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FAIRCHILD WESTON SYSTEMS INC.

Contract No. NAS 9-16850
SOW TASK: K
Report No. ED-AX-316

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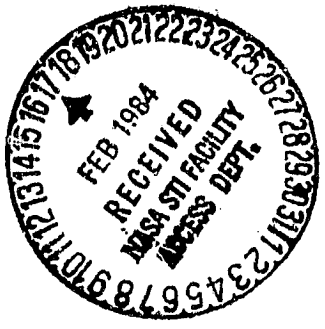
SPAS COLOR CAMERA

FINAL REPORT

MAY 10, 1983



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FINAL REPORT
SPAS COLOR CAMERA
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Director of Target Acquisition Systems

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ACCEPTANCE TEST PROCEDURE
FOR
SPAS COLOR CAMERA
P.O. NO. 3-025-012(Y) CONT. NO. NAS9-16850
I/T PROCEDURE 2071
MARCH 1983

Prepared for: NASA Lyndon B. Johnson Space Center

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SECTION 1

1.0 TEST EQUIPMENT

1.1 List of Test Equipment (or equivalent)

Color TV Monitor, Tektronix 650-1
Two Power Supplies (+28V)
Oscilloscope, Tektronix T935A
Light Meter, Tektronix J16
Test Pattern Generator, Tele-Pat III (Color Bars)
Resolution Test Pattern, TM302
Gray Scale Test Pattern, TM315
Color Test Pattern, TM318
MacBeth Color Chart

1.2 Equipment Calibration

All test equipment shall be verified for proper calibration in accordance with MIL-C-45662A. No equipment shall be used if the expiration date has been reached. The expiration date shall be displayed on all test equipment.

SECTION II

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this procedure to the extent specified herein:

Military Specifications

MIL-C-45662 Calibration System Requirements

SECTION III

3.0 GENERAL INFORMATION

3.1 Standard Conditions

Unless otherwise specified, the tests will be conducted under the following standard ambient conditions:

a.	Temperature	-23° ± 10°C (73°F ± 18°F)
b.	Relative Humidity	-50% ± 30%
c.	Altitude	-Local atmosphere (725^{+50}_{-75} MM. Hg)

3.2 General Failure Critieria

Variations of operational and performance characteristics outside of the limits specified herein are reason to consider the equipment having failed the test.

3.3 Test Log

A log book of tests shall be maintained which shall contain all information relative to testing of the Color Camera.

3.4 Final Inspection

Upon completion of the Acceptance Test Procedure, the Color Camera shall be subjected to a final inspection for workmanship. (exterior only.)

3.5 Test Article

The test article will consist of the complete camera system.

Item	Part No.
MOS Color Camera	1317INSTL10

4.0 Performance Electrical Tests

For the performance of the required tests, power for the color camera shall be supplied through a Power Supply (+28V). Unless otherwise specified, the TV monitor along with 75 ohm termination and channel one of the oscilloscope shall be connected to the video output.

4.1 Resolution

4.1.1 Objective

The objective of this procedure is to determine that the horizontal resolution of the color camera is equal to or greater than 250 TVL/PH and that the vertical resolution is equal to or greater than 350 TVL/PH.

4.1.2 Accept/Reject Criteria

The resolution shall be acceptable if it is 250 TVL/PH or better in the horizontal direction and 350 TVL/PH or better in the vertical direction.

4.1.3 Procedure

Set up the camera with a light box using standard RETMA (TM302) target. Adjust light box so that highlight illumination of target is 90 to 170 FT. Lamberts as measured with spot photometer. Adjust White Balance control on camera for purest white reproduction on monitor. Observe maximum horizontal and vertical resolution and record on data sheet.

4.2 Video

4.2.1 Objective

The objective of this procedure is to determine that the color camera provides a video signal with a nomi-

nal 2.25 Volt peak-to-peak signal when driving a 75 Ohm load.

4.2.2 Accept Reject Criteria

Video signal shall be 2.25 Vpp ± 0.225V with a 75 ohm load. Sync and Video modulation shall have a correct p-p swing as indicated on the data sheet.

4.2.3 Procedure

Using the setup of paragraph 4.1.3, measure peak-to-peak voltage and record on data sheet.

4.3 Grey Scale Rendition

4.3.1 Objective

The objective of this procedure is to determine that the color camera will reproduce the proper grey scale rendition at a light level of 50 ± 5 Ft. Lamberts.

4.3.2 Accept/Reject Criteria

The color camera shall produce a minimum of 9 grey shades of the test pattern starting at the brightest end of the target.

4.3.3 Procedure

Set up the camera and light box using the TM315 grey scale test target. Adjust the light box so that the highest grey level is at 45 to 55 Ft. Lamberts. Observe the monitor and record the number of grey scales reproduced.

5.0 Environmental Test

5.1 Objective

The objective of this procedure is to screen out the color camera systems with inherent defects which may cause time and stress dependent failures.

5.2 Accept/Reject Criteria

Each unit shall demonstrate failure free operation through vibration and temperature testing detailed in Figure 1 and 2. The color camera will be set up with the MacBeth color chart. Observe the monitor and verify that the color camera is reproducing the proper color rendition.

5.3 Performance Electrical Test

For the performance of the required test, power for the color camera shall be supplied through a +28V Power Supply. Unless otherwise specified, the TV monitor with 75 ohm termination shall be oscilloscope for all test (see Figure 3).

6.1 Signal-To-Noise Ratio

6.1.1 Objective

The objective of this procedure is to determine that the color camera has a signal-to-noise ratio (SNR) greater than 40 db at 100 $\pm$ 10 Ft. Lamberts. In order to simplify the data handling, the test will be quantified as a pure ratio; 40 db corresponds to a pure ratio of 16.7.

$$40 \text{ db} \Rightarrow V_{p-p}/N_{p-p} = 16.7$$

6.1.2 Accept/Reject Criteria

SNR will be considered acceptable if the ratio peak-to-peak video (V p-p) to peak-to-peak random noise (n p-p) is greater than 16.7. Bandwidth to be considered is DC to 3.58 MHz.

6.1.3 Procedure

Set up the color camera and light box using the signal-to-noise test target shown in Figure 4. Adjust the highlight light level for 100 ± 10 Ft. Lamberts. Observe a line of video on the oscilloscope. Record p-p signal and p-p random temporal noise on the signal. Exclude the 3.58 MHz chrominance from this measurement and measure only the temporal random noise on the signal. (See figure 5 for a sample waveform.) Record results on data sheet.

6.2 Grey Scale Rendition

6.2.1 Objective

The objective of this procedure is to determine that the color camera will reproduce the proper grey scale rendition at a light level of 50 ± 5 Ft. Lamberts.

6.2.2 Accept/Reject Criteria

The color camera shall produce a minimum of 9 grey shades of the test pattern starting at the brightest end of the target.

6.2.3 Procedure

Set up the camera and light box using the TM315 grey scale test target. Adjust the light box so that the highest grey level is at 45 to 55 Ft. Lamberts. Observe the monitor and record the number of grey scales reproduced.

6.3 Video

6.3.1 Objective

The objective of this procedure is to determine that the color camera provides a video signal with a nominal 2.25 volt peak-to-peak signal when driving a 75 ohm load.

6.3.2 Accept/Reject Criteria

Video signal shall be 2.25Vpp ± 0.225V with a 75 ohm load. Sync and video modulation shall have a correct p-p swing as indicated on the data sheet.

6.3.3 Procedure

Using the setup of paragraph 4.1.3, measure peak-to-peak voltage and record on data sheet.

6.4 Resolution

6.4.1 Objective

The objective of this procedure is to determine that the horizontal resolution of the color camera is equal to or greater than 250 TVL/PH and that the vertical resolution is equal to or greater than 350 TVL/PH.

6.4.2 Accept/Reject Criteria

The resolution shall be acceptable if it is 250 TVL/PH or better in the horizontal direction and 350 TVL/PH or better in the vertical direction.

6.4.3 Procedure

Set up the camera with a light box using standard RETMA (TM302) target. Adjust light box so that highlight illumination of target is 90 to 110 Ft. Lamberts as measured with spot photometer. Adjust White Balance control on camera for purest white reproduction on monitor. Observe maximum horizontal and vertical resolution and record on data sheet.

6.5 COLOR RENDITION

6.5.1 Objective

The objective of this procedure is to determine that the color camera is producing proper color rendition, and to document the performance.

6.5.2 Accept/Reject Criteria

Color shall be distinguishable on TV monitor. A single hue adjustment on the monitor is permissible due to color temperature/white balance effects.

6.5.3 Procedure

Set up the color camera with Pattern Generator #III (color bars) with the highlight illumination set to 150 $\pm$ 15 Ft. Lamberts. Observe the TV monitor. The hue adjustment on the monitor may be varied to a single new setting for best color rendition in order to compensate for color temperature/white balance effects. Once the hue adjustment is made, the entire set of readings shall be made at that new setting. Observe each of the color blocks shown in Figure 6, and enter on data sheet. A polaroid photo of the vectorscope shall be taken and attached to the data sheet.

6.6 WHITE BALANCE CORRECTION

6.6.1 Objective

The objective of this procedure is to insure that the color camera is delivered with the white balance set for daylight operation (as opposed to incandescent illumination).

6.6.2 Accept/Reject Criteria

This test will be considered "complete" if the white balance control has been optimized for outdoor operation.

6.6.3 Procedure

On a sunny (non-overcast) day, set up the MacBeth color chart outdoors. Point the camera out a window at the chart and adjust white balance using external potentiometer for best color fidelity and tighten potentiometer nut.

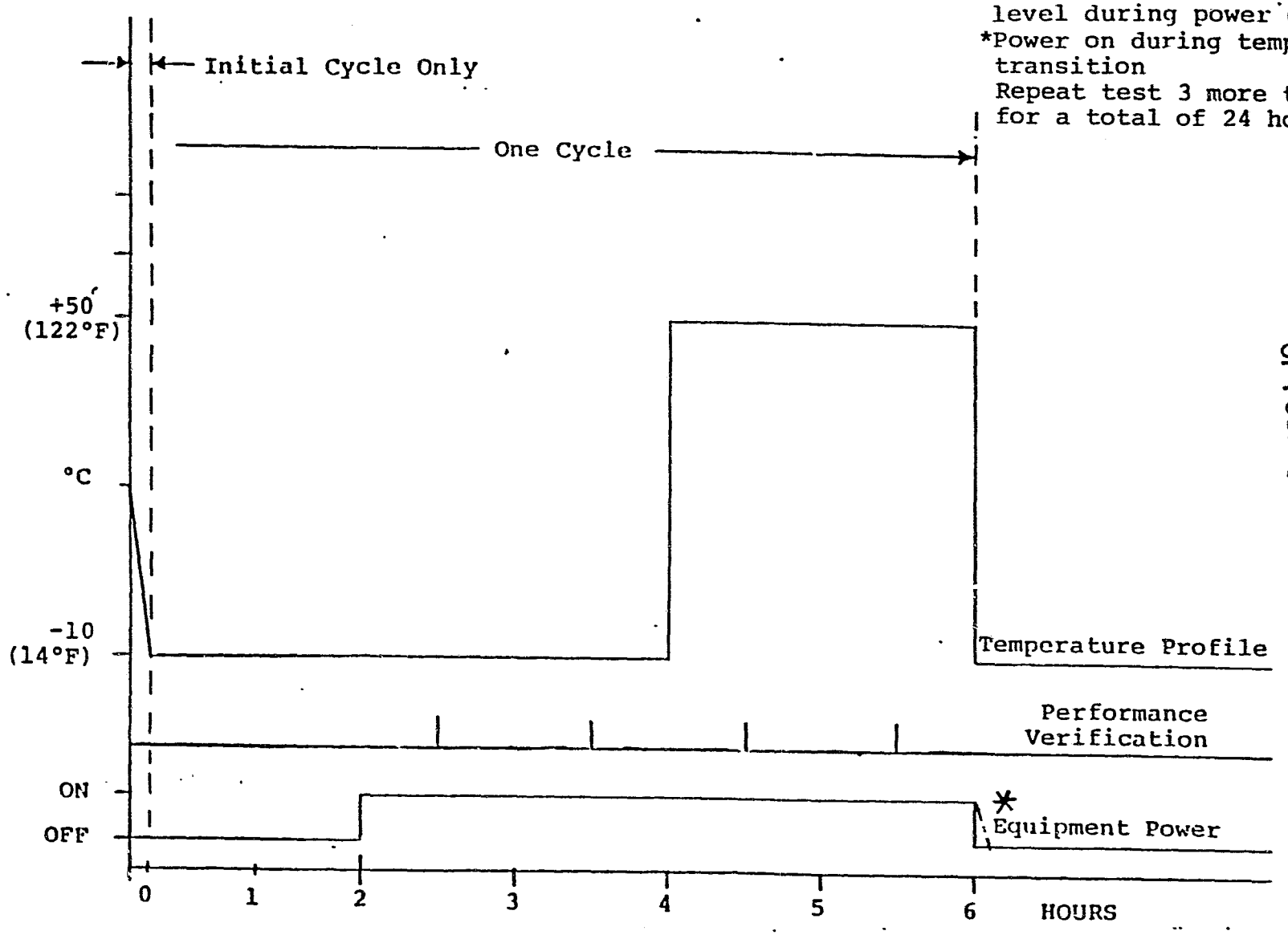

FIGURE 1

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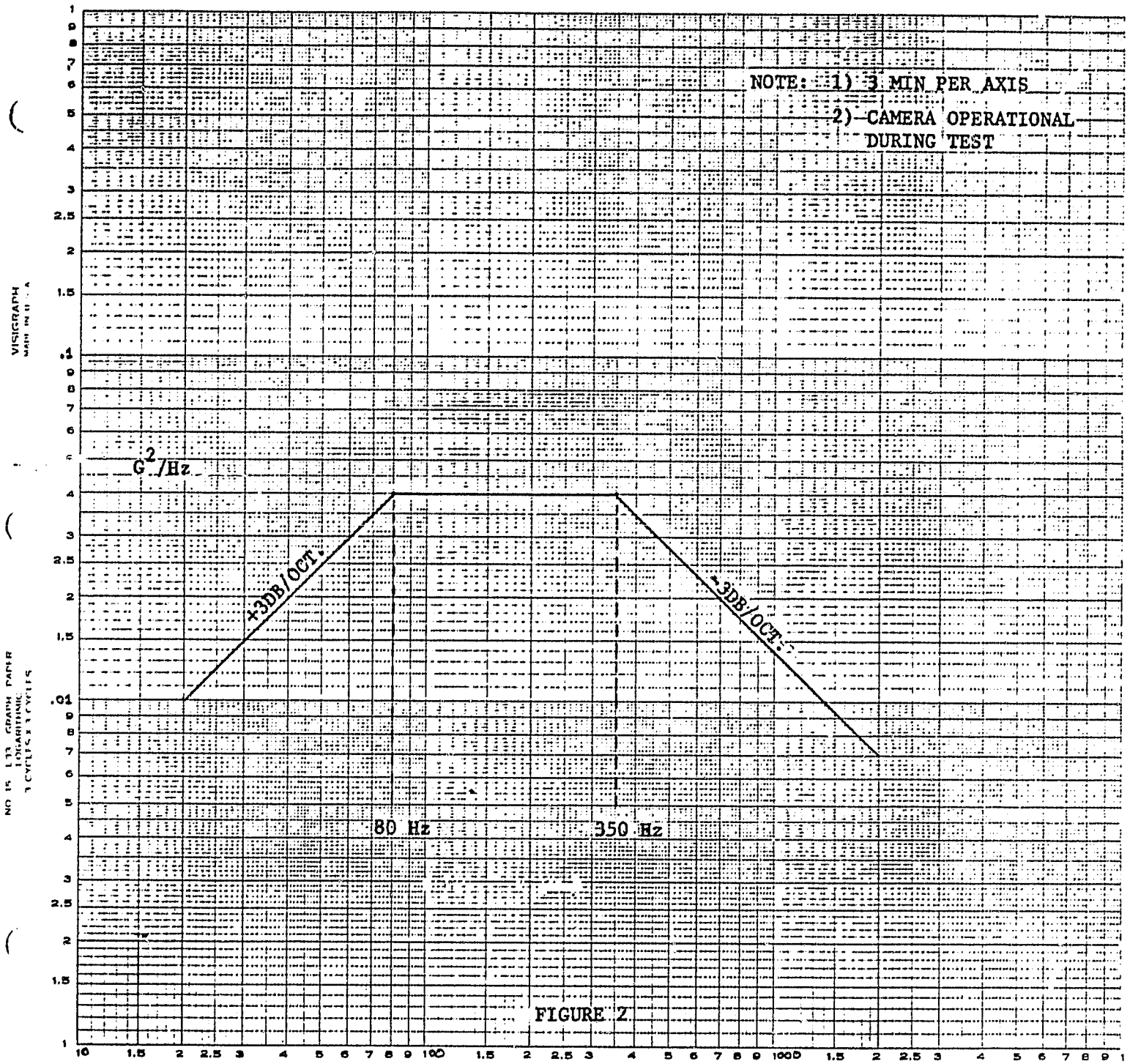

FIGURE 7

FREQUENCY (Hz)

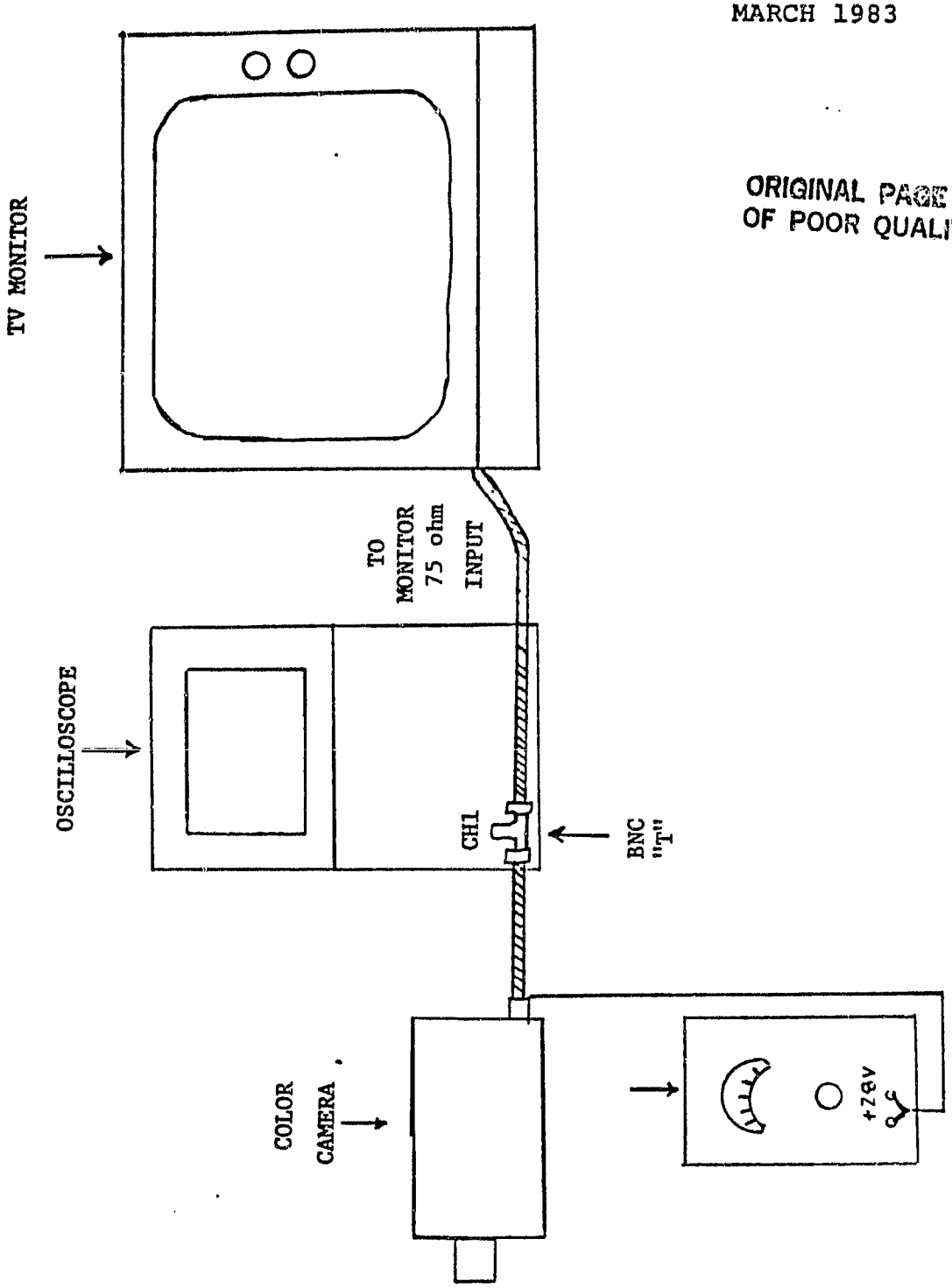

FIGURE 3

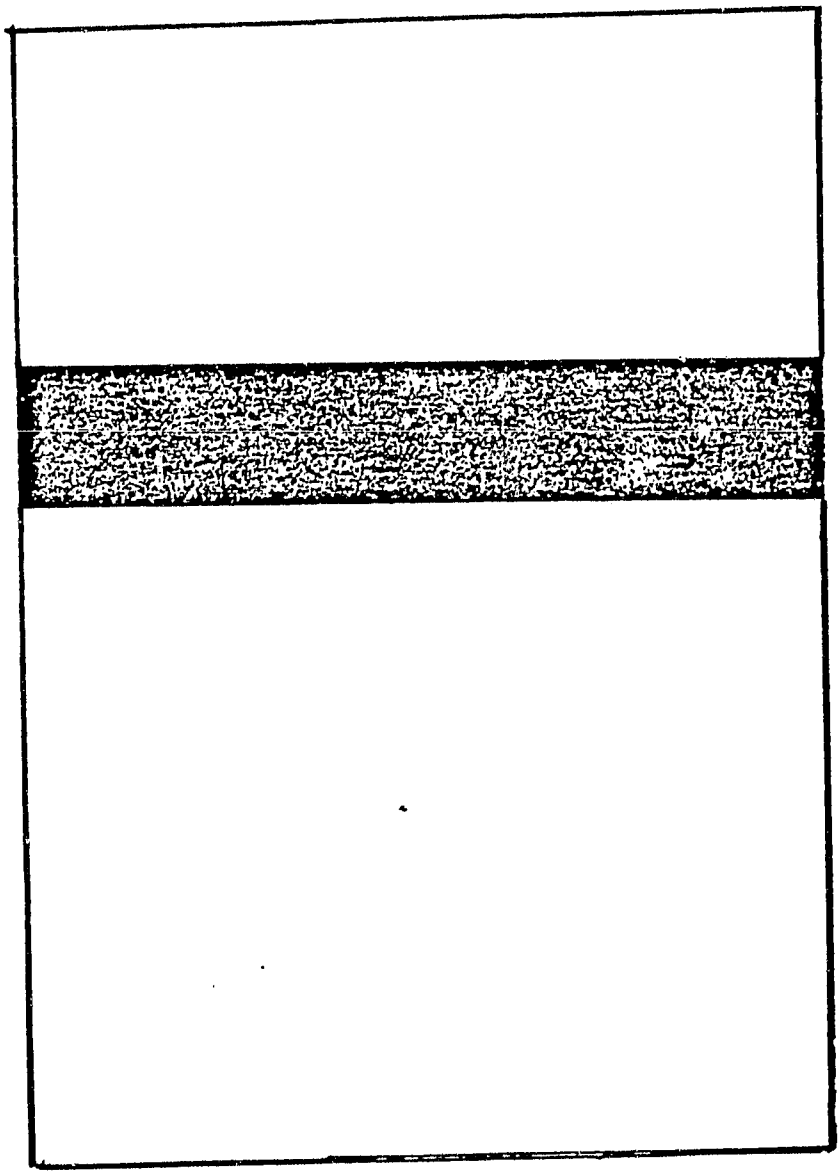

FIGURE 4
SIGNAL-TO-NOISE-CHART

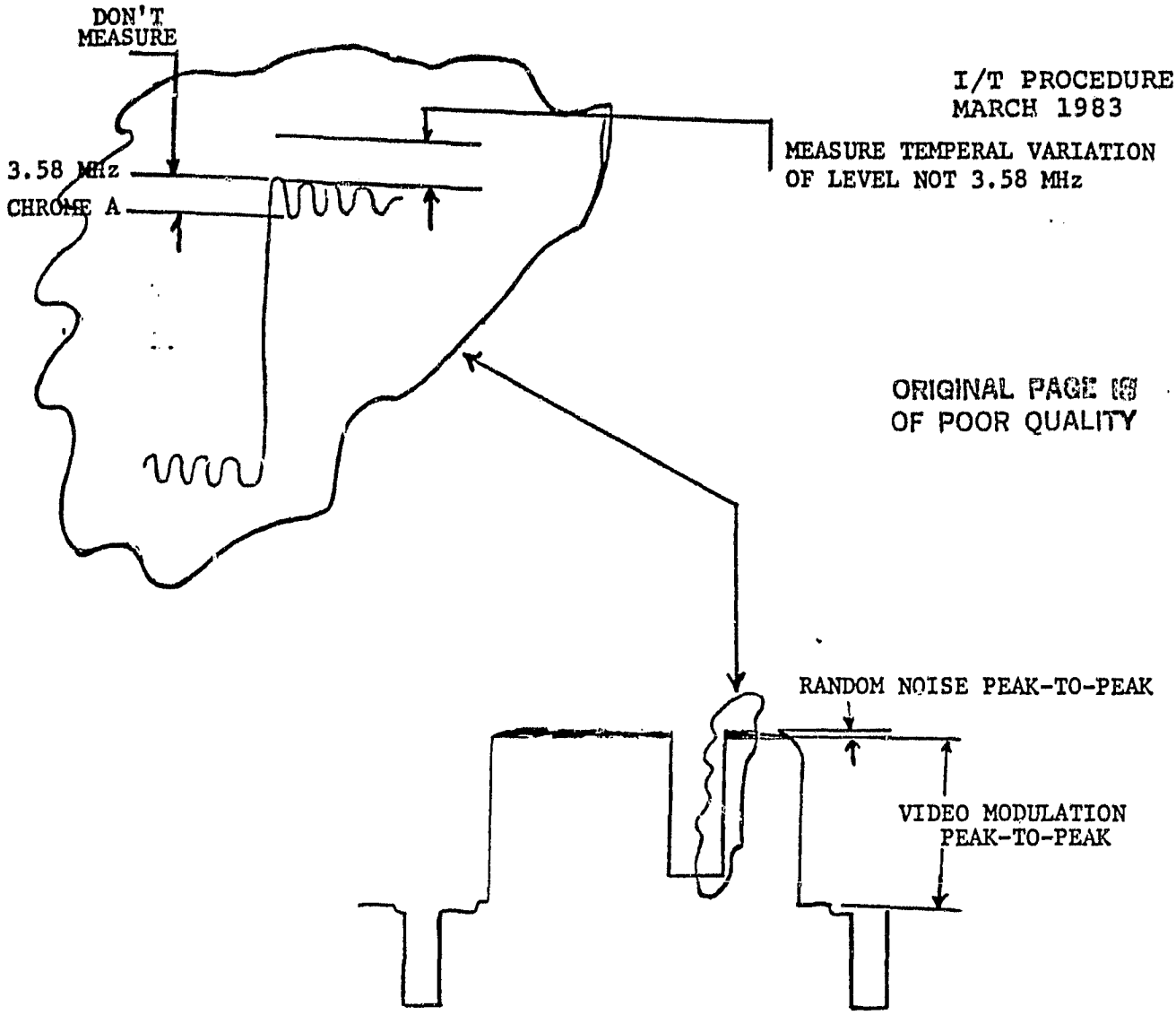

FIGURE 5

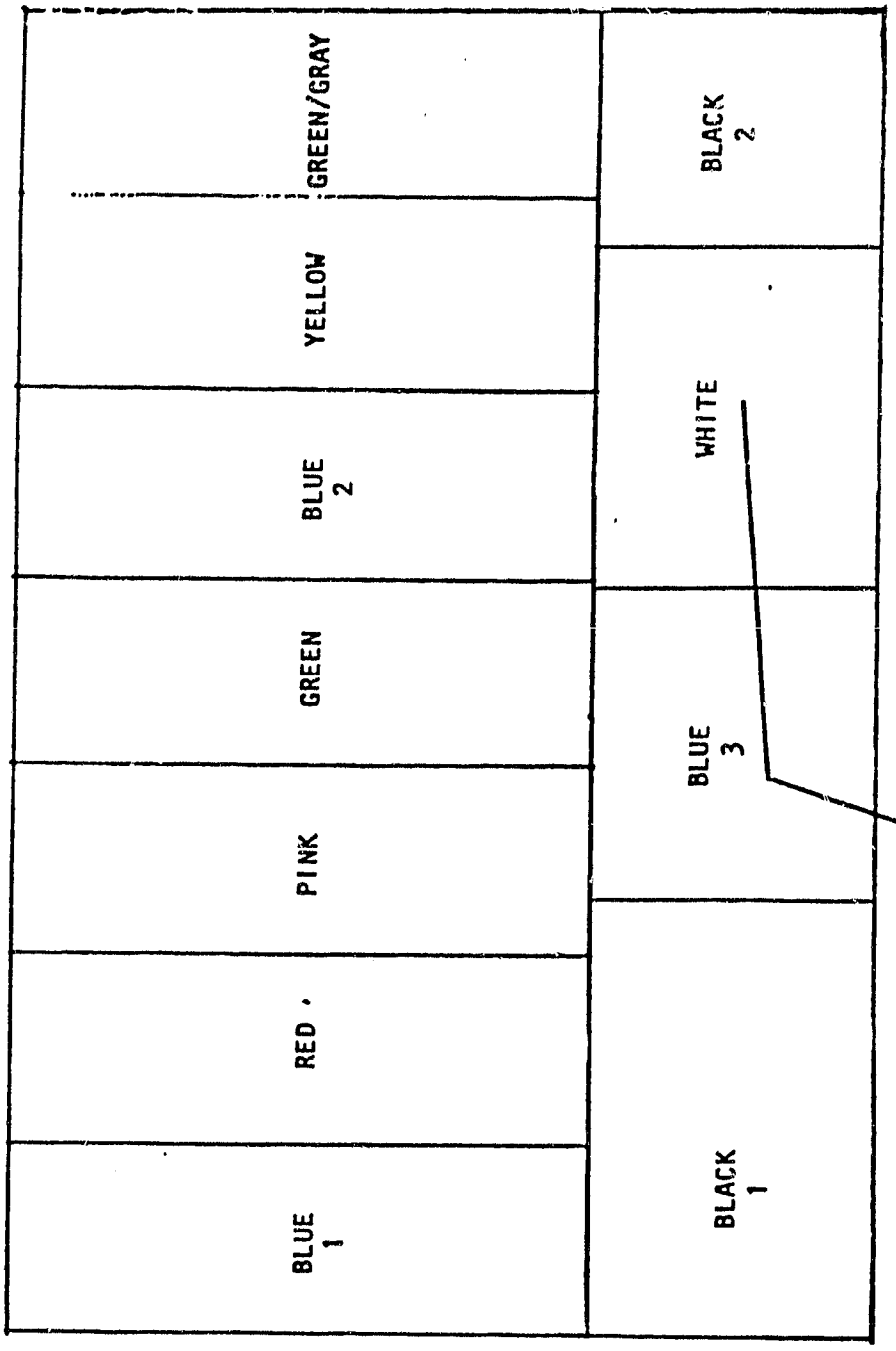

Figure 6

COLOR BAR TEST PATTERN

ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N_____ Date Test Complete_____

Paragraph	Test	Requirement	Recorded	Stamped
4.1.3	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	_____	_____
		Actual Vertical Resolution 350 TVL/PH min.	_____	_____
4.2.2	Video	Video Output 2.025 to 2.475 Vp-p		
		Video 1.44 to 1.76V	_____	_____
		Sync 0.585 to 0.715V	_____	_____
		Clamp Sync Tips -1.35 to -1.65V	_____	_____
4.3.3	Grey Scale Rendition	9 Shades minimum at 50 ± 5 Ft. L.	_____	_____
5.3	Environmental Test.	Satisfactorily Completed		_____
6.1.3	Signal-to-Noise Ratio	Vp-p/Np-p = 16.7 min.		
		Vp-p	_____	
		Np-p	_____	
		Vp-p/Np-p	_____	_____
6.2.3	Grey Scale Rendition	9 Shades min. at 50 ± 5 Ft. L.	_____	_____

ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N_____ Date Test Complete_____

Paragraph	Test			
6.3.3	Video	Video Output 2.025 to 2.475Vp-p	_____	_____
		Video 1.44 to 1.76V	_____	_____
		Sync 0.585 to 0.715V	_____	_____
		Clamp Sync Tips -1.35 to -1.65V	_____	_____
6.4.3	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	_____	_____
		Actual Vertical Resolution 350 TVL/PH min.	_____	_____
6.5.3	Color Rendition	Refer to Figure: 6		
		Blue 1	_____	_____
		Red	_____	_____
		Green	_____	_____
		Blue 2	_____	_____
		Yellow	_____	_____
		Green/Grey	_____	_____
		Black 1	_____	_____
		Blue 3	_____	_____
		White	_____	_____
		Photo Attached	_____	_____
6.6.3	White Balance Correction	Set for outdoor Operation	_____	_____

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ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N 001 Date Test Complete 3-17-83

Paragraph	Test	Requirement	Recorded	Stamped
4.1.3	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	275	[illegible]
		Actual Vertical Resolution 350 TVL/PH min.	400	F0232
4.2.2	Video	Video Output 2.025 to 2.475 Vp-p		
		Video 1.44 to 1.76V	1.6	
		Sync 0.585 to 0.715V	0.68	[illegible]
		Clamp Sync Tips -1.35 to -1.65V	1.5	F0232
4.3.3	Grey Scale Rendition	9 Shades minimum at 50 ± 5 Ft. L.	10	F0232
5.3	Environmental Test.	Satisfactorily Completed		F0232
6.1.3	Signal-to-Noise Ratio	Vp-p/Np-p = 16.7 min.		
		Vp-p	1.4	F0232
		Np-p	0.02	
		Vp-p/Np-p	70	
6.2.3	Grey Scale Rendition	9 Shades min. at 50 ± 5 Ft. L.	10	F0232

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ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N 001 Date Test Complete 3-22-83

Paragraph	Test			
	Video	Video Output 2.025 to 2.475Vp-p	2.3	[illegible]
		Video 1.44 to 1.76V	1.6	F0232
		Sync 0.585 to 0.715V	0.7	[illegible]
		Clamp Sync Tips -1.35 to -1.65V	-1.5	F0232
	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	250	[illegible]
		Actual Vertical Resolution 350 TVL/PH min.	350	F0232
	Color Rendition	Refer to Figure: 6		
		Blue 1	✓	[illegible]
		Red	✓	F0232
		Green	✓	[illegible]
		Blue 2	✓	F0232
		Yellow	✓	
		Green/Grey	✓	[illegible]
		Black 1	✓	F0232
		Blue 3	✓	[illegible]
		White	✓	[illegible]
		Photo Attached	✓	F0232
	White Balance Correction	Set for outdoor Operation	✓	F0232

ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N 002 Date Test Complete 4-8-83

Paragraph	Test	Requirement	Recorded	Stamped
4.1.3	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	250	F0232
		Actual Vertical Resolution 350 TVL/PH min.	350	F0232
4.2.2	Video	Video Output 2.025 to 2.475 Vp-p	2.2	
		Video 1.44 to 1.76V	1.48	
		Sync 0.585 to 0.715V	.7	
		Clamp Sync Tips -1.35 to -1.65V	-1.5	F0232
4.3.3	Grey Scale Rendition	9 Shades minimum at 50 ± 5 Ft. L.	10	F0232
5.3	Environmental Test	Satisfactorily Completed		F0232
6.1.3	Signal-to-Noise Ratio	Vp-p/Np-p = 16.7 min.		
		Vp-p	1.36	F0232
		Np-p	.025	
		Vp-p/Np-p	54.4	
6.2.3	Grey Scale Rendition	9 Shades min. at 50 ± 5 Ft. L.	10	F0232

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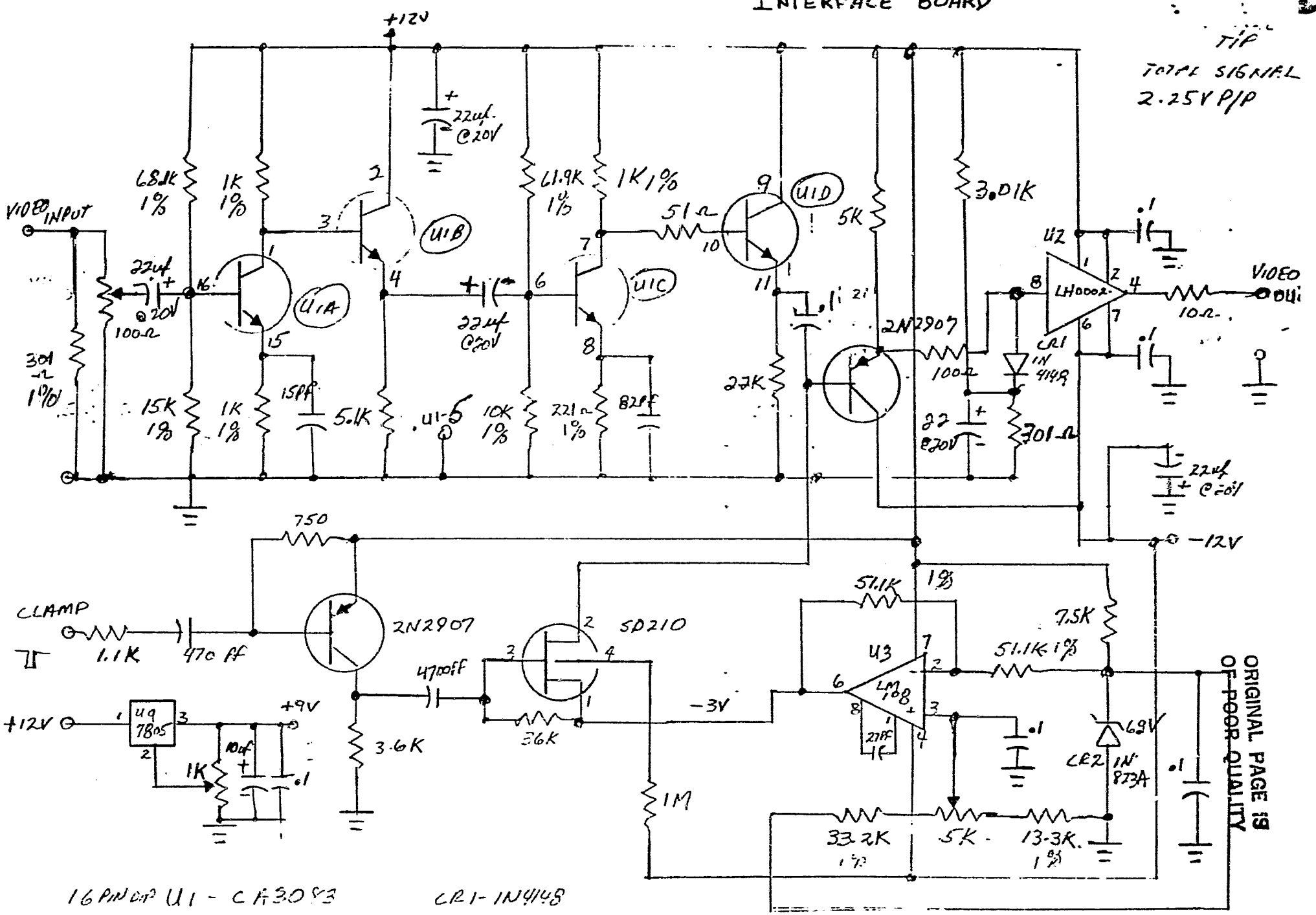
ACCEPTANCE TEST
COLOR CAMERA
DATA SHEET

System S/N 002 Date Test Complete 4-14-83

Paragraph	Test			
6.3.3	Video	Video Output 2.025 to 2.475Vp-p	2.1	F0232
		Video 1.44 to 1.76V	1.44	F0232
		Sync 0.585 to 0.715V	0.7	F0232
		Clamp Sync Tips -1.35 to -1.65V	-1.5	F0232
6.4.3	Resolution	Actual Horizontal Resolution 250 TVL/PH min.	250	F0232
		Actual Vertical Resolution 350 TVL/PH min.	350	F0232
6.5.3	Color Rendition	Refer to Figure: 6		F0232
		Blue 1	✓	F0232
		Red	✓	F0232
		Green	✓	F0232
		Blue 2	✓	F0232
		Yellow	✓	F0232
		Green/Grey	✓	F0232
		Black 1	✓	F0232
		Blue 3	✓	F0232
		White	✓	F0232
		Photo Attached	✓	F0232
6.6.3	White Balance Correction	Set for outdoor Operation		

INTERFACE BOARD



16 PIN DIP U1 - CA3083
8 PIN U2 - LH0002
8 PIN U3 - LM108

CR1 - IN4148
CR2 - LM129

CA3083 UNITS