALS AND ASSOCIATED EQUIPMENT

The following test signals are required:

1. PULSE: 2T; 12.5T Modulated; 20T Window (Lenco PPB-325)
2. STAIRSTEP: 5 Step Unmodulated (Lenco PSS-324)
3. RAMP: Modulated (Lenco PSS-324)
4. MULTIBURST: (Lenco PMB-323)
5. FLAT FIELD: 50 IRE, Unmodulated (Lenco PFF-323)
6. FLAT FIELD: 50 IRE, Modulated (Lenco PFF-323)
7. 3-LEVEL CHROMINANCE (Not available at this time)

The following display equipment is required:

1. VIDEO WAVEFORM MONITOR (Tektronix 1480R)
2. VECTORSCOPE (Tektronix 1420 or 520R)
3. LUMINANCE NOISE METER (Lenco VNM-428)
4. CHROMA NOISE METER (ShibaSoka/Asaka 925C)

The following film recording equipment is required:

1. POLAROID 3X4 INSTRUMENT FILM CAMERA/BEZZEL
2. POLAROID 667 B/W FILM (13 pictures required/link)

TESTING SEQUENCE

The proof-of-performance is easiest when the tests are performed by source. The following sequence is followed. The numbers in parenthesis refer to the related sections in the *NTC REPORT NO. 7.*

I. PULSE: 2T; 12.5T Modulated; 20T Window
1. Insertion Gain (3.2)
2. Field Distortion/Vertical Tilt (3.3)
3. Line Distortion/Horizontal Tilt (3.4)
4. Short Time 2T (3.5)
5. Short Time Bar (3.5)
6. Chroma to Luminance Gain Inequality (3.6)
7. Chroma to Luminance Phase Inequality (3.7)

II. STAIR STEP/MODULATED RAMP
1. Luminance Gain Linearity (3.9)
2. Differential Gain (3.13)
3. Differential Phase (3.14)

III. FLAT FIELD
1. Luminance Signal-to-Noise [SNR] (3.16)
2. Chrominance Signal-to-Noise [SNR]

IV. 3-LEVEL CHROMA (Not currently available)
1. Chroma Gain Linearity (3.10)
2. Chroma Phase Linearity (3.11)
3. Chroma Intermodulation (3.15)

V. MULTIBURST
1. Frequency Response (3.8)

VI. OTHER VIDEO
1. Dynamic Bounce (3.12)
2. Non-Useful DC (4.5)

VII. AUDIO
1. High Frequency Response/THD [10 Khz]
2. Low Frequency Response/THD [400 Hz]
3. Signal-to-Noise Ratio [400 Hz]
4. Mid Frequency Response/THD [1 Khz]

TEST SETUP - OBJECTIVE TESTING

Test signals were injected at the video camera and audio microphone input to the system in the classrooms for Links 1A (Bainer Hall, RM 1062) and 1C (Bainer Hall, RM 1120) on the UCD campus. The test signals were analyzed at the University Monitoring (UM) racks (B131, RM1282B) at LLNL. For Link 1B checks, the transmission was from the UM room to Bainer Hall, RM 1122, UCD.

To insert the test signal in the classrooms of Links 1A and 1C, remove the video camera video out feed and barrel-through a cable connection to the generator. The audio may be connected in place of the JPL 7510A mixer output. This feeds a Shure M267 audio mixer located in the wire closet (RM 1103) at line level. To test the 1B signal, all sources are available in the wire closet (RM 1103).

TEST SETUP - SUBJECTIVE TESTING

The test signals were analyzed subjectively at the following locations: LLNL - B571: Receiving Classrooms; T1578: Davis Classroom; DAS.

Subjective tests included relative picture quality (reception) and audio quality. At the UCD campus, relative talkback quality was rated.

PARTICIPANTS

LLNL: David Dirks, John Baptista, Bruce Somerhalder, Larson Jin, Mike Betz.
UCD: Fred Brink
SNL: Brian Chamberlain

USEFUL INFORMATION

Classroom locations at UCD	Phone No.
Link 1A: RM1062, Bainer Hall	916-752-1679
Link 1B: RM 1122, Bainer Hall	
Link 1C: RM 1120, Bainer Hall	916-752-6057
Link 1D: RM , Bainer Hall	
Wire Closet: RM 1103, Bainer	
Playback Center, Olson Hall	916-752-9559
University Monitoring Racks (UM), B131, RM 1282B	415-422-9936

TEST RESULTS - DATA

LINK 1A

Signal-to-Noise Ratio (SNR)

1. Luminance SNR (tangential)	48.2 dB
2. Chroma SNR Unweighted AM	56.0 dB

Variances	Specification	Variance
1. Chroma to lumina gain	100 IRE +/- 3 IRE	-7 IRE
2. Differential Phase	5 degrees	15 degrees
3. Frequency Response	+6, -10 to 4.2 mhz	-15 IRE

LINK 1B

Signal-to-Noise Ratio (SNR)

1. Luminance SNR (tangential)	44 dB
2. Chroma SNR Unweighted AM	59 dB
3. Chroma SNR Unweighted PM	59.5 dB

Variances	Specification	Variance
1. Chroma to lumina gain	100 IRE +/- 3 IRE	-5 IRE (95)
2. Insertion gain (loss)	100 IRE (no gain/loss)	130 IRE
3. Vertical timebase problem occurring at microwave.		

LINK 1C

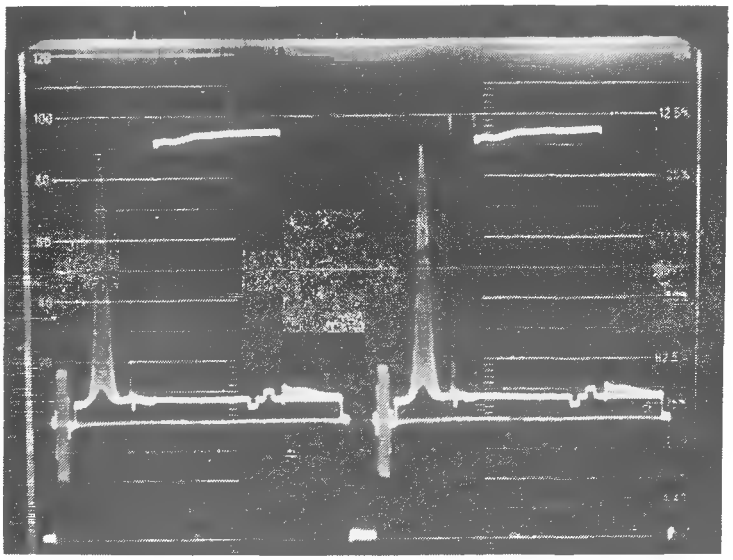
Signal-to-Noise Ratio (SNR)

1. Luminance SNR (tangential)	46 dB
2. Chroma SNR Unweighted AM	59 dB
3. Chroma SNR Unweighted PM	62 dB

Variances	Specification	Variance
1. Chroma to lumina gain	100 IRE +/- 3 IRE	Beat Pattern
2. Insertion gain (loss)	100 IRE (no gain/loss)	-12 IRE
3. Horizontal tilt	4 IRE p-p	6 IRE p-p
4. Vertical interval has low frequency problem		

TEST RESULTS - SCOPE PHOTOS

The following pages are the scope photos taken as documentation during the proof-of-performance.



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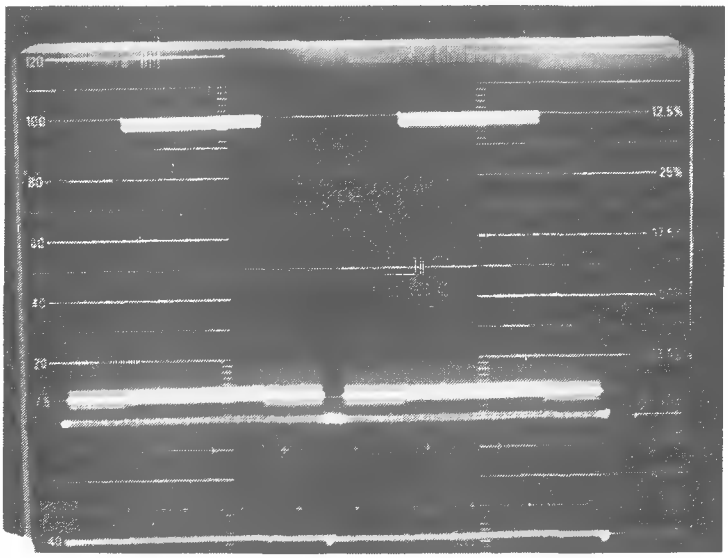
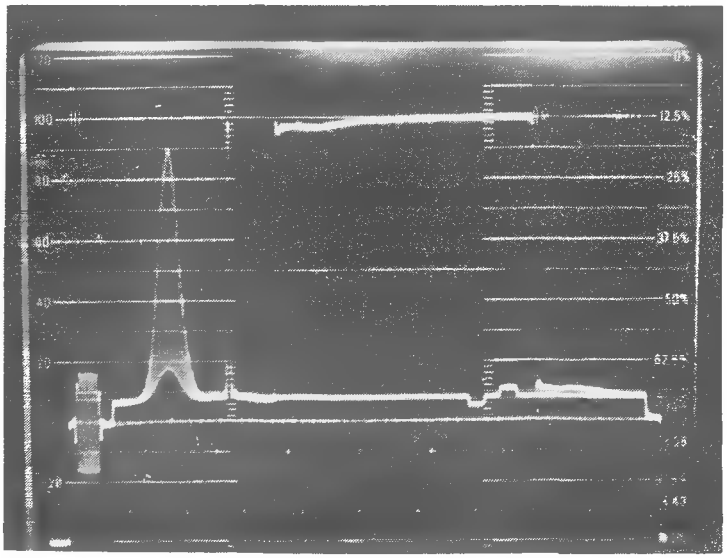
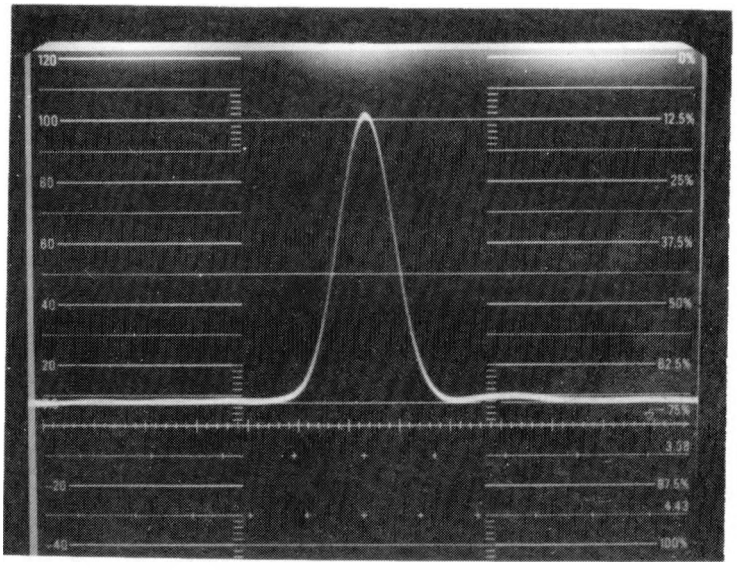


Link 1A
Vertical Tilt
(12/18/89)



Link 1A
Horizontal Tilt
(12/18/89)



Link 1A
2T Pulse
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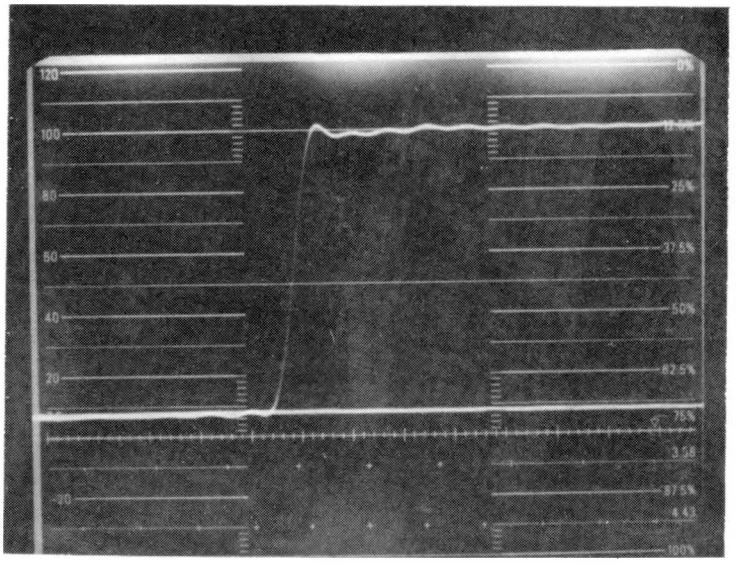
(12/18/89)



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20 T Bar
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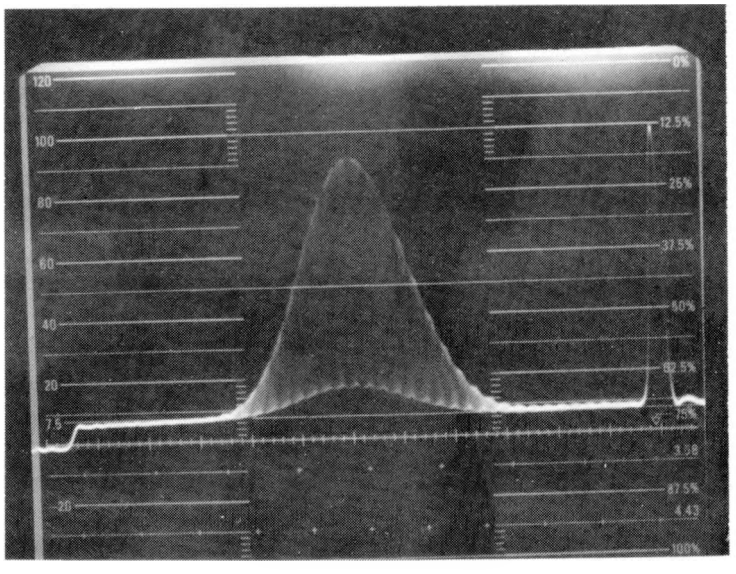
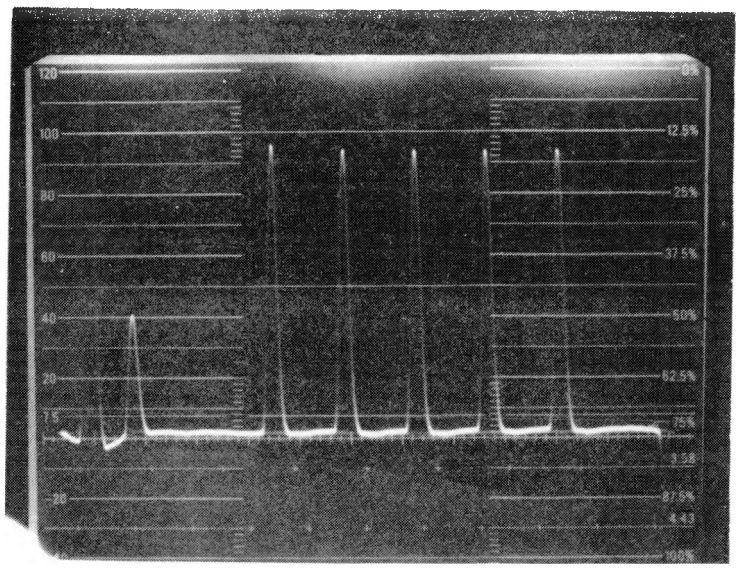
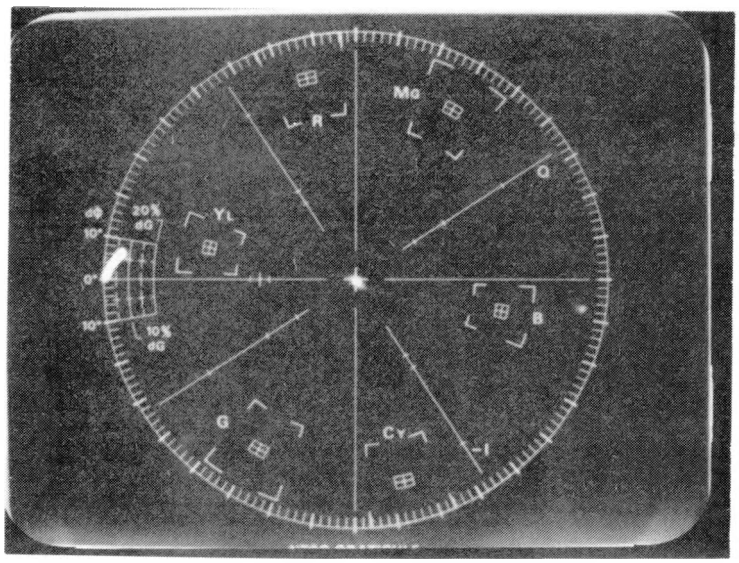
(12/18/89)



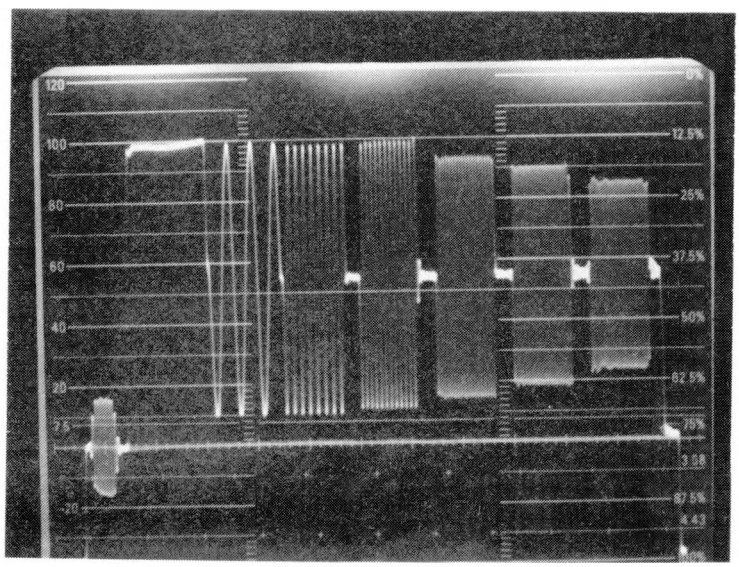
Link 1A
Chroma to Luma
Delay/Gain
(12/18/89)



Link 1A
5 Step Luma
GainLinearity
(12/18/89)



Link 1A
Differential
Gain/Phase
(12/18/89)



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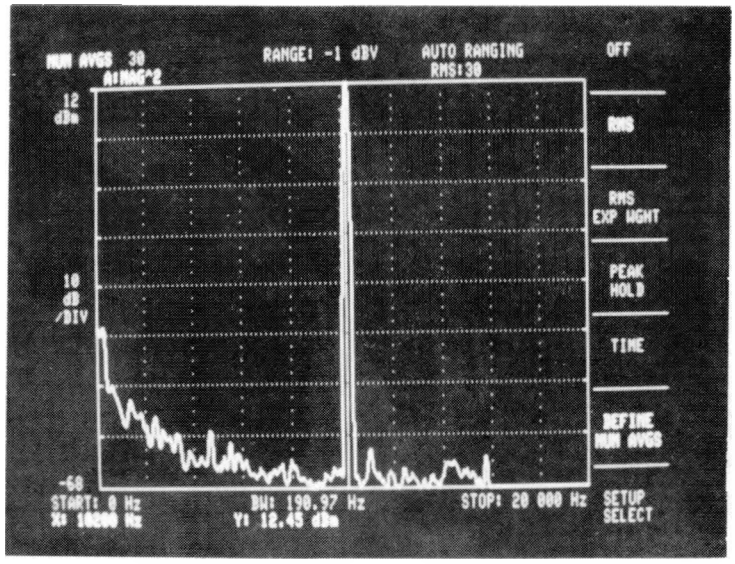
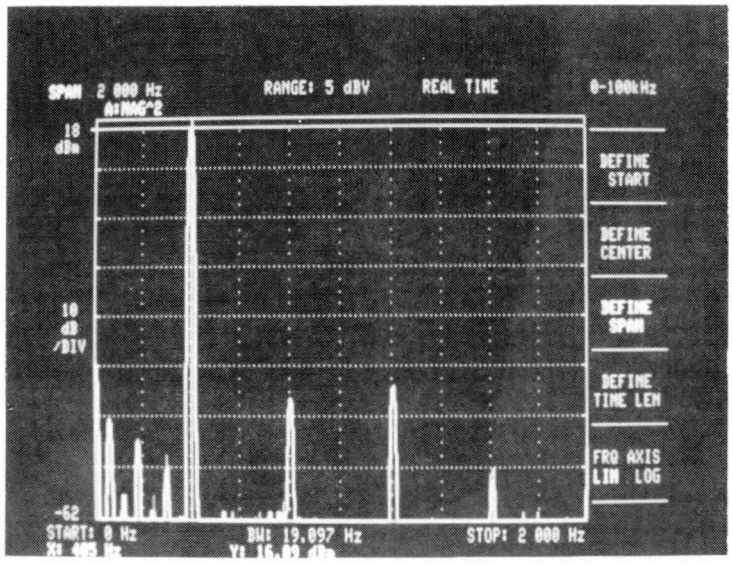
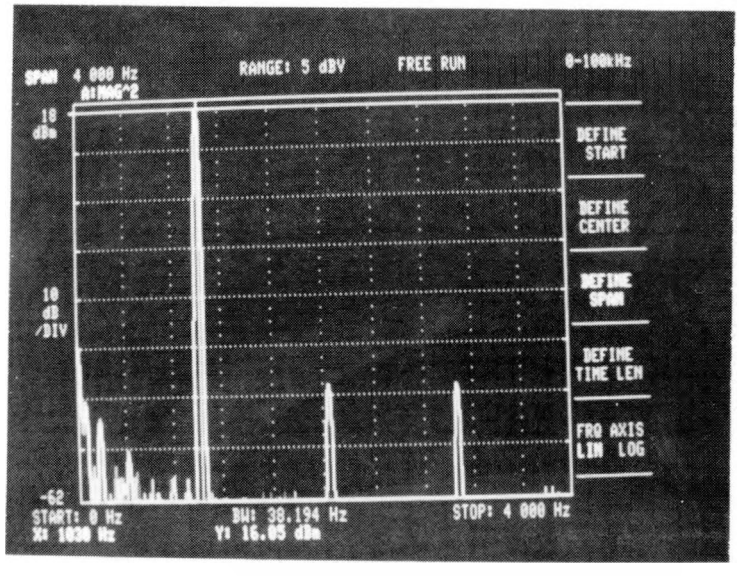
Multiburst
(12/18/89)



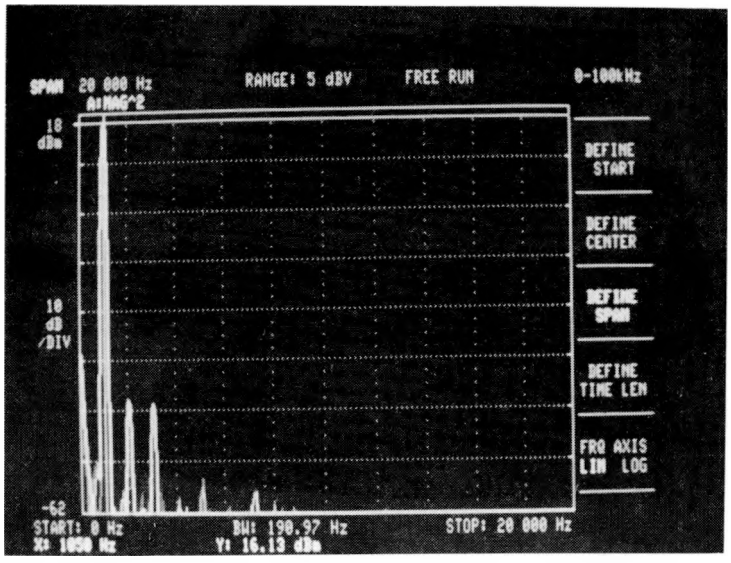
Link 1A
10 kHz, 30 avgs
(12/18/89)



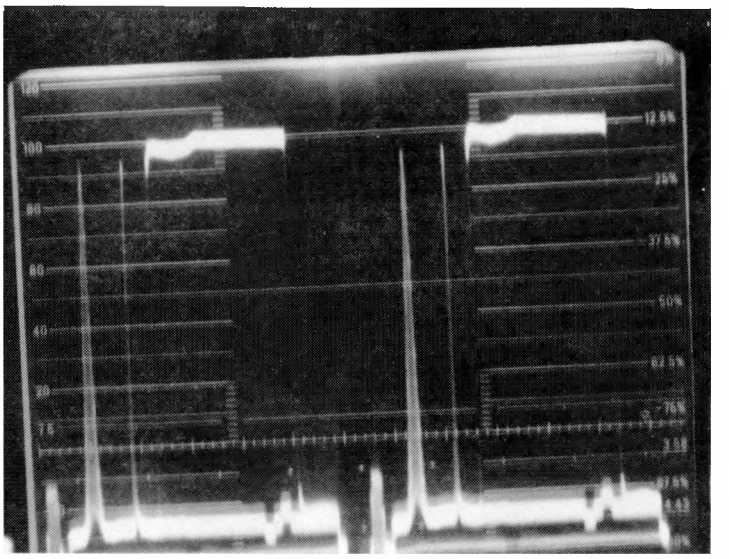
Link 1A
400 Hz
(12/18/89)



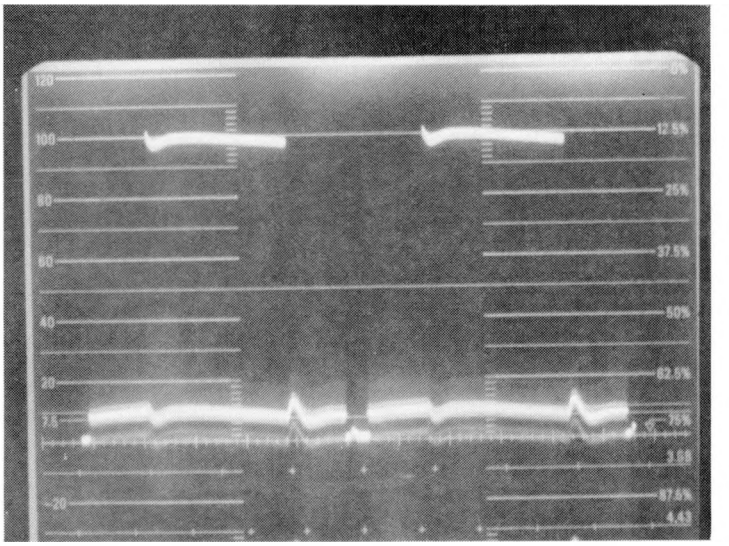
Link 1A
1 kHz
(12/18/89)



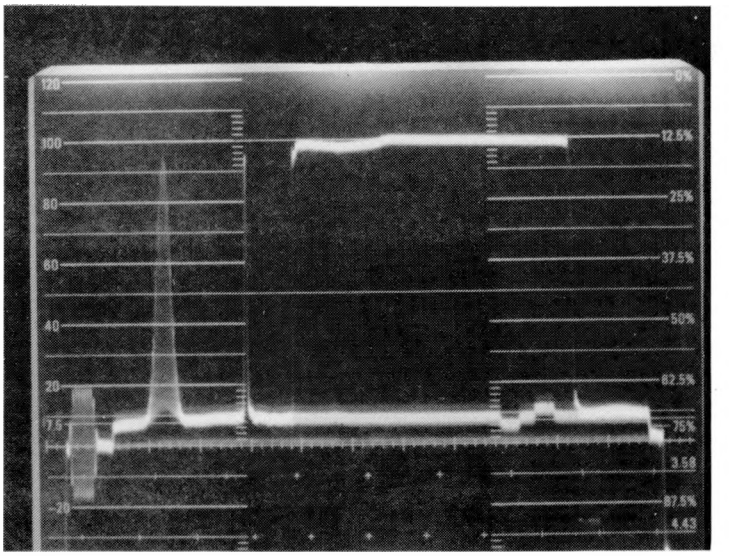
Link 1A
1 kHz,
20 kHz span
(12/18/89)



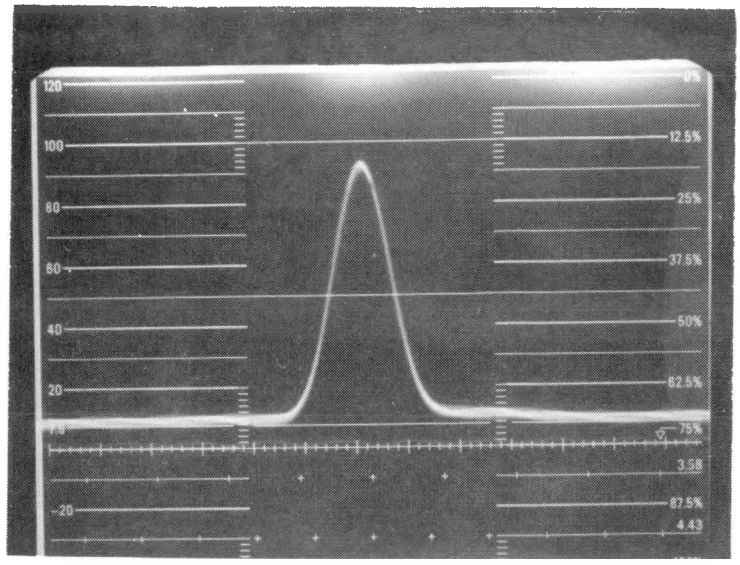
Link 1B
Insertion Loss
(12/18/89)



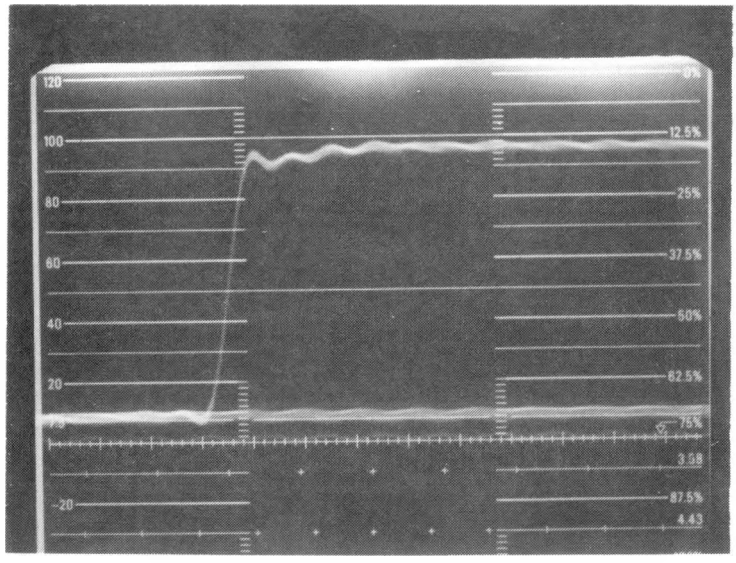
Link 1B
Vertical Tilt
(12/18/89)



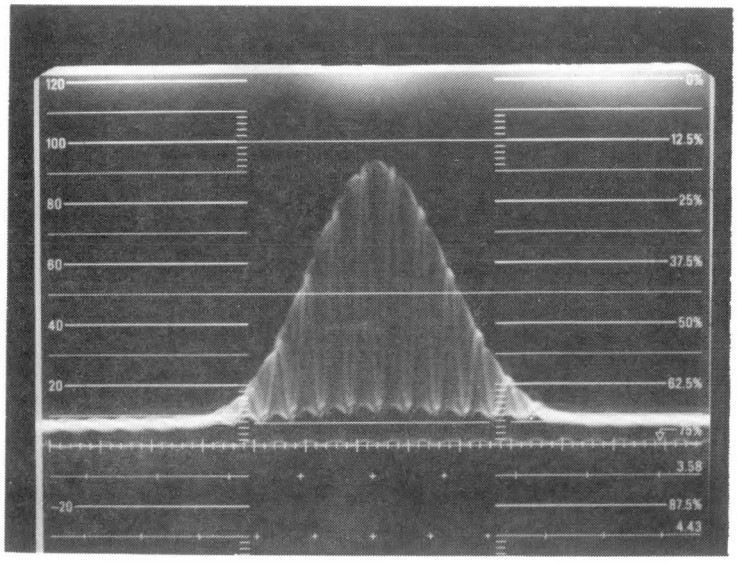
Link 1B
Horizontal Tilt
5 µsec/div
(12/18/89)



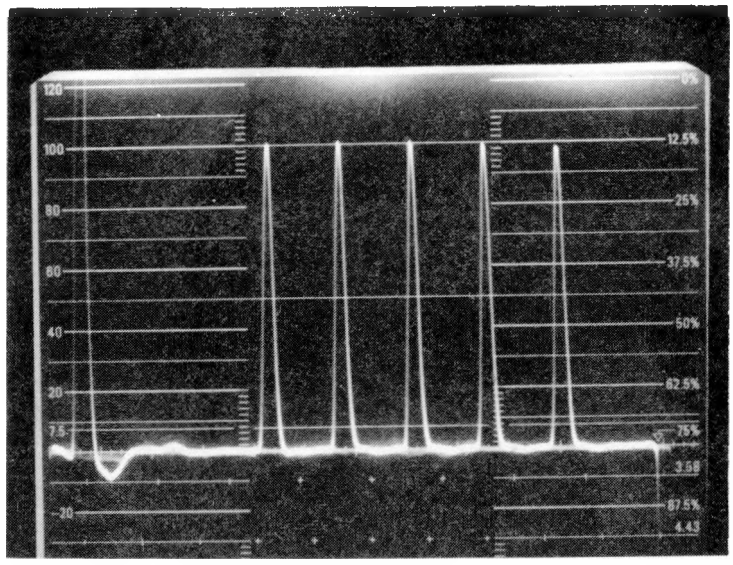
Link 1B
2T Pulse
5 µsec/div x25
(12/18/89)



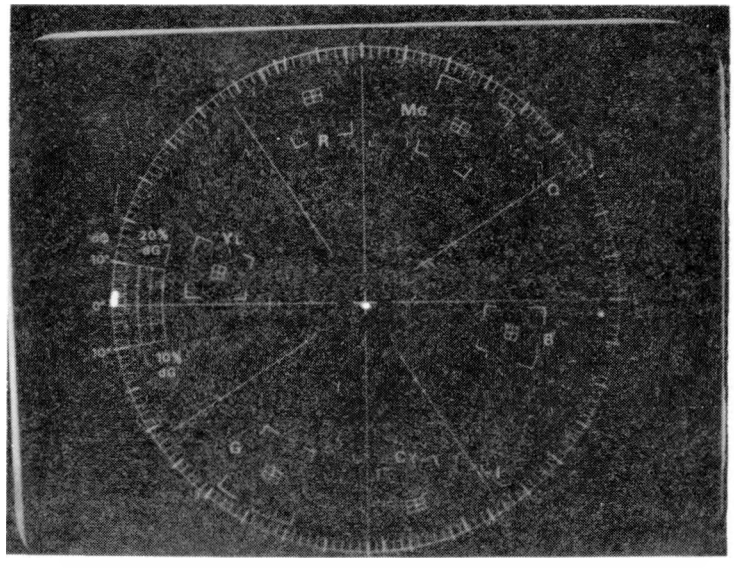
Link 1B
20 T Bar
5 µsec/div x20
(12/18/89)



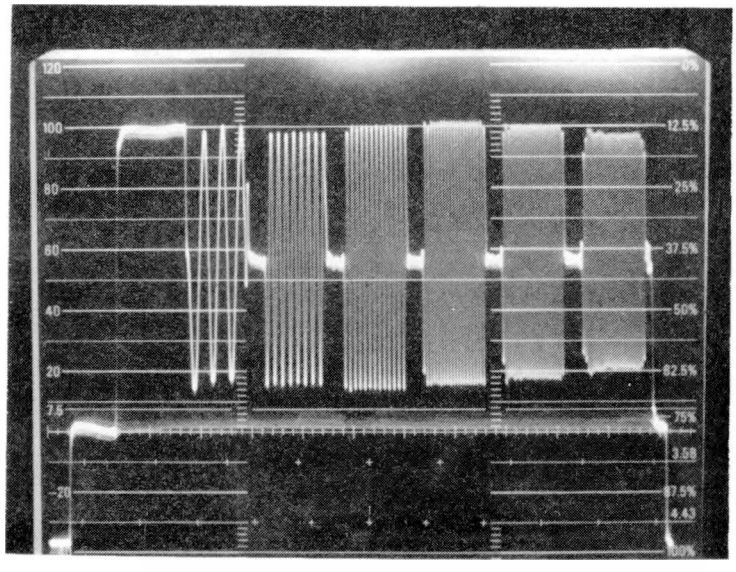
Link 1B
Chroma to Luma
Delay/Gain
(12/18/89)



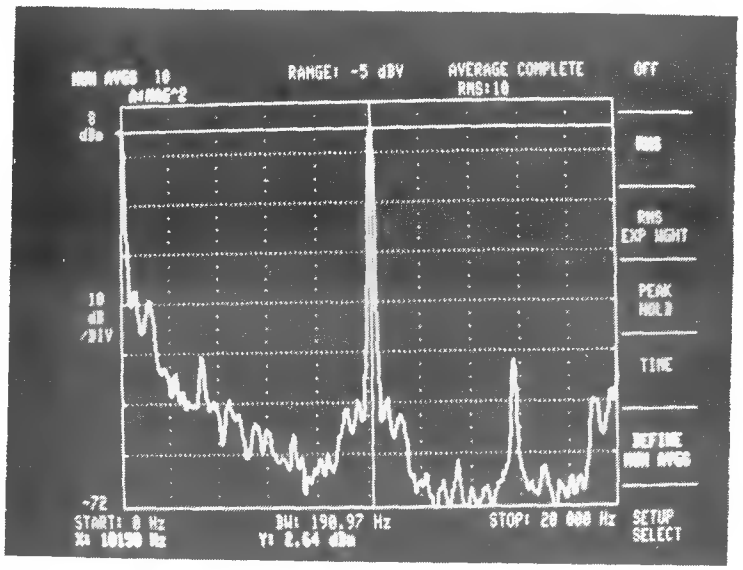
Link 1B
5 Step Luma
GainLinearity
(12/18/89)



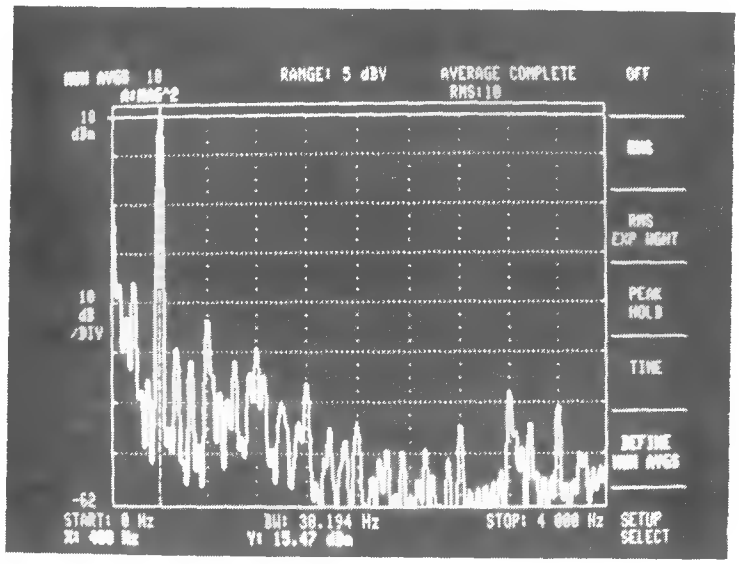
Link 1B
Differential
Gain/Phase
(12/18/89)



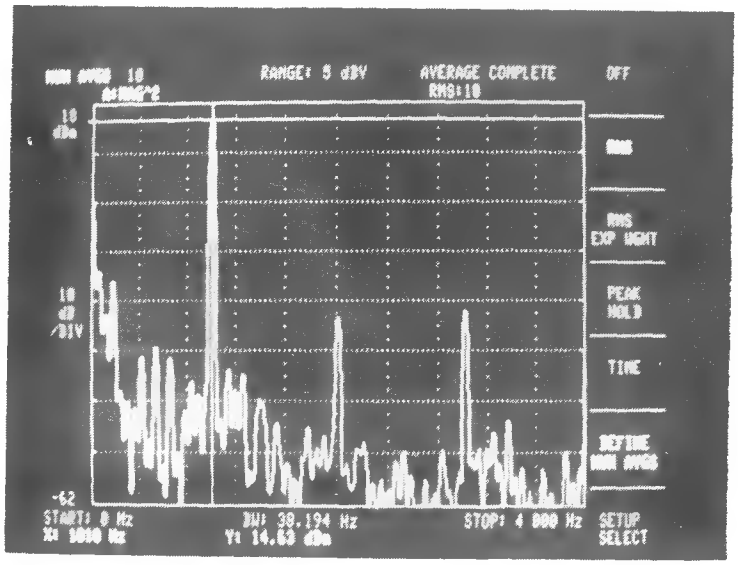
Link 1B
Multiburst
(12/18/89)



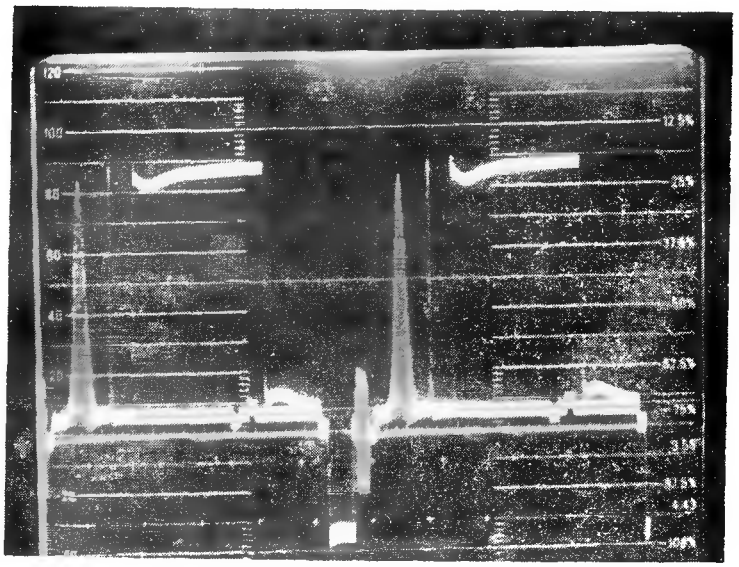
Link 1B
10 kHz, 30 avgs
(12/18/89)



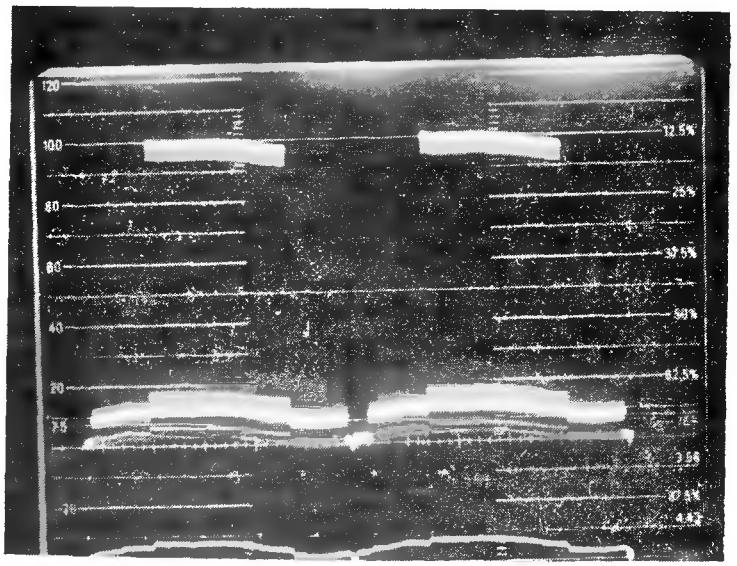
Link 1B
400 Hz
(12/18/89)



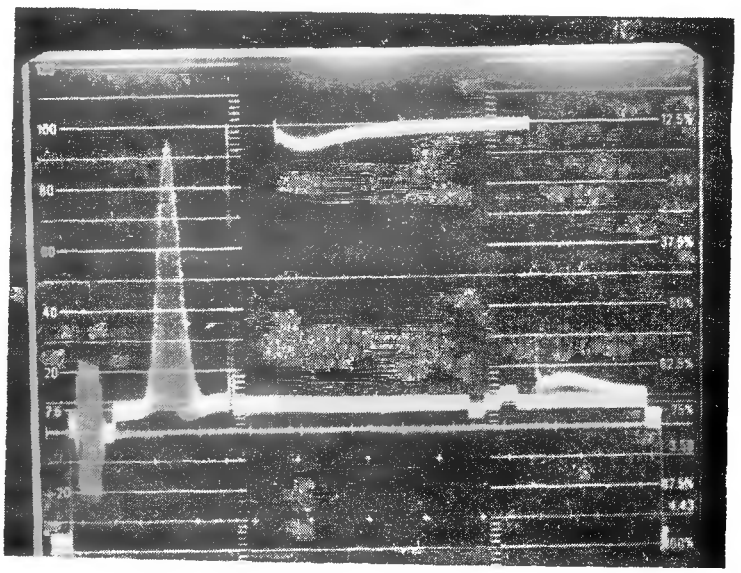
Link 1B
1 kHz
(12/18/89)



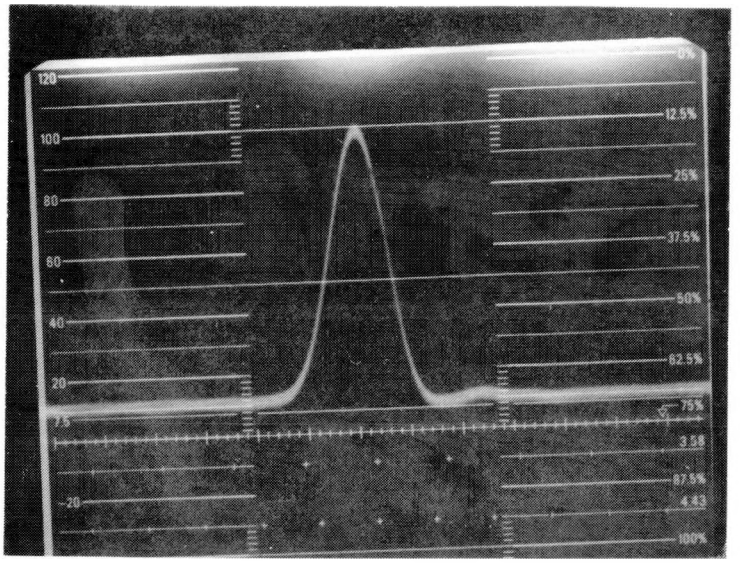
Link 1C
Insertion Loss
(12/18/89)



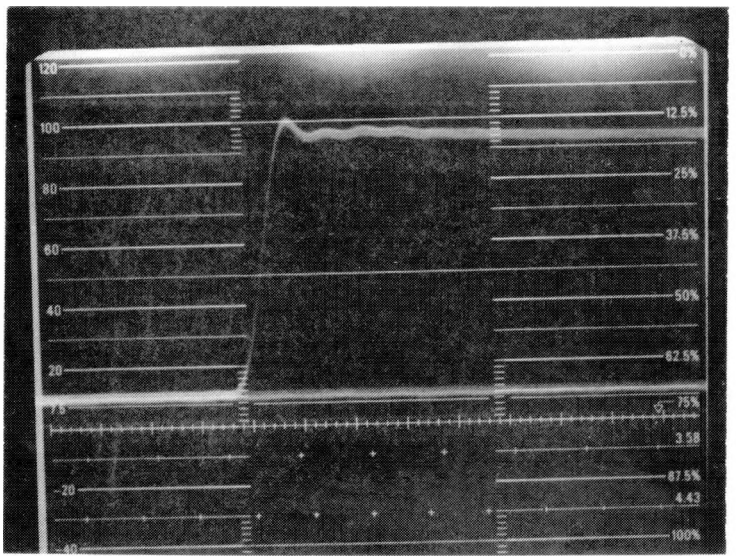
Link 1C
Vertical Tilt
(12/18/89)



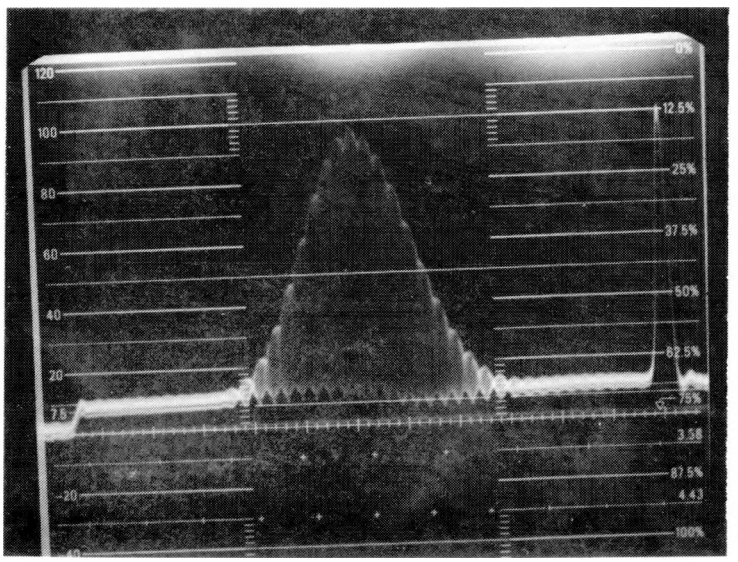
Link 1C
Horizontal Tilt
5 µsec/div
(12/18/89)



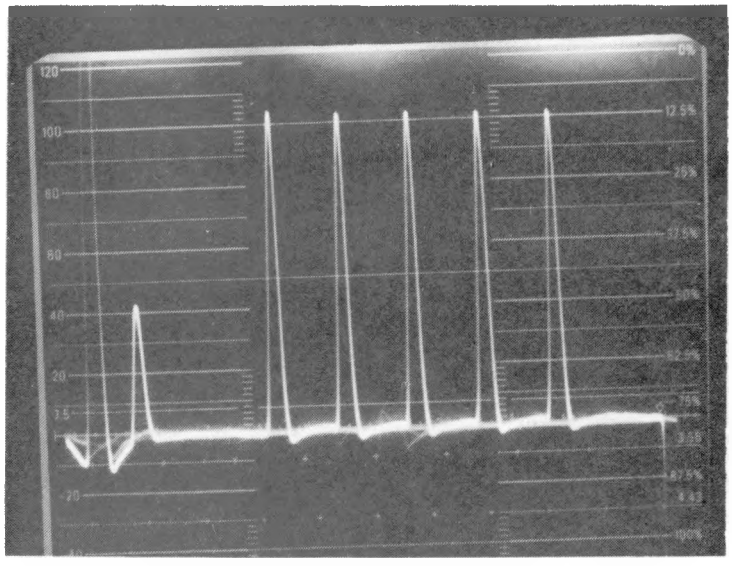
Link 1C
2T Pulse
5 µsec/div x25
(12/18/89)



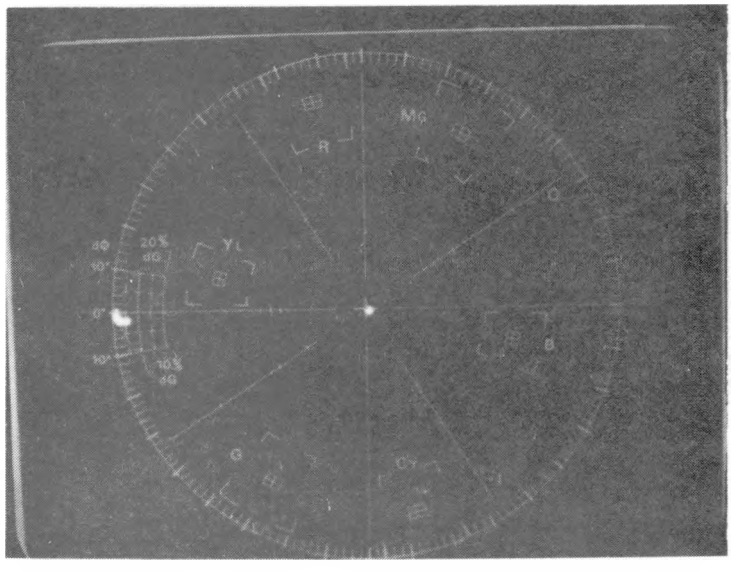
Link 1C
20 T Bar
5 µsec/div x20
(12/18/89)



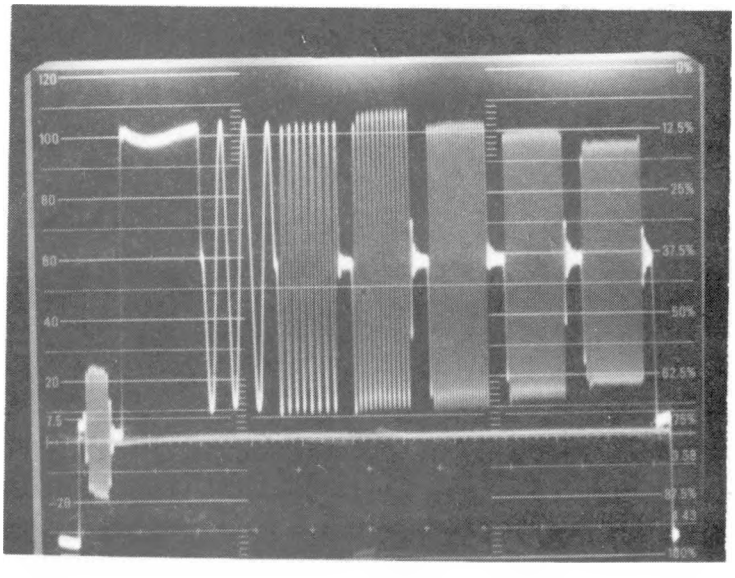
Link 1C
Chroma to Luma
Delay/Gain
(12/18/89)



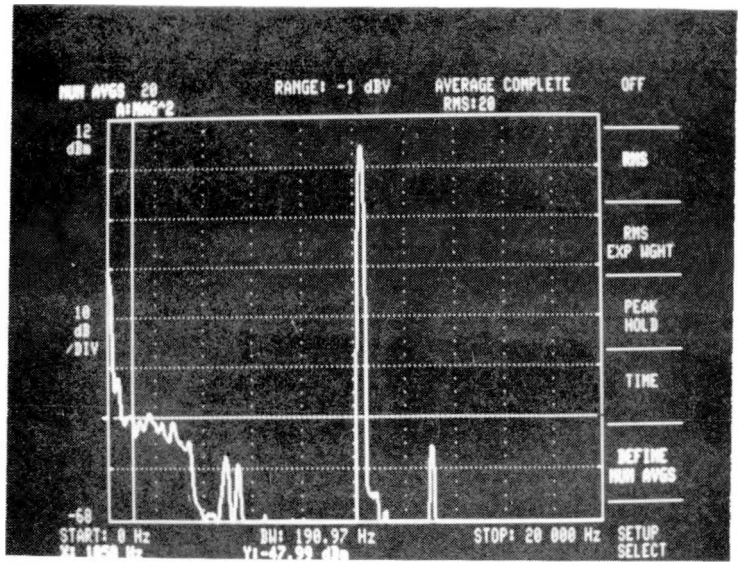
Link 1C
5 Step Luma
GainLinearity
(12/18/89)



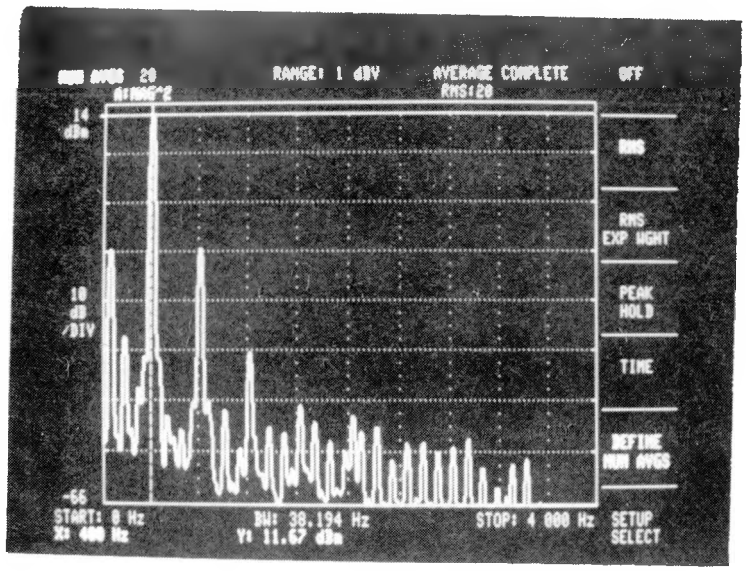
Link 1C
Differential
Gain/Phase
(12/18/89)



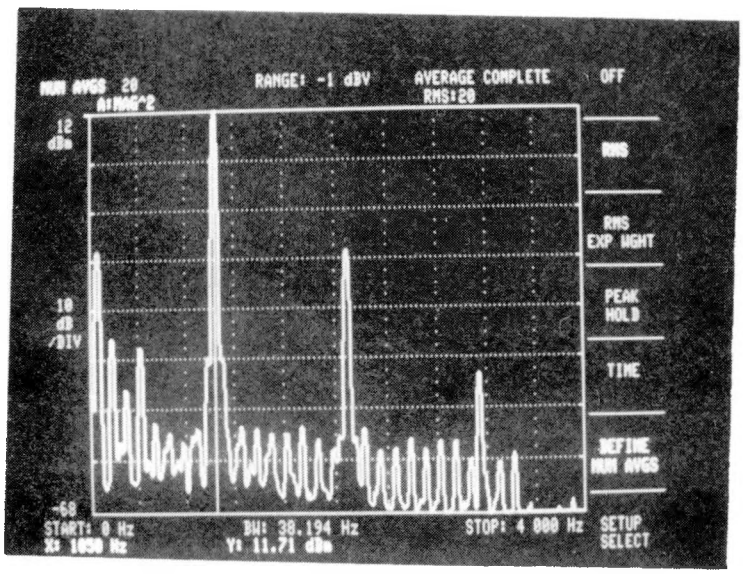
Link 1C
Multiburst
(12/18/89)



Link 1C
5 Step Luma
GainLinearity
(12/18/89)



Link 1C
Differential
Gain/Phase
(12/18/89)



Link 1C
Multiburst
(12/18/89)