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HS 236-0019-361

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SEPT 1982

THEMATIC MAPPER

(E83-10262) THEMATIC MAPPER FLIGHT MODEL PRESHIPMENT REVIEW DATA PACKAGE. VOLUME 3, PART B: SYSTEM DATA Final Report (Santa Barbara Research Center) 203 p HC A10/MF A01 CSCL 14B G3/43

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Unclas
00262

Prepared for
GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland 20771

CONTRACT NAS 5-24200

FLIGHT MODEL
PRESHIPMENT REVIEW
DATA PACKAGE
VOLUME III - SYSTEM DATA
PART B

Article IV -3A

HUGHES

HUGHES AIRCRAFT COMPANY
SPACE AND COMMUNICATIONS GROUP

HS 236-0019-1679

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Hughes Ref No. D4598

THEMATIC MAPPER
FLIGHT MODEL
PRESHIPMENT REVIEW
VOLUME III
SYSTEM DATA

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THEMATIC MAPPER

FLIGHT MODEL

PRESHIPMENT REVIEW

VOLUME III

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3.2.5 IA07 TEST

Electronics Module Integration

Test Summary: HS236-8129 IA07 Test - Electronics Module Test Procedure.

Test Specification: TP32015-531,532,533 Electronics Module Integration Test Procedure.

Reference Documentation: None

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SANTA BARBARA RESEARCH CENTER

A Subsidiary of Hughes Aircraft Company

INTERNAL MEMORANDUM

TO: Distribution

DATE: 16 SEP 82

REF: HS236-8129

FROM. IA07R Test Team

SUBJECT: Flight IA07R Test Result Summary, (Part 1, 2 & 3)

BLDG: B11 M/S: 101
EXT: 6388

REFERENCES:

1. TP32015-531 (Part 1) "Thematic Mapper Power and Grounding Test Procedure IA07R".
2. TP32015-532 (Part 2) "Thematic Mapper Command and Telemetry Functional Test Procedure IA07R".
3. TP32015-533 (Part 3) "Thematic Mapper Video and System Testing Test Procedure IA07R".
4. Test Requirements for IA07R (HS236-6807)
5. History Tapes D03016, D03019, D03020, D03021 and D03044.
6. System Test Computer Log Books #1 - #3 (23 MAR 1982 thru 10 JULY 1982)

INTRODUCTION:

IA07R test procedures were started without the following items assembled as authorized by deviation D-143.

1. Radiative Cooler: 51200

2. Circuit Boards: 50720 Temp. Controller and DC Restore

   50942 Temp. Controller

   50912 Band 6 Buffer

   50908-1 Band 5 Buffer

   50908-2 Band 7 Buffer

As the above items became available the testing continued with that portion of tests that involved these particular items.

This report summarizes the results of all three (TP32015-531, 532, and 533) IA07R Test Procedures run from 26 Mar 82 through 7 July 82. Part I (531) verifies the wiring of mating connectors between the Electronics Module and the Thematic Mapper (TM), and the mating connectors between the Electronic Module and the test equipment. After the verification by Part I, Part II (532) and Part III (533) checks all functions (except the irreversable functions such as Fusible Link heaters) by exercising the appropriate commands, checking the responding telemetry and verifying specific operations of the TM Because of the many different tests involved a summary of individual tests and groups of tests are given. Data and/or reports for further review are included.

If a failure occured, and was repaired then remeasured, readings before the retest are not given Only the most recent data is presented for a given paramete

SUMMARY

A) Part 1 Power and Grounding

1 The isolation of returns from chassis were checked at the Mapper end of the "Stand by Power" cable W5061 from the Spacecraft Simulator Console (SSC) and all readings satisfied the test requirements after a short on the A8 and A7 circuit boards were repaired

Voltage readings were taken and the correct voltages appeared at the proper power and return leads as per cable pin out. All readings met the test objectives.

2. Isolation checks were conducted at connectors J28 "Standby Power" input to the SMA, and the output of the Electronics Module to verify that 10 meg isolation exists between all returns and chassis ground. All met the test objectives.

   The voltage checks proved that the voltages were correct and appeared at the proper pins after wiring error corrected in P28 harness.

3. Continuity between corresponding signals in the Primary and Redundant cables were checked looking in to the System Interface Unit (SIU) and the Electronics Module. The corresponding discrete Primary, Redundant commands and telemetry should be hardwired together in the SIU. All of the discrete commands and telemetry in the Primary cables W5009, W5020, W5011 and W5016 were shorted to the same functions in the Redundant cables W5012, W5013, W5015 and W5017. This meets the objective of the test except Pin 66 of (Band 1 ON CMD) in the SIU which is open. See list of discrepancies that were corrected.

4. Isolation between all power returns and chassis ground at J26 were checked. All readings were approximately 10 megs ohm or greater which satisfies the test requirements See list of discrepancies that were corrected prior to J16 meeting requirements.

5. The +28V input to the TM power supply in cables W5018 and W5019 was checked on the TM side of the cables. Returns were isolated from chassis and voltage values were correct, and the voltages and returns were located on the proper pins. All test objectives were satisfied.

6. All Post amplifiers were checked at connectors J30, J31, J32, J33, J35, J36, J37, J38, J40, J41, and J42. All returns were above the required 10 meg ohm to chassis ground and all signal returns were connected to power returns as required after correcting wearsaver problem at J30 pin 4.

   The voltage checks were satisfactory as were the shield terminations

7. All aft optic connectors were checked for proper

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grounding and voltage. These checks satisfied the test requirements.

8. A complete system grounding check was made and all readings were within test requirements.

   After completion of the system grounding test, Signal Ground and Chassis Grounds were wired together at the A26 mushroom board.

9. The conclusion from the above results were that all connectors were wired correctly and were compatible for mating, when all discrepancies were corrected.

10. All connectors between the Electronic Module, Scan Mirror Assembly, Aft Optics and the Test Equipment were mated as required for testing Part II (532) and Part III (533).

11. Test procedure changes are listed as per the red-lined Data Master verified by Test Director and Systems Engineering.

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TABLE I
DISCREPANCIES CORRECTED

DATE	FUNCTION	FR. NO. /DISCREPANCE	PROC. NO.	PARA.
30MAR82	P24 Sig. Grd. Check	8107/ Short on A8 Civ. Bvd.	32015-531	5. 1. 1
30MAR82	P24 Sig. Grd. Check	8116/SME Sig. Grd. to Chassis Short	(Found trouble shooti FR 8110)	
31MAR82	J9-J12 Band 1 on CMD	8109/ PIN 66 open in SIU	32015-531	5. 1. 2
04APR82	P24 Sig. Grd. Check	8110/Short on A7 cir. brd.	32015-531	5. 1. 1
05APR82	SIU Chasis Grd.	8131/Loose Connector on SIU	32015-531	5. 3. 1
05APR82	TM 28 Volts	8395/Kepco in current limit	32015-531	5 1. 1
06APR82	Band 1 Sig Grd.	8126/Cir. Brd. Wearsave	32015-531	5. 3. 2
06APR82	Band 1 Sig. Grd.	8126/Cir. Brd. Wearsave	32015-531	5 3. 2.
07APR82	Band 3 Sig. Grd.	NONE/BOB Cable open	32015-531	5. 3. 3.
14APR82	Telemetry Cal. Lamp Cur.	8130/Scale factor error in sw.	32015-532	5. 2. 5. 5 2. 5.
16APR82	SMA Heater Voltage	8134/Wiring error in P28 harness	32015-531	5. 1. 1.
06MAY82	Fusible Link Voltage	8133/ Bad DVM	32015-532	5. 2 8 1 2 [illegible] 5 2. 8. 2. 3[illegible]
19MAY82	DC Restore	NONE/Resistor Value	32015-531	5. 2. 4
20MAY82	Band 1 Ch. 9	5771/Resistor Loose from Standoff	32015-532	Test Set Check

B) The following are the functional test that were conducted in TP32015-507 Rev. B Part II and Part III.

1. All commands were executed and verified by telemetry command file and visually observing the CRT output.

2. Calibration Lamps were sequenced through all levels and the radiance levels were checked.

3. Main and Redundant Shutters were exercised and timed.

4. The Scan Mirror assembly was exercised and timed.

5. The DC Restore circuitry was checked for pulse and timing.

6. The Scan Line Corrector was checked for operation and timing.

7. Radiative door operation and telemetry status were checked

8. Radiative Cooler Door and Calibration Shutter Fusible Link circuits were checked.

9. The output format of the video system was checked.

10. The multiplexer processing was checked along with the electrical connections Y+/-FOV (and) location in the Primary focal plane.

11. The Scan Line Corrector was checked for magnitude and phase.

12. The scan direction of the Scan Mirror Assembly was verified.

13. Inchworm move test was conducted to demonstrate and verify the proper operation of the Relay Optics Inchworms and their linear variable differential transformers (LVDT) position transducers.

C) Command, Telemetry and Performance test results

Several command, telemetry and functional tests were not run at beginning of the test because all assemblies were not available As the assemblies became available all commands, telemetry and functional tests were satisfactory. A list of anomalies included in Table I.

1. All commands were checked and verified with CRT output and computer command files [327,6]IA7PCT.DSL, [327,6]IA7INICF.DSL, [327,6]PRIM.DSL, , and [327,6]REDUND.DSL.

2. The Main shutter timing was satisfactory.

   The Redundant Shutter timing did not meet the test specifications. The symetry was out of spec, and the DC Restore obscuration relationship was marginal. After changing components on circuit board resulting from test data all test requirements were met.

3. Scan Line Corrector (SLC) timing waveforms and timing values are recorded in Figure 1, 2 and 3.

4. The mid Scan Pulse check met all requirements of the test.

5. The Frame D.C Restore check was completed in its entirety. All commands and temperature checks satisfied the requirement of the test

TABLE III

MAIN SHUTTER TIMING MEASUREMENTS

FUNCTION	SAM MODE SME 1	SAM MODE SME 2	CALCULATED MEASURED VALUE	VALUE
O Deg Ref. to P2 (Transition)	--X-	----	4.92+/-0.68 ms	5.20 ms
	----	--X-		5.20 ms
O Deg Ref. to P5 (Transition)	--X-	----	5.31+/-0.80 ms	5.40 ms
	----	--X-		5.40 ms
O Deg. Ref. (P2P3 turn-around) to O Deg Ref. (P5PO turnaround)	--X-	----	71.46+/-2.0 ms	71.0 ms
	----	--X-		72.2 ms
O Deg. Ref. (P5PO Turnaround) to O Deg Ref (P2P3 turnaround)	--X-	----	71.46+/-0.50 ms	72.0 ms
	----	--X-		71.8 ms
DC Restore Trailing Edge (P2P3 Turnaround) to O Deg Ref.	--X-	----	0 0+/-0 17 ms	0.00 ms
	----	--X-		0.00 ms
DC Restore Leading Edge (P5PO turnaround) to O Deg. Ref.	--X-	----	0 0+/ 0 10 ms	0 00 ms
	----	--X-		0.00 ms
DC Restore Width	--X-	----	3 00+/-0.15 ms	2.90 ms
	----	----		2.80 ms
P2 to P3 (Turnaround Interval	--X-	----	10 60 to 10 90	10.80 ms
	----	--X-		10 80 ms
P5 to PO (Turnaround Interval)	--X-	----	10.60 to 10 90	10 80 ms
	----	--X-		10.80 ms
	BUMPER SME1	MODE SME2		
O Deg Ref to 02	--X-	----	4.97+/-0 68	5.0 ms
	----	--X-		5 1 ms

O Deg. Ref. to	--X-	----	5.31+/-0.80 ms	5.8 ms
Q5	----	--X-		5.1 ms
Trailing Edge	--X-	----	0.00+/-0.10 ms	0.00 ms
DC Restore to				
O Deg Ref. (Q2Q3)				0.00 ms
Turnaround)	----	--X-		
Leading Edge	--X-	----	0.00+/-0.10 ms	0.00 ms
DC Restore to				
O Deg. Ref (Q5Q0				
Turnaround)	----	--X-		0.02 ms
Q2 to Q3	--X-	----	10.522 to 10.719 ms	10.70 ms
(Turnaround			in Vacuum (10.6 to	
Interval)	----	--X-	11.0 ms in Air)	10.75 ms
Q5 to Q0	--X-	----	10.522 to 10.719 ms	10.70 ms
(Turnaround			in Vacuum (10.6 to	
Interval)	----	--X-	11.0 ms in Air)	10.70 ms

PSEUDO SAM PULSES WITH SMA LOCKED

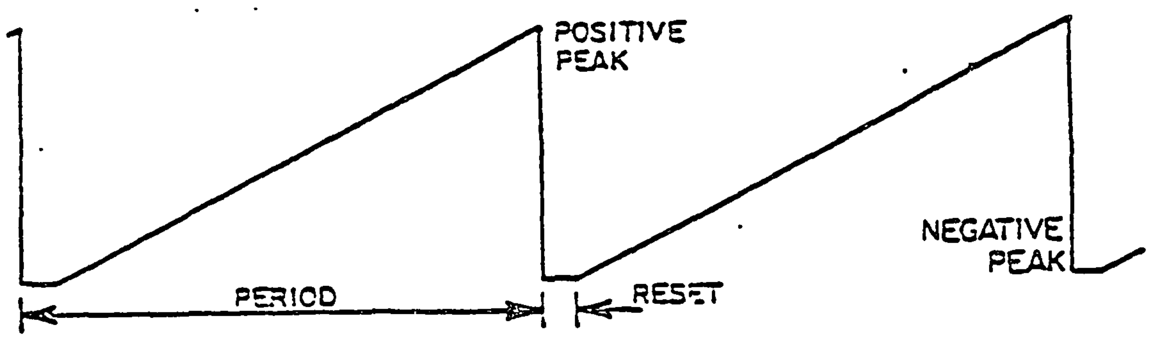
O Deg. Ref. to	--X-	----	4.97+/-0.68 ms	5.10 ms
P2 (Transition)	----	--X-		
P2 to P3	--X-	----	10.8+/-0.350 ms	10.80 ms
(Turnaround				
Interval)	----	--X-		
P5 to P0	--X-	----	10.8+/-0.350 ms	10.90 ms
(Turnaround				
Interval)	----	--X-		

TABLE IV

REDUNDANT SHUTTER TIMING MEASUREMENTS

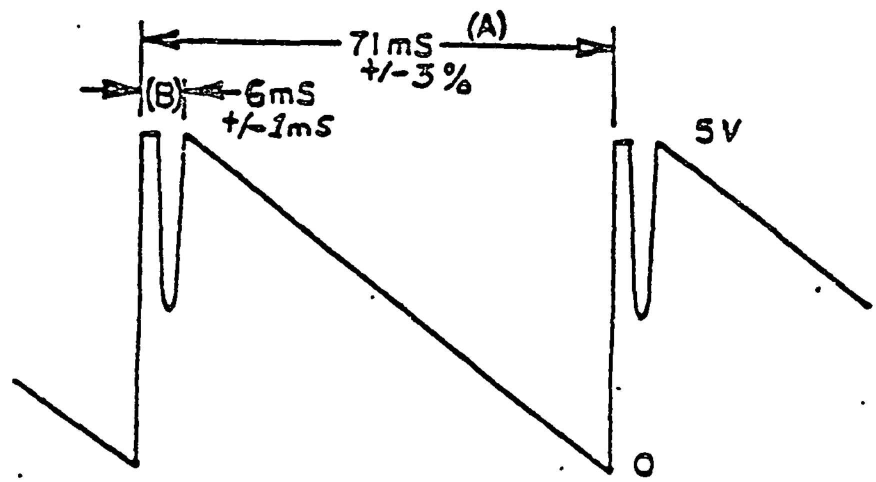
FUNCTION	MODE SME 1 SAM	SME 2 SAM	CALCULATED VALUE	MEASURED VALUE	REMARKS
0 Deg. Ref. to P2 (Transition)	--X--	-----	5.36+/-0.629 ms	5.4 ms	
	-----	--X--		5.4 ms	
0 Deg. Ref. to P5 (Transition)	--X--	-----	5.46+/-0.50 ms	5.4 ms	
	-----	--X--		5.4 ms	
DC Restore to P2 (P2P3 Turn-around)(Leading-Edge)	--X--	-----	4.22+/-0.63	4.5 ms	
	-----	--X--		3.7 ms	
DC Restore P5 (P5P0 Turn-around)(Leading-Edge)	--X--	-----	3.620+/-0.780	3.7 ms	
	-----	--X--		3.7 ms	

FUNCTION	SME 1 BUMPER	SME 2 BUMPER	CALCULATED VALUE	MEASURED VALUE	REMARKS
0 Deg Ref. to Q2 (Q2Q3 Turn-around)	--X--	-----	5.30+/-0.50	4.8 ms	
	-----	--X--		5.0 ms	
0 Deg Ref. to Q5 (Q5Q0 Turn-around)	--X--	-----	5.30+/-0.50	5.0 ms	
	-----	--X--		5.2 ms	



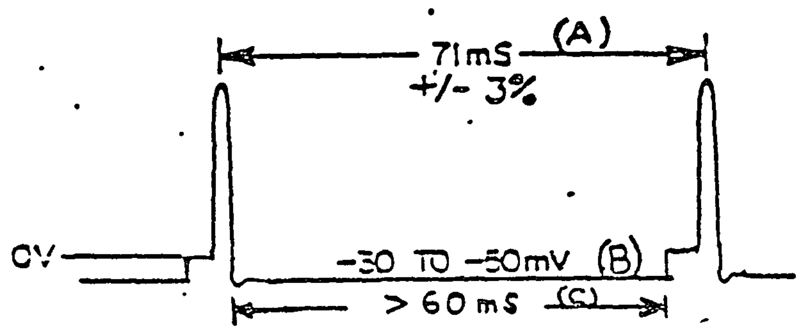
		SLC #1	SCL #2
Period	71+/-3% ms	71.5 ms	72.30 ms
Reset	5.00 ms+/-5.0 ms	5.00 ms	5.00 ms
Neg Peak	-2V+/-0.5V	-2.10V	-2.20V
Pos Peak	+2V+/-0.5V	+1.90V	+1.90V

FIGURE 1 SLC INTEGRATOR WAVEFORM



SLC #1	SLC #2
72.00 ms	72.00 ms
6.00 ms	6.00 ms

FIGURE 2 SLC TORQUER CURRENT WAVEFORM



	SLC #1	SLC #2
A)	72.00	72.00 ms
B)	- 50 mv	- 50 mv
C)	60 60 ms	61 70 ms

FIGURE 3 SLC SWITCH TACH WAVEFORM

6. Calibration Lamp Test was run via command file [327,6]CALLMP.DBL. The results were within the limits set by the test. The radiance levels are listed in Table V.

7. The Thermal Tests were run with the clean room temperature at 59 DEG F. All requirements were met with the following exceptions:

   a) CFPA T1 set point was not checked because the bench test cooler could not reach 90 DEG K. The set point was check with a resistive decade box.

   b) The cold stage temperatures and the intermediate stage temperatures were checked with a decade resistance box. They responded properly with the change in resistance.

   c) SMA +/- Z heaters wer checked with a decade resistance box.

8. The Inchworm Move Test was accomplished in IA04R TP32015-504 procedure during the focussing portion of the test. This was used to verify the movement of the Inchworms instead of IA07 Inchworm Move Test as per deviation D-151.

9. The Fusible Link Test was completed satisfactorily The voltage appeared only after all three fusible link switches were closed. The resistance of the Cooler Door Fusible Link was 16.41 ohms and the Shutter Fusible Link read 15.34 ohms.

10. Telemetry in the Data Stream Test was completed and the counter was reading correctly.

11 Time Code in the Data Stream was completed and does appear in the Data Stream.

12. The Scan Line Corrector magnitude and phase test met all test requirements.

13. The Forward/Reverse Scan Verification test was run and all requirements met.

14 The mux Interconnect Verification test was run, and the electrical connections and IFOV locations on the focal planes were verified as being properly interconnected. The processing by the multiplexer was found to be within the requirements of the test No cross wired detector channels exist and all detector/channels respond correctly.

TABLE V

CALIBRATION LAMP RADIANT LEVELS

NO.	SEQ. SCALE	% FULL LEVELS	REVERSE BAND 1 SNSR 7 (LEVELS)	SCAN BAND 4 SNSR 2 (LEVELS)	FORWARD BAND 1 SNSR 7 (LEVELS)	SCAN BAND 4 SNSR 2 (LEVELS)	LAMPS ON
1	0	0	2	3	2	2	NONE
2	40	102	112	113	113	112	1
3	70	179	185	223	190	223	1, 2
4	30	76	85	95	87	94	2
5	50	128	165	160	167	163	2, 3
6	90	230	253	255	254	255	1, 2, 3
7	60	153	178	187	179	185	1, 3
8	20	51	69	71	70	70	

The postamplifier gains were not set prior to the test therefore the levels varied with the band gains.

15. The Power Profile was completed and the results are as follows:

a. The turn-off transients were within the specifications of the test.

b. The turn-on transient reached the steady state condition in 450 milli-seconds. This meets the test requirement of 500 ms max. The voltage Change was not measured.

c. The in-rush of current in the first 10 micro-seconds was within the test specifications.

Photographs of the Turn ON and OFF transients are in Appendix C.

d. In the Picture Mode at 27.80V TM drew 12.29 amps This is with the SMA +/-Z heaters cycling ON, (See Table VII for individual currents for the functions in picture mode).

16 A Video Test was conducted and the results were as follows:

a. Data was displayed at the video display. This demonstrates that the system achieves bit sync, frame sync and scan line sync.

b. The line length was proper.

c. The on board calibrator properly cycled through 8 levels

d. Post amplifiers gains were not set prior to this test therefore, channels of some bands saturated when all three calibration lamps were illuminated

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TABLE VI

HISTORY TAPE RECORD

04/27/82	System Timing Test Fusible Link Test Initial Configuration, Primary and Redundant Command Sequences	D03016
05/05/82	Retest of Initial Configuration, Primary and Redundant Command Sequences. Retest of system timing (Redundant Shutter) Scan Line Corrector Magnitude/Phase Test Mux Interconnect Test	D03019
05/18/82	Retest of System Timing (Redundant Shutter) Power Profile Test Thermal Tests	D03020
06/03/82	Frame DC Restore Test Cooler Door Test	D03028
07/13/82	Inchworm Move in IA04 Test	D03044

TABLE VII
POWER PROFILE BY FUNCTIONS IN
PICTURE MODE AT 28VDC

FUNCTION	AMPS
SHUTDOWN ENABLE	.3
MUX 1	3.11
SME 2	1.71
CAL SHUTTER	.30
BAND 1	.25
2	.26
3	.27
4	.26
5	.49
6	.41
7	.33
SLC 2	1.16
BAFFLE HRT	.71
BLACKBODY HRT	.16
SMA + Z HRT	1.16
SMA - Z HRT	1.10
CAL LAMP 1	.103
CAL LAMP 2	.103
CAL LAMP 3	104
	-------
	12 29

APPENDIX C

OSCILLOSCOPE PHOTOGRAPHS

All of the photographs in this Appendix were taken during the POWER PROFILE TEST.

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: - -

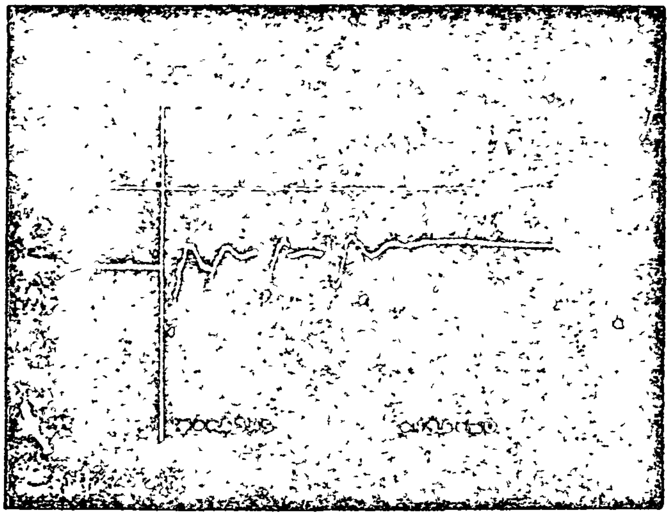
DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.11.9

DATA REF. NO: ______

TEST DESCRIPTION: Power Profile - Picture Mode - 28V Power Supply 1 Turn ON with P/S Filter installed (J18/J19)

DATE: 5/11/82 TIME: 1550



TRACES:

1. P/S 1 current at J18 wearsa4
2. ______
3. ______
4. ______

~~SYNC~~ 2amps/10mv

HORIZ. TIME: 50m sec/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK TP32015-532 REV. - -

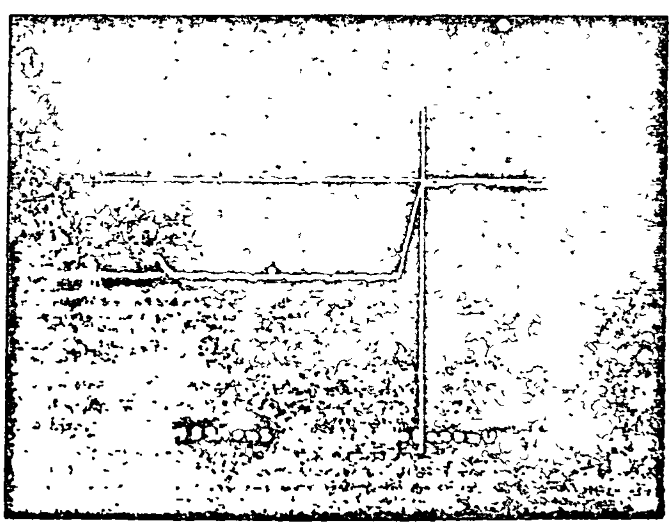
DATA STORAGE NO· ______

TEST TECHNIQUE ______ SUB-STEP 5.2.11.11.9

DATA REF. NO· ______

TEST DESCRIPTION. Power Profile - Picture Mode - 28V Power Supply One - Turn ON w/P/S Filters INSTALLED

DATE: 5/11/82 TIME. 1555



TRACES.

1. P/S 1 current at J18 wearsa4
2. ______
3. ______
4. ______

~~SYNC~~ 2amps/10mV

HORIZ. TIME 200 µsec/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

POLAROID PRINT DATA CARD

PROC. BK: TP32615-532 REV: --

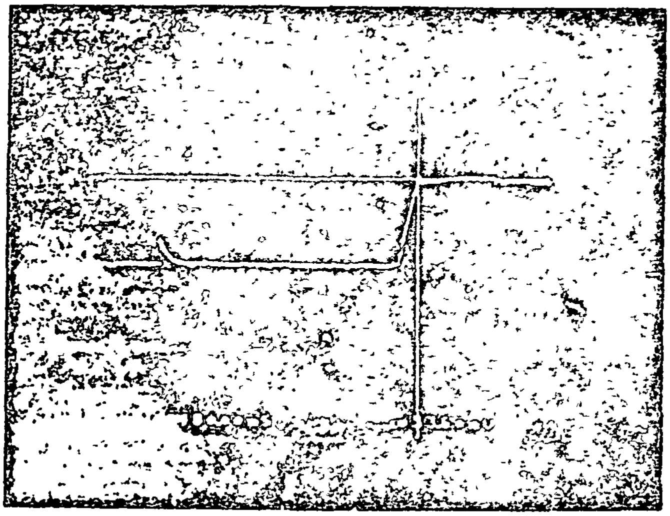
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.11.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile - Picture Mode - 28V Power Supply ON Turn ON with P/S Filter Installed at J18/P18

DATE: 5/11/82 TIME: 1530



TRACES:

1. P/S I current at J18 wave

2.

3.

4.

SYNC: 2 amps/10 mV

HORIZ. TIME: 200 μ sec/DT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

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POLAROID PRINT DATA CARD

PROC. BK REV

DATA STORAGE NO.

TEST TECHNIQUE SUB-STEP

DATA REF. NO

TEST DESCRIPTION.

DATE. TIME·

POLAROID PRINT
(STAPLE TO CARD FOR TRANSMITTAL)

TRACES:

1.

2.

3.

4.

SYNC

HORIZ. TIME

NOTE USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

0-1007-115

POLAROID PRINT DATA CARD

PROC. BK: TP37015-532 REV: – –

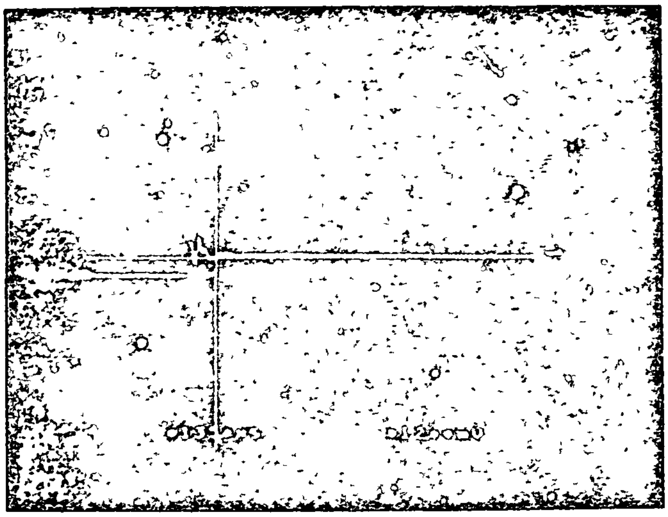
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.13.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile – Pic Mode 28V Power Supply 1 Turn ON

DATE: 5/11/82 TIME:



TRACES:

1. P/S 1 current at J18 wearsaver
2.
3.
4.

SYNC: 500 ms / PT

HORIZ. TIME: 20 Amps / 10 mV

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

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POLAROID PRINT DATA CARD

PROC. BK: TP37015- 532 REV

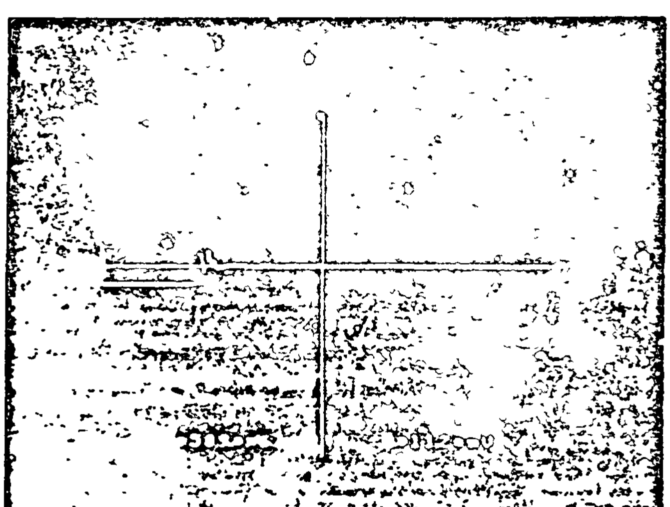
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.13.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile – Picture Mode 28V Power Supply 2 Turn ON

DATE: 5/11/82 TIME:



TRACES:

1. P/S 2 current at J18 wearsaver
2.
3.
4.

SYNC: 5 ms / PT

HORIZ. TIME: 2 amps / 10 mV

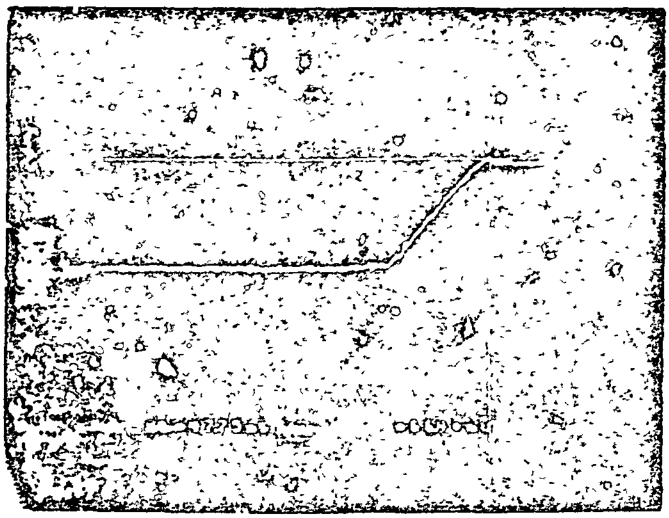
NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMEN

POLAROID PRINT DATA CARD

PROC. BK: TP 32015 - 532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 52.11.13.9 DATA REF. NO: ______

TEST DESCRIPTION Power Profile - Picture Mode 28V Power Supply 1 Turn On DATE: 5/11/82 TIME: ______



TRACES:

1. P/S 1 current at J18 measure
2. ______
3. ______
4. ______

SYNC: 2amps/10mV

HORIZ. TIME: 50 us/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV: - - DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP ______ DATA REF. NO: ______

TEST DESCRIPTION Power Profile - Picture mode 28V Power Supply 2 Turn ON DATE: 5/11/82 TIME: ______

TRACES

1. P/S 2 current at J18 meas
2. ______
3. ______
4. ______

SYNC: 2amps/10mV

HORIZ. TIME: 50usec/PT

POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV: --

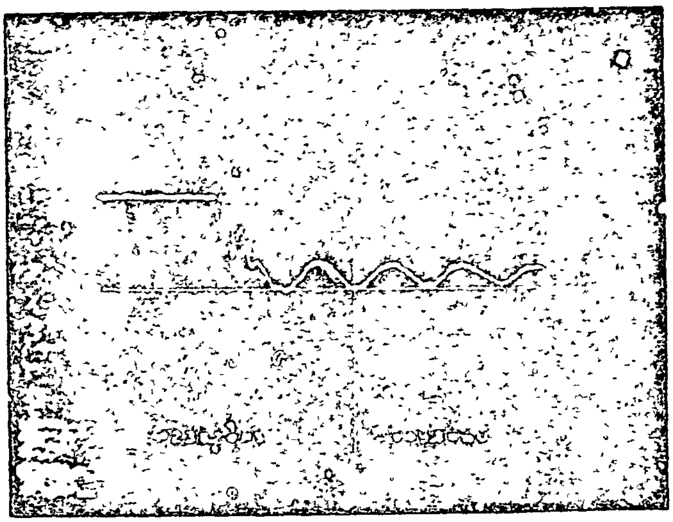
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.13.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile - Picture mode 28V Power Supply 1 Turn OFF

DATE: 5/11/82 TIME:



TRACES:

1. P/S 2 current at J18 wearsaver
2.
3.
4.

SYNC: 2amps/10mV

HORIZ. TIME: 200usec/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK: TP 32015 - 532 REV: --

DATA STORAGE NO

TEST TECHNIQUE: SUB-STEP 5.2.11.13.9

DATA REF. NO:

TEST DESCRIPTION. Power Profile, Picture Mode 28V PS 2 Turn OFF

DATE: 5/11/82 TIME:

TRACES.

1. PS 2 current at J18 Wears
2.
3.
4.

SYNC: 2amps/1cmV

HORIZ. TIME: 200usec/PT

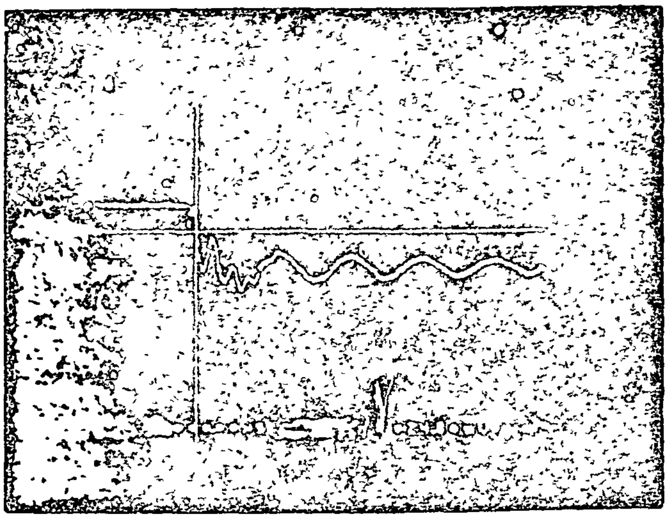
POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: – DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.139 DATA REF. NO:

TEST DESCRIPTION: Power Profile - Picture mode 36V DATE: 5/11/82 TIME:

Power Supply 1 Turn OFF



TRACES:

1. P/S 1 current at J18 wears

2.

3.

4.

SYNC: 2 amps/10mV

HORIZ. TIME. 200 usec/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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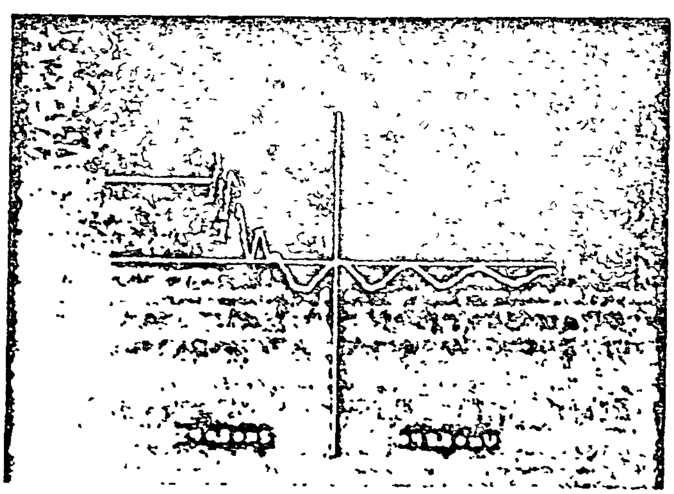
POLAROID PRINT DATA CARD

PROC. BK REV DATA STORAGE NO

TEST TECHNIQUE SUB-STEP DATA REF. NO

TEST DESCRIPTION Power Profile - Picture mode 23V DATE 5/11/82 TIME:

Power Supply 2 Turn Off



TRACES

1. P/S 2 current at J18 wears

2.

3.

4.

SYNC 2 amps/10 mV

HORIZ. TIME 200 us/Pt

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: ______

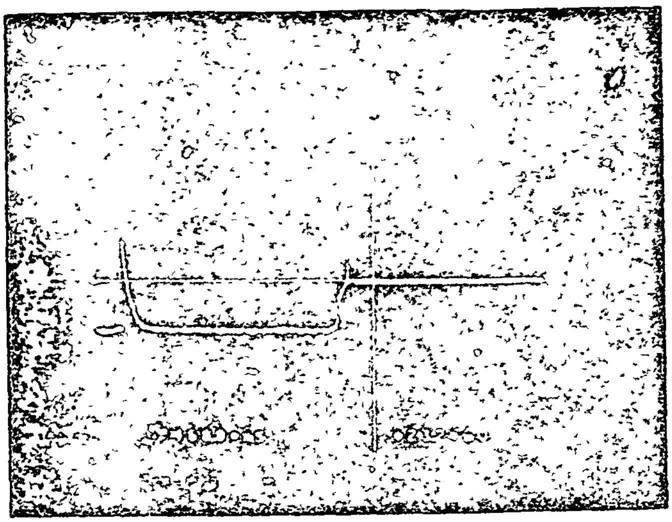
DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.211.124

DATA REF. NO: ______

TEST DESCRIPTION: Power Profile - Internal Stby 35V Power Supply 2 Turn ON

DATE: [illegible] TIME: ______



TRACES:

1. P/S 2 current at J18 [illegible]
2. ______
3. ______
4. ______

~~SYNC:~~ "Inrush" - 1.44A @ 437 msec

~~HORIZ. TIME:~~ Pk - 1.76A @ 420.8 msec

Pk - 2.88A @ .40 msec

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK: ______ REV. ______

DATA STORAGE NO ______

TEST TECHNIQUE ______ SUB-STEP ______

DATA REF. NO ______

TEST DESCRIPTION ______

DATE: ______ TIME: ______

POLAROID PRINT
(STAPLE TO CARD FOR TRANSMITTAL)

TRACES:

1. ______
2. ______
3. ______
4. ______

SYNC ______

HORIZ. TIME ______

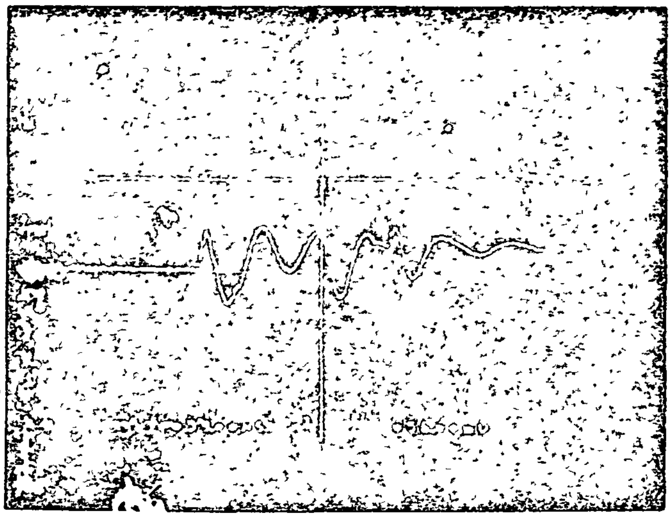
POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP ______ DATA REF. NO: ______

TEST DESCRIPTION: Power Profile 35V Turn ON DATE: 5/11/82 TIME: ______

Power Supply #1 Picture Mode



TRACES:

1. Power Supply ONE current at J18 wear saver
2. ______
3. ______
4. ______

SYNC: INTERNAL

HORIZ. TIME: 100 μ sec PT

2 Amps/10mV

NOTE USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMEN

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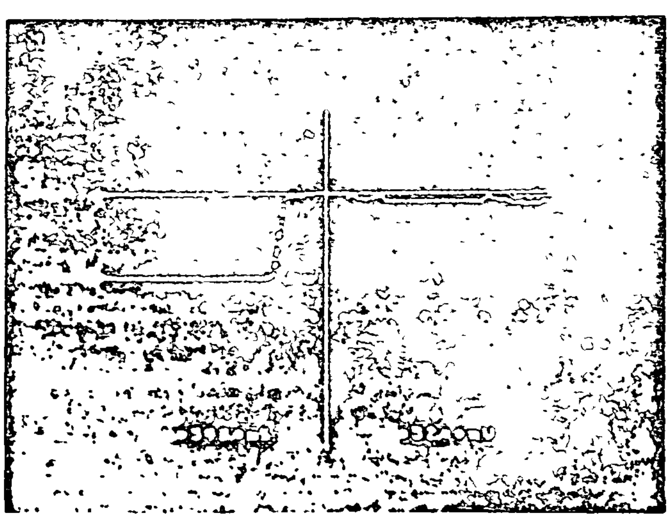
POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV ______ DATA STORAGE NO. ______

TEST TECHNIQUE ______ SUB-STEP ______ DATA REF. NO ______

TEST DESCRIPTION: Power Profile Pic. Mode 35V DATE ______ TIME ______

Power Supply #1 Turn ON



TRACES

1. Power Supply 1 current at J18 wearsaver
2. ______
3. ______
4. ______

SYNC ______

HORIZ. TIME 2ms/PT

2amps/10mV

POLAROID PRINT DATA CARD

PROC. BK: TPS2015 - 532 REV:

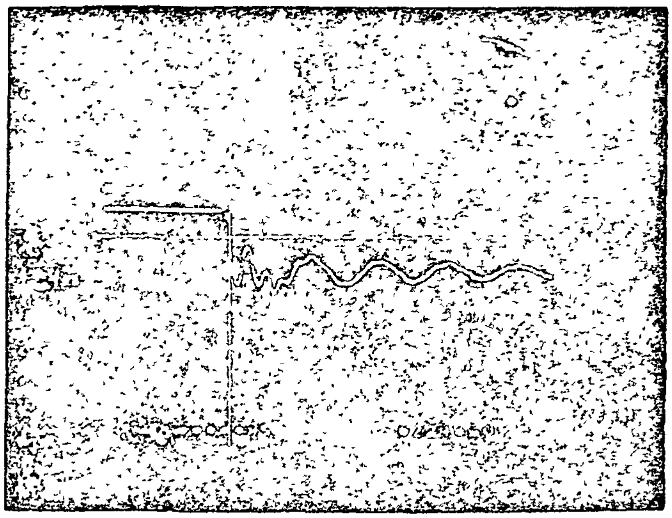
TEST TECHNIQUE: SUB-STEP

TEST DESCRIPTION: Power Profile Pic. Mode 35V Power supply #2 Turn OFF

DATA STORAGE NO:

DATA REF. NO:

DATE: 5/1/82 TIME:



TRACES:

1. Power Supply 2 current at J18 measured.
2.
3.
4.

SYNC:

HORIZ. TIME: 200 Usec / PT

2amps / 10mv

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK. TPS2015 - 532 REV:

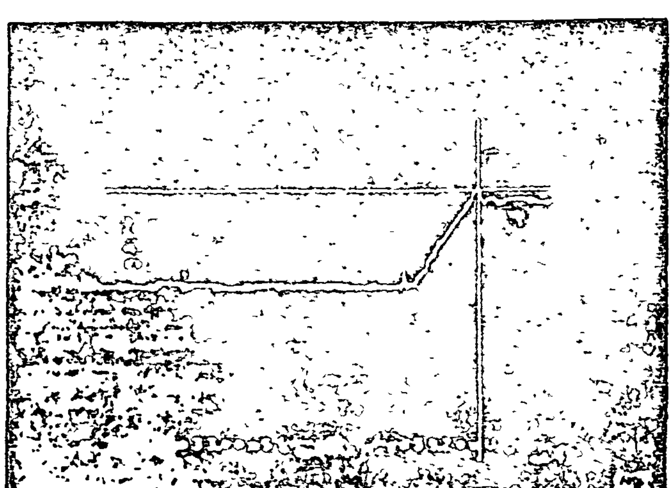
TEST TECHNIQUE. SUB-STEP

TEST DESCRIPTION. Power Profile Pic. Mode 35V Power supply 1 Turn OFF

DATA STORAGE NO:

DATA REF. NO:

DATE: TIME:



TRACES:

1. Power Supply 1 current at J18 measured
2.
3.
4.

SYNC:

HORIZ. TIME: 50 u sec / PT

2AMPS / 10mv

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: - -

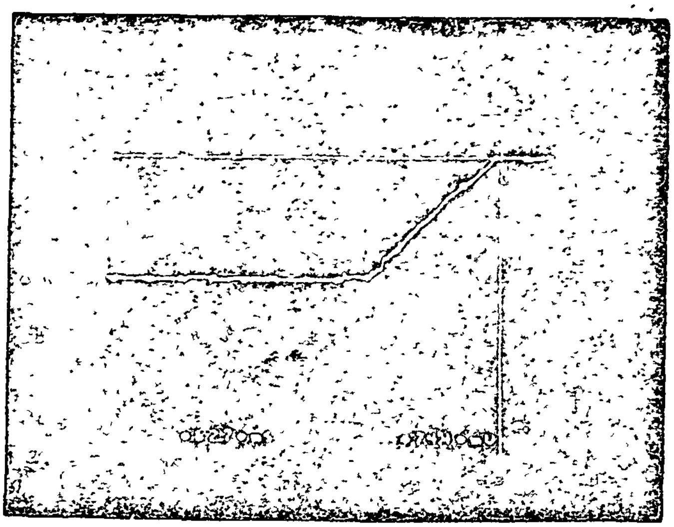
TEST TECHNIQUE: SUB-STEP

TEST DESCRIPTION: Power Profile - Picture Mode - 23V P/S1 Turn ON

DATA STORAGE NO:

DATA REF. NO:

DATE: TIME:



TRACES:

1. P/S 1 current at J18 wears...
2.
3.
4.

SYNC: 2 amps/10 mV

HORIZ. TIME: 500 us/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

0-1007-115

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POLAROID PRINT DATA CARD

PROC. BK. TP32015-532 REV: - -

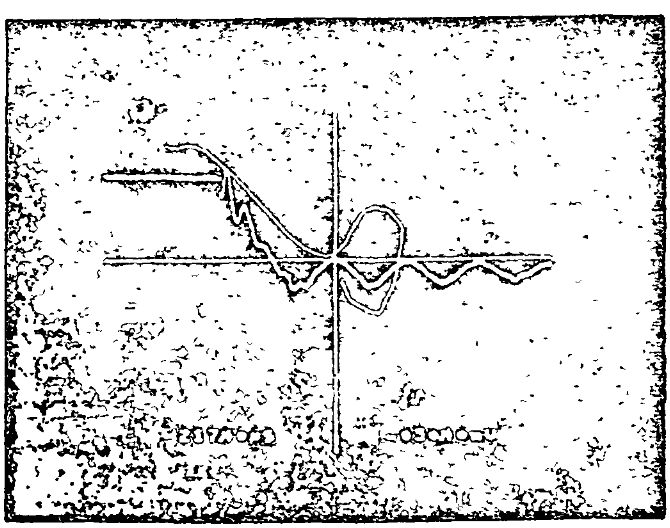
TEST TECHNIQUE: SUB-STEP

TEST DESCRIPTION Power Profile Picture Mode 23V P/S1 Turn OFF

DATA STORAGE NO·

DATA REF. NO.

DATE: TIME:



TRACES:

1. P/S 1 current at J18 wears...
2.
3.
4.

SYNC. 2 amps/10 mV

HORIZ. TIME 200 ms/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV:

DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.11.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile Outage Mode 28V Power Supply #1 Turn ON

DATE: 5/10/82 TIME:

TRACES:

1. Power Supply #2 current at J18 wiresense
2.
3.
4.

~~SYNC~~ 2.08 amps @ 490 msec

~~HORIZ TIME:~~ 3.2 Amps @ 438 ms

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: TP32015 - 532 REV:

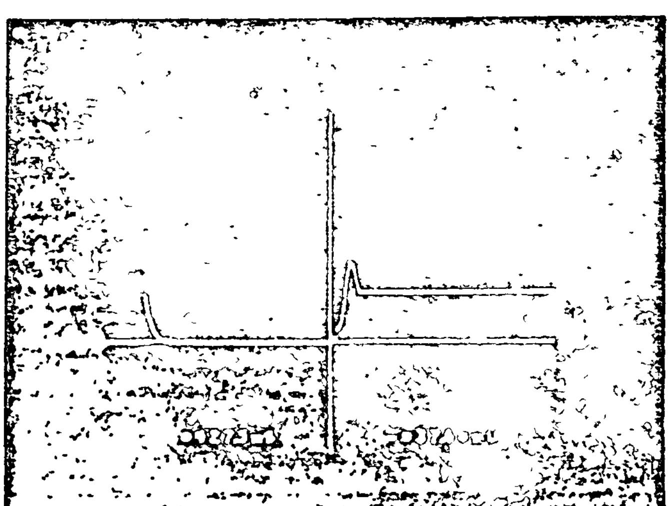
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.11.9

DATA REF. NO:

TEST DESCRIPTION: Power Profile Outage mode 28V Power Supply #1 Turn ON

DATE: 5/10/82 TIME:



TRACES:

1. Power Supply one current at J18 wiresense
2.
3.
4.

~~SYNC~~ Quiescent ≈ 3.0A @ 495 ms

~~HORIZ. TIME~~ PK = 4.72 Amp. @ 473.0

NOTE: USE REVERSE SIDE OF CARD FOR

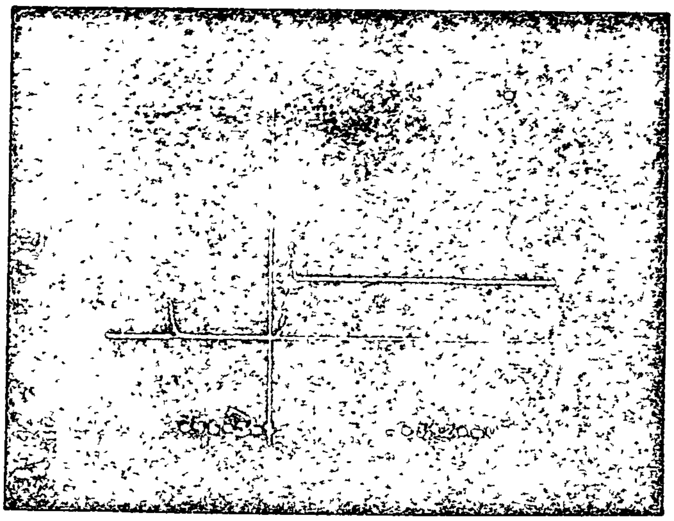
POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.11.9 DATA REF. NO: ______

TEST DESCRIPTION. Power Profile Outgas Mode 23V DATE: 5/10/85 TIME: ______

Power Supply #1 Turn ON



TRACES:

1. Power Supply One current at J18 measured
2. ______
3. ______
4. ______

SYNC: Quiescent = 5.6 Amp @ 58

~~HORIZ. TIME~~: PK = 5.9? Amps @ 55

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

ORIGINAL PAGE IS
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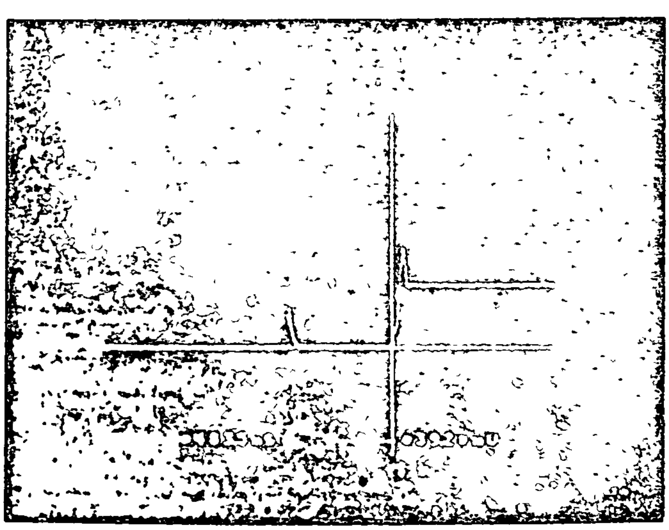
POLAROID PRINT DATA CARD

PROC. BK TP32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE. ______ SUB-STEP 5.2.11.11.9 DATA REF. NO: ______

TEST DESCRIPTION Power Profile Outgas mode 23V DATE: ______ TIME: ______

Power Supply #2 Turn ON



TRACES:

1. Power Supply 2 current at J18 measured
2. ______
3. ______
4. ______

SYNC: Quiescent = 4.0? Amps @ 5

HORIZ. TIME. PK = 6.0? Amps @ 5?

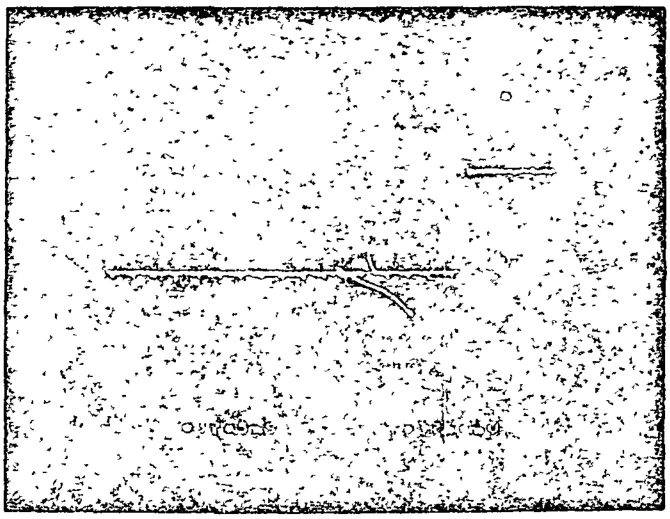
NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.11.9 DATA REF. NO: ______

TEST DESCRIPTION: Power Profile Outgas Mode 35V Power Supply #2 Turn On DATE: 5/1/82 TIME: ______



TRACES:

1. Power Supply 2 current at ~~J18~~ J18 measured.
2. ______
3. ______
4. ______

~~SYNC~~ Quiescent 3.14 Amps @ 540 m[illegible]

~~HORIZ. TIME~~ P/K ~~[illegible]~~ 4.98 Amps @ [illegible]

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

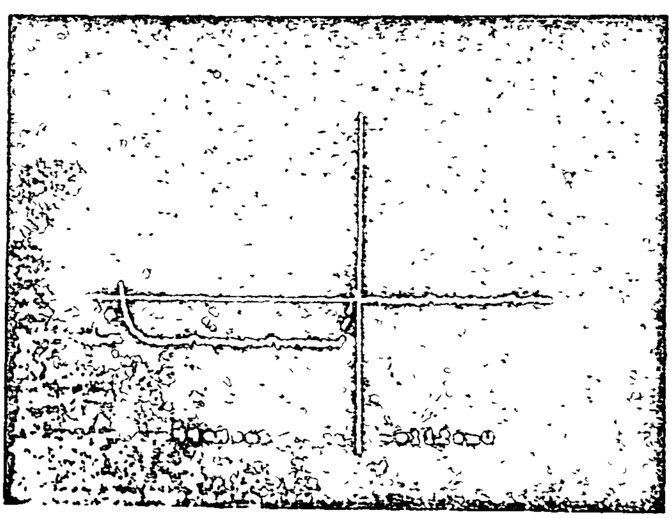
ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.11.9 DATA REF. NO: ______

TEST DESCRIPTION: Power Profile Outgas Mode 35V Power Supply #2 Turn On DATE: 5/1/82 TIME: ______



TRACES:

1. Power Supply 2 current at J18 measured
2. ______
3. ______
4. ______

Quiescent ~~SYNC~~ 2.64 amp @ 440 msec

~~HORIZ. TIME~~ 3.68 Amp @ 408 msec

P/K 3.92 Amp @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR

IA07 (II)

POLAROID PRINT DATA CARD

PROC. BK. P32015 - 532 REV:

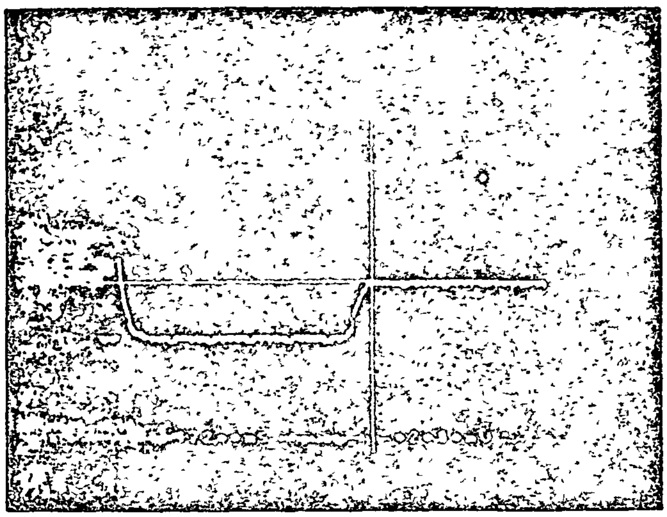
DATA STORAGE NO:

TEST TECHNIQUE: SUB-STEP 5.2.11.12A

DATA REF. NO:

TEST DESCRIPTION: Power Profile - Intern. Stby 28V Power Supply #1 Turn ON

DATE: 5/10/82 TIME:



TRACES:

1. P/S 2 current at J18 wearsaver.
2.
3.
4.

~~SYNC:~~ Quiescent - 1.66A @ 472 ms

HORIZ. ~~TIME:~~ PK = 3.76A @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK. TP 32015 - 532 REV:

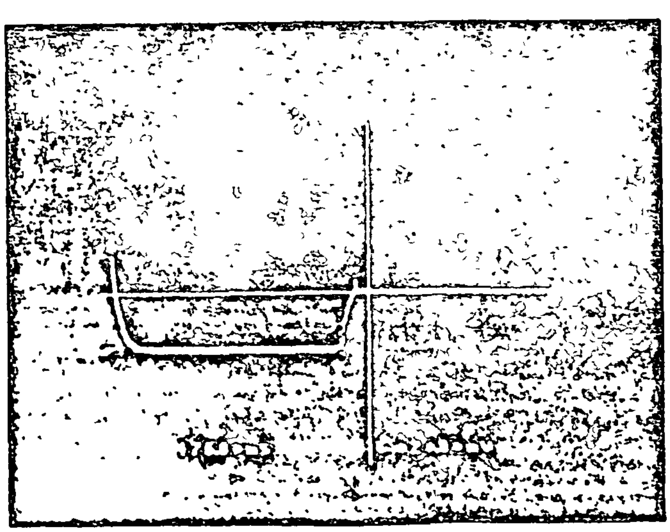
DATA STORAGE NO

TEST TECHNIQUE: SUB-STEP 5.2.11.12.4

DATA REF. NO

TEST DESCRIPTION Power Profile - Intern. Stby 28V Power Supply 2 Turn ON

DATE: 5/10/82 TIME.



TRACES:

1. P/S 2 current at J18 wearsaver.
2.
3.
4.

SYNC Quiescent = 1.76A @ 459 ms

~~HORIZ. TIME~~ PK = 2.0A @ 453 ms

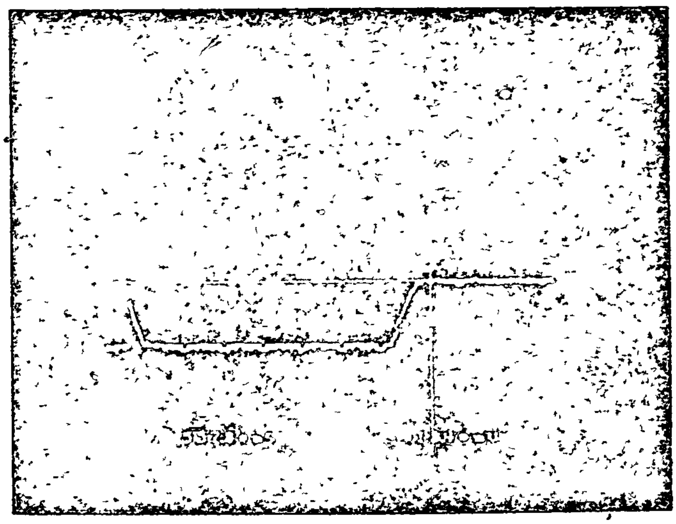
PK = 2.8A @ 0 msec

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.12.4 DATA REF. NO: ______

TEST DESCRIPTION: Power Profile Intern. Stby 23V Power Supply #1 Turn ON DATE: 5/10/82 TIME: ______



TRACES:

1. Power Supply 1 current. J18 measure
2. ______
3. ______
4. ______

~~SYNC:~~ Quiescent 1.994 @ 530 msec

~~HORIZ. TIME:~~ Pk .208 amp @ .535

Pk - 1.3 A @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMEN

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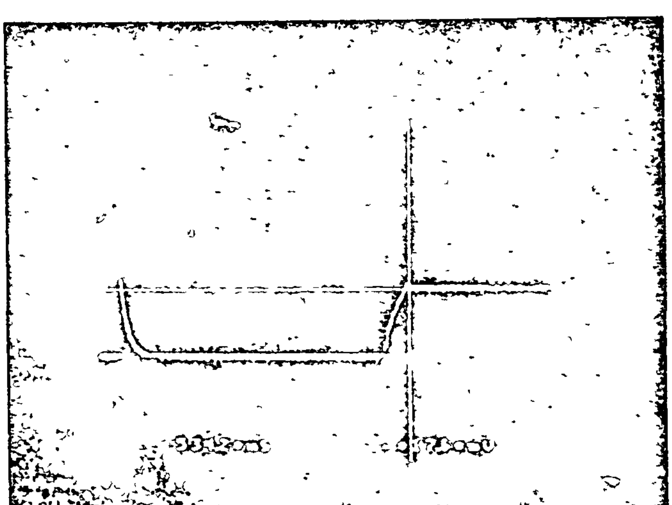
POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: ______ DATA STORAGE NO: ______

TEST TECHNIQUE: ______ SUB-STEP 5.2.11.12.4 DATA REF. NO: ______

TEST DESCRIPTION: Power Profile Intern. Stby 23V Power Supply #2 Turn ON DATE: 5/10/82 TIME: ______



TRACES:

1. P/S 2 current at J18 measure
2. ______
3. ______
4. ______

~~SYNC:~~ Quiescent 2.0 amp @ 557 msec

~~HORIZ. TIME~~ Pk - 2.16 amp @ 52

Pk = 2.40 Amp @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMME

APPENDIX E

VIDEO TEST REPORT

SUMMARY:

A test was conducted on the Thematic Mapper Flight model on 13, 14 April 82 to verify that the video output of onboard calibrator data is functionally correct. This memo presents the test results. In summary:

1. Data was displayed on the video display. This, in itself, demonstrates that the system achieves bit sync, frame sync and scan line sync.

2. The line length was proper.

3. The onboard calibrator properly cycled through eight levels.

4. Channels of some bands saturate when all three calibration lamps are powered.

LINE STOP/LINE LENGTH CODE.

When line stop occurs, the Thematic Mapper is to replace the video data from each of bands 1, 2, 3, 4, 5 and 7 with level zero (black) data for 48 words. Following these 48 words, the Thematic Mapper is to replace video data with level 255 (white) data for 48 words. This is to be followed by a repetition of the 48 words of black and a repetition of the 48 words of white At the conclusion of this line stop pattern, the Thematic Mapper is to encode video data normally until the next minor frame sync, after which the line length code and scan direction are to be sent

The data recorded at the end of reverse scan were as follows:

MINOR FRAME	WORD 6 LEVEL (B 1 SENSOR 1)	WORD 97 LEVEL (B 2 SENSOR 16)	COMMENT
6317	6	1	
6318	5	0	Video/Line Stop
6319	0	0	Line stop
6320	0	2	Line stop/Video
6321	255	0	Line length code
6322	255	255	Line length code/ scan direction
6323	6	2	Video

The data indicated proper Thematic Mapper operation. Line stop began in frame 6318 (6319 is normal). The black/white/black/white pattern ended two frames later and normal video data were inserted until the start of the next frame. In the next frame line length code and scan direction were transmitted. A logic 1 correctly indicates a forward scan (forward scan length data are transmitted after the next reverse scan).

The data recorded at the end of a forward scan were as follows:

MINOR FRAME	WORD 6 LEVEL (B 1 SENSOR 1)	WORD 97 LEVEL (B 2 SENSOR 16)	COMMENT
6319	6	2	Video
6320	4	255	Video/line stop began
6321	255	255	Line stop
6322	255	1	Line stop/video
6323	255	255	Line length code
6324	2	2	Line length code/scan direction

The data indicate proper Thematic Mapper operation.

ON BOARD CALIBRATOR:

The on board calibrator cycled through eight radiance levels in the proper sequence However, the data (given in Table 1) show some channels saturate when all three lamps are powered.

The time to complete a calibration cycle of eight steps was properly 160 forward scans.

TABLE I
FLIGHT ONBOARD CALIBRATOR DATA
13 APRIL 1981

[illegible] STEP	SPECIFIED RADIANCE % FULL SCALE	LEVELS	BAND 1 FWD LEVELS	SEN 1 REVERSE LEVELS	BAND 2 FWD LEVELS	SEN 3 REVERSE LEVELS	BAND 3 FWD LEVELS	SEN 14 REVERSE LEVELS	BAND 5 FWD LEVELS	SEN 1 REVERSE LEVELS	BAND 7 FWD LEVELS	SEN 16 REVERSE LEVELS
		[illegible]	2	2	2	2	2	[illegible]	2	2	2	[illegible]
	[illegible]	132	115	120	122	125	55	58	[illegible]	46	91	91
	[illegible]	179	198	206	214	220	101	104	92	92	132	132
[illegible]	[illegible]	76	94	96	97	101	49	49	50	50	67	67
[illegible]	[illegible]	129	153	156	159	171	88	89	80	80	104	104
[illegible]	[illegible]	230	250	247	255	255	141	144	120	129	197	197
[illegible]	[illegible]	153	164	167	192	195	95	97	73	73	124	124
8	20	51	67	66	74	75	45	42	33	33	41	41

NOTE Cold focal plane temperature was [illegible] deg C
Bands 5 and 7 readings are [illegible]
[illegible] gives the average [illegible]
Reverse scans

APPENDIX H

FLIGHT MODEL SCAN LINE CORRECTOR (Ref. HS236-7959)

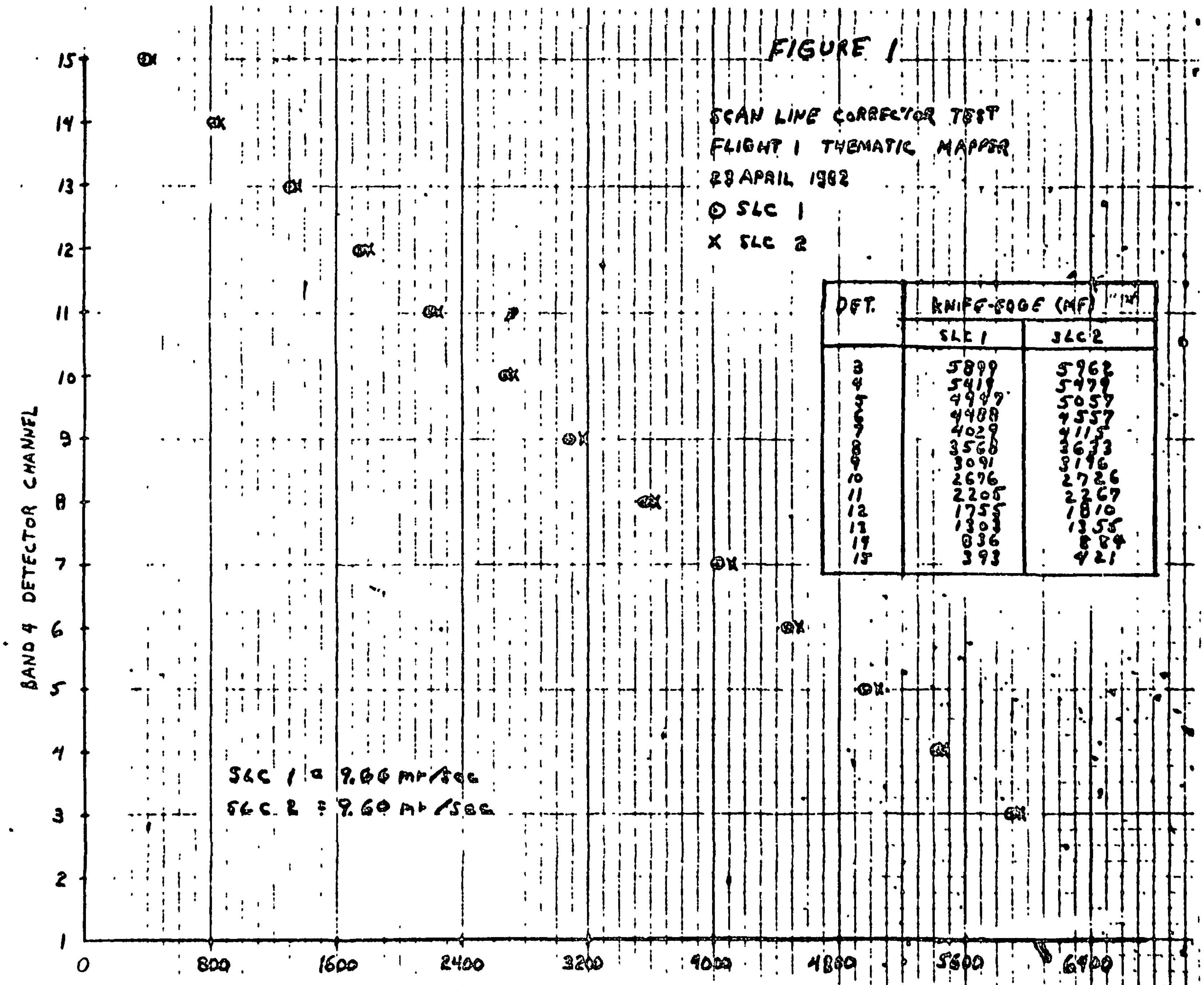
Summary:

The scan line corrector in the Flight Model Thematic Mapper scans in the proper direction at the proper rate.

Discussion:

A knife-edge was scanned by the scan line corrector (SLC) with the scan mirror locked. The location of the knife- edge on the detectors of Band 4 was obtained from the video display. Both scan line corrector drives were tested.

The data are presented in the attached Figure 1. The SLC properly scanned in the "detector 16 to detector 1" direction. Assuming a nominal detector size (42.5 micro-rad) and a nominal minor frametime (9.611 micro-sec), the SLC rate is 9.66 milliradians/second with drive 1 and 9.60 milliradians/ second with drive 2. Both rates are within 0.5 percent of nominal (9.610 milliradians/second).



DET.	KNIFE-EDGE (MF)	
	SLC 1	SLC 2
3	5899	5962
4	5419	5479
5	4949	5057
6	4488	4557
7	4029	4115
8	3568	3633
9	3091	3196
10	2676	2726
11	2205	2267
12	1755	1810
13	1303	1355
14	836	884
15	393	421

3.2.6 AC02 TEST

Radiometric Calibration of Calibrator

Test Summary: HS236-8101 J. Lansing, J. Walker

Test Specification: TP32015-512 Gain Setting, Radiometric Calibration Bands 1 through 5 and 7, and OBC Calibration Test Procedure

Reference Documentation: None

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SANTA BARBARA RESEARCH CENTER
A Subsidiary of Hughes Aircraft Company
INTERNAL MEMORANDUM

TO: J. Engel CC: J. Barker (GSFC) DATE: 8-9-82
O. Weinstein REF: SED 166
HS236-8101
SUBJECT: TM AC02R Test Result Summary, FROM: J. Lansing
J. Walker
Flight 1 Model BLDG: B11 MS: 40
EXT: 6261

References:

1. TP32015-512 Rev. C , Gain Setting, Radiometric Calibration Bands 1 through 5 and 7, and OBC Calibration Test Procedure AC02R.

2. [322,5]A02Ai.VID (Jun 21 through Jun 29, 82) Gain setting video files. Note: i is the radiance level counter, i = 1, ..., 13.

3. [322,5]A02DjjLk.VID (July 13 82) Radiometric calibration, sequence 1, video files. Note: jj = 01,....,12. (Radiance level counter) k = 1 (temperature counter).

4. [322,5]A02EnLk.VID (July 13, 82) Radimetric calibration, sequence 2, video files. Note: n = 1,....,8 (Radiance level counter). k = 1 (temperature counter).

5. [322,5]A02SF.VID (July 13, 82) Internal calibrator calibration-normal mode-video files. Note: m = 1,....8 (Radiance level counter).

6. [322,5]A02BFm.VID (July 13, 82) Internal calibrator calibration-override/backup mode-video files. Note: m = 1,...,8 (Radiance level counter).

7. [322,5]INDEXA1.IVF, [322,5]INDEXA1.RED, and [3222,5]INDEXA1.RPT (June 21 through June 22, 82) First iteration gain setting intermediate value files and reduced value files, respectively.

8. [322,5]INDEXA2.IVF, [322,5]INDEXA2.RED, and [322,5]INDEXA2.RPT (June 22 through June 23, 82) Second iteration gain setting intermediate value files and reduced value files, respectively.

9. [322,5]INDEXA3.IVF, [322,5]INDEXA3.RED, and [322,5]INDEXA3.RPT (June 28 through June 29, 82) Third iteration gain setting intermediate value files and reduced value files, respectively.

10. [322,5]INDEXDk.IVF and [322,5]INDEXA2.RED, and [322,5]INDEXD4.RPT (july 13, 82) Radiometric calibration intermediate value files and reduced value files, respectively. Note: k = (temperature counter).

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11. [322,1]ACO2ALOG.LOG,[322,1] TLMLOG.LOG (for D & E collects)

12. [322,1]ACO2SFLOG.LOG. Telemetry Log for the respective data collects (June 21 through July 14, 82)

13. [322,5]INDEXSF.IVF and [322,5]INDEXSF.RED, (July 13, 82) Internal calibrator calibration intermediate value files and reduced value files, respectively.

14. [322,5]INDESF.IVF and [322,5]INDEXF.RED (July 13, 82) Backup mode OBC Calibration.

15. [322,5]INDEXQ.IVF and [322,5]INDEXQ.RED, (july 13, 82) Signal to noise ratio (SNR) intermediate value files and reduced value files, respectively.

16. [324,1]DIRECTORY.DIR; 23 Master Directory of data bases.

17. History Tapes: D03036, D03037, D03040, D03042, D03044, D03045, AND D03046 (June 21 through July 14, 82).

18. BTCE # 2 EVENT LOG for period June 21, through July 14, 1982.

19. T.M.F1 System Test Log, Book 1, pages 39 through 48.

20. T.M. System Test Log, Flight 1 Model, Book 2 & 3, dated June 21 through July 14, 1982.

21. [324,1]GSM.DAB;XX, Data base parameters (June 21 through July 14, 82)

22. [324,1]GSMLISDB.DAT; 26 and [324,1]GSMRTMDB.DAT; 24 data base values for 48 SIS spectral radiance values and TM relative response values.

23. GSFC Specification 400.8-D-210 Rev. B, April 1978

Table 1 shows the gains and offsets from the 48" sphere calibration of the TM Flight 1 model (except band 6) after final adjustment of select resistors. The data was collected 14 July 1982 at 02:07. The gain and offset are slope and intercept of the least squares line fitted to the set of average MUX counts vs sphere spectral radiance data for each channel. The graphs of the data are attached. The units on the graphs are MUX counts and in-band radiance. In-band radiance units are used to allow direct comparison with reference 1, and were obtained by multiplying the spectral radiances by the nominal spectral bandwidths.

Uniformity of gain setting within each band is shown in Table 2. the spread is the percent difference between the maximum and minimum gain channels.

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Table 1 TM F1 gains in MUX counts per spectral radiance units (cts/(mW/cm^2-sr-μm)) and offsets (cts).

GAIN

CH	BAND 1	BAND 2	BAND 3	BAND 4	BAND 5	BAND 7
1	16.9030	8.3053	10.6527	11.1396	79.0780	145.6091
2	16.8413	8.2656	10.7767	11.0083	78.1966	144.4557
3	17.0490	8.2579	10.6681	11.0098	78.6530	145.6574
4	16.8054	8.249[illegible]	10.7365	10.9506	78.2746	145.0960
5	17.1129	8.2656	10.6365	11.0603	78.7238	145.6919
6	16.7751	8.2322	10.5981	11.2759	78.7010	144.5236
7	17.0214	8.2507	10.5133	11.0399	78.1153	146.0927
8	16.8433	8.3392	10.6861	11.1361	79.5489	145.6729
9	16.6933	8.2780	10.5536	10.9428	78.7212	145.6115
10	16.9536	8.2827	10.6729	11.1728	79.3475	145.3598
11	16.9942	8.3066	10.5569	11.0568	79.3291	146.7156
12	16.9547	8.3432	10.7194	11.0446	79.2211	146.0823
13	16.9055	8.2883	10.6060	11.0371	78.7607	144.7390
14	16.7687	8.2516	10.7238	11.0648	78.3371	145.9730
15	16.8875	8.3299	10.6687	11.0200	78.7365	145.8595
16	16.9234	8.2013	10.7589	11.1118	79.0292	145.4371

OFFSET

CH	BAND 1	BAND 2	BAND 3	BAND 4	BAND 5	BAND 7
1	2.3611	2.3642	2.5291	2.7296	3.2741	3.7249
2	1.9696	1.7276	2.0640	1.9443	3.0327	3.0994
3	1.8903	1.9534	2.0706	2.3745	2.9877	3.1522
4	1.8663	1.7034	1.8335	1.9773	3.0701	3.1319
5	1.7870	1.6286	2.0013	2.0315	2.9358	3.0771
6	1.9857	1.9431	1.8939	2.2553	3.0896	3.1341
7	1.7765	1.6620	2.0094	2.6539	2.9341	3.0318
8	2.0248	1.8121	1.9625	2.1356	3.2646	3.1544
9	1.6703	1.8053	2.1497	2.2266	3.0019	2.9691
10	1.7897	1.7908	1.9559	1.9655	3.2023	3.0615
11	1.5947	1.9276	2.0539	2.3155	2.9620	3.0575
12	1.7278	1.7046	1.9210	1.9610	3.0430	2.9621
13	1.7458	1.7081	1.9415	2.0231	2.9406	2.8572
14	1.9115	1.7411	1.9533	2.1192	3.1673	3.1948
15	1.5611	1.7416	1.9716	2.1018	2.9183	2.9619
16	1.8567	1.6448	1.9773	2.0190	3.1127	3.1552

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Table 2 Maximum spread of channel gains

Band	1	2	3	4	5	7
% Spread	2.1	1.7	2.5	2.1	1.8	1.6

The same data is used to derive signal, noise, and signal-to-noise ratio at the two in-band radiance levels for each band from reference 1: the radiometric sensitivity level ("low") and the minimum saturation level ("high"). See Table 3. The noise is obtained by first taking the standard deviation of each set of MUX counts collected at a sphere radiance level. Then a least squares line is fitted to the standard deviations plotted against radiance, just as was done with the average counts (described above). These graphs are also attached to this memorandum. Finally, noise at the two specified levels is taken from the line.

The signal values are taken from the signal lines similarly.

A value of 243 for high signal represents a 5% margin from saturation, and is the maximum desired in gain setting. Some channels exceed this, but the worst case still shows 3.5% margin, under the temperature conditions of this test.

The signal-to-noise ratios show good margin. Noise noticeably above the band average appears in band 5, channels 7 and 10. Channel 10 has shown higher noise since the first cold focal plane assembly tests, but appears to be stable. The channel 7 noise excess is predominantly coherent noise at 9 kHz, which is the difference between power supply frequency and MUX sampling rate. Full band test imagery has been produced and coherent noise is not detectable, so the noise excess which was measured is not a problem

The on board calibrator calibration is done by averaging counts for each detector, each lamp combination, and using the gains and offsets of Table 1 to convert the counts to apparent spectral radiance for each case. The results for the sequencing mode are shown in Table 4. The data was collected 13 July at 22:25.

J. Lansing

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SIGNAL TO NOISE RATIO

BAND/CHANNEL	CALCULATED VALUES LOW	CALCULATED VALUES HIGH	SPEC VALUES LOW	SPEC VALUES HIGH	CHANNELS OUT OF SPEC LOW	CHANNELS OUT OF SPEC HIGH
1/ 1	59.811	142.656	32	85		
1/ 2	59.416	145.642	32	85		
1/ 3	59.921	142.817	32	85		
1/ 4	54.690	133.302	32	85		
1/ 5	64.523	143.339	32	85		
1/ 6	59.767	142.827	32	85		
1/ 7	65.210	151.104	32	85		
1/ 8	56.546	136.217	32	85		
1/ 9	63.300	148.984	32	85		
1/10	61.641	147.096	32	85		
1/11	61.175	144.124	32	85		
1/12	59.707	143.461	32	85		
1/13	62.324	147.681	32	85		
1/14	54.987	135.423	32	85		
1/15	63.672	147.011	32	85		
1/16	50.408	138.903	32	85		
2/ 1	48.274	230.109	35	170		
2/ 2	48.381	258.185	35	170		
2/ 3	54.217	245.625	35	170		
2/ 4	57.023	261.509	35	170		
2/ 5	55.632	240.866	35	170		
2/ 6	71.010	267.260	35	170		
2/ 7	56.426	241.585	35	170		
2/ 8	68.784	226.299	35	170		
2/ 9	58.919	243.915	35	170		
2/10	74.555	249.639	35	170		
2/11	62.196	223.926	35	170		
2/12	76.375	218.234	35	170		
2/13	54.699	212.340	35	170		
2/14	62.422	239.335	35	170		
2/15	38.375	203.709	35	170		
2/16	48.621	194.784	35	170		
3/ 1	43.126	213.808	26	143		
3/ 2	49.299	239.205	26	143		
3/ 3	42.401	201.831	26	143		
3/ 4	43.235	212.961	26	143		
3/ 5	43.699	203.180	26	143		
3/ 6	45.108	213.653	26	143		
3/ 7	45.124	230.690	26	143		
3/ 8	52.015	215.031	26	143		
3/ 9	41.090	208.138	26	143		
3/10	49.029	212.120	26	143		
3/11	47.833	221.933	26	143		
3/12	48.449	210.429	26	143		
3/13	44.723	205.893	26	143		
3/14	51.027	221.417	26	143		
[illegible]	[illegible]	201.215	26	143		

Table 3 TM F1 Signal-to-Noise ratio, signal (cts), and noise (cts) at two radiance levels

BAND/CHANNEL	SIGNAL CALCULATED VALUES LOW	SIGNAL CALCULATED VALUES HIGH	NOISE CALCULATED VALUES LOW	NOISE CALCULATED VALUES HIGH
1/ 1	69.992	243.777	1.170	1.709
1/ 2	69.354	242.501	1.167	1.665
1/ 3	70.108	245.360	1.170	1.718
1/ 4	69.113	241.874	1.264	1.814
1/ 5	70.259	246.197	1.089	1.718
1/ 6	69.107	241.567	1.156	1.691
1/ 7	69.881	244.882	1.072	1.621
1/ 8	69.421	242.575	1.228	1.781
1/ 9	69.262	242.945	1.094	1.631
1/10	69.626	243.920	1.130	1.658
1/11	69.591	244.310	1.138	1.695
1/12	69.569	243.071	1.164	1.709
1/13	69.386	243.199	1.113	1.647
1/14	69.006	241.403	1.255	1.783
1/15	69.230	242.851	1.087	1.652
1/16	69.570	243.859	1.191	1.753
2/ 1	27.299	244.229	0.566	1.061
2/ 2	26.548	242.430	0.549	0.939
2/ 3	26.740	242.445	0.493	0.987
2/ 4	26.484	241.937	0.464	0.925
2/ 5	26.463	242.318	0.476	1.006
2/ 6	26.645	241.700	0.375	0.904
2/ 7	26.447	241.812	0.409	1.001
2/ 8	26.843	244.671	0.390	1.081
2/ 9	26.513	241.415	0.450	0.990
2/10	26.655	243.001	0.358	0.973
2/11	26.864	243.836	0.432	1.009
2/12	26.759	244.666	0.350	1.110
2/13	26.604	243.062	0.486	1.145
2/14	26.522	242.032	0.425	1.011
2/15	26.753	244.320	0.458	1.199
2/16	26.283	240.461	0.541	1.234
3/ 1	25.649	242.185	0.596	1.133
3/ 2	25.431	244.528	0.516	1.022
3/ 3	25.222	242.073	0.595	1.199
3/ 4	25.132	243.377	0.581	1.143
3/ 5	25.075	241.302	0.574	1.188
3/ 6	24.807	240.328	0.552	1.125
3/ 7	24.815	238.538	0.650	0.999
3/ 8	25.145	242.378	0.483	1.127
3/ 9	25.040	239.589	0.609	1.151
3/10	25.104	242.078	0.512	1.141
3/11	24.950	239.567	0.522	1.079
3/12	25.174	243.088	0.520	1.156
3/13	24.944	240.559	0.568	1.169
3/14	25.215	243.219	0.494	1.090
3/15	25.111	242.001	0.537	1.203
3/16	25.321	244.028	0.539	1.099

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SIGNAL TO NOISE RATIO

BAND/ CHANNEL	CALCULATED VALUES		SPEC VALUES		CHANNELS OUT OF SPEC	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
4/ 1	45.089	350.771	32	240		
4/ 2	45.858	292.800	32	240		
4/ 3	42.364	280.562	32	240		
4/ 4	59.749	278.666	32	240		
4/ 5	52.865	277.687	32	240		
4/ 6	47.231	307.187	32	240		
4/ 7	41.741	279.422	32	240		
4/ 8	41.271	321.024	32	240		
4/ 9	51.735	321.058	32	240		
4/10	38.515	345.690	32	240		
4/11	41.754	287.109	32	240		
4/12	50.702	284.002	32	240		
4/13	50.761	277.865	32	240		
4/14	44.107	291.752	32	240		
4/15	47.485	270.749	32	240		
4/16	39.076	304.905	32	240		
5/ 1	39.183	189.483	13	75		
5/ 2	39.962	187.925	13	75		
5/ 3	35.344	171.395	13	75		
5/ 4	35.071	171.119	13	75		
5/ 5	37.005	170.453	13	75		
5/ 6	38.772	181.017	13	75		
5/ 7	25.381	143.860	13	75		
5/ 8	37.021	180.969	13	75		
5/ 9	36.224	173.279	13	75		
5/10	28.854	163.497	13	75		
5/11	38.541	188.094	13	75		
5/12	33.001	169.719	13	75		
5/13	35.900	172.849	13	75		
5/14	37.027	182.058	13	75		
5/15	37.313	178.886	13	75		
5/16	38.308	182.679	13	75		
7/ 1	31.240	182.865	5	45		
7/ 2	28.356	181.367	5	45		
7/ 3	29.813	182.927	5	45		
7/ 4	28.533	181.121	5	45		
7/ 5	31.670	189.415	5	45		
7/ 6	27.624	177.119	5	45		
7/ 7	29.788	178.736	5	45		
7/ 8	25.136	170.458	5	45		
7/ 9	28.040	181.500	5	45		
7/10	25.834	171.397	5	45		
7/11	27.755	179.790	5	45		
7/12	25.318	174.796	5	45		
7/13	29.812	189.124	5	45		
7/14	26.129	174.330	5	45		
7/15	29.418	185.068	5	45		
7/16	27.646	189.337	5	45		

Table 3 TM F1 Signal-to-Noise ratio, signal (cts), and noise (cts) at two radiance levels. (Cont.)

BAND/ CHANNEL	SIGNAL CALCULATED VALUES		NOISE CALCULATED VALUES	
	LOW	HIGH	LOW	HIGH
4/ 1	17.877	241.408	0.396	0.680
4/ 2	17.014	239.531	0.371	0.818
4/ 3	17.289	238.324	0.408	0.849
4/ 4	16.848	236.624	0.287	0.849
4/ 5	17.039	239.039	0.322	0.861
4/ 6	17.521	243.913	0.371	0.794
4/ 7	17.545	239.305	0.420	0.869
4/ 8	17.240	240.774	0.418	0.748
4/ 9	17.080	236.729	0.330	0.737
4/10	17.145	241.366	0.445	0.698
4/11	17.295	239.269	0.414	0.833
4/12	16.968	238.615	0.333	0.840
4/13	17.008	238.528	0.335	0.859
4/14	17.140	239.216	0.389	0.820
4/15	17.060	238.242	0.359	0.855
4/16	17.140	240.090	0.439	0.787
5/ 1	34.714	240.635	0.896	1.270
5/ 2	34.096	237.787	0.853	1.265
5/ 3	34.274	239.080	0.970	1.395
5/ 4	34.154	238.067	0.975	1.391
5/ 5	34.229	239.258	0.925	1.341
5/ 6	34.338	239.370	0.886	1.322
5/ 7	33.992	237.424	1.339	1.654
5/ 8	34.851	242.090	0.921	1.284
5/ 9	34.290	239.318	0.947	1.381
5/10	34.701	241.428	1.203	1.477
5/11	34.499	241.098	0.895	1.287
5/12	34.509	240.876	1.046	1.419
5/13	34.253	239.369	0.954	1.386
5/14	34.273	238.353	0.926	1.309
5/15	34.212	239.281	0.917	1.338
5/16	34.486	240.382	0.900	1.316
7/ 1	28.159	235.394	0.908	1.287
7/ 2	27.541	232.932	0.971	1.284
7/ 3	27.818	234.879	0.933	1.284
7/ 4	27.675	233.971	0.970	1.292
7/ 5	27.900	236.464	0.881	1.249
7/ 6	27.589	233.073	0.999	1.316
7/ 7	27.756	235.463	0.932	1.317
7/ 8	27.813	234.914	1.093	1.378
7/ 9	27.623	234.626	0.985	1.293
7/10	27.669	234.321	1.071	1.367
7/11	27.093	236.475	1.005	1.319
7/12	27.690	235.372	1.094	1.347
7/13	27.375	233.116	0.918	1.733
7/14	27.894	235.440	1.068	1.351
7/15	27.653	235.018	0.940	1.270
7/16	27.763	234.548	1.004	1.239

Table 4 TM F1 OBC calibration, sequencing mode, mW/cm²-sr

DATA COLLECTED AT: 7/13/82 22:25:23
DATA REDUCED AT: 21-JUL-82 11:22:16

CALIBRATION

AC02 OBCS

CH	BAND 1	BAND 2	BAND 3	BAND 4	BAND 5	BAND 7
RADIANCE LEVEL 1						
1	0.444	0.918	0.526	1.056	0.077	0.112
2	0.446	0.890	0.473	0.864	0.082	0.111
3	0.441	0.919	0.528	1.056	0.075	0.110
4	0.453	0.889	0.474	0.867	0.081	0.109
5	0.442	0.917	0.530	1.051	0.074	0.110
6	0.452	0.897	0.472	0.845	0.081	0.109
7	0.438	0.921	0.530	1.052	0.074	0.110
8	0.451	0.889	0.470	0.866	0.080	0.109
9	0.439	0.920	0.528	1.062	0.074	0.109
10	0.452	0.889	0.471	0.860	0.080	0.108
11	0.444	0.917	0.528	1.057	0.074	0.108
12	0.448	0.892	0.472	[illegible]	0.080	[illegible]
13	0.441	0.922	0.529	1.061	0.074	0.109
14	0.448	0.887	0.472	0.867	0.080	0.108
15	0.449	0.917	0.527	1.058	0.078	0.109
16	0.444	0.890	0.474	0.865	0.082	0.110
RADIANCE LEVEL 2						
1	0.795	1.639	0.918	1.963	0.147	0.187
2	0.764	1.477	0.861	1.719	0.153	0.184
3	0.788	1.640	0.924	1.943	0.143	0.184
4	0.774	1.488	0.864	1.730	0.151	0.182
5	0.789	1.638	0.928	1.951	0.142	0.184
6	0.776	1.499	0.860	1.682	0.151	0.182
7	0.780	1.643	0.925	1.951	0.141	0.183
8	0.773	1.486	0.856	1.727	0.150	0.181
9	0.783	1.640	0.923	1.955	0.141	0.182
10	0.772	1.486	0.859	1.712	0.150	0.180
11	0.795	1.637	0.923	1.945	0.141	0.181
12	0.767	1.496	0.860	1.726	0.149	0.180
13	0.789	1.650	0.925	1.950	0.141	0.180
14	0.768	1.483	0.859	1.727	0.150	0.180
15	0.804	1.642	0.922	1.944	0.143	0.181
16	0.762	1.493	0.866	1.724	0.152	0.182

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RADIANCE LEVEL 3

1	0.358	0.734	0.398	0.912	0.077	0.075
2	0.323	0.605	0.395	0.882	0.075	0.073
3	0.355	0.735	0.400	0.914	0.075	0.074
4	0.327	0.613	0.395	0.882	0.073	0.072
5	0.355	0.732	0.402	0.920	0.074	0.074
6	0.326	0.617	0.394	0.862	0.074	0.072
7	0.350	0.734	0.402	0.920	0.074	0.074
8	0.325	0.611	0.392	0.884	0.073	0.072
9	0.352	0.733	0.401	0.920	0.074	0.073
10	0.326	0.611	0.393	0.878	0.073	0.071
11	0.356	0.731	0.400	0.916	0.074	0.072
12	0.323	0.614	0.394	0.884	0.073	0.071
13	0.355	0.735	0.401	0.919	0.074	0.072
14	0.323	0.609	0.394	0.886	0.073	0.071
15	0.360	0.732	0.400	0.916	0.075	0.073
16	0.320	0.609	0.396	0.883	0.075	0.072

RADIANCE LEVEL 4

1	0.614	1.274	0.733	1.471	0.121	0.122
2	0.544	1.058	0.731	1.471	0.118	0.131
3	0.611	1.276	0.736	1.474	0.118	0.119
4	0.552	1.071	0.732	1.471	0.116	0.130
5	0.610	1.273	0.741	1.483	0.117	0.120
6	0.551	1.078	0.729	1.461	0.117	0.129
7	0.602	1.278	0.740	1.485	0.116	0.119
8	0.549	1.067	0.726	1.477	0.116	0.129
9	0.606	1.276	0.739	1.489	0.116	0.118
10	0.550	1.069	0.729	1.463	0.116	0.129
11	0.613	1.272	0.738	1.481	0.116	0.117
12	0.546	1.072	0.730	1.476	0.116	0.128
13	0.610	1.290	0.741	1.485	0.117	0.117
14	0.545	1.066	0.730	1.476	0.116	0.128
15	0.620	1.274	0.738	1.482	0.118	0.118
16	0.542	1.068	0.734	1.477	0.119	0.130

RADIANCE LEVEL 5

1	0.993	2.196	1.252	2.494	0.190	0.233
2	0.955	1.931	1.196	2.275	0.196	0.242
3	0.965	2.177	1.259	2.494	0.185	0.230
4	0.964	1.950	1.200	2.291	0.193	0.240
5	0.983	2.178	1.265	2.507	0.183	0.230
6	0.965	1.957	1.196	2.234	0.193	0.240
7	0.981	2.186	1.265	2.505	0.183	0.230
8	0.960	1.942	1.191	2.292	0.193	0.239
9	0.986	2.180	1.262	2.517	0.183	0.228
10	0.960	1.946	1.194	2.274	0.192	0.238
11	0.989	2.174	1.261	2.503	0.183	0.226
12	0.953	1.956	1.197	2.289	0.192	0.238
13	0.988	2.193	1.263	2.509	0.183	0.225
14	0.957	1.940	1.196	2.286	0.192	0.237
15	0.995	2.186	1.259	2.503	0.185	0.226
16	0.947	1.948	1.203	2.284	0.195	0.239

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RADIANCE	LEVEL 6					
1	0.693	1.451	0.857	1.599	0.113	0.15
2	0.663	1.331	0.806	1.417	0.121	0.16
3	0.689	1.454	0.863	1.603	0.110	0.15
4	0.673	1.344	0.807	1.425	0.119	0.167
5	0.688	1.451	0.866	1.608	0.109	0.15
6	0.673	1.351	0.804	1.389	0.119	0.167
7	0.683	1.457	0.865	1.610	0.109	0.15
8	0.670	1.339	0.801	1.425	0.119	0.16
9	0.683	1.454	0.862	1.612	0.108	0.15
10	0.672	1.341	0.803	1.415	0.119	0.16
11	0.693	1.454	0.862	1.606	0.108	0.15
12	0.666	1.350	0.805	1.424	0.118	0.16
13	0.687	1.464	0.864	1.613	0.109	0.15
14	0.668	1.337	0.805	1.426	0.119	0.16
15	0.702	1.457	0.861	1.607	0.111	0.15
16	0.664	1.343	0.811	1.425	0.121	0.167

RADIANCE	LEVEL 7					
1	0.258	0.547	0.338	0.567	0.010	0.04
2	0.224	0.458	0.339	0.599	0.010	0.057
3	0.257	0.548	0.340	0.569	0.010	0.04
4	0.227	0.463	0.340	0.601	0.009	0.05
5	0.257	0.547	0.342	0.574	0.010	0.04
6	0.227	0.467	0.339	0.564	0.009	0.057
7	0.254	0.549	0.342	0.571	0.010	0.04
8	0.226	0.463	0.337	0.600	0.009	0.057
9	0.255	0.548	0.342	0.574	0.010	0.044
10	0.226	0.464	0.339	0.595	0.009	0.05
11	0.257	0.547	0.341	0.571	0.010	0.044
12	0.223	0.466	0.340	0.600	0.009	0.05
13	0.257	0.551	0.343	0.575	0.010	0.04
14	0.225	0.464	0.340	0.601	0.009	0.05
15	0.261	0.548	0.342	0.572	0.010	0.04
16	0.223	0.467	0.342	0.600	0.010	0.05

RADIANCE	LEVEL 8					
1	0.002	0.001	0.001	0.001	-0.002	-0.00
2	0.002	0.003	0.001	0.002	-0.002	-0.00
3	0.002	0.002	0.001	-0.003	-0.002	-0.00
4	0.002	0.003	0.002	0.002	-0.002	-0.00
5	0.002	0.003	0.001	0.001	-0.002	-0.00
6	0.002	0.001	0.001	-0.002	-0.002	-0.00
7	0.002	0.003	0.001	-0.007	-0.002	-0.00
8	0.002	0.002	0.001	0.000	-0.002	-0.00
9	0.002	0.002	0.001	-0.002	-0.002	-0.00
10	0.002	0.002	0.001	0.002	-0.002	-0.00
11	0.002	0.001	0.001	-0.002	-0.002	-0.00
12	0.002	0.003	0.001	0.002	-0.002	-0.00
13	0.002	0.002	0.001	0.001	-0.002	-0.00
14	0.002	0.003	0.001	0.000	-0.002	-0.00
15	0.002	0.002	0.001	0.000	-0.002	-0.00
16	0.002	0.003	0.001	0.003	-0.002	-0.00

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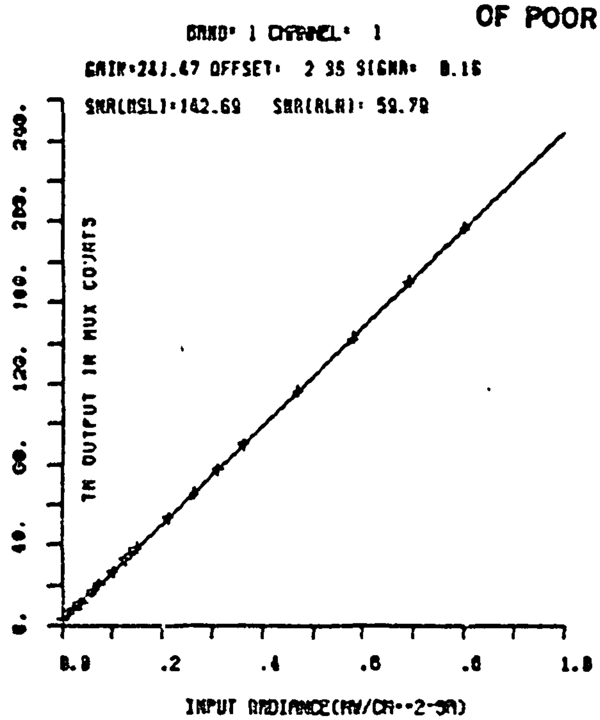

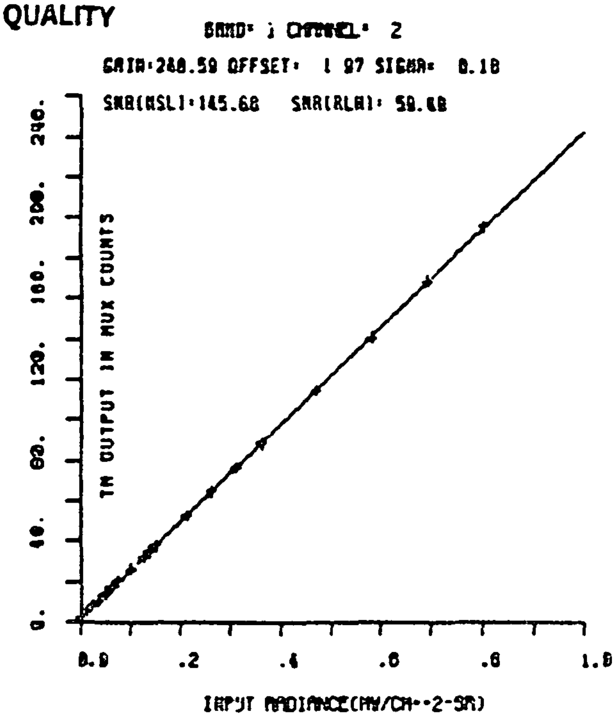

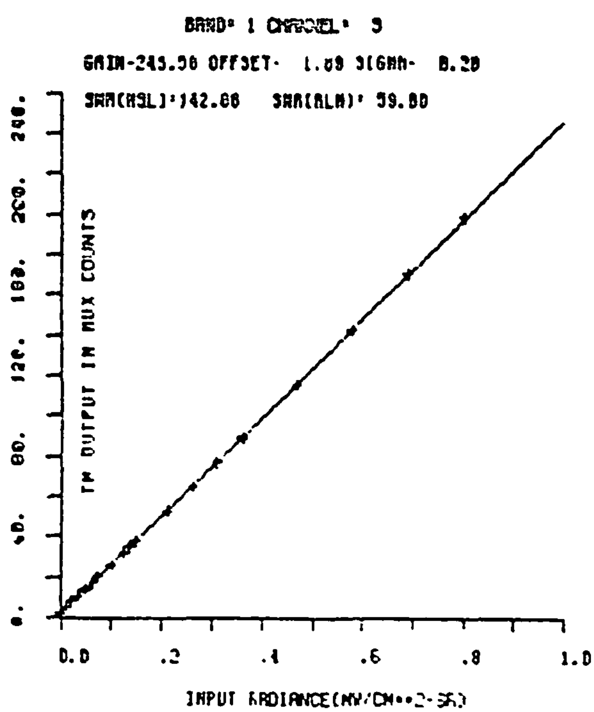

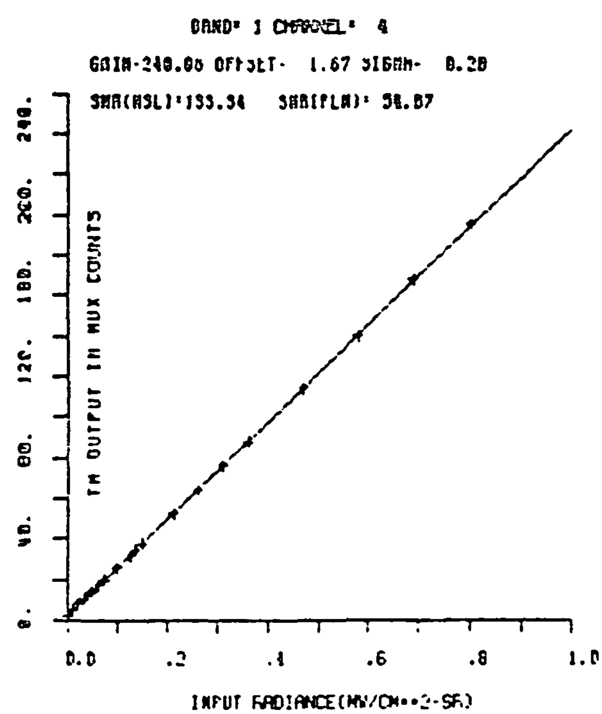

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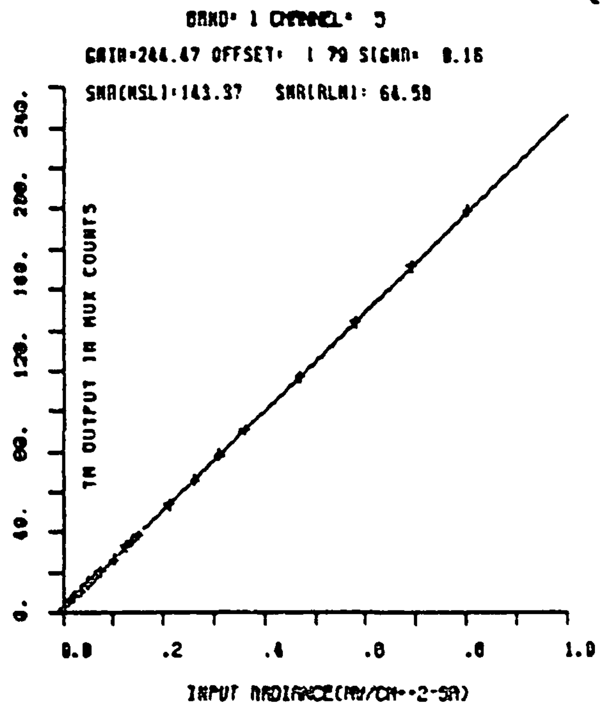
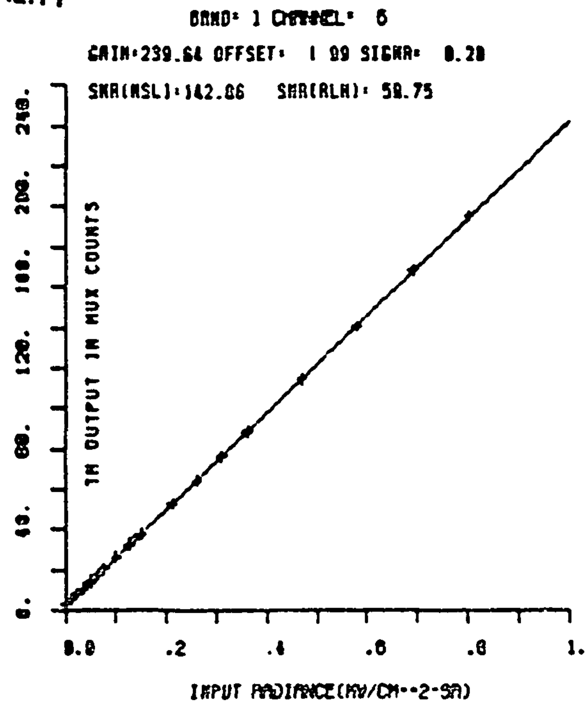
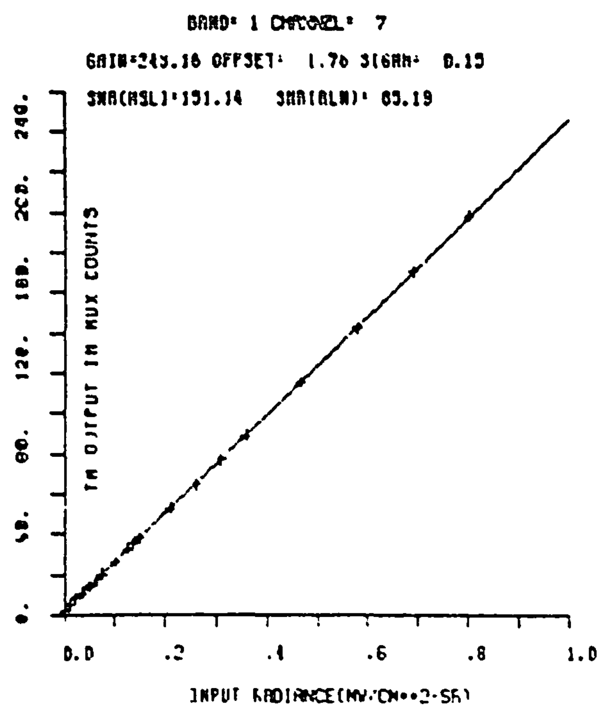
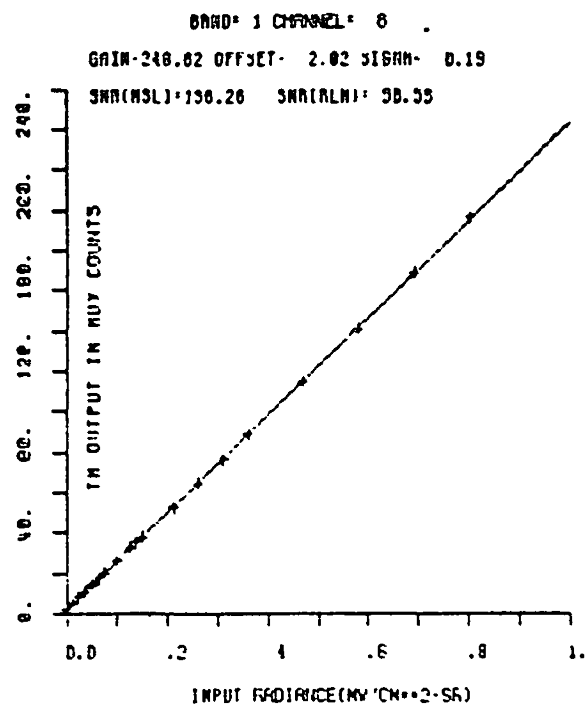
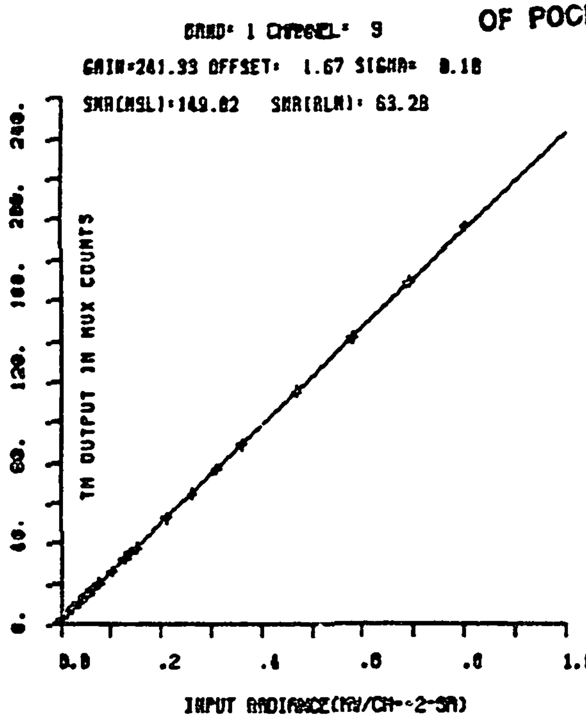
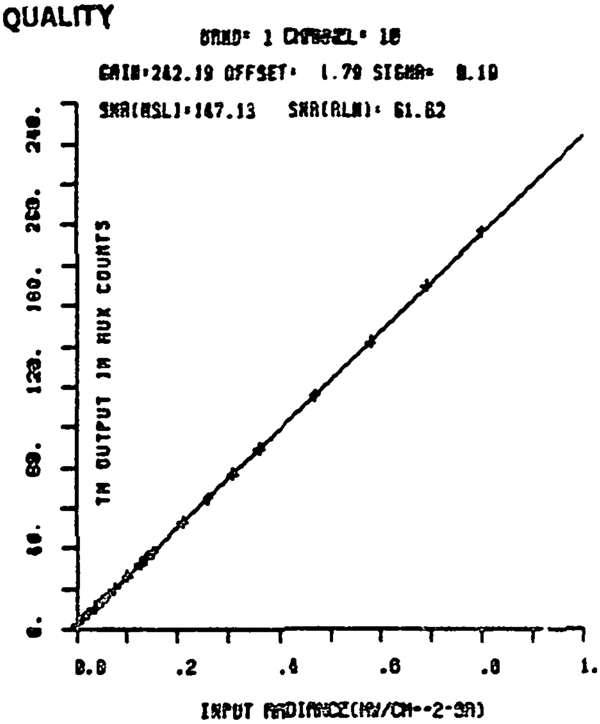


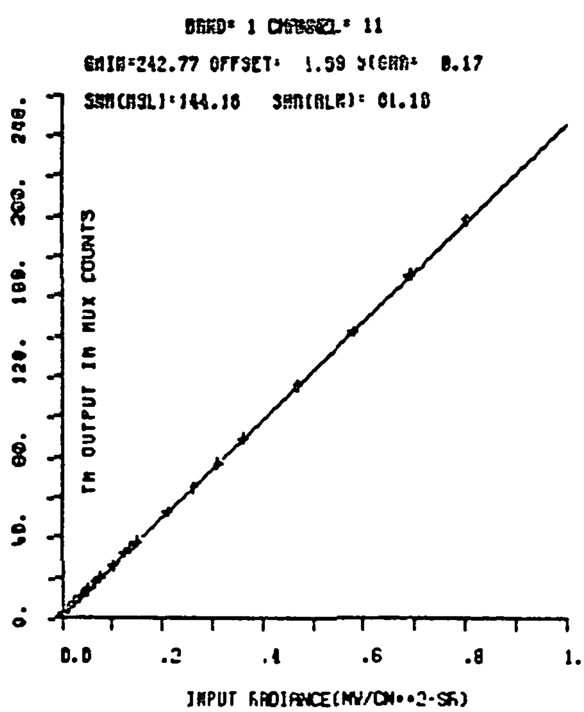


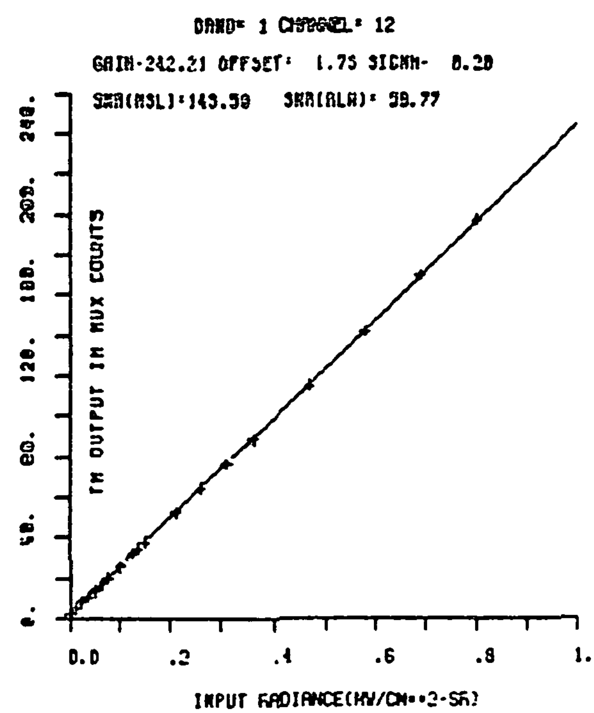





BAND= 1 CHANNEL= 9
GAIN=241.93 OFFSET= 1.67 SIGMA= 0.18
SNR(MSL)=149.82 SNR(RLM)= 63.28
TM OUTPUT IN MUX COUNTS
0.
40.
80.
120.
160.
200.
240.
0.0
.2
.4
.6
.8
1.0
INPUT RADIANCE(MW/CM**2-SR)


BAND= 1 CHANNEL= 10
GAIN=242.19 OFFSET= 1.79 SIGMA= 0.10
SNR(MSL)=147.13 SNR(RLM)= 61.62
TM OUTPUT IN MUX COUNTS
0.
40.
80.
120.
160.
200.
240.
0.0
.2
.4
.6
.8
1.0
INPUT RADIANCE(MW/CM**2-SR)


BAND= 1 CHANNEL= 11
GAIN=242.77 OFFSET= 1.59 SIGMA= 0.17
SNR(MSL)=144.16 SNR(RLM)= 61.10
TM OUTPUT IN MUX COUNTS
0.
40.
80.
120.
160.
200.
240.
0.0
.2
.4
.6
.8
1.0
INPUT RADIANCE(MW/CM**2-SR)


BAND= 1 CHANNEL= 12
GAIN=242.21 OFFSET= 1.75 SIGMA= 0.20
SNR(MSL)=143.50 SNR(RLM)= 59.77
TM OUTPUT IN MUX COUNTS
0.
40.
80.
120.
160.
200.
240.
0.0
.2
.4
.6
.8
1.0
INPUT RADIANCE(MW/CM**2-SR)

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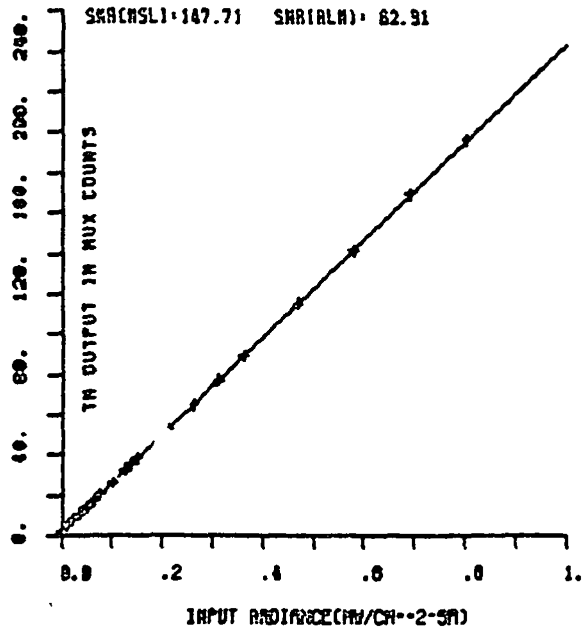
BAND= 1 CHANNEL= 13

GAIN=241.51 OFFSET= 1.75 SIGMA= 0.17

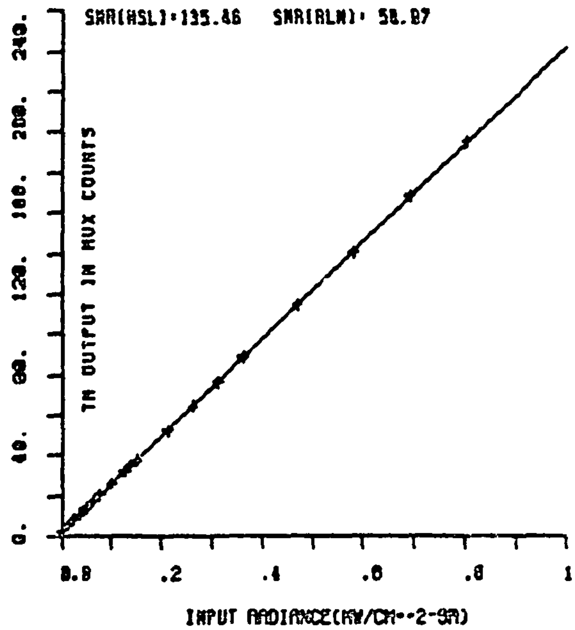
SNR(MSL)=147.71 SNR(ALM)= 62.91



BAND= 1 CHANNEL= 14

GAIN=239.55 OFFSET= 1.91 SIGMA= 0.19

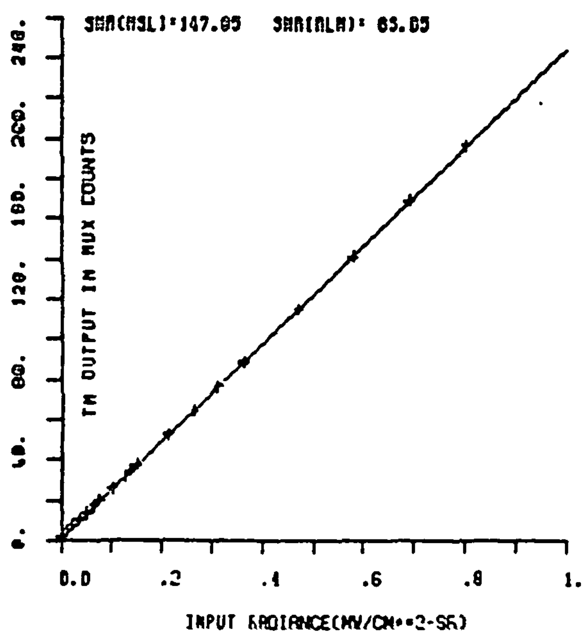
SNR(MSL)=135.46 SNR(ALM)= 58.87



BAND= 1 CHANNEL= 15

GAIN=241.25 OFFSET= 1.66 SIGMA= 0.17

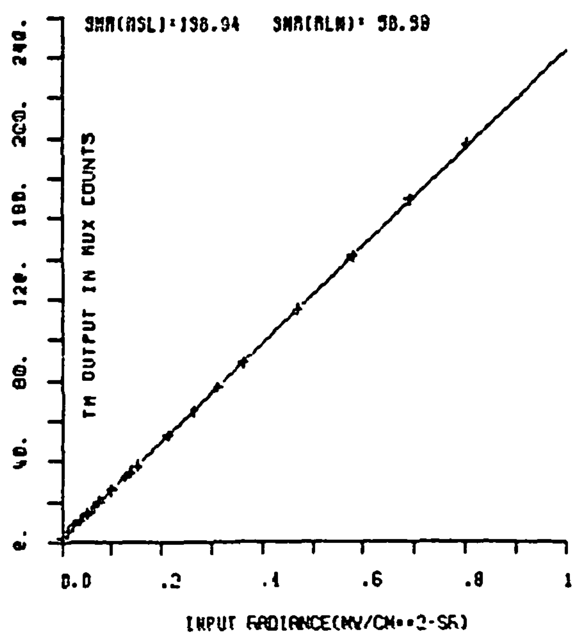
SNR(MSL)=147.85 SNR(ALM)= 63.85



BAND= 1 CHANNEL= 16

GAIN=241.76 OFFSET= 1.00 SIGMA= 0.16

SNR(MSL)=138.94 SNR(ALM)= 58.98



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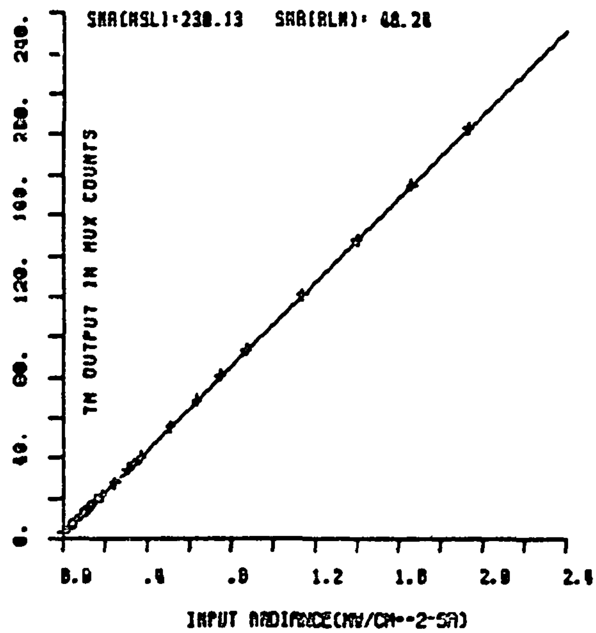
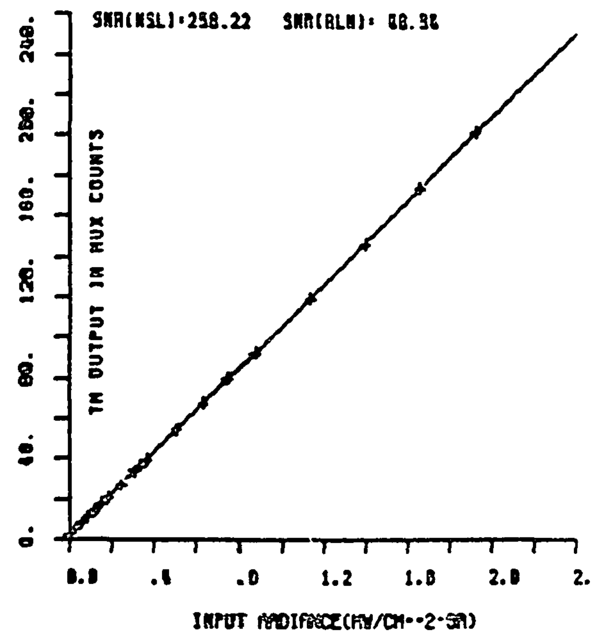
BAND= 2 CHANNEL= 1

GAIN=103.82 OFFSET= 2.38 SIGMA= 0.19



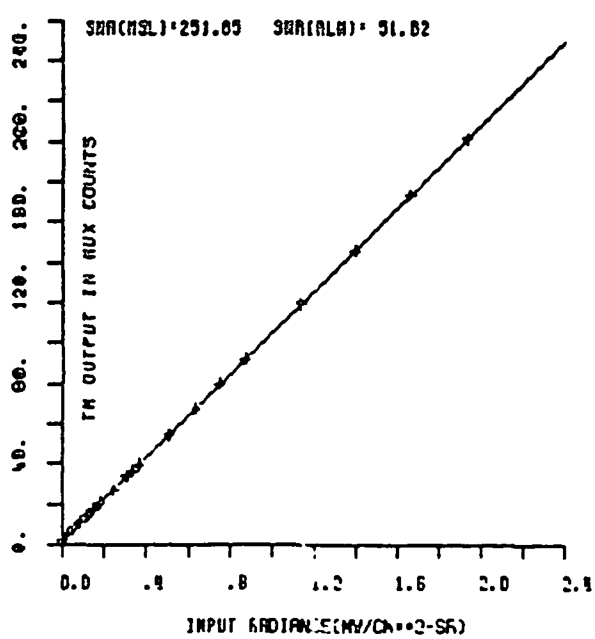
BAND= 2 CHANNEL= 2

GAIN=103.32 OFFSET= 1.73 SIGMA= 0.18



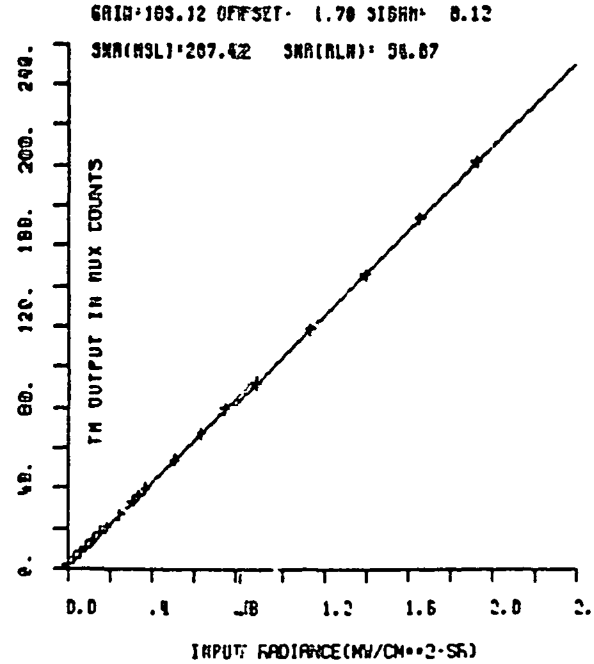
BAND= 2 CHANNEL= 3

GAIN=103.22 OFFSET= 1.93 SIGMA= 0.18



BAND= 2 CHANNEL= 4

GAIN=103.12 OFFSET= 1.70 SIGMA= 0.12



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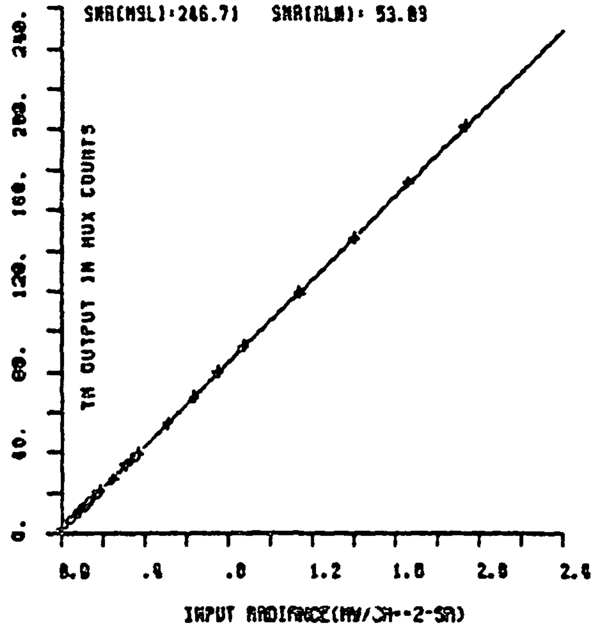
BAND= 2 CHANNEL= 5

GAIN=103.32 OFFSET= 1.63 SIGMA= 0.18

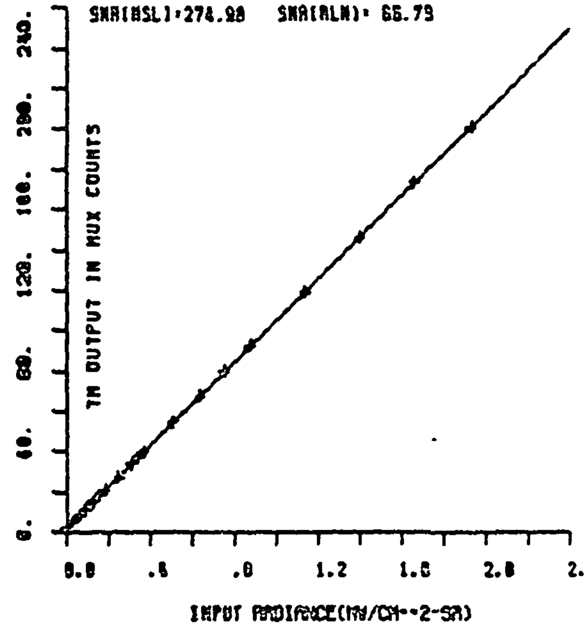
SNR(MSL)=246.71 SNR(ALN)= 53.83



BAND= 2 CHANNEL= 6

GAIN=102.90 OFFSET= 1.96 SIGMA= 0.17

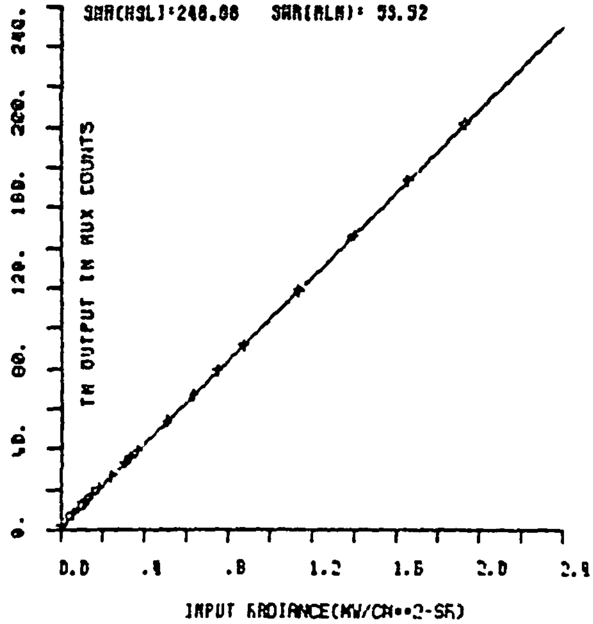
SNR(MSL)=274.98 SNR(ALN)= 66.79



BAND= 2 CHANNEL= 7

GAIN=103.13 OFFSET= 1.66 SIGMA= 0.18

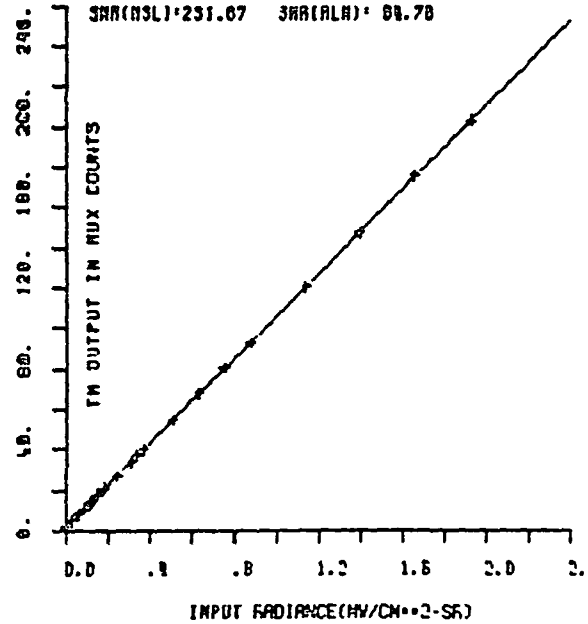
SNR(MSL)=248.06 SNR(ALN)= 53.52

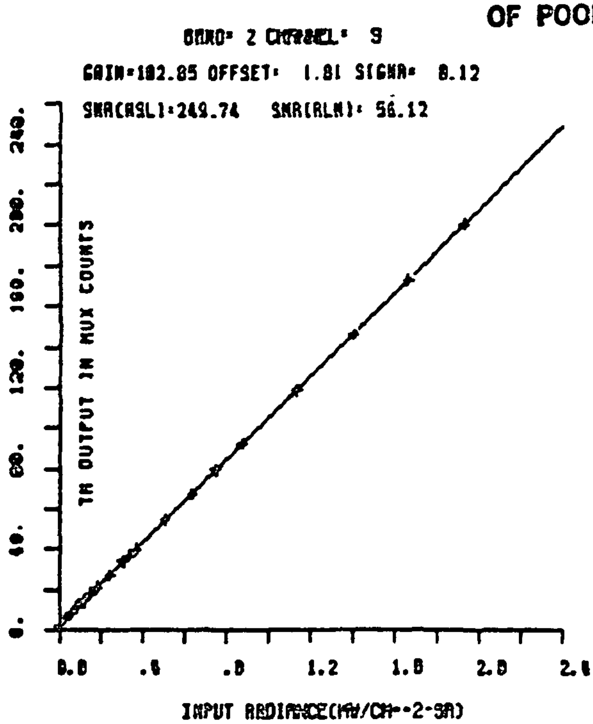


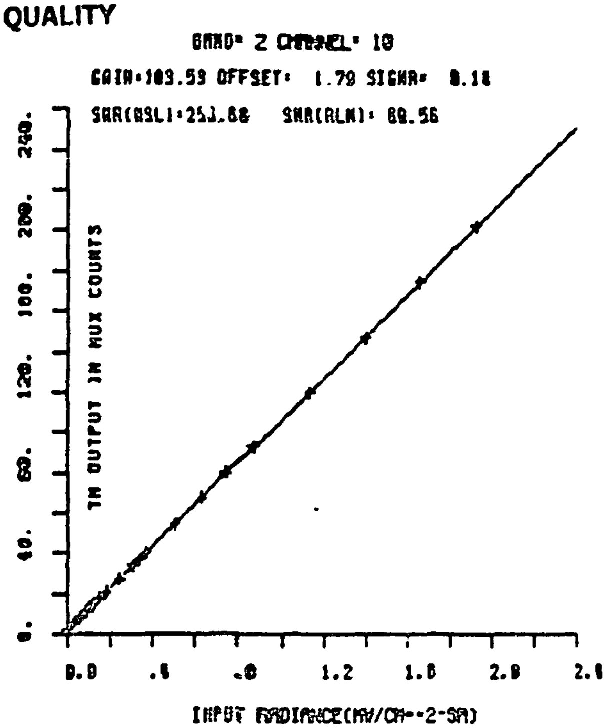
BAND= 2 CHANNEL= 8

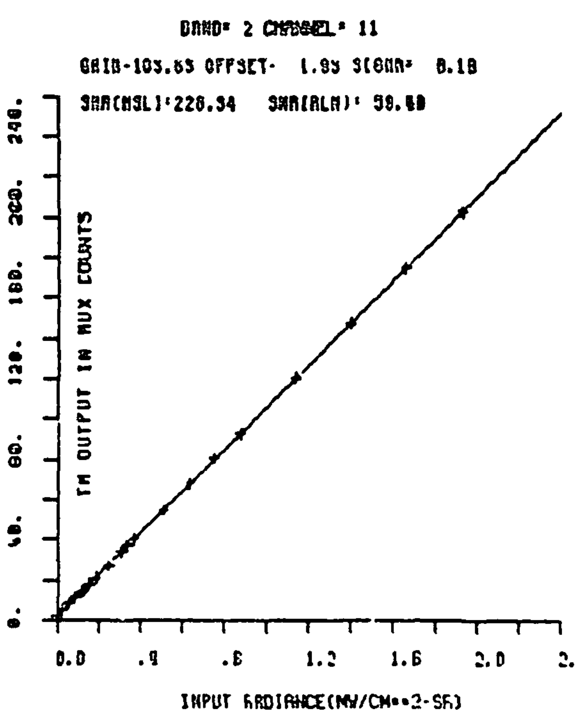
GAIN=104.24 OFFSET= 1.81 SIGMA= 0.17

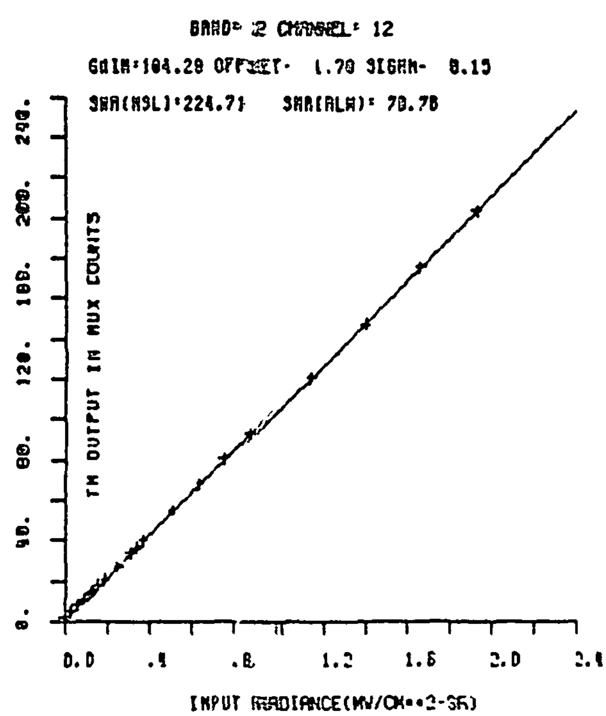
SNR(MSL)=231.67 SNR(ALN)= 58.78




BAND= 2 CHANNEL= 9
GAIN=102.85 OFFSET= 1.81 SIGMA= 0.12
SNR(NSL)=249.74 SNR(RLN)= 56.12
TM OUTPUT IN MUX COUNTS
INPUT RADIANCE(MW/CM**2-SR)


BAND= 2 CHANNEL= 10
GAIN=103.53 OFFSET= 1.79 SIGMA= 0.16
SNR(NSL)=253.88 SNR(RLN)= 68.56
TM OUTPUT IN MUX COUNTS
INPUT RADIANCE(MW/CM**2-SR)


BAND= 2 CHANNEL= 11
GAIN=103.63 OFFSET= 1.93 SIGMA= 0.18
SNR(NSL)=228.34 SNR(RLN)= 59.60
TM OUTPUT IN MUX COUNTS
INPUT RADIANCE(MW/CM**2-SR)


BAND= 2 CHANNEL= 12
GAIN=104.29 OFFSET= 1.70 SIGMA= 0.15
SNR(NSL)=224.71 SNR(RLN)= 70.70
TM OUTPUT IN MUX COUNTS
INPUT RADIANCE(MW/CM**2-SR)

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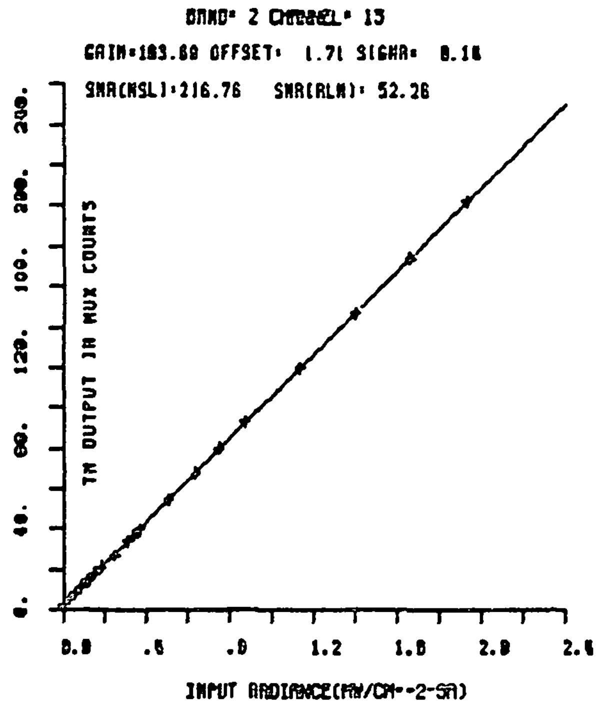
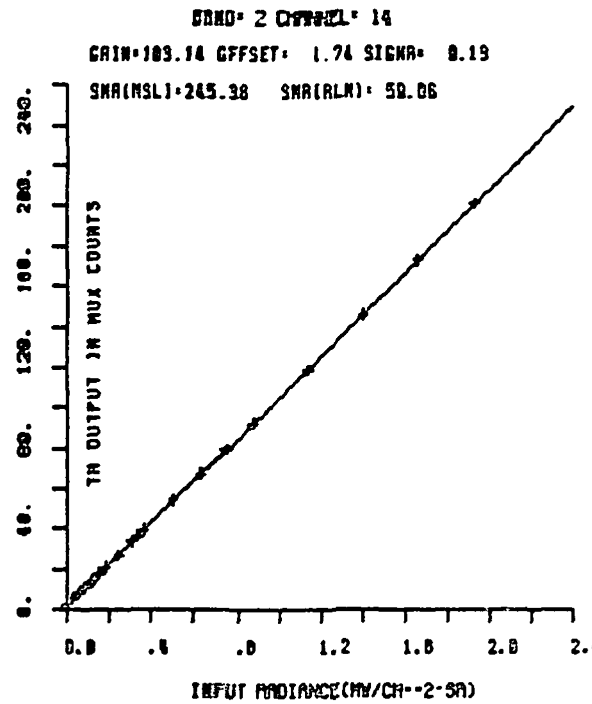
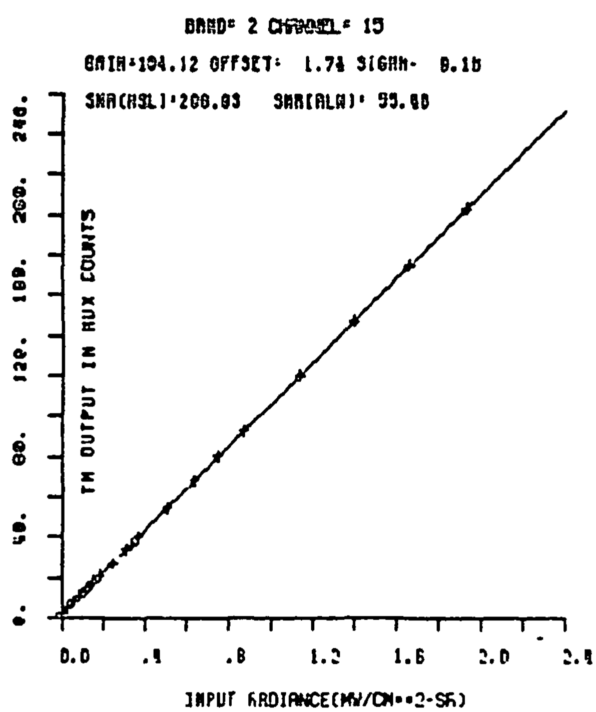
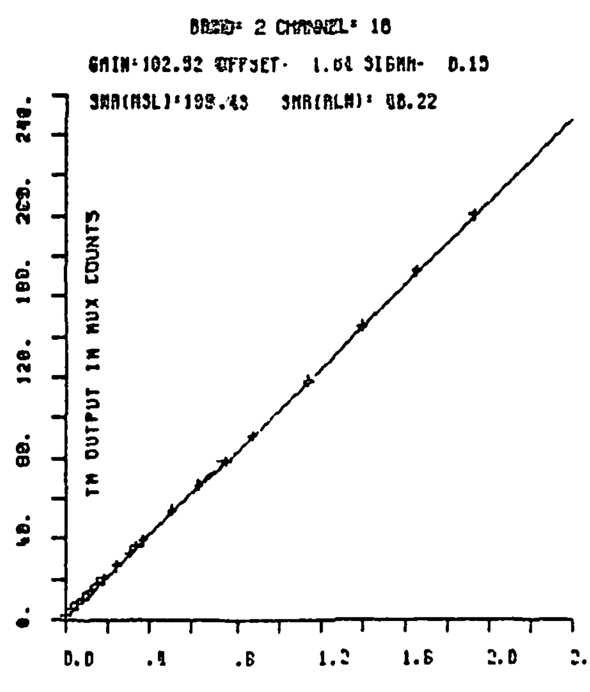
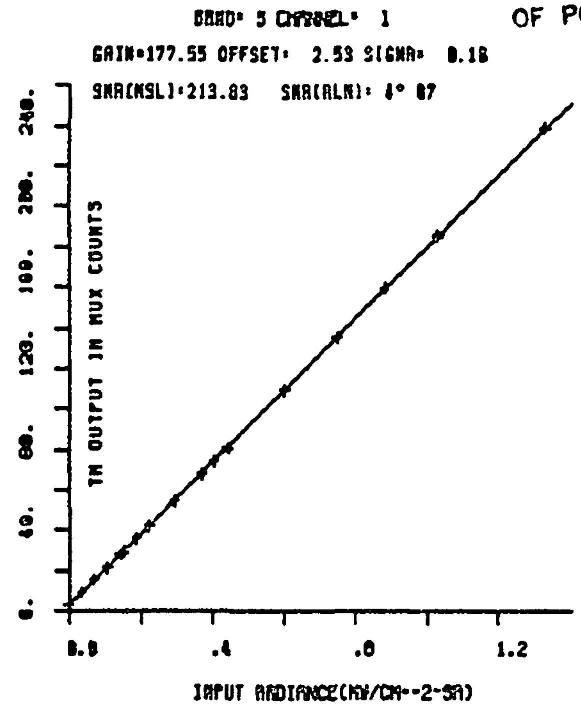
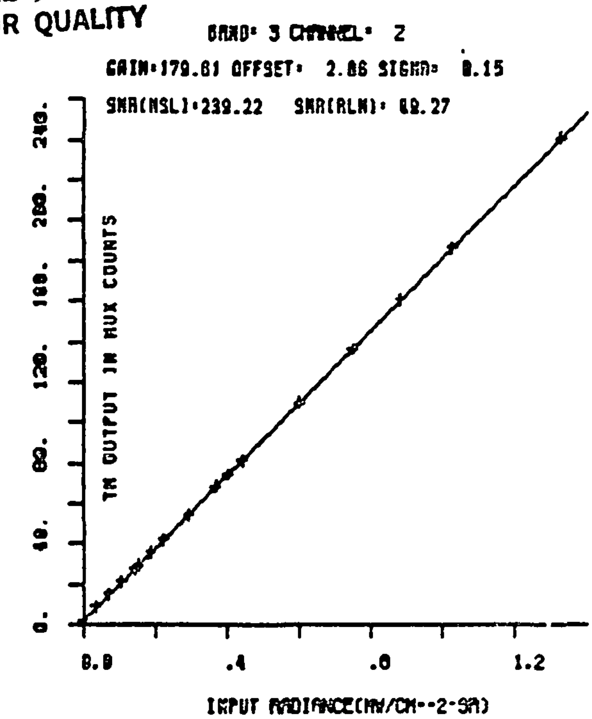


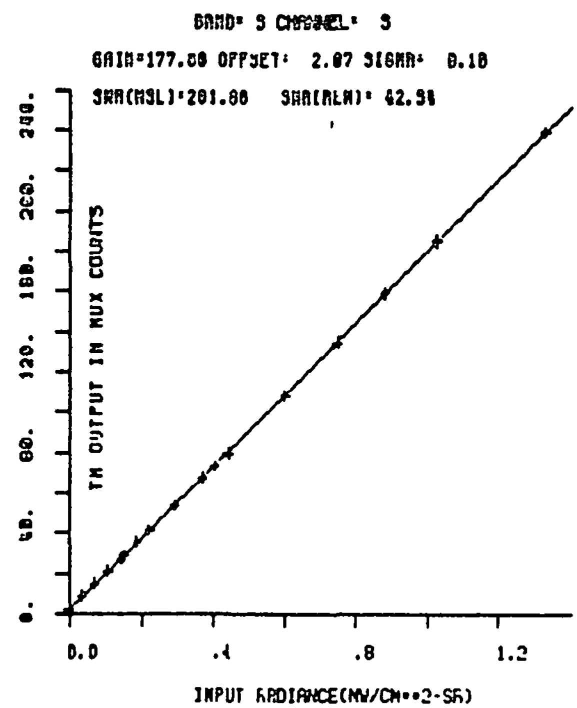


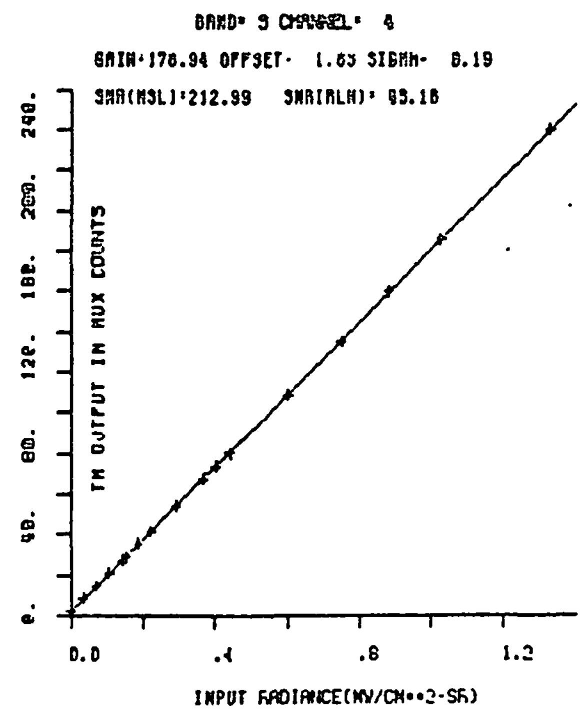





BAND= 5 CHANNEL= 1
GAIN=177.55 OFFSET= 2.53 SIGMA= 0.18
SNR(MSL)=213.83 SNR(ALN)= 4° 87
TM OUTPUT IN MUX COUNTS
0. 40. 80. 120. 160. 200. 240.
0.0 .4 .8 1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 2
GAIN=179.81 OFFSET= 2.86 SIGMA= 0.15
SNR(MSL)=239.22 SNR(ALN)= 69.27
TM OUTPUT IN MUX COUNTS
0. 40. 80. 120. 160. 200. 240.
0.0 .4 .8 1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 3
GAIN=177.08 OFFSET= 2.07 SIGMA= 0.18
SNR(MSL)=201.80 SNR(ALN)= 42.94
TM OUTPUT IN MUX COUNTS
0. 40. 80. 120. 160. 200. 240.
0.0 .4 .8 1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 4
GAIN=178.94 OFFSET= 1.63 SIGMA= 0.19
SNR(MSL)=212.99 SNR(ALN)= 65.18
TM OUTPUT IN MUX COUNTS
0. 40. 80. 120. 160. 200. 240.
0.0 .4 .8 1.2
INPUT RADIANCE(MW/CM**2-SR)

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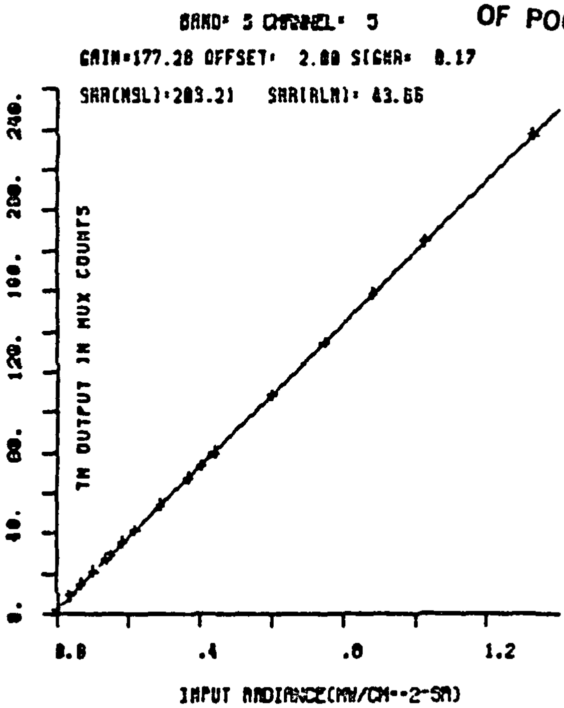

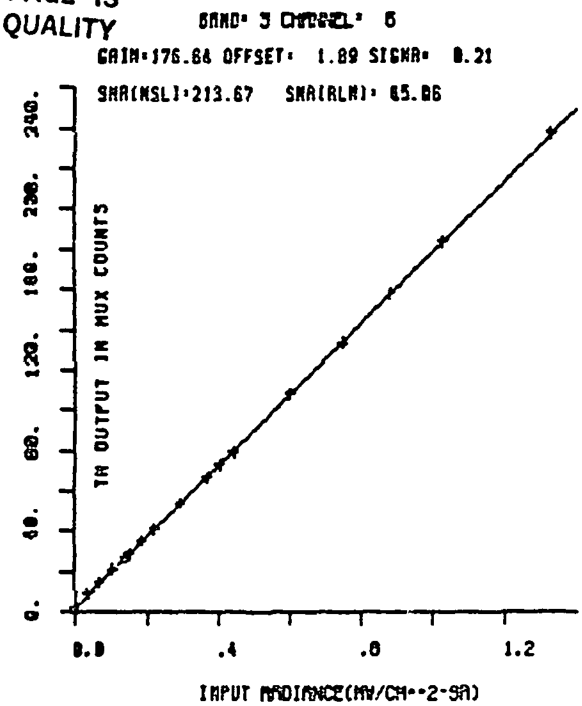

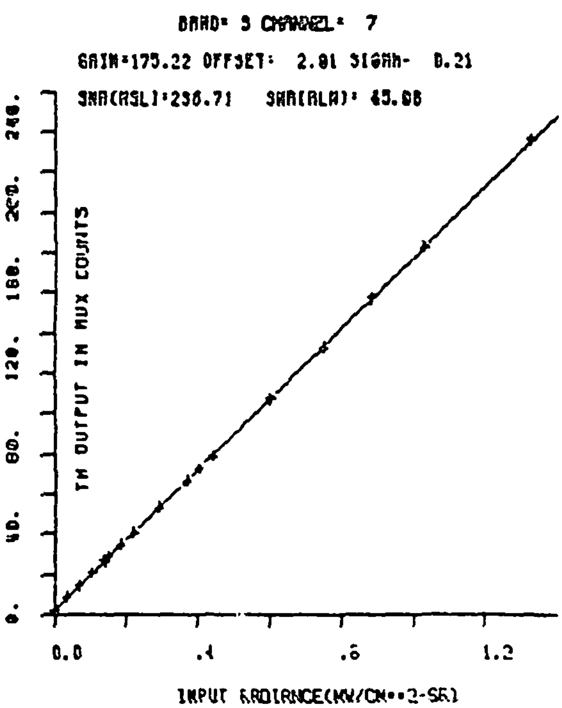

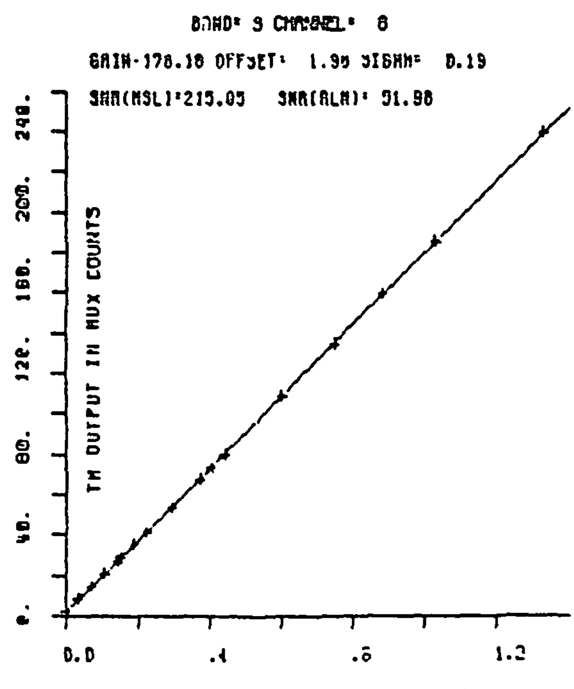

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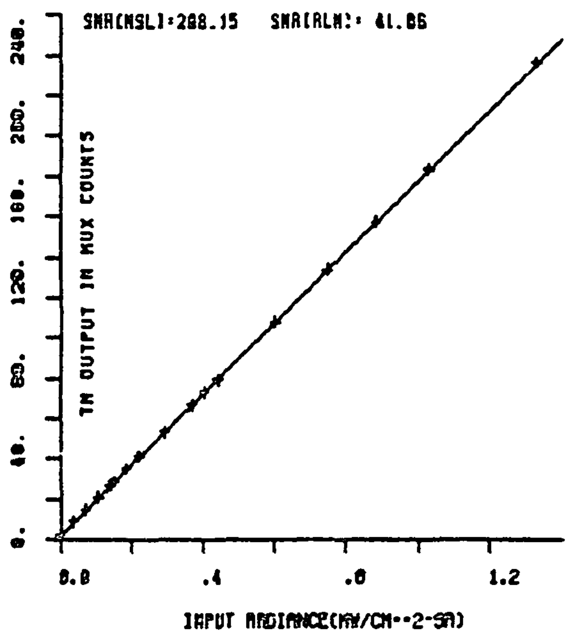
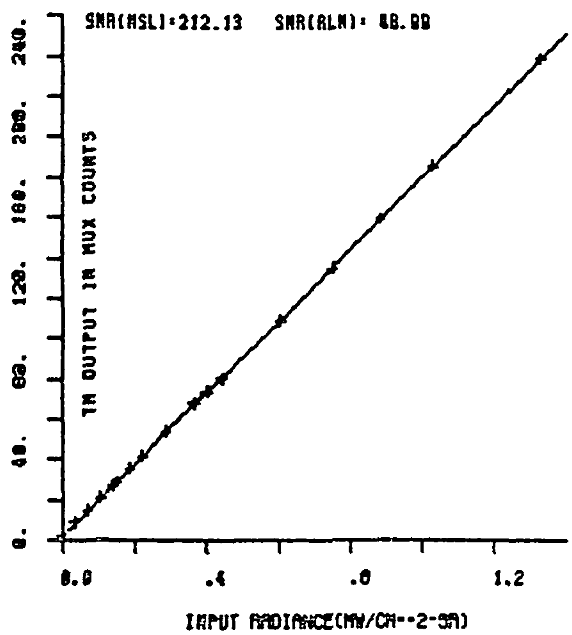
BAND= 3 CHANNEL= 9

GAIN=175.89 OFFSET= 2.15 SIGMA= 0.18



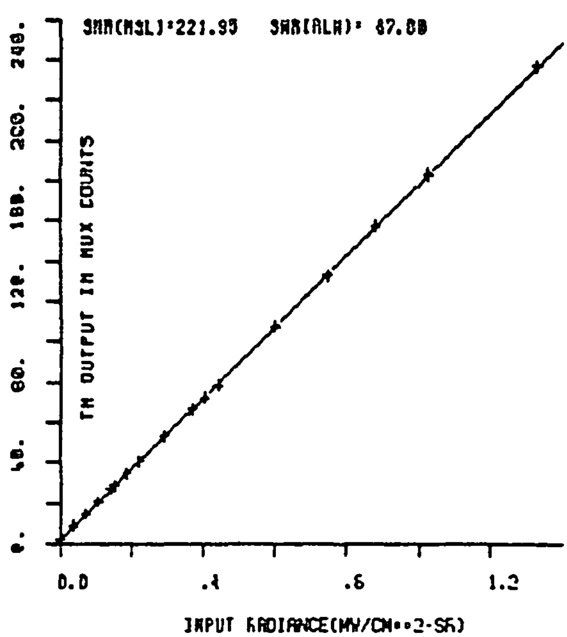
BAND= 3 CHANNEL= 10

GAIN=177.88 OFFSET= 1.96 SIGMA= 0.17



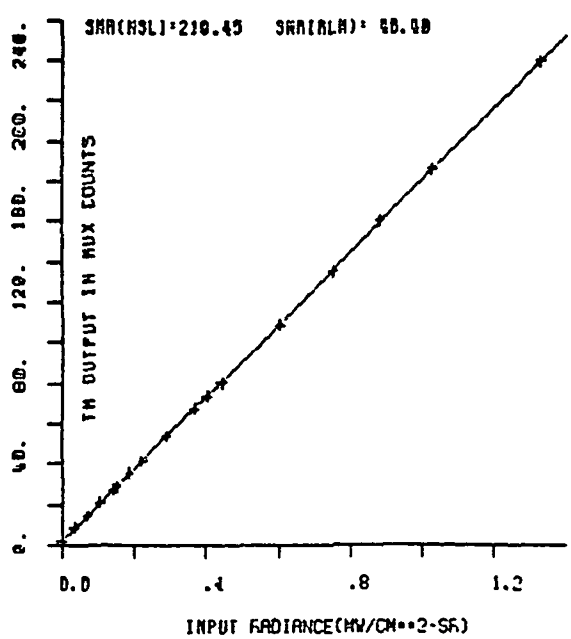
BAND= 3 CHANNEL= 11

GAIN=179.85 OFFSET= 2.05 SIGMA= 0.21



BAND= 3 CHANNEL= 12

GAIN=178.66 OFFSET= 1.92 SIGMA= 0.15



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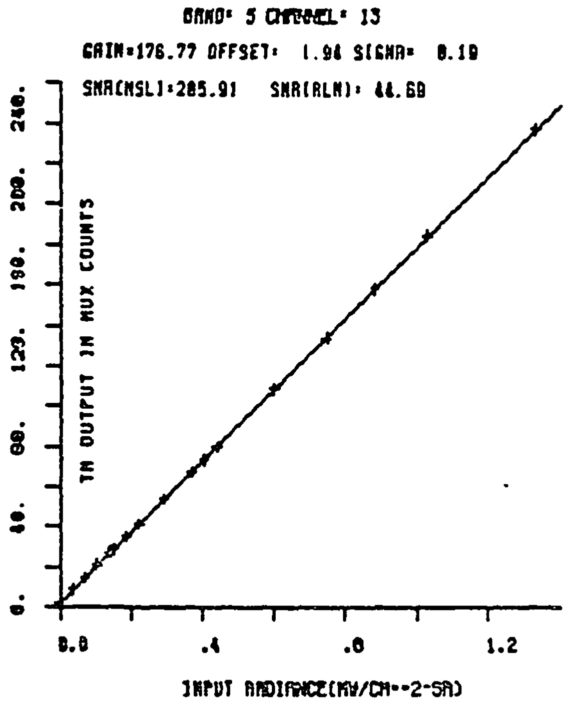

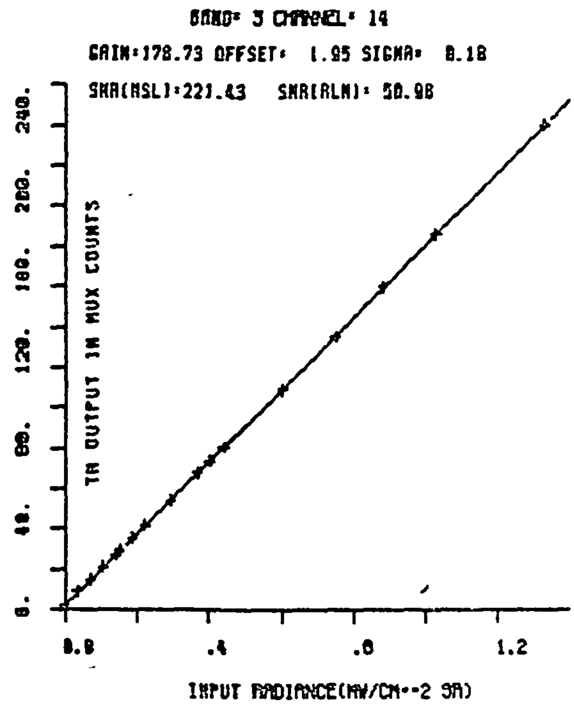

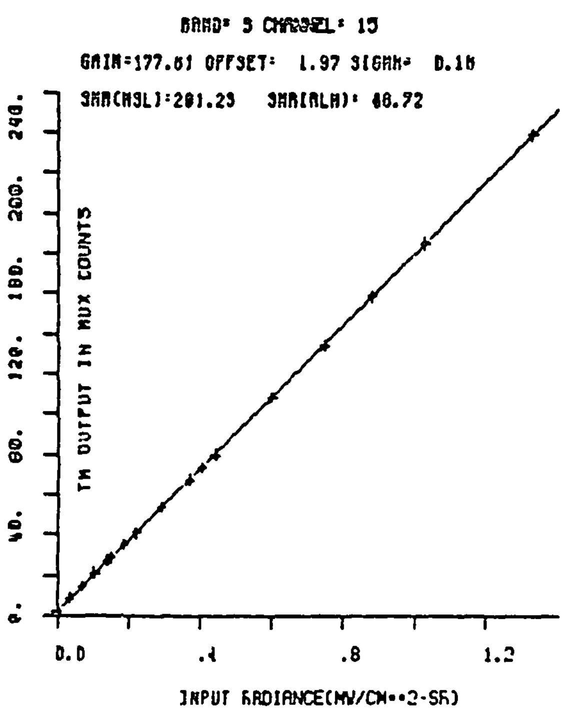

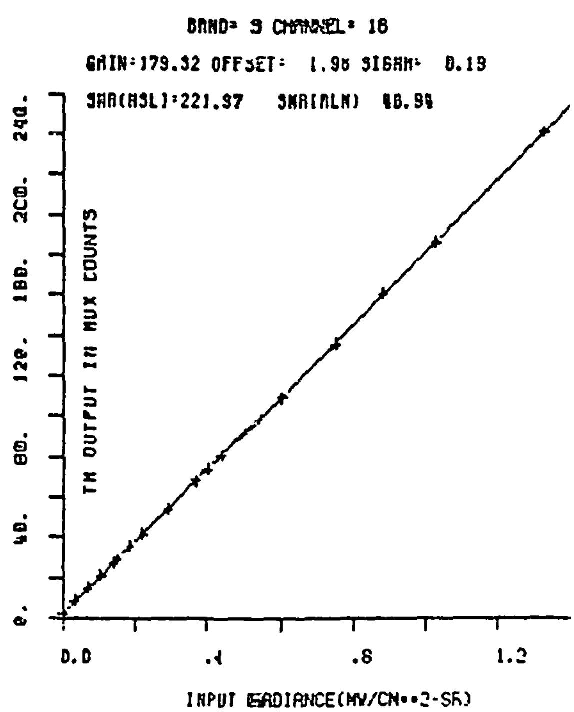

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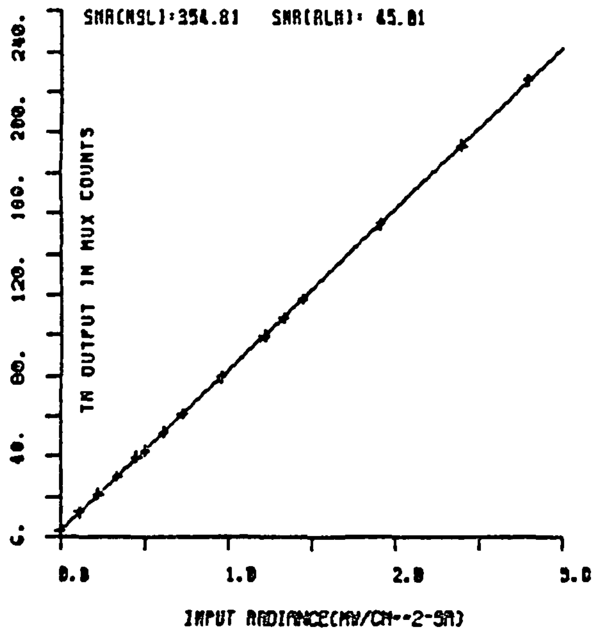
BAND= 4 CHANNEL= 1

GAIN= 79.57 OFFSET= 2 73 SIGMA= 0.10

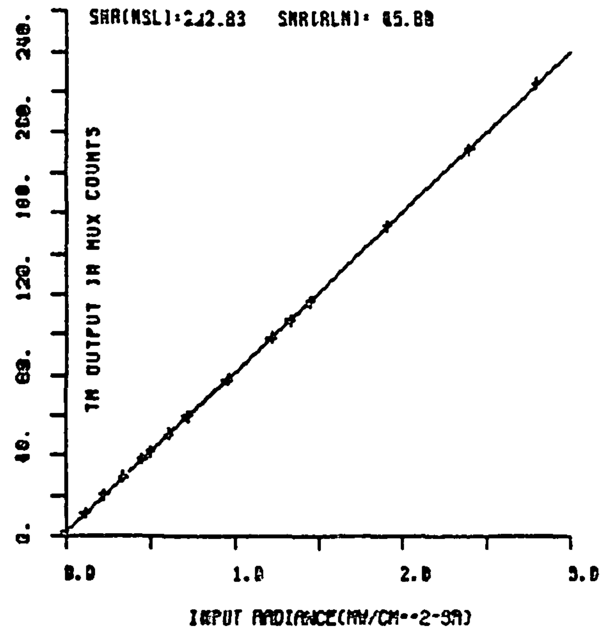
SNR(NSL)=354.81 SNR(RLN)= 45.81



BAND= 4 CHANNEL= 2

GAIN= 79.28 OFFSET= 1.94 SIGMA= 0.23

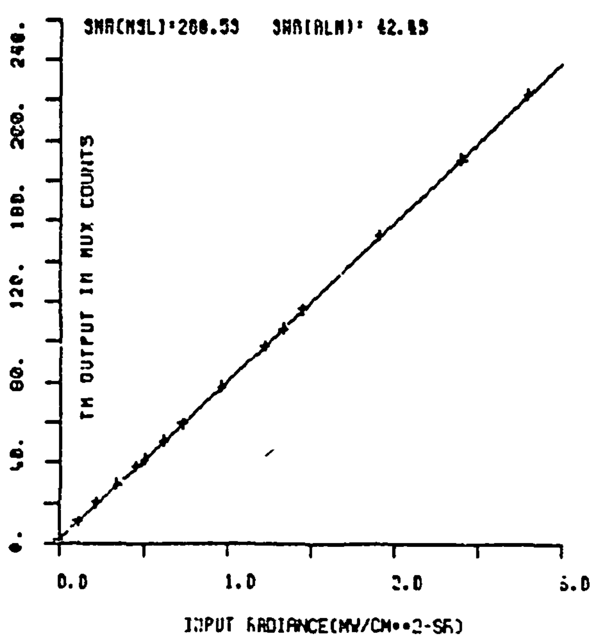
SNR(NSL)=2?2.83 SNR(RLN)= 45.88



BAND= 4 CHANNEL= 3

GAIN= 78.64 OFFSET= 2.37 SIGMA= 0.16

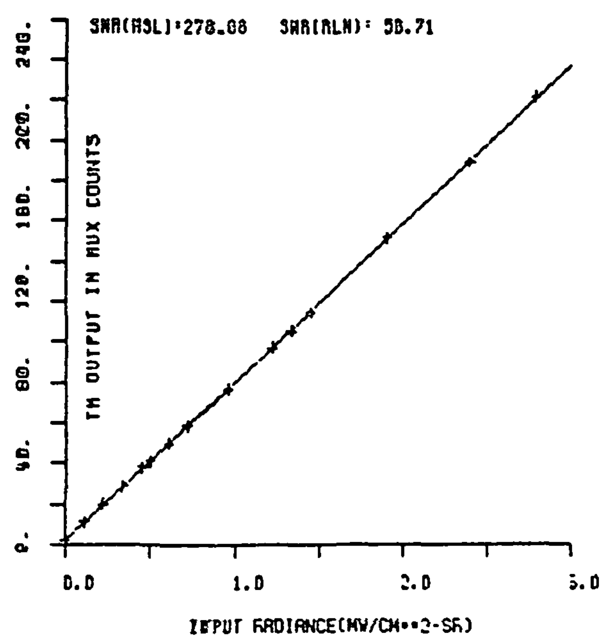
SNR(NSL)=280.53 SNR(RLN)= 42.45



BAND= 4 CHANNEL= 4

GAIN= 78.22 OFFSET= 1.96 SIGMA= 0.25

SNR(NSL)=278.08 SNR(RLN)= 58.71



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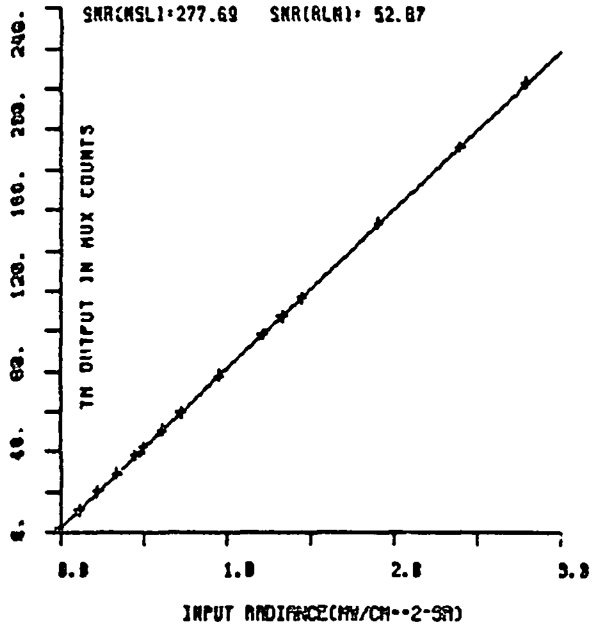
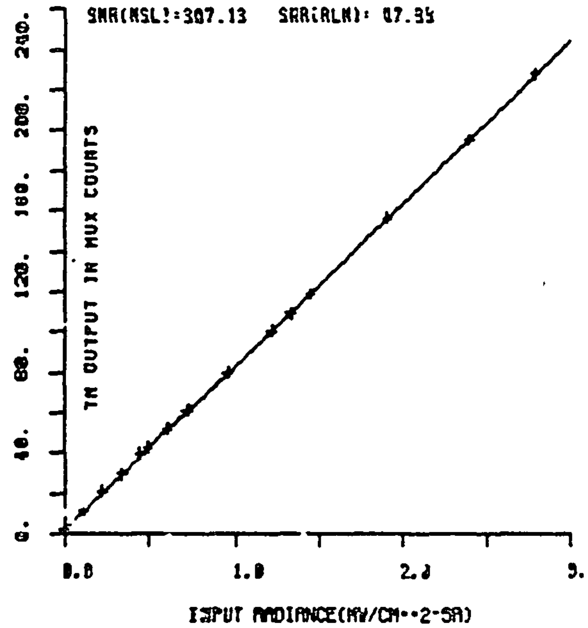
BAND= 4 CHANNEL= 5

GAIN= 79.88 OFFSET= 2.83 SIGMA= 0.21



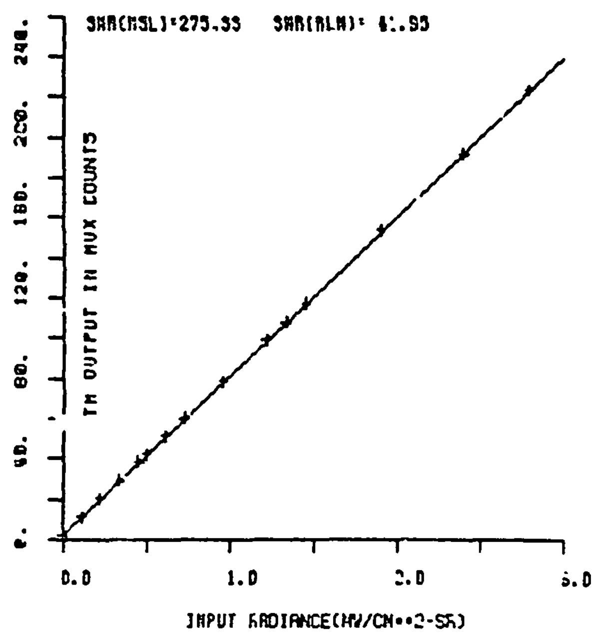
BAND= 4 CHANNEL= 6

GAIN= 80.54 OFFSET= 2.28 SIGMA= 0.21



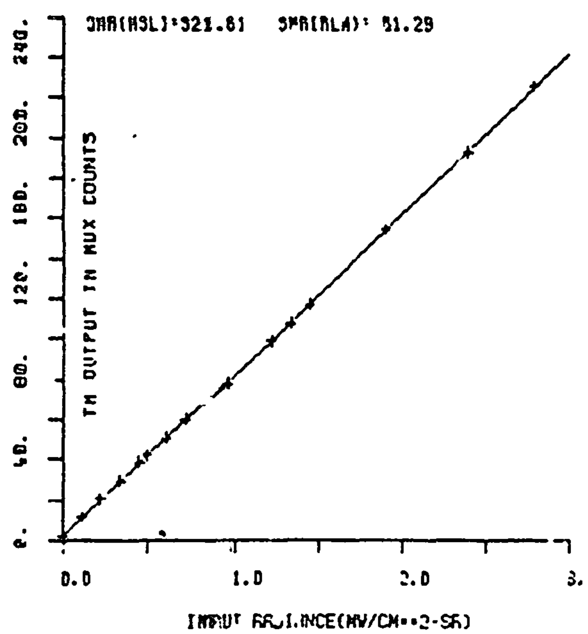
BAND= 4 CHANNEL= 7

GAIN= 78.86 OFFSET= 2.65 SIGMA= 0.16



BAND= 4 CHANNEL= 8

GAIN= 79.54 OFFSET= 2.14 SIGMA= 0.22



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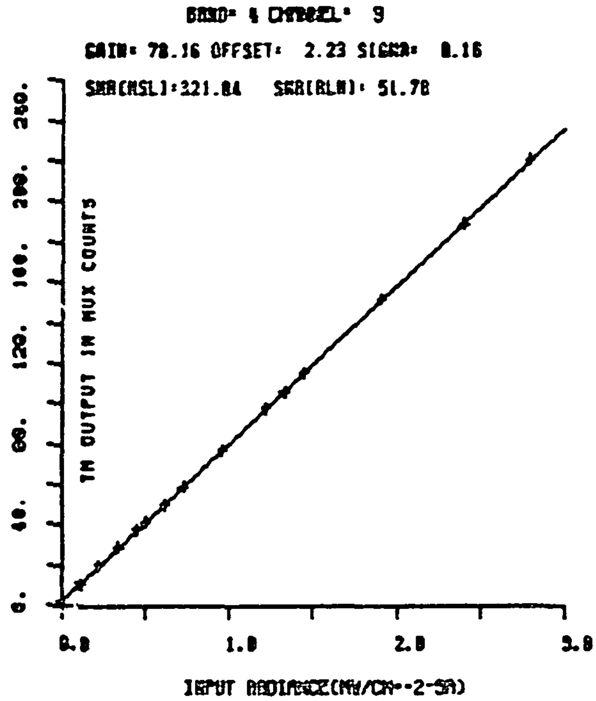

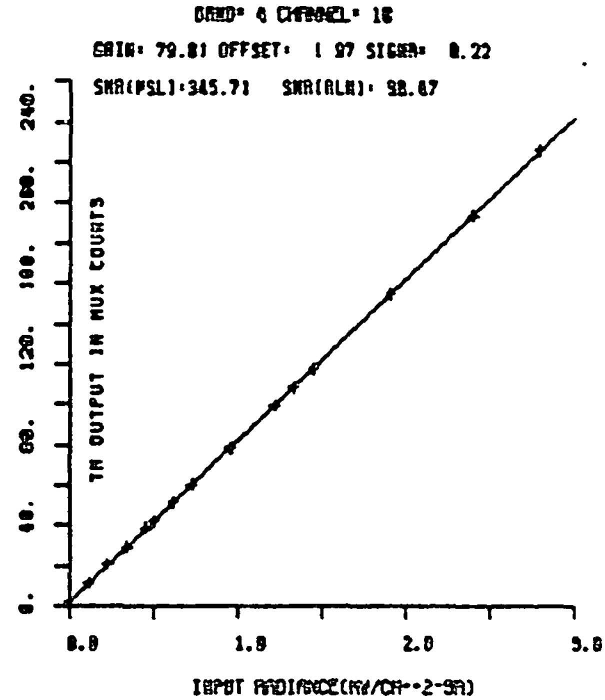

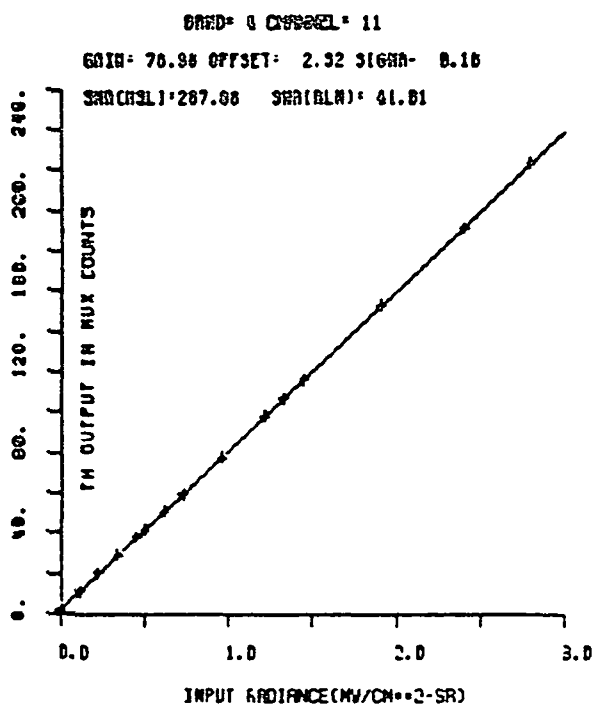

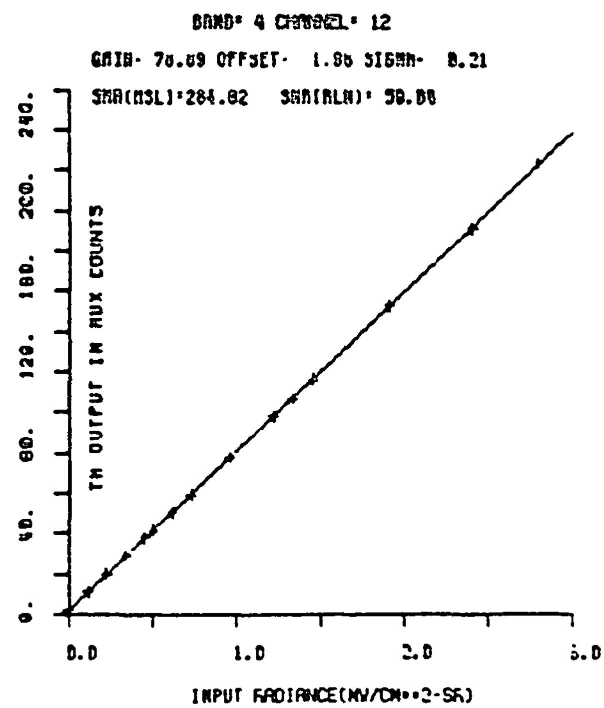

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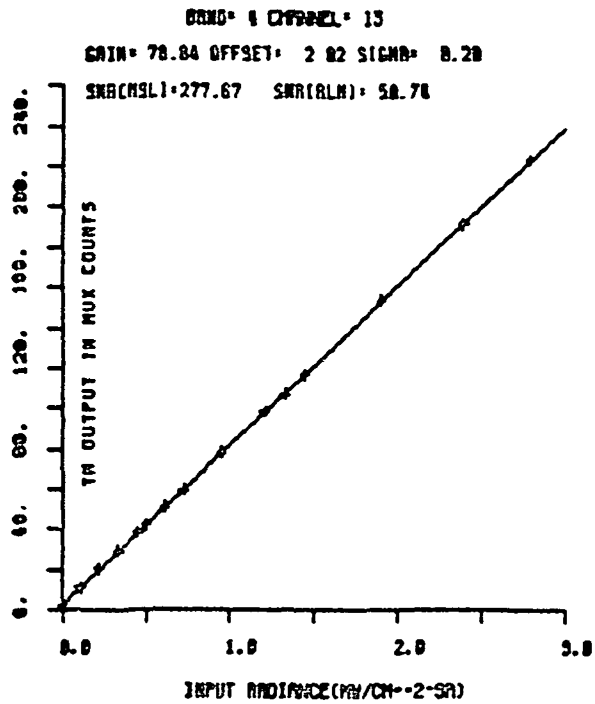

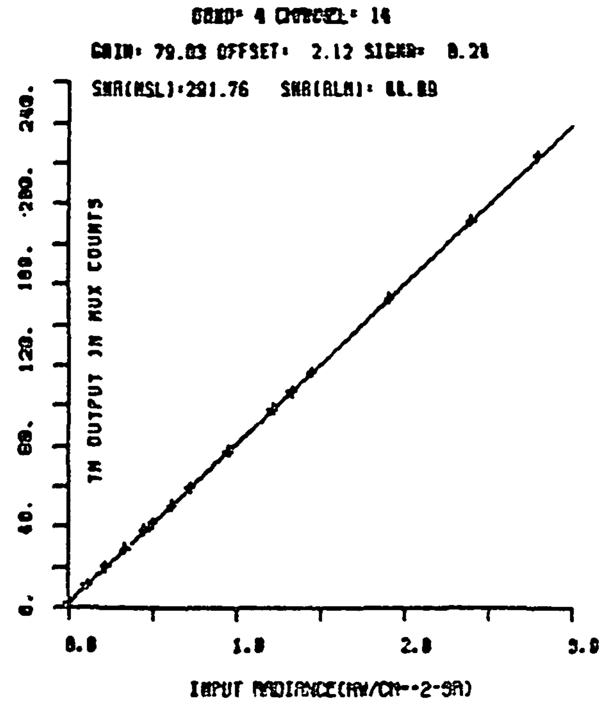

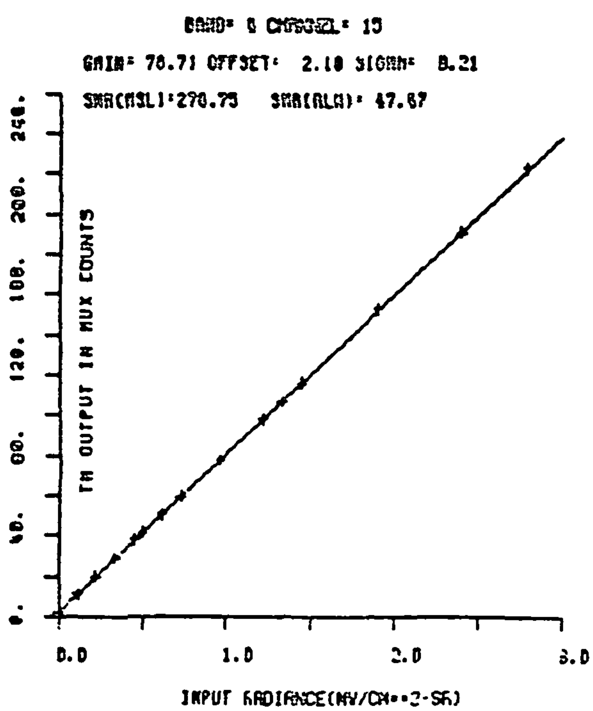

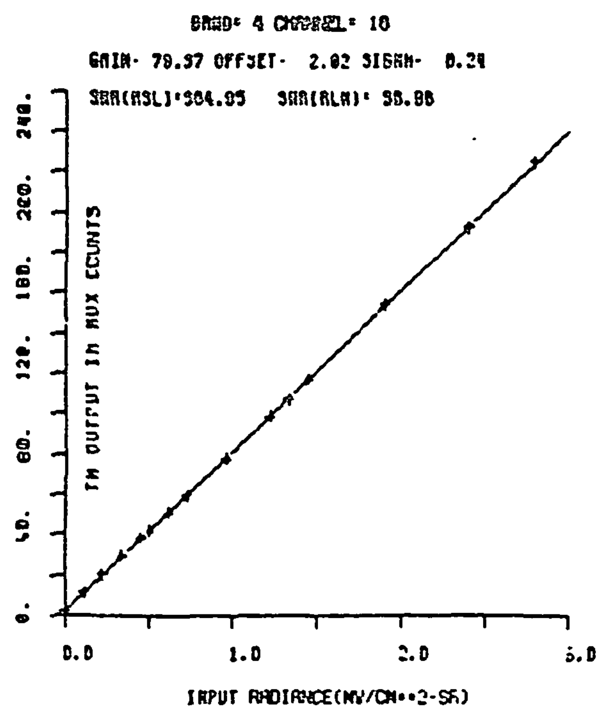

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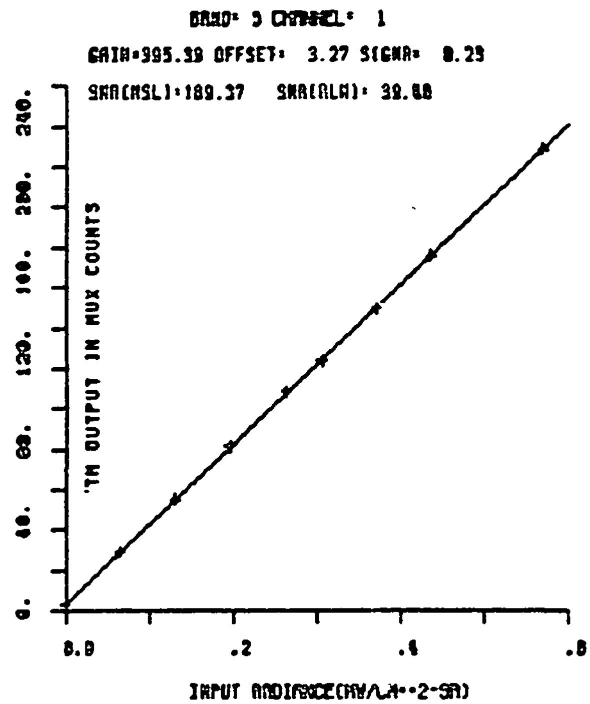
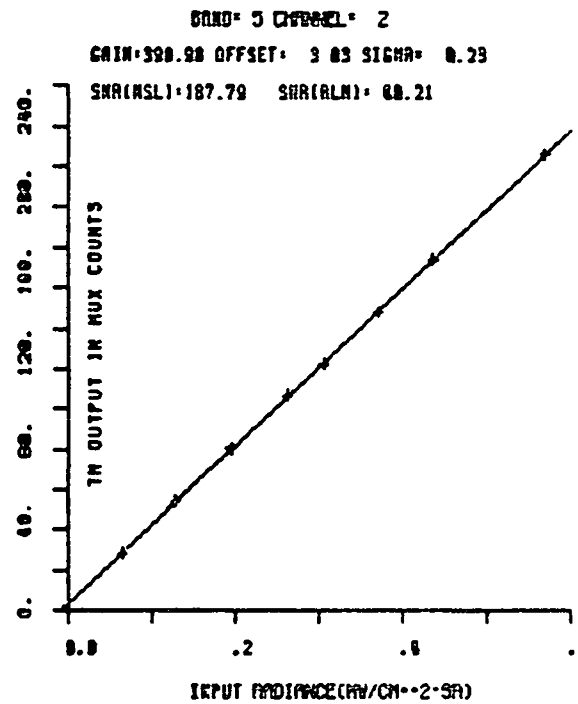
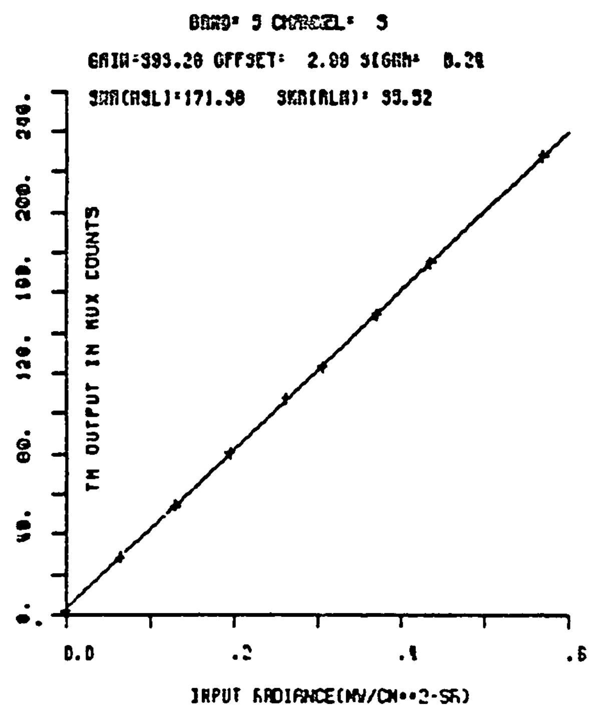
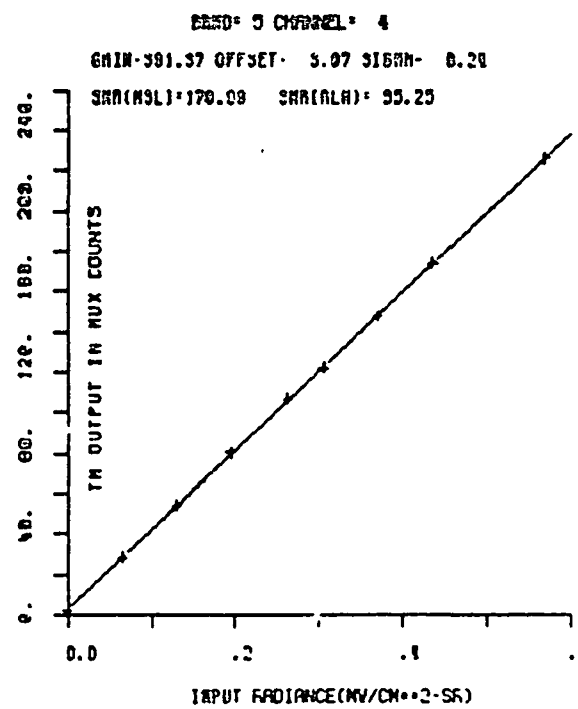


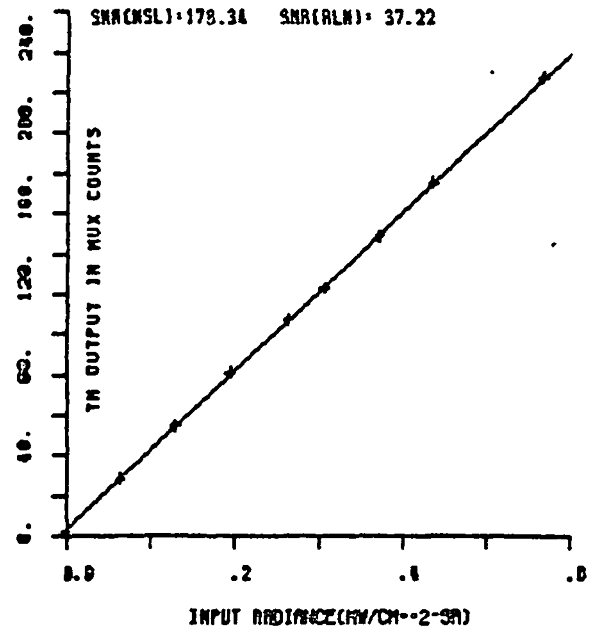






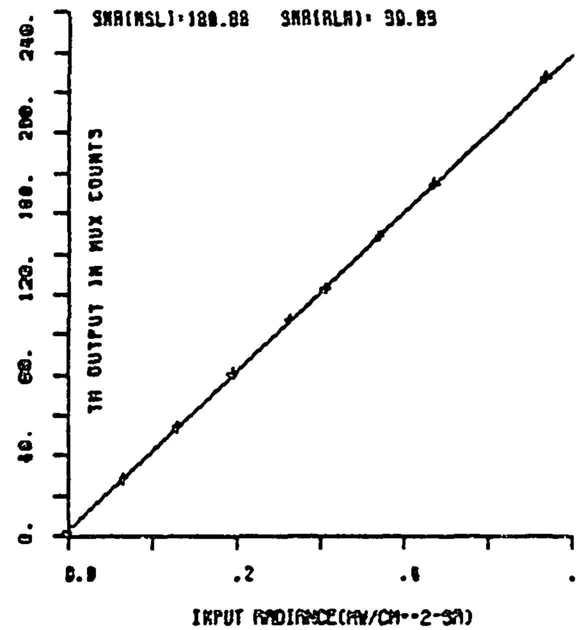
BAND= 5 CHANNEL= 5

GAIN=393.62 OFFSET= 2.94 SIGMA= 0.23



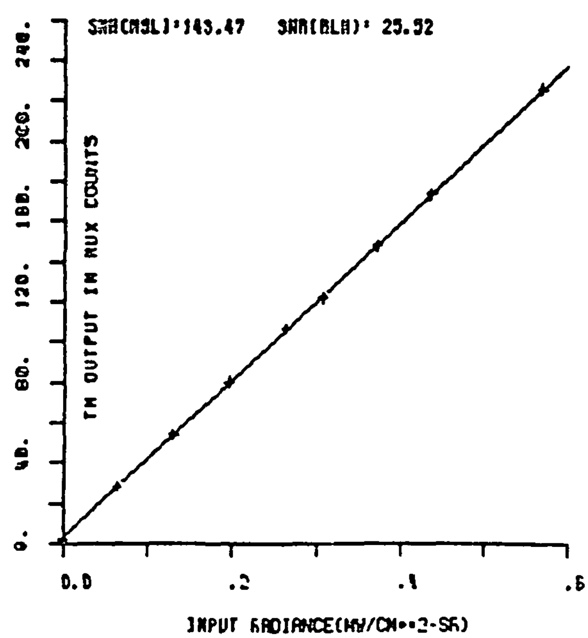
BAND= 5 CHANNEL= 6

GAIN=393.56 OFFSET= 3.09 SIGMA= 0.25



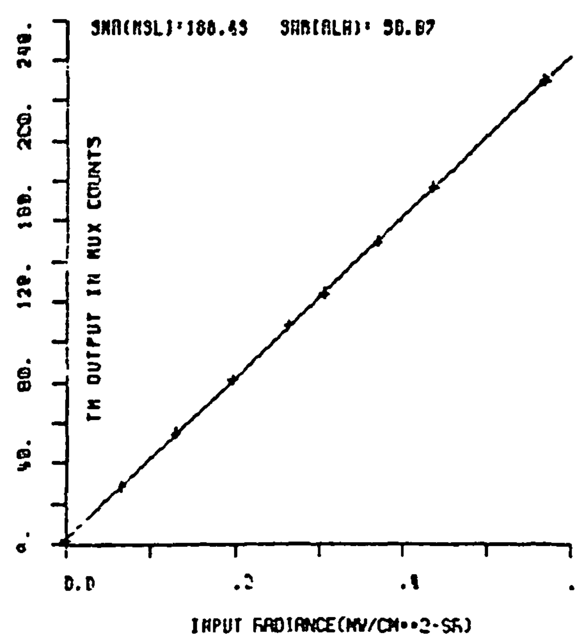
BAND= 5 CHANNEL= 7

GAIN=380.56 OFFSET= 2.95 SIGMA= 0.22



BAND= 5 CHANNEL= 8

GAIN=397.74 OFFSET= 3.26 SIGMA= 0.25



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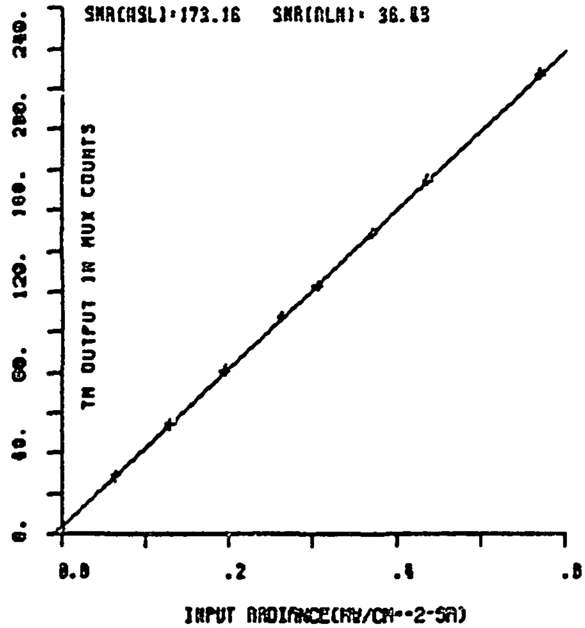
BAND= 5 CHANNEL= 9

GAIN=393.81 OFFSET= 3.00 SIGMA= 0.29

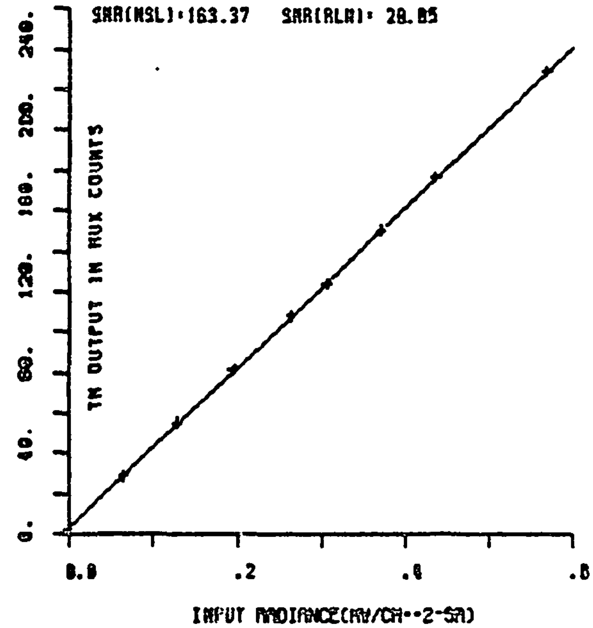
SNR(HSL)=173.16 SNR(RLH)= 36.83



BAND= 5 CHANNEL= 10

GAIN=328.74 OFFSET= 3.20 SIGMA= 0.29

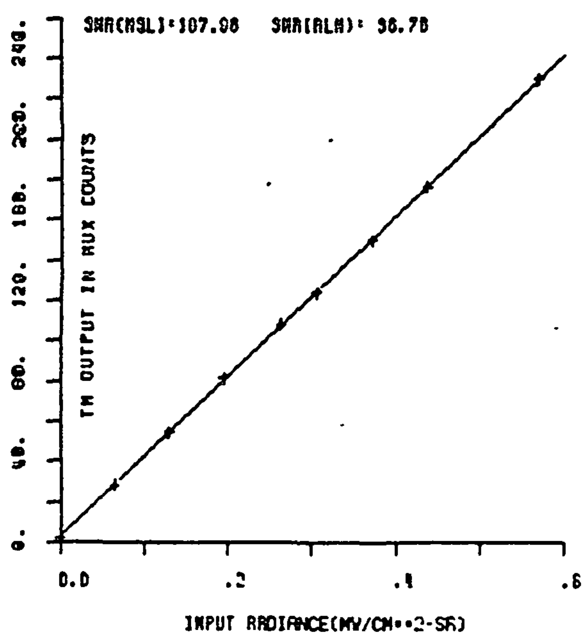
SNR(HSL)=163.37 SNR(RLH)= 28.05



BAND= 5 CHANNEL= 11

GAIN=308.65 OFFSET= 2.90 SIGMA= 0.22

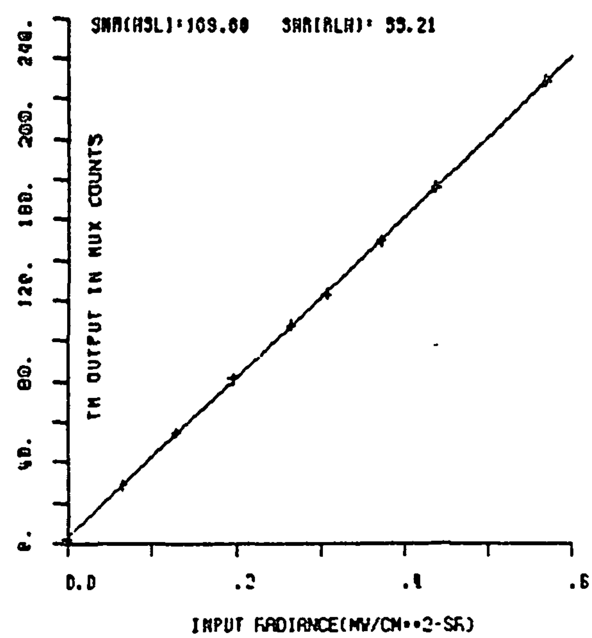
SNR(HSL)=107.08 SNR(RLH)= 36.70



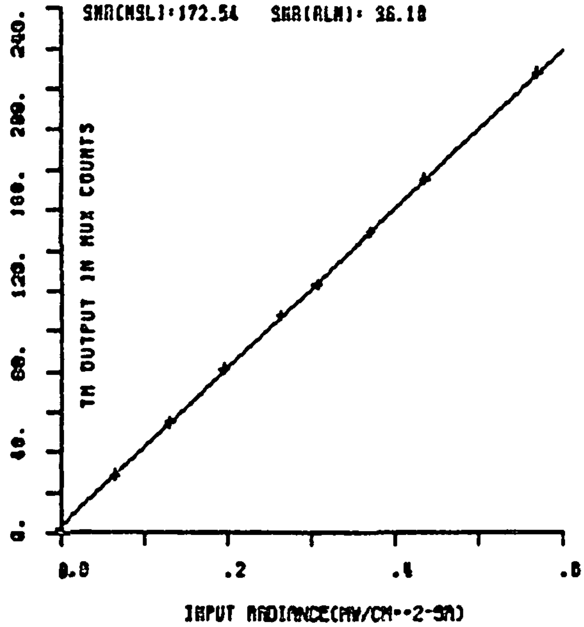
BAND= 5 CHANNEL= 12

GAIN=336.11 OFFSET= 3.04 SIGMA= 0.22

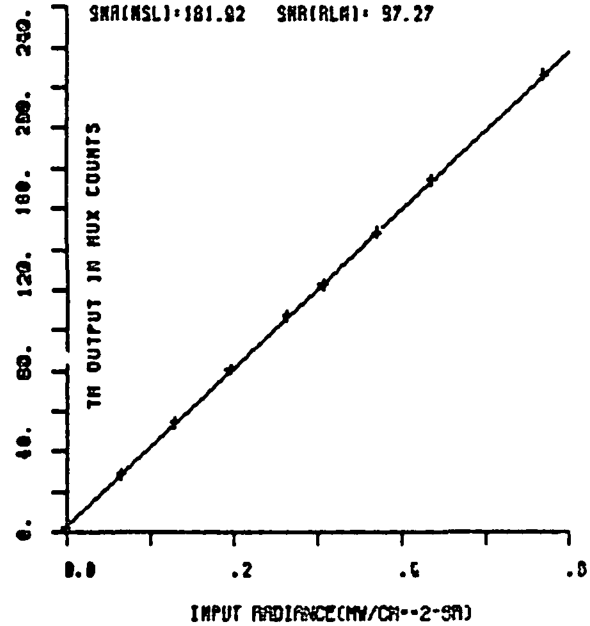
SNR(HSL)=109.60 SNR(RLH)= 33.21



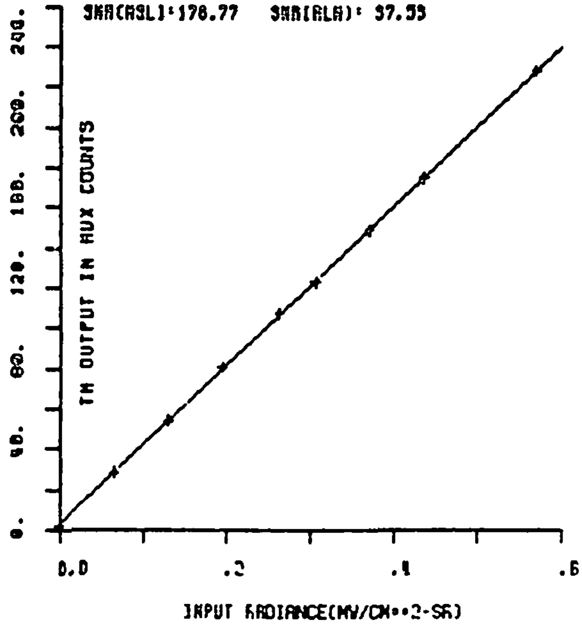
BAND= 5 CHANNEL= 13
GAIN=393.89 OFFSET= 2.96 SIGMA= 0.23
SNR(NSL)=172.54 SNR(RLM)= 36.18



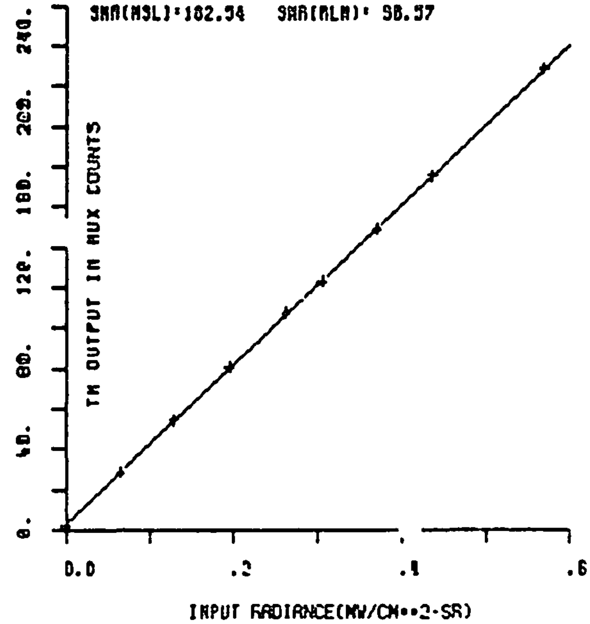
BAND= 5 CHANNEL= 14
GAIN=391.89 OFFSET= 3.17 SIGMA= 0.28
SNR(NSL)=181.92 SNR(RLM)= 37.27



BAND= 5 CHANNEL= 15
GAIN=393.08 OFFSET= 2.82 SIGMA= 0.21
SNR(NSL)=176.77 SNR(RLM)= 37.55



BAND= 5 CHANNEL= 16
GAIN=395.15 OFFSET= 3.11 SIGMA= 0.25
SNR(NSL)=182.54 SNR(RLM)= 38.57



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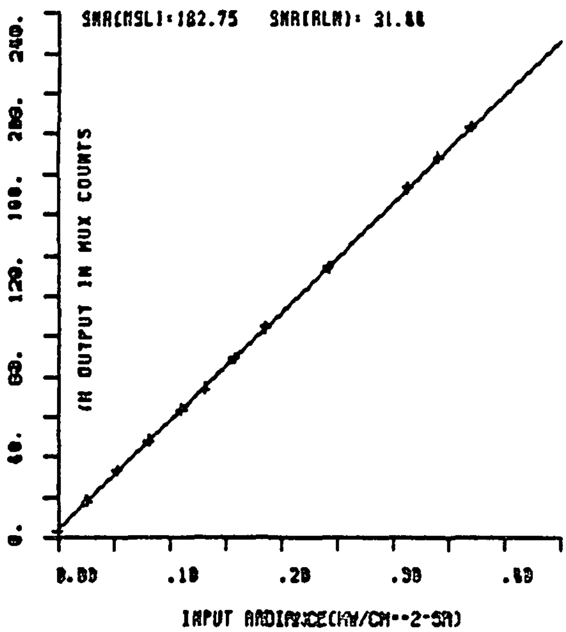
BAND= 7 CHANNEL= 1

GAIN=539.29 OFFSET= 3.72 SIGMA= 0.95

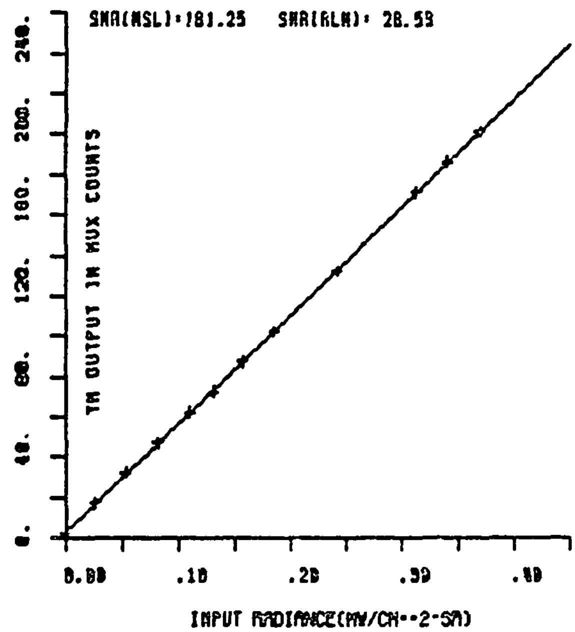
SNR(MSL)=182.75 SNR(RLN)= 31.88



BAND= 7 CHANNEL= 2

GAIN=535.02 OFFSET= 3.10 SIGMA= 0.99

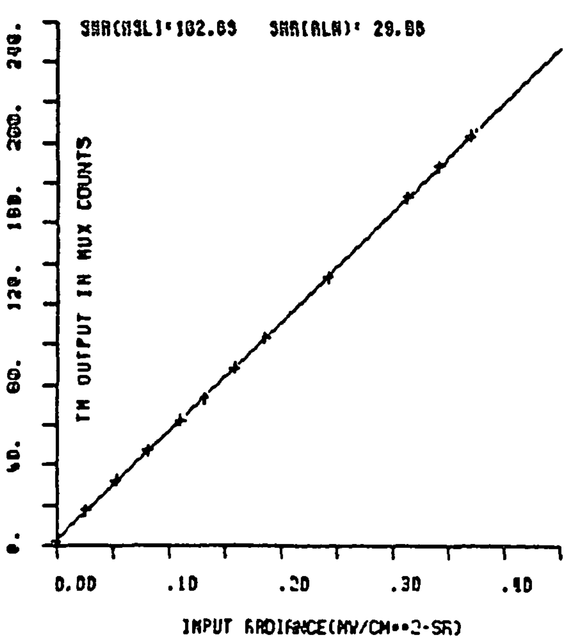
SNR(MSL)=181.25 SNR(RLN)= 28.59



BAND= 7 CHANNEL= 3

GAIN=539.47 OFFSET= 3.15 SIGMA= 0.55

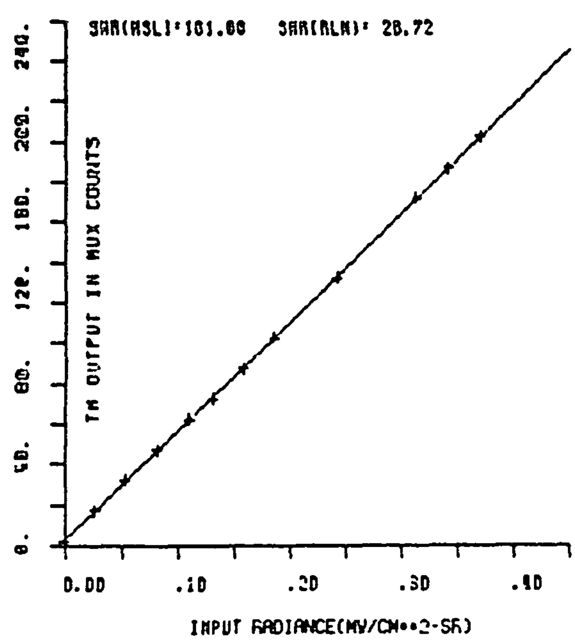
SNR(MSL)=182.69 SNR(RLN)= 29.88



BAND= 7 CHANNEL= 4

GAIN=537.38 OFFSET= 3.15 SIGMA= 0.35

SNR(MSL)=181.60 SNR(RLN)= 28.72



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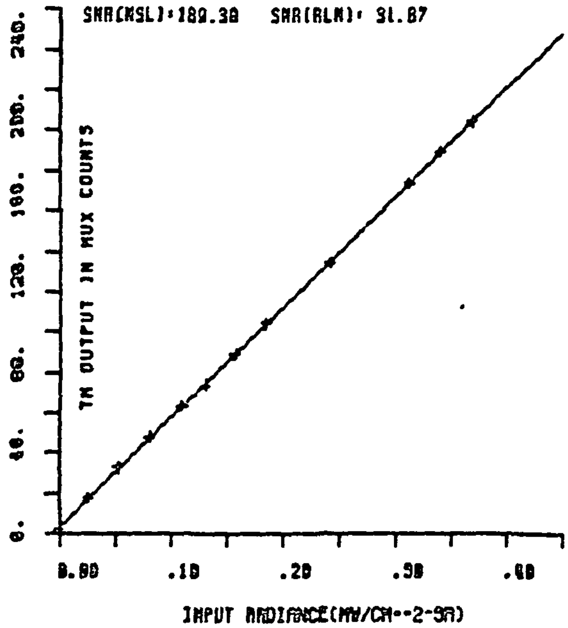
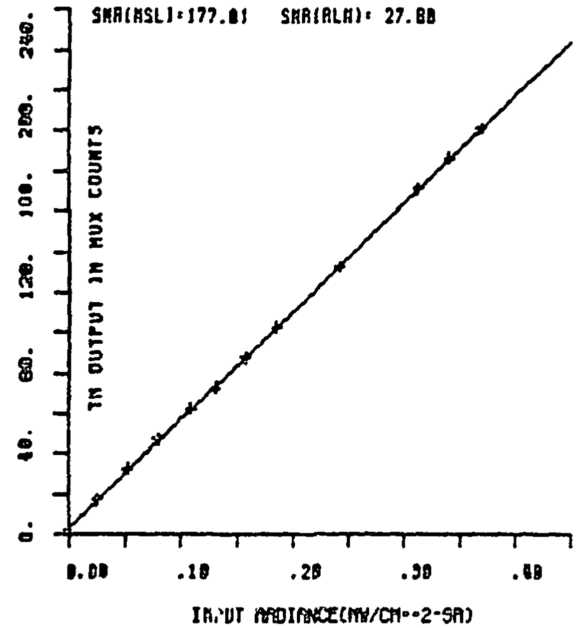
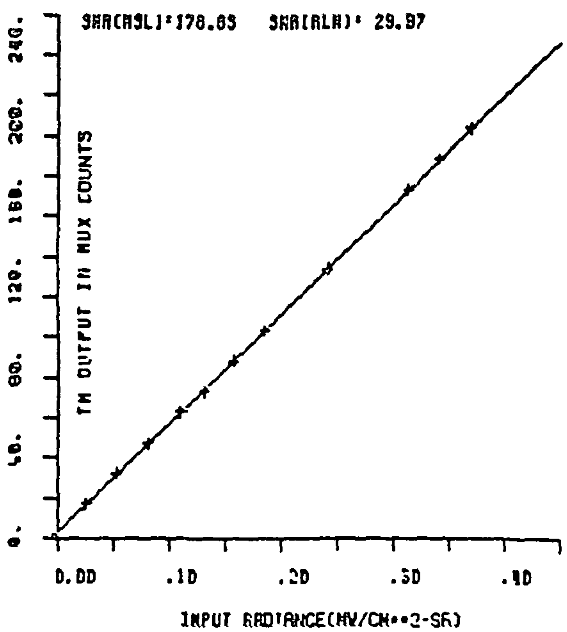
BAND= 7 CHANNEL= 5
GAIN=543.38 OFFSET= 3.08 SIGMA= 0.85
SNR(MSL)=180.38 SNR(RLM)= 31.87



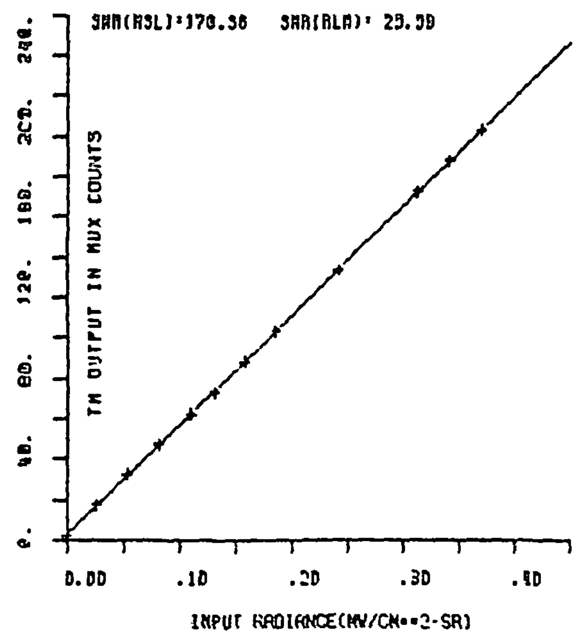
BAND= 7 CHANNEL= 6
GAIN=535.27 OFFSET= 3.13 SIGMA= 0.93
SNR(MSL)=177.01 SNR(RLM)= 27.88



BAND= 7 CHANNEL= 7
GAIN=541.08 OFFSET= 3.03 SIGMA= 0.98
SNR(MSL)=178.65 SNR(RLM)= 29.87



BAND= 7 CHANNEL= 8
GAIN=539.53 OFFSET= 3.13 SIGMA= 0.94
SNR(MSL)=170.36 SNR(RLM)= 25.59



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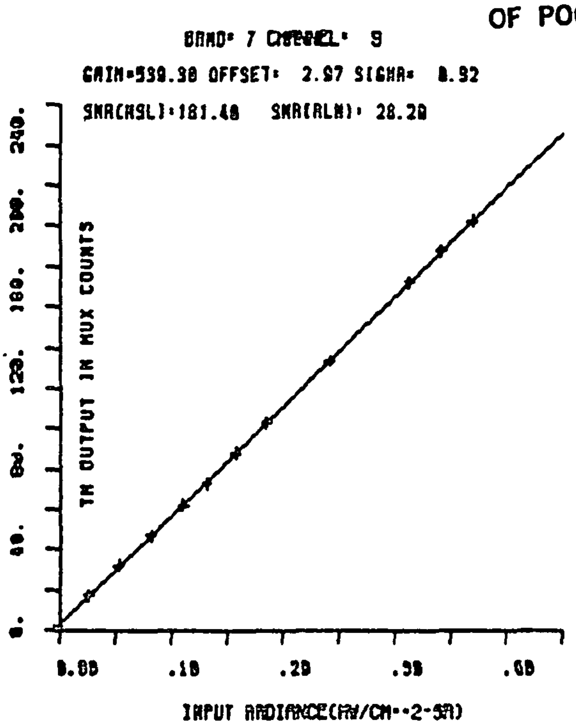

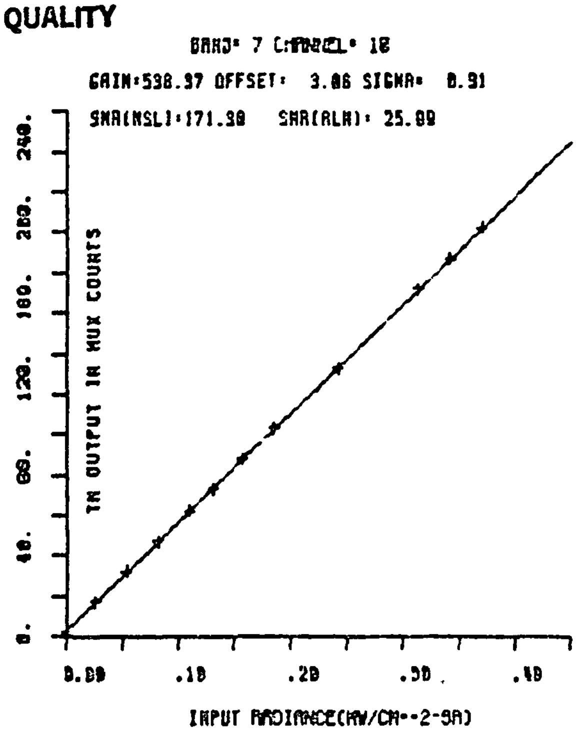

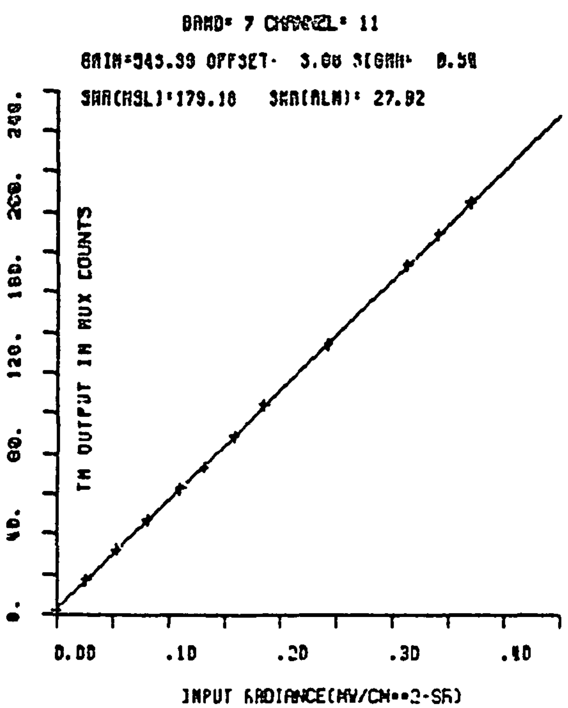

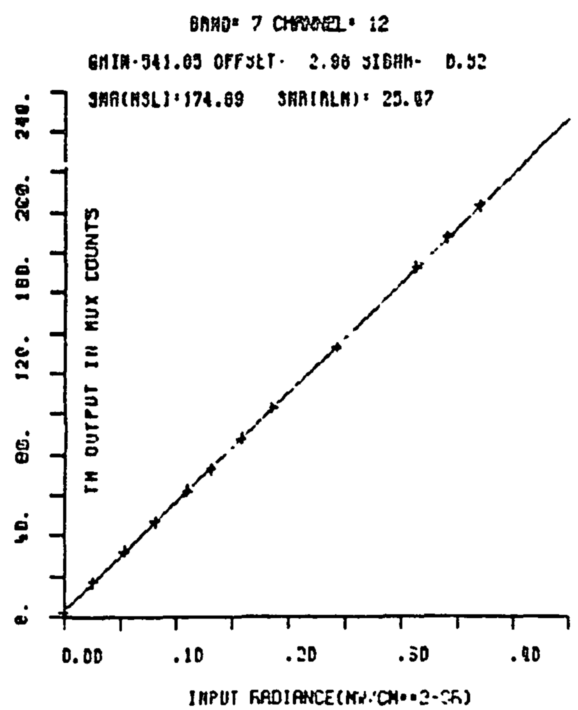

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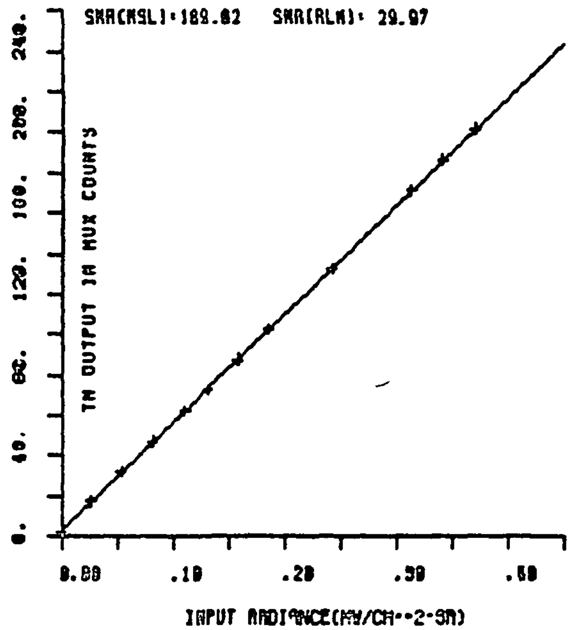
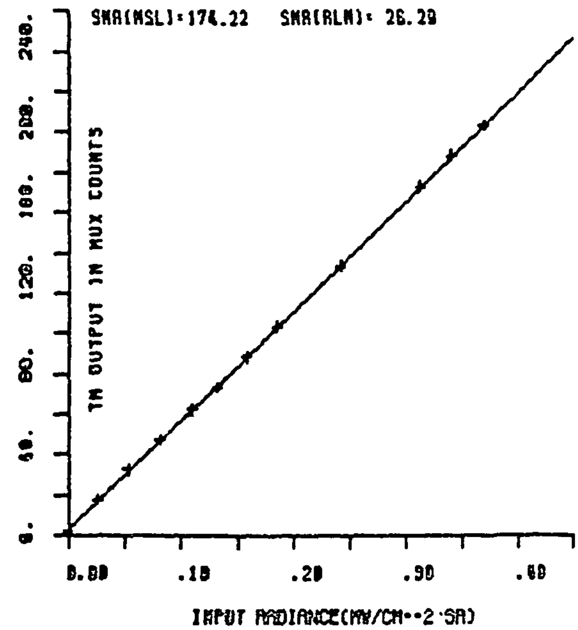
BAND= 7 CHANNEL= 13

GAIN=536.07 OFFSET= 2.86 SIGMA= 0.38



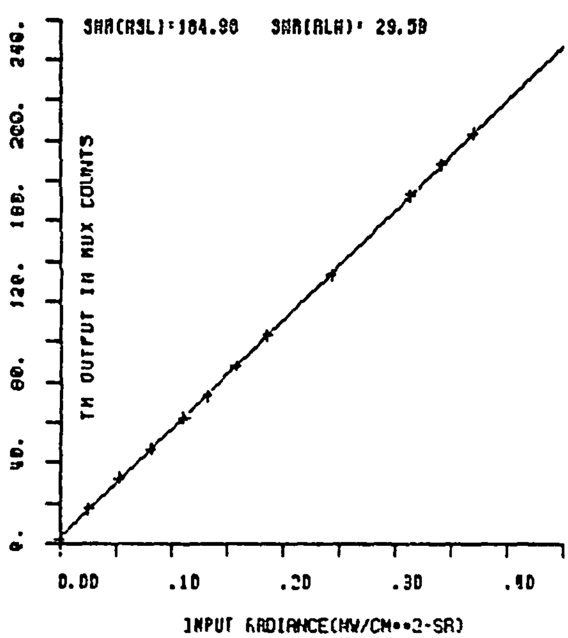
BAND= 7 CHANNEL= 14

GAIN=540.64 OFFSET= 3.19 SIGMA= 0.33



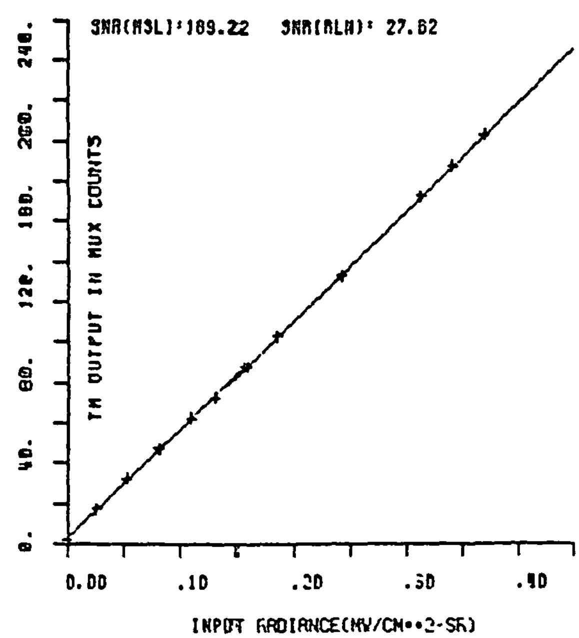
BAND= 7 CHANNEL= 15

GAIN=540.22 OFFSET= 2.96 SIGMA= 0.32



BAND= 7 CHANNEL= 16

GAIN=536.66 OFFSET= 3.16 SIGMA= 0.33



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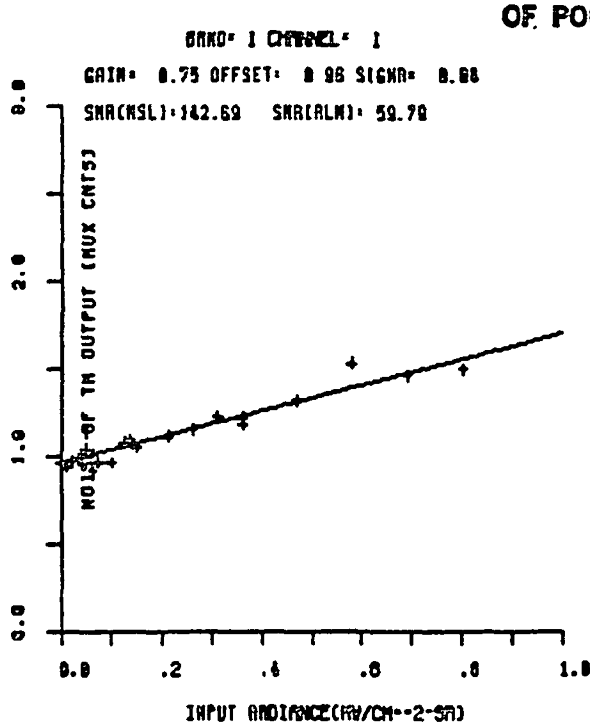

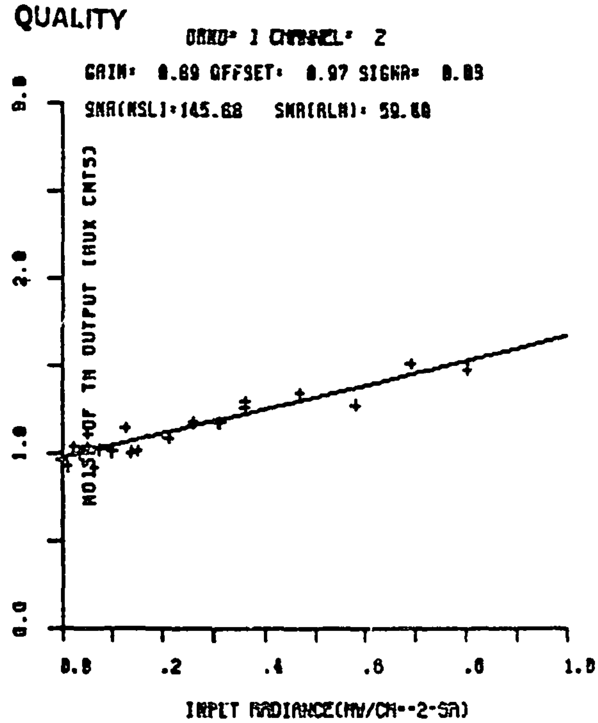

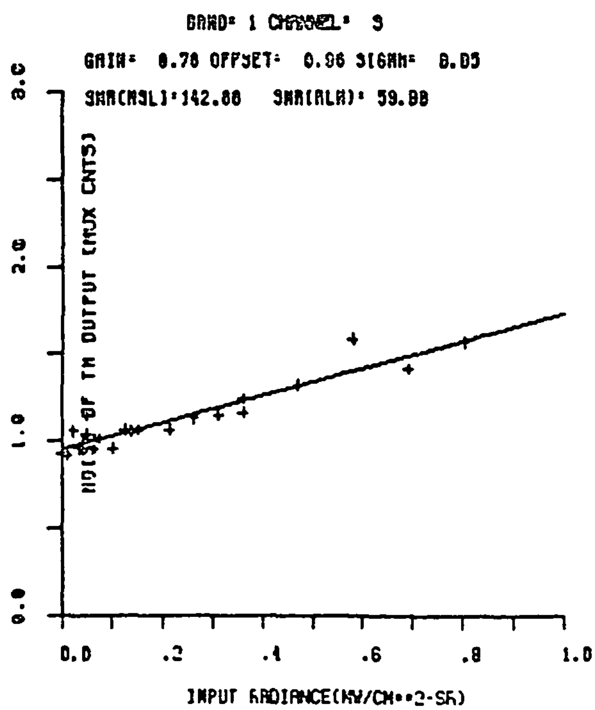

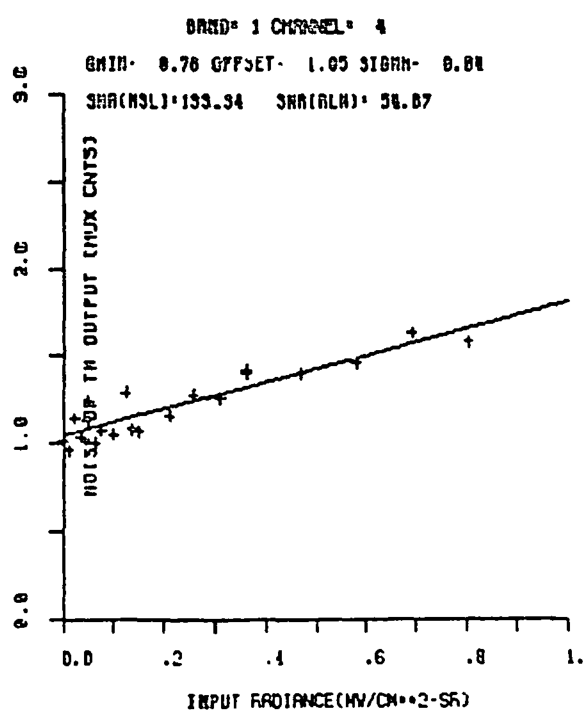

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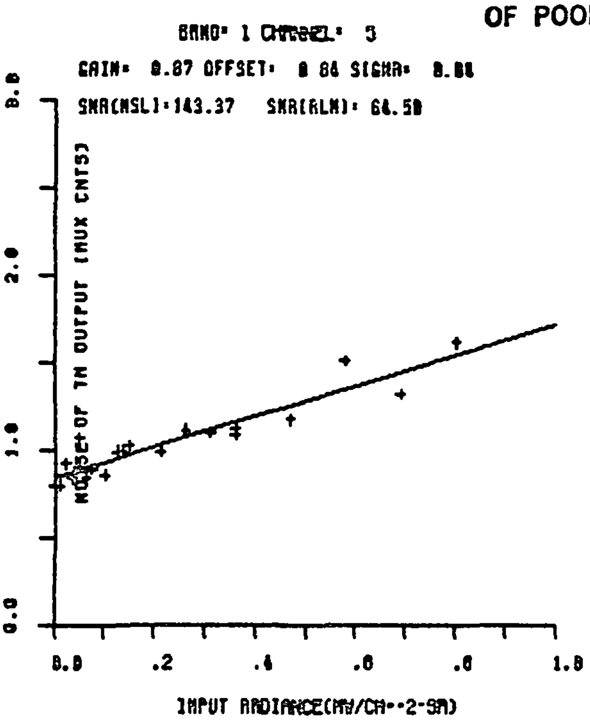

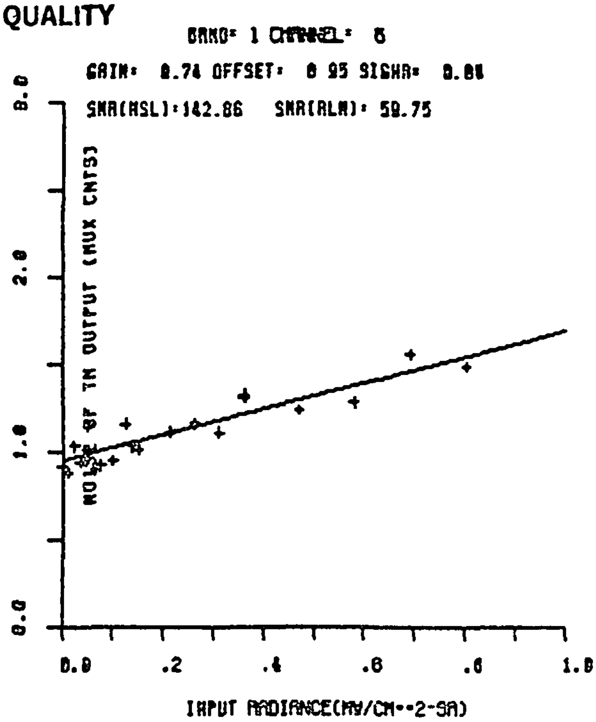

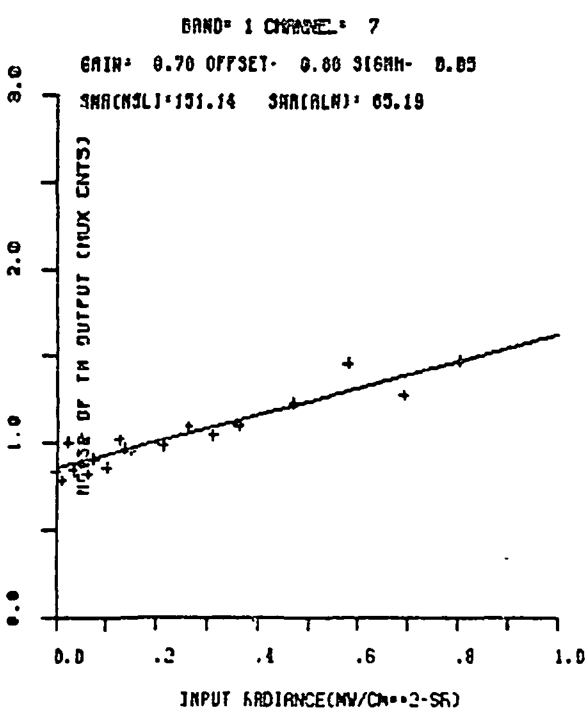

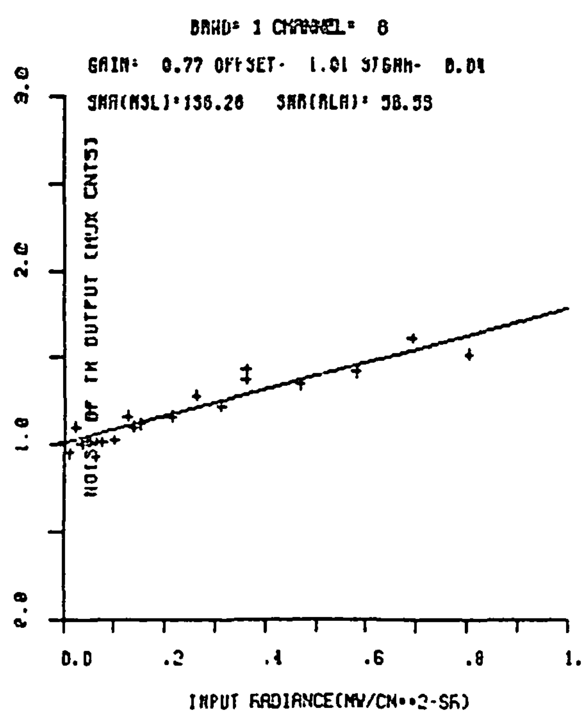

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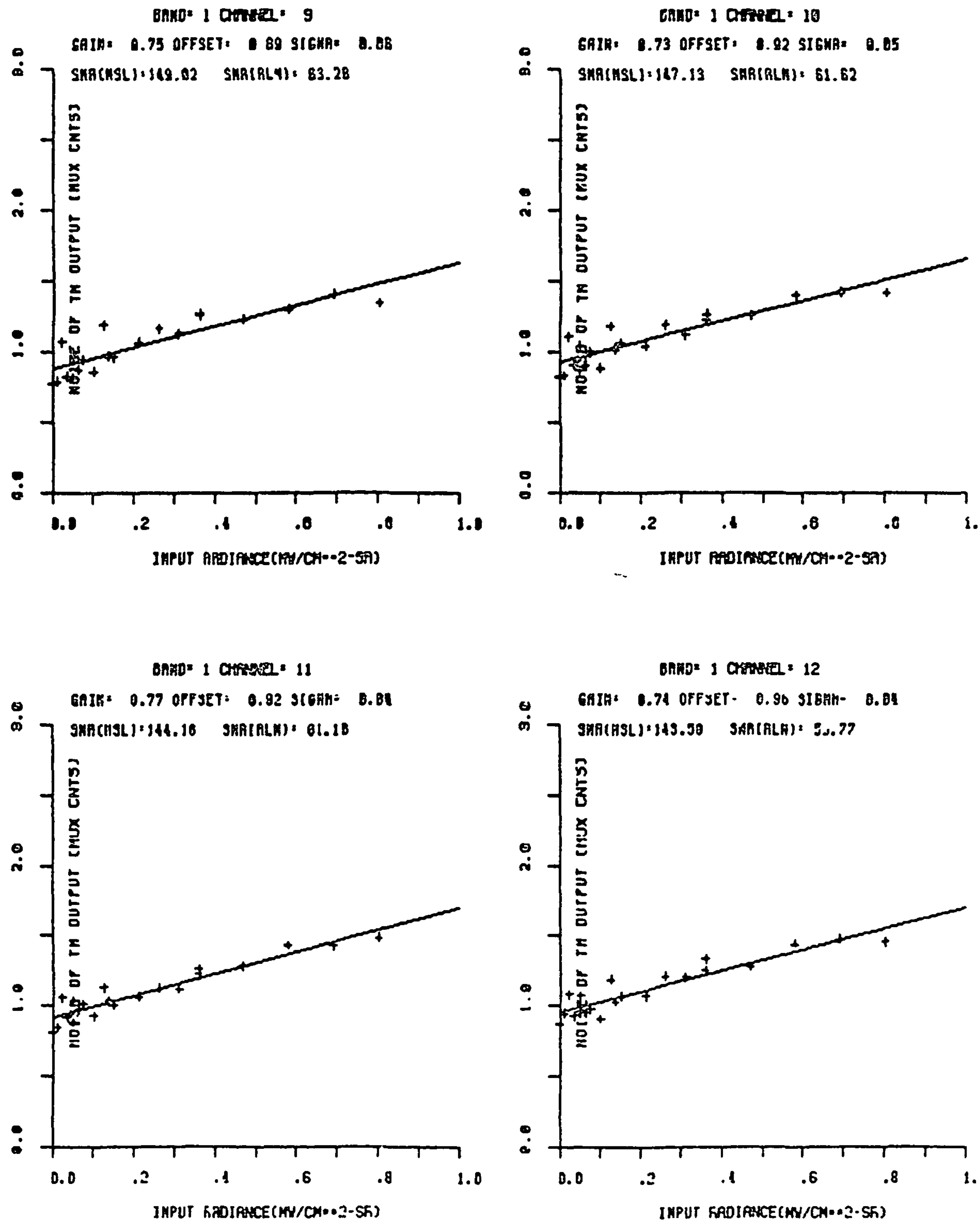

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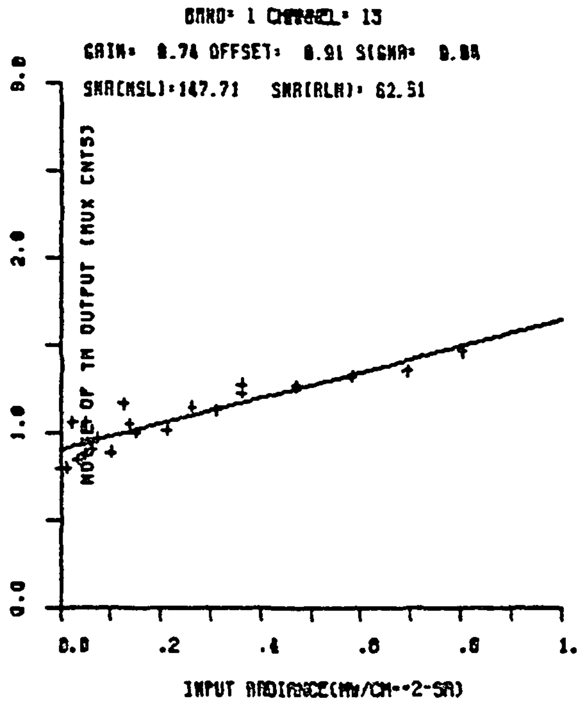

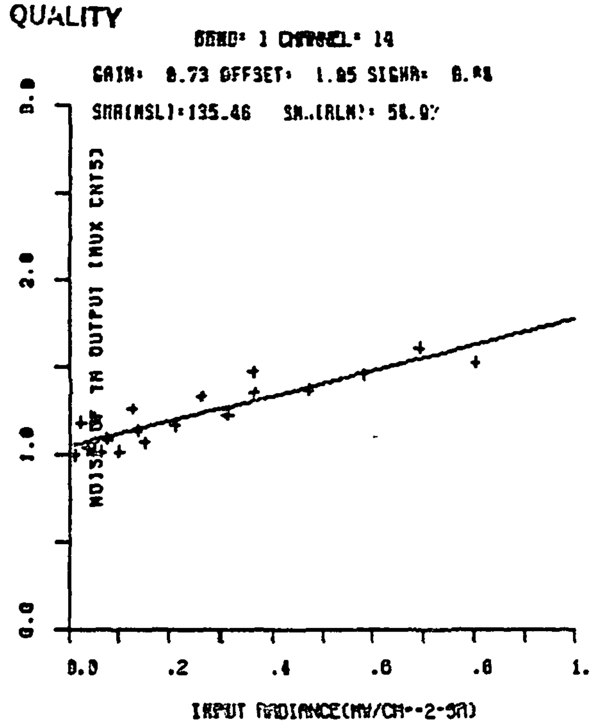

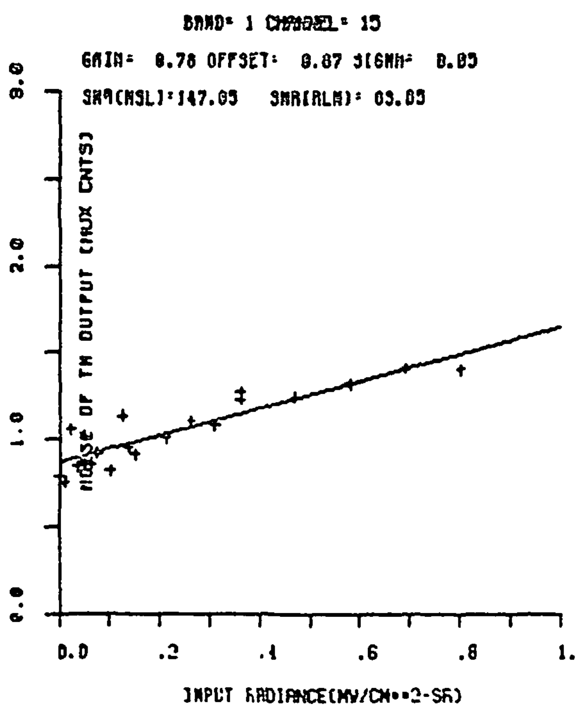

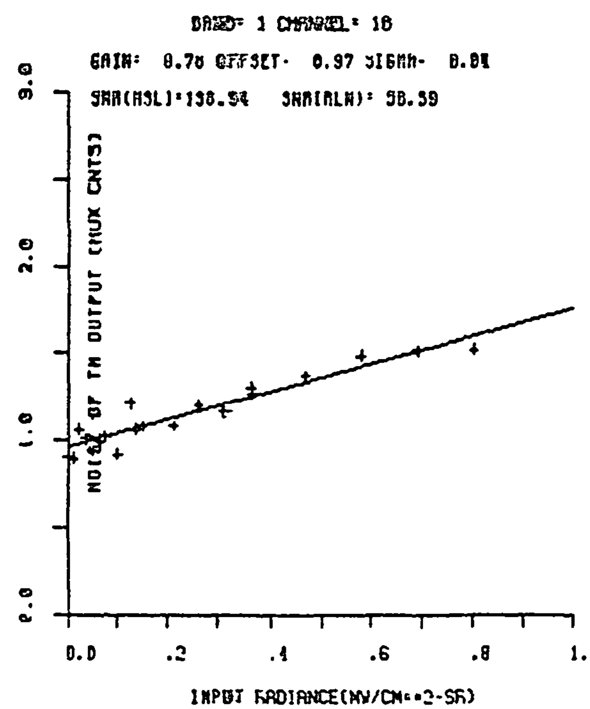

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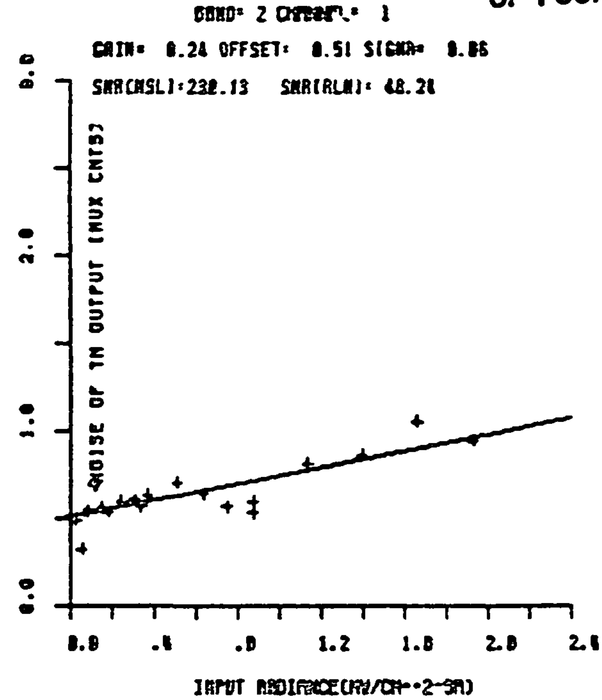

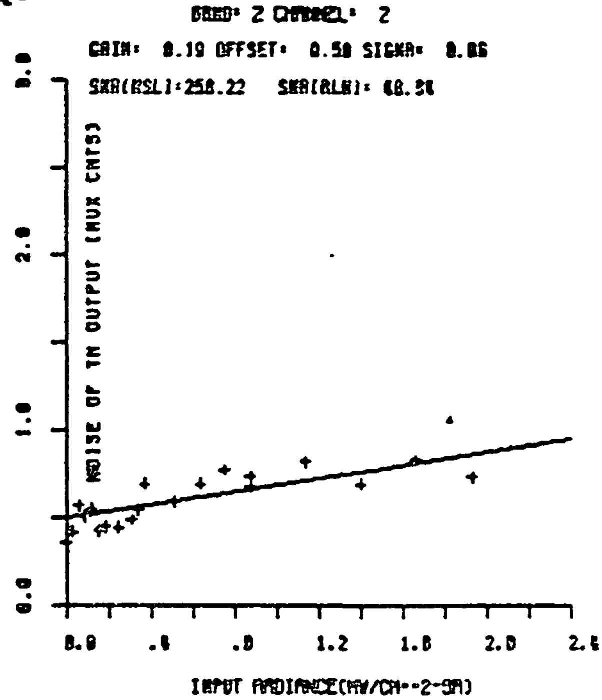

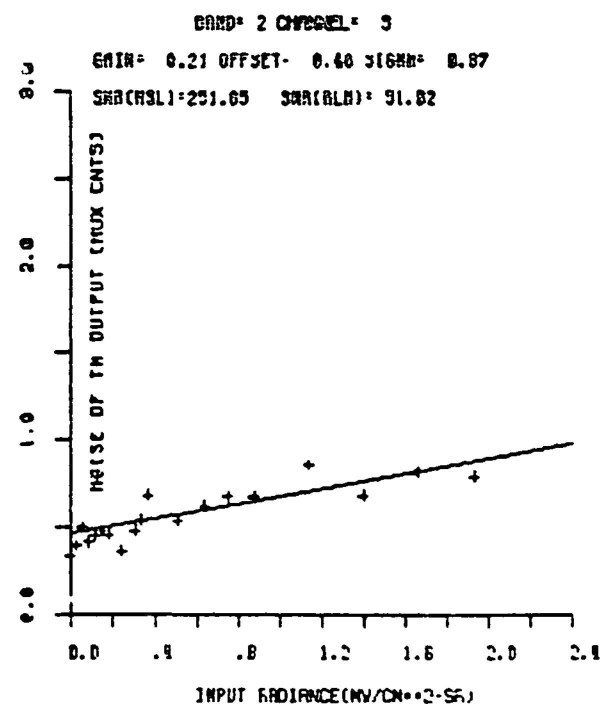

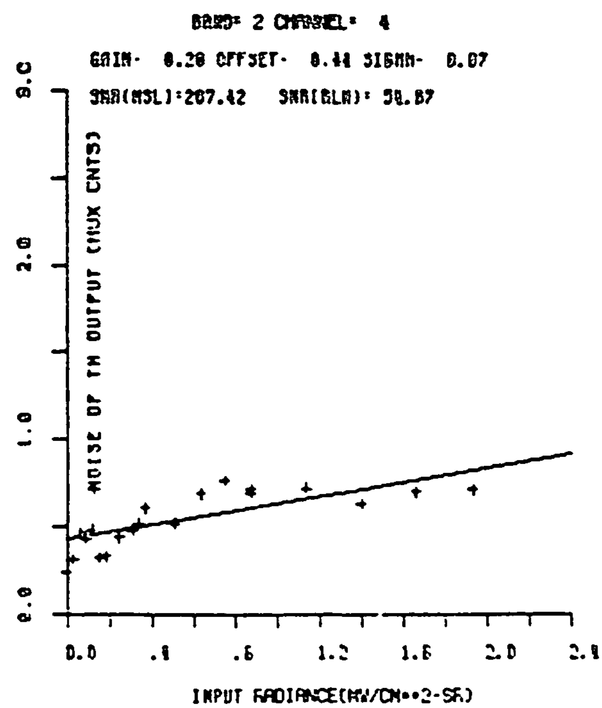

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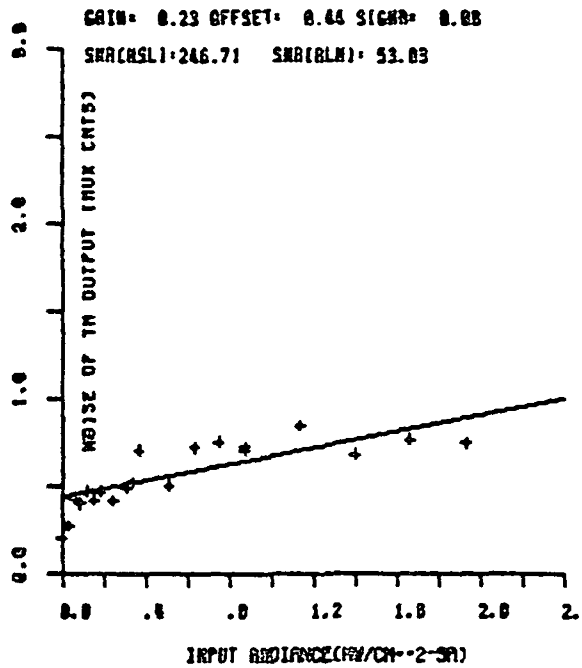

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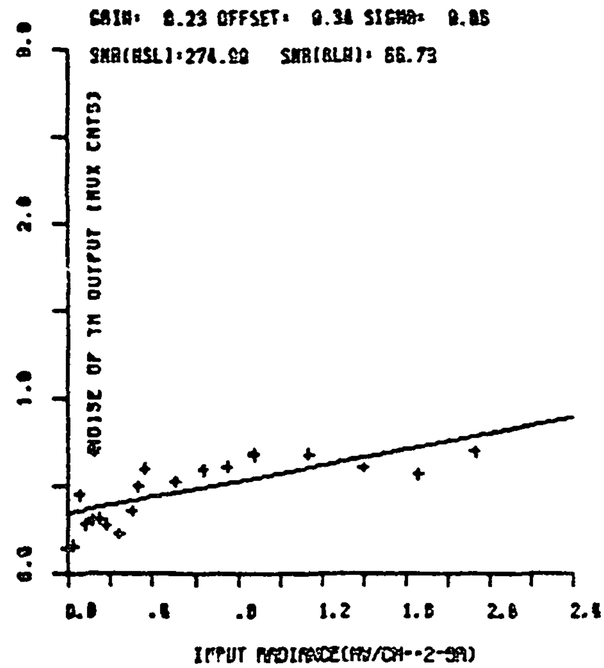

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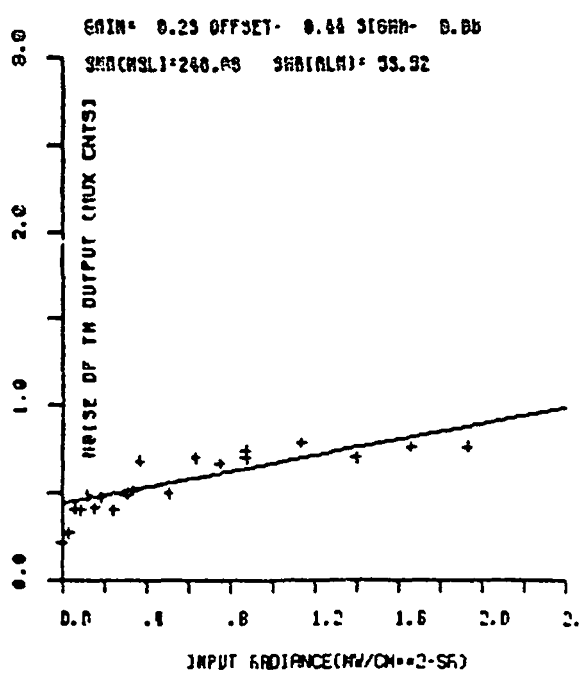
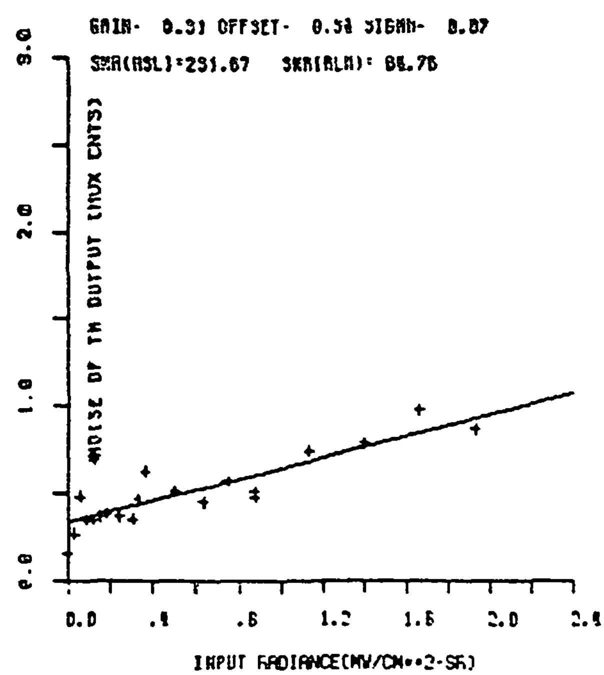


BAND= 2 CHANNEL= 8



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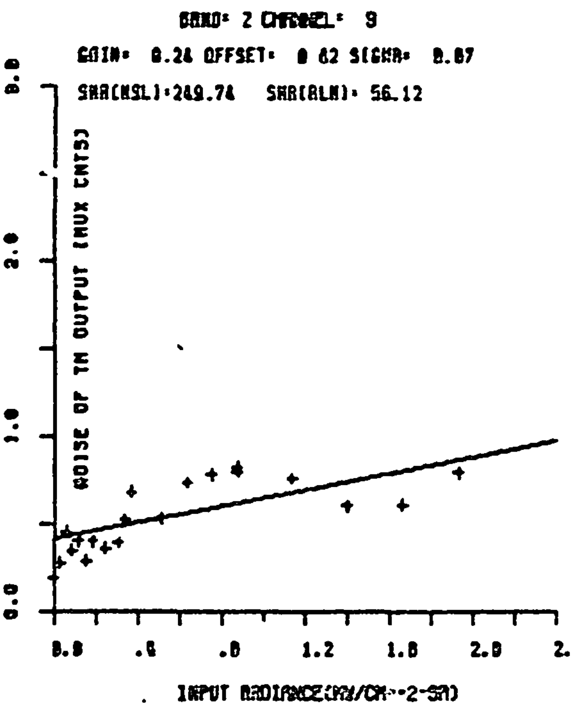

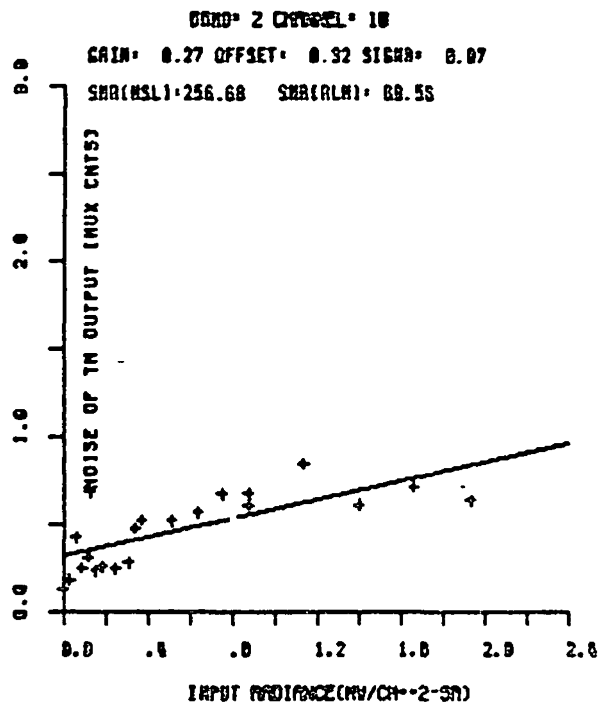

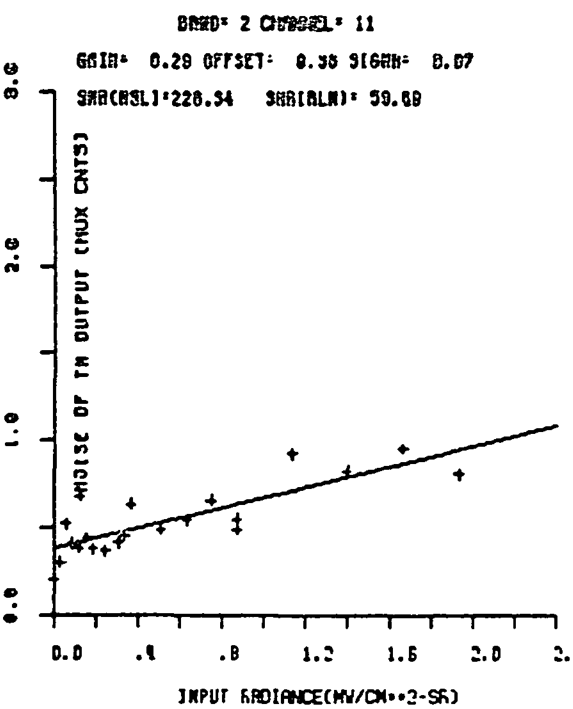

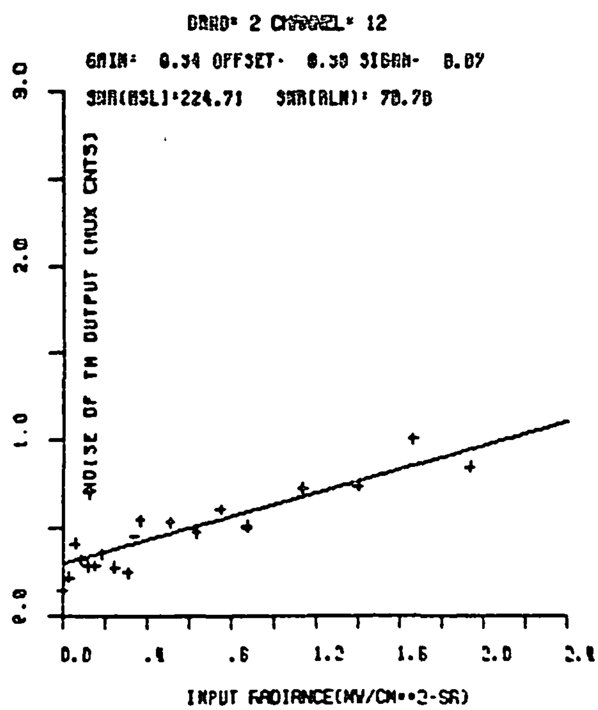

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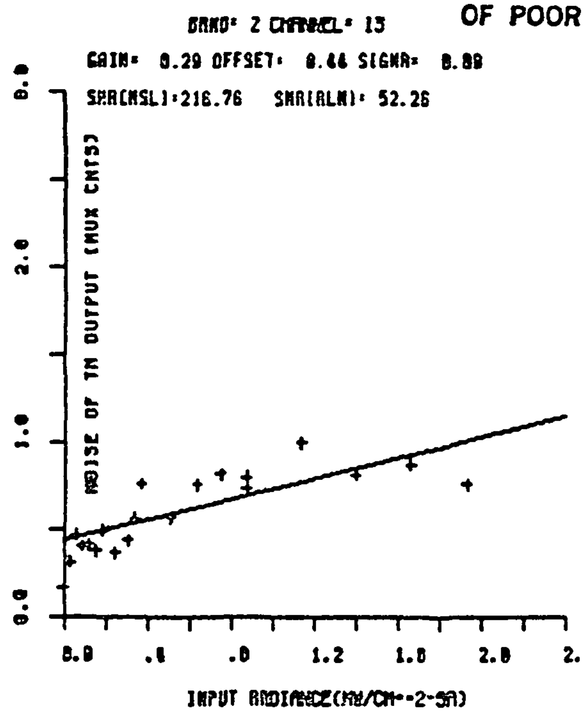

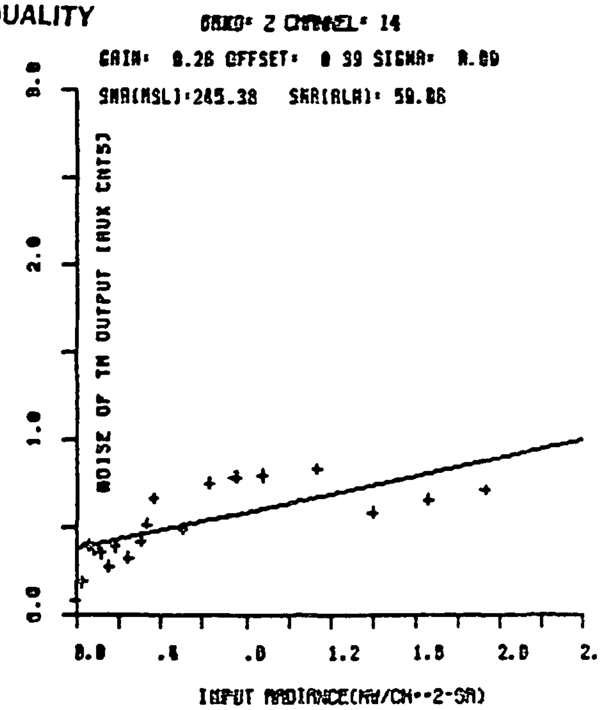

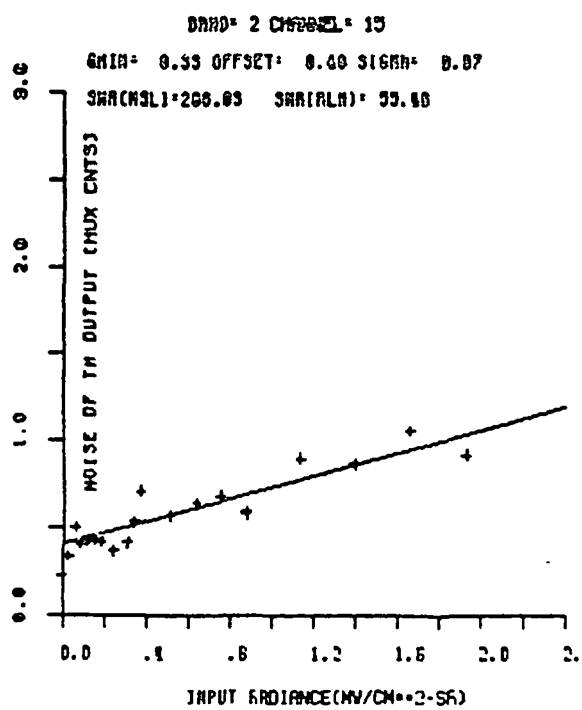

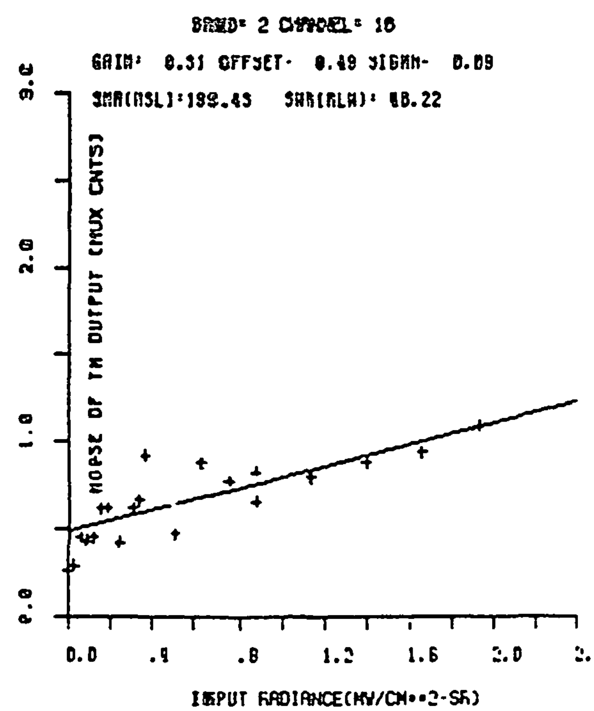

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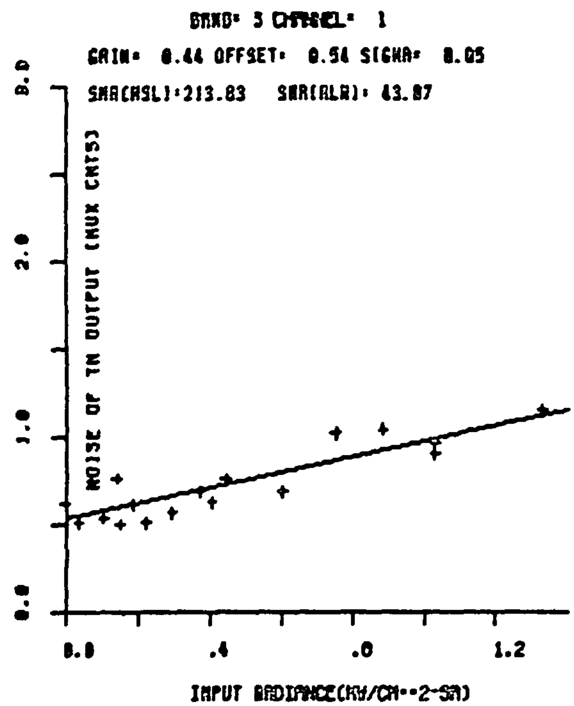

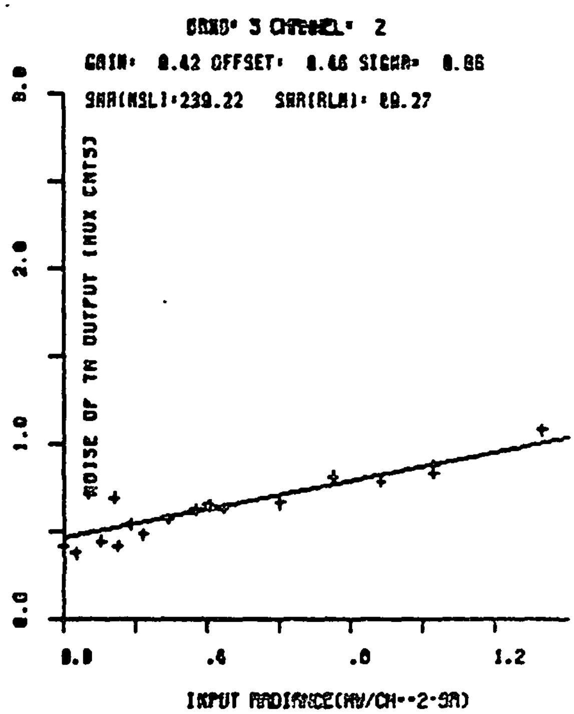

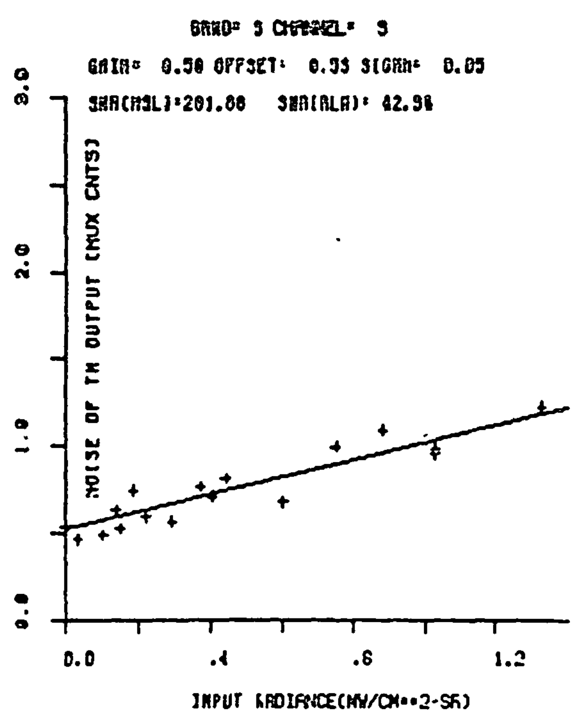

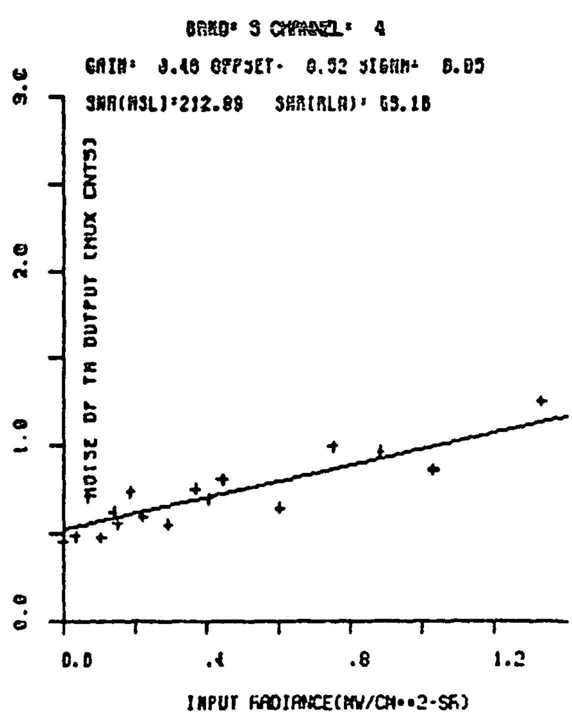

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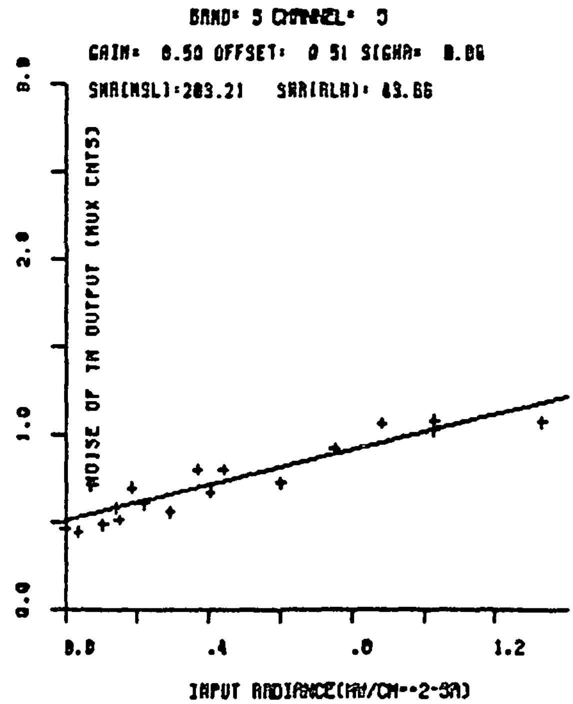

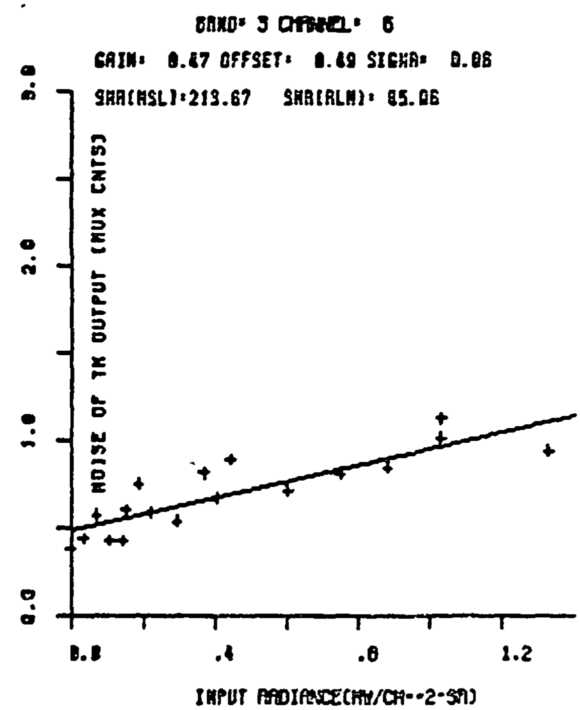

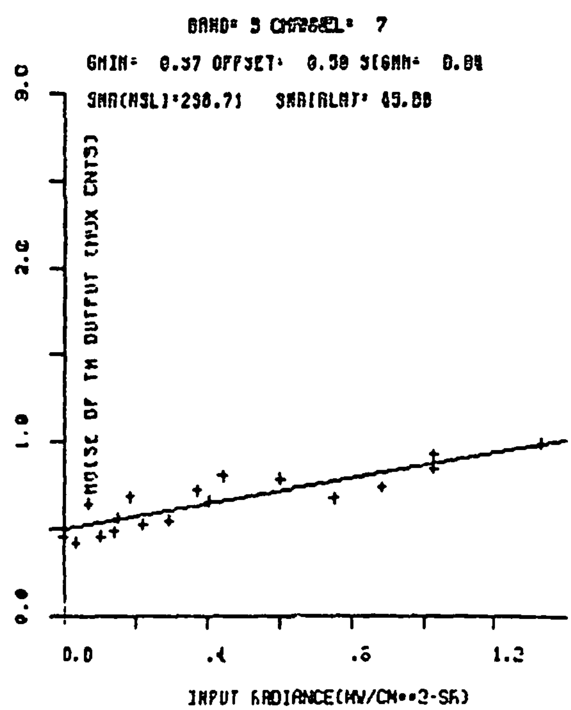

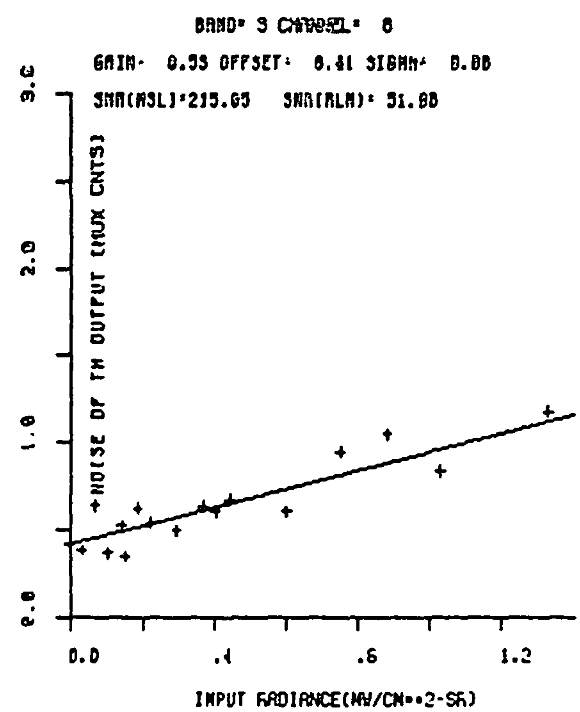

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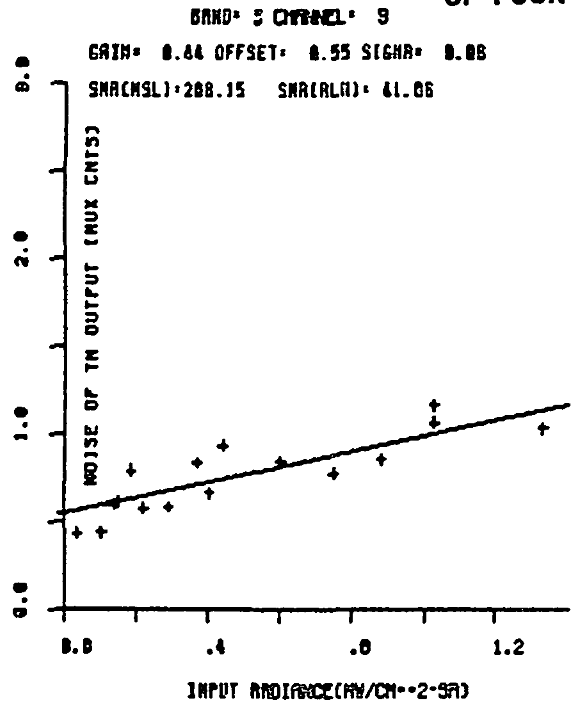

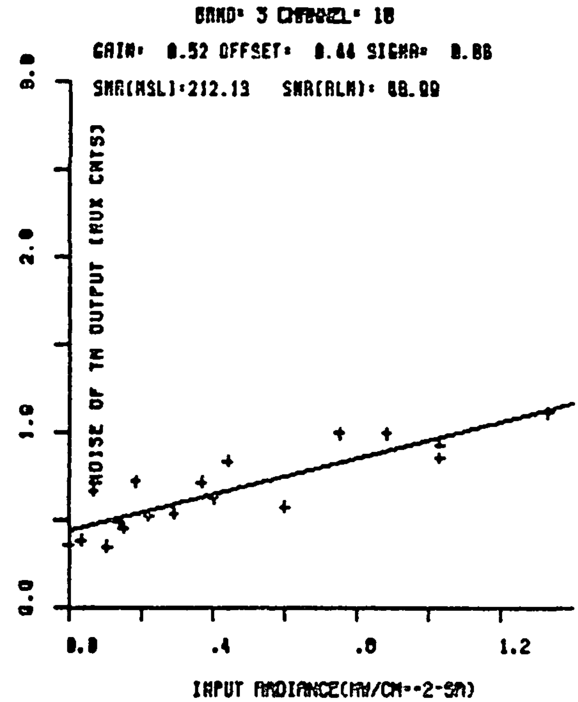

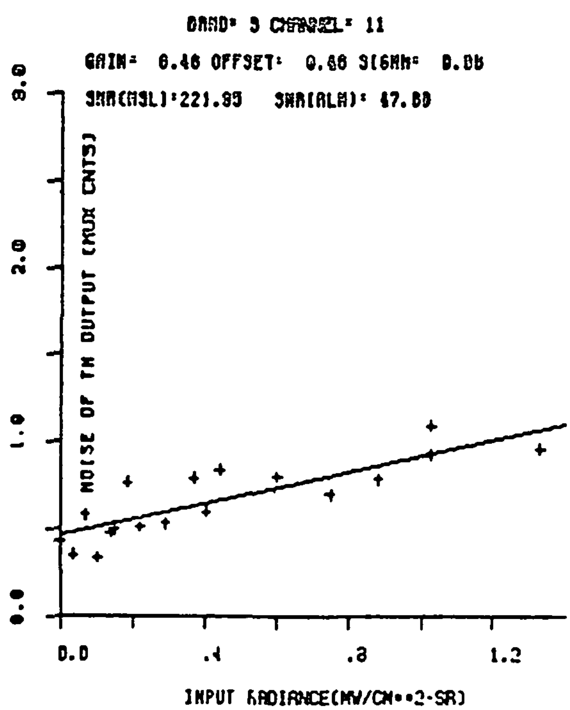

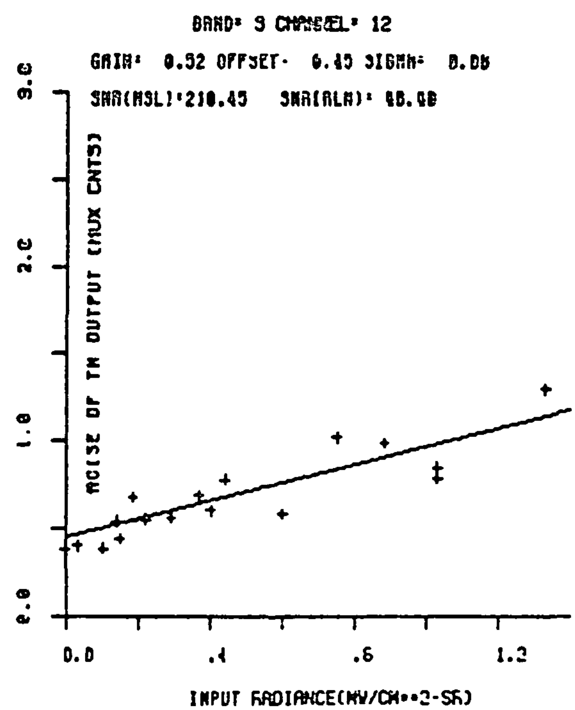

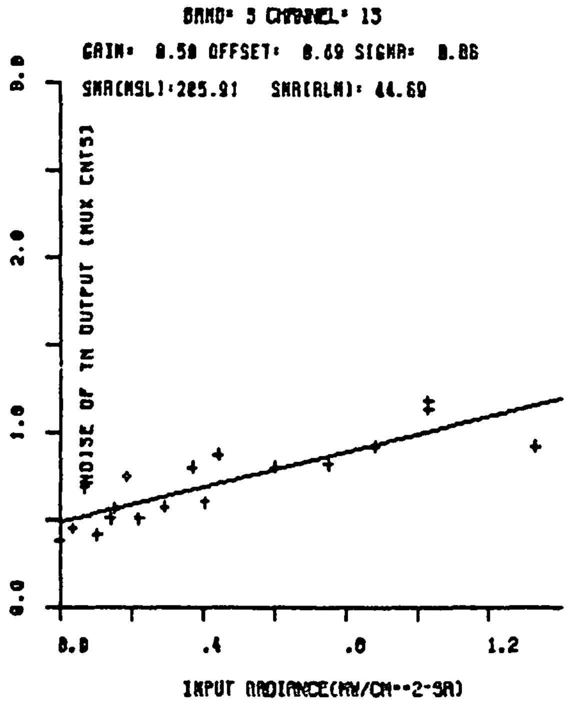
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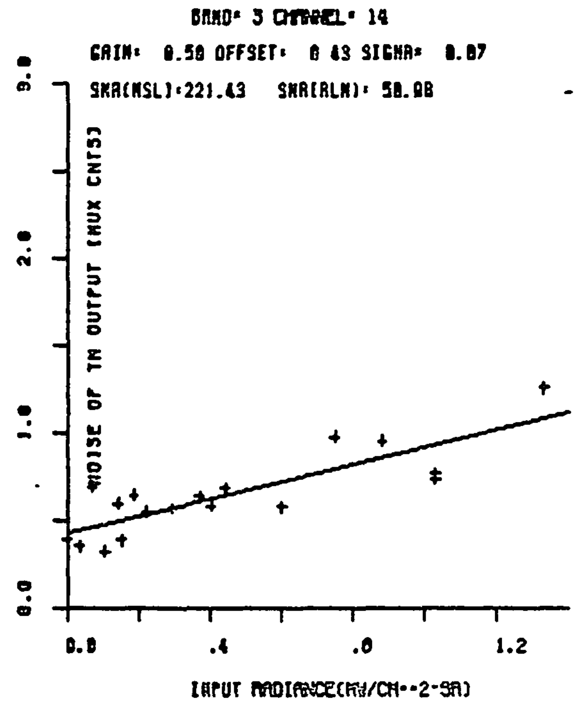
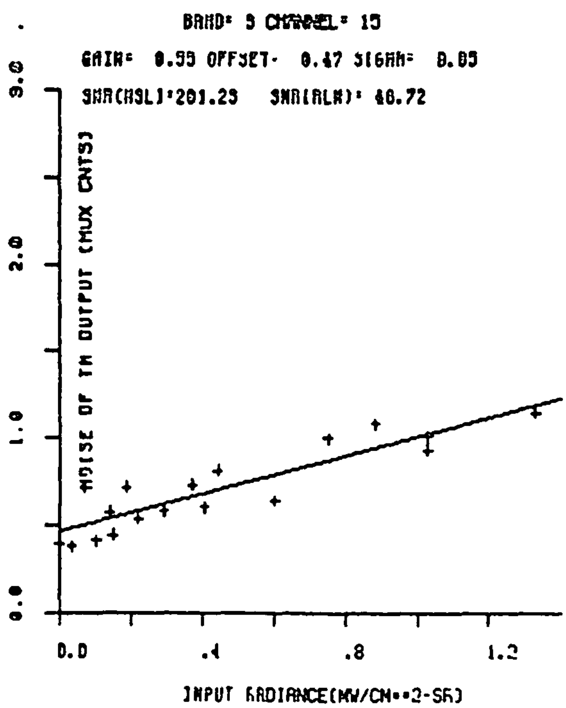
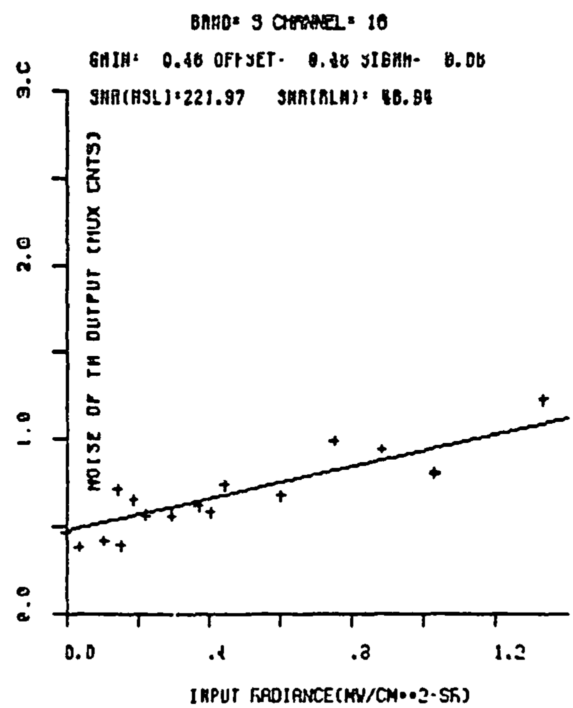
GAIN= 0.50 OFFSET= 0.49 SIGMA= 0.86
SNR(MSL)=285.91 SNR(RLM)= 44.69
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.4
.8
1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 14
GAIN= 0.50 OFFSET= 0.43 SIGMA= 0.87
SNR(MSL)=221.43 SNR(RLM)= 50.98
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.4
.8
1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 15
GAIN= 0.55 OFFSET= 0.47 SIGMA= 0.85
SNR(MSL)=201.23 SNR(RLM)= 46.72
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.4
.8
1.2
INPUT RADIANCE(MW/CM**2-SR)


BAND= 3 CHANNEL= 16
GAIN= 0.46 OFFSET= 0.46 SIGMA= 0.86
SNR(MSL)=221.97 SNR(RLM)= 46.84
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.4
.8
1.2
INPUT RADIANCE(MW/CM**2-SR)

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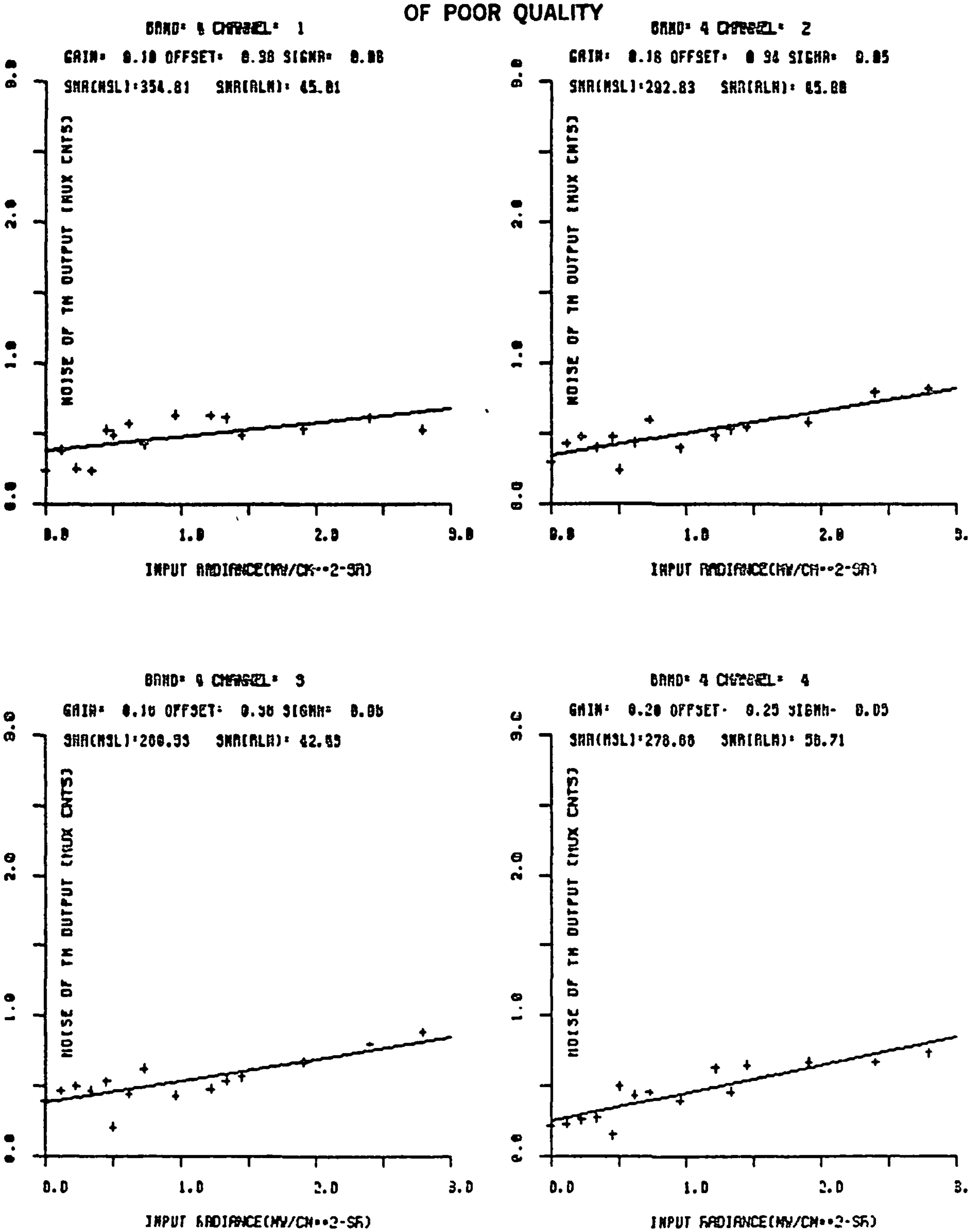

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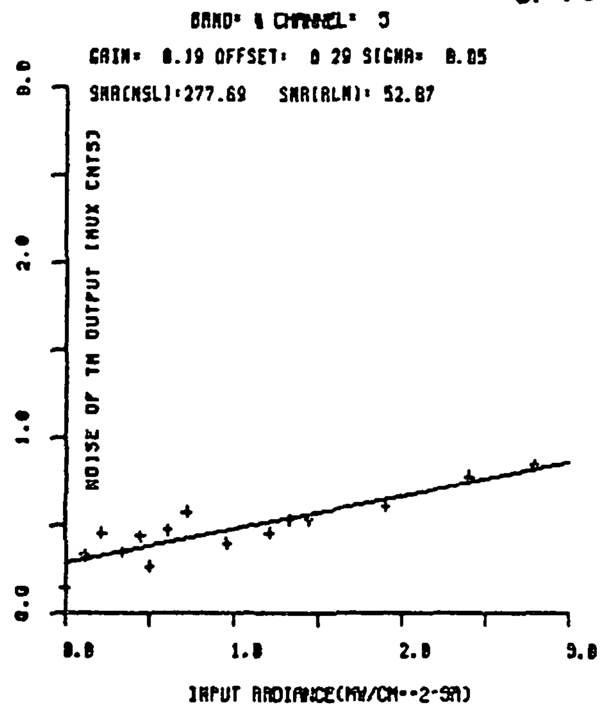

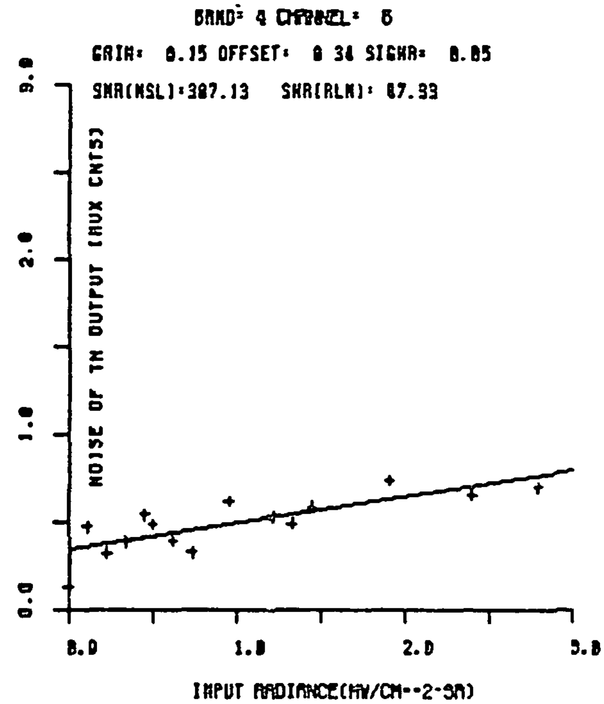

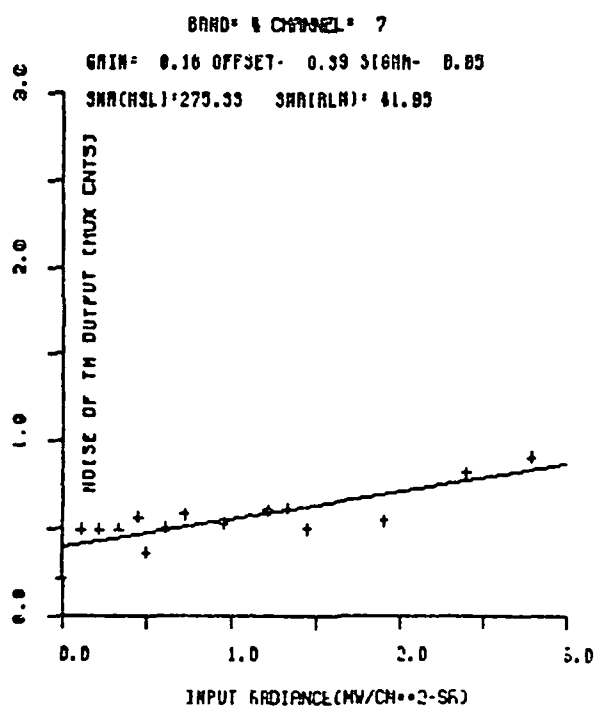

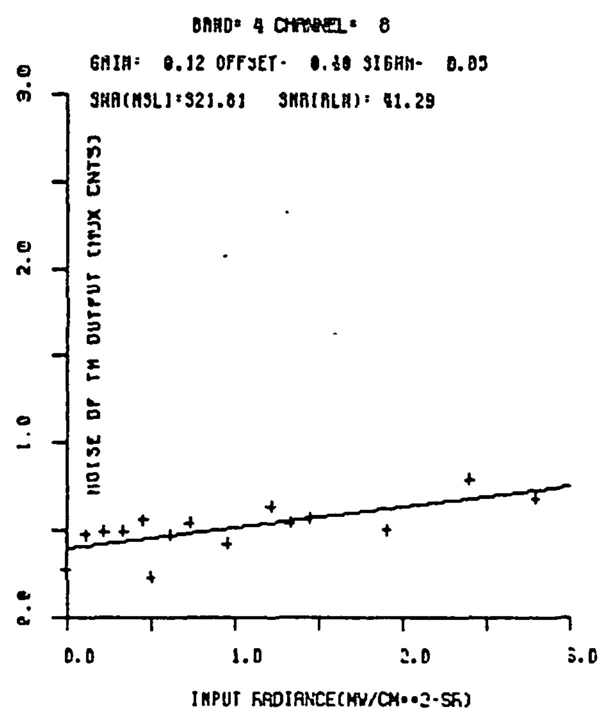

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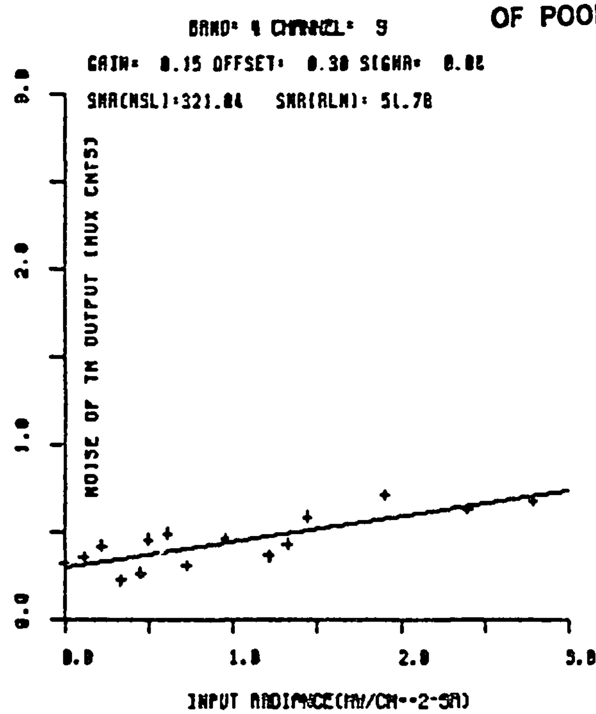

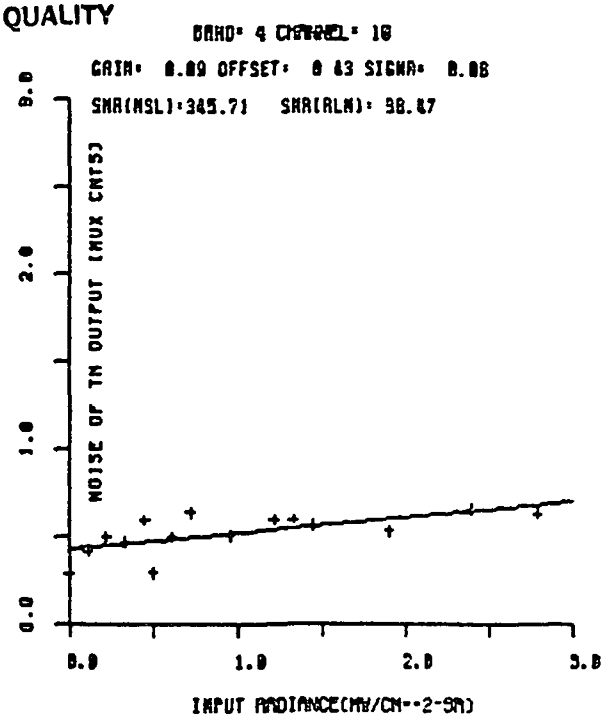

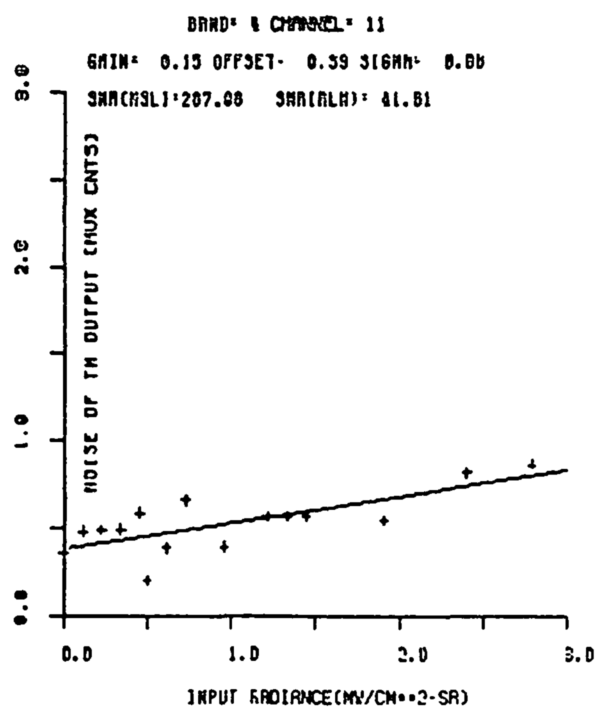

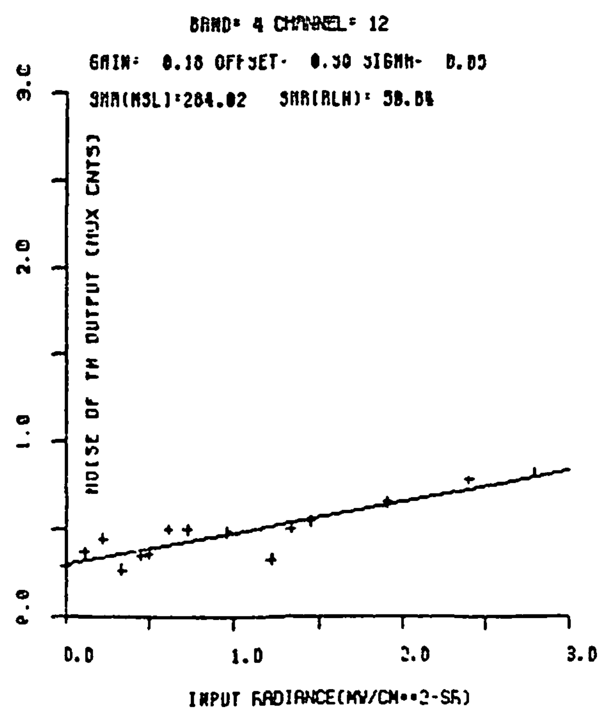

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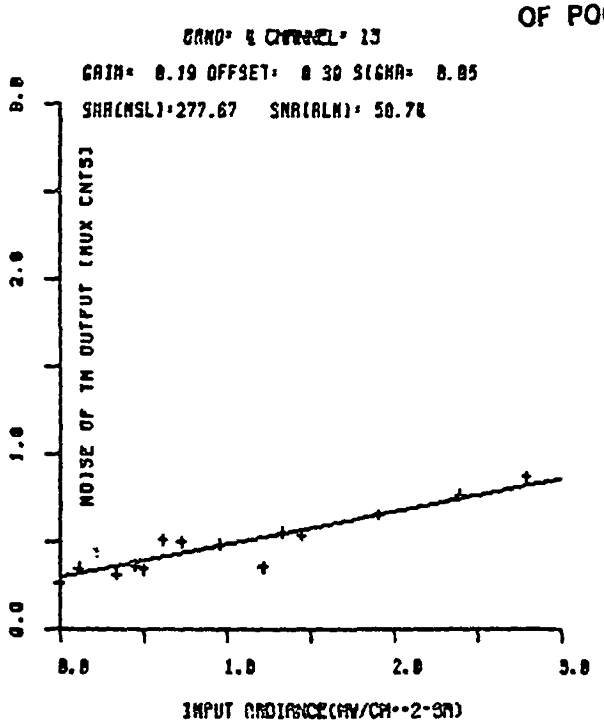

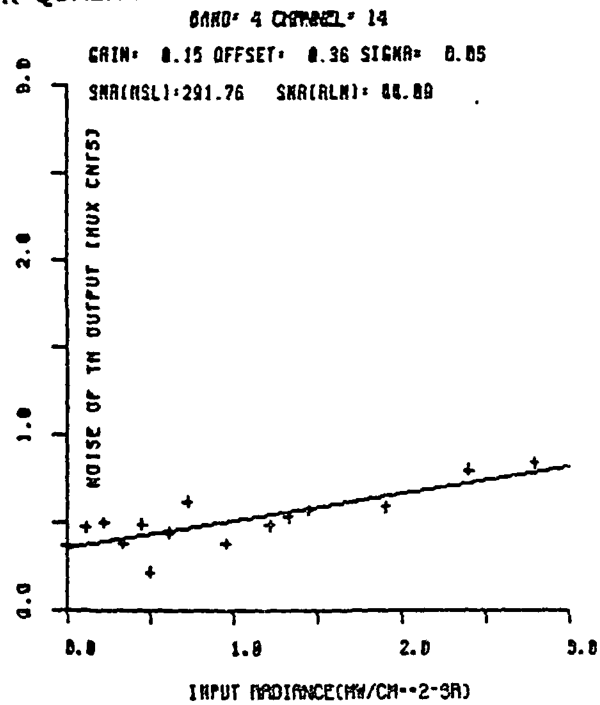

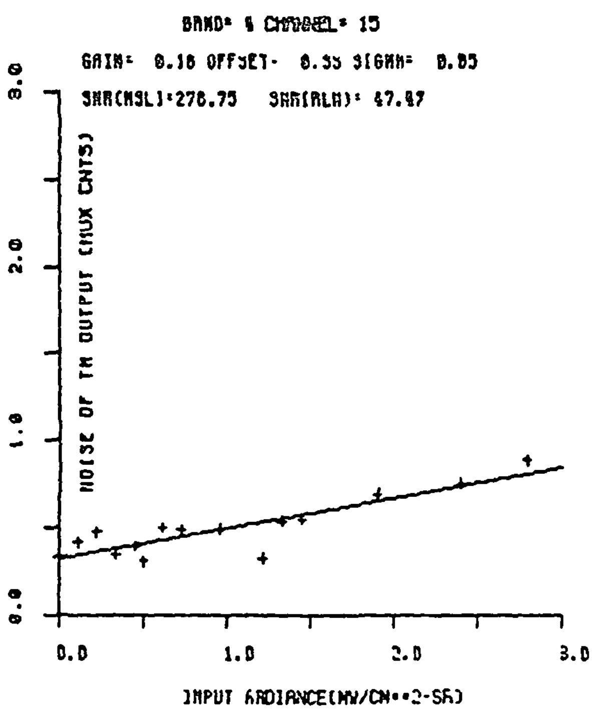

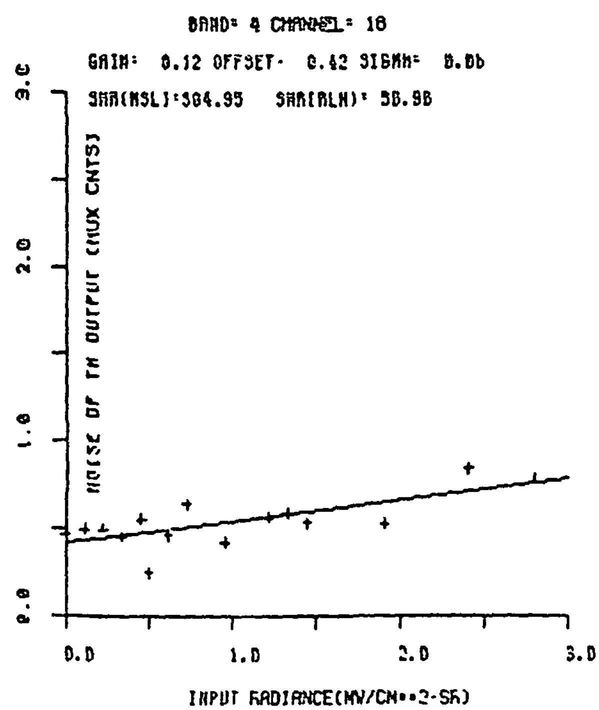

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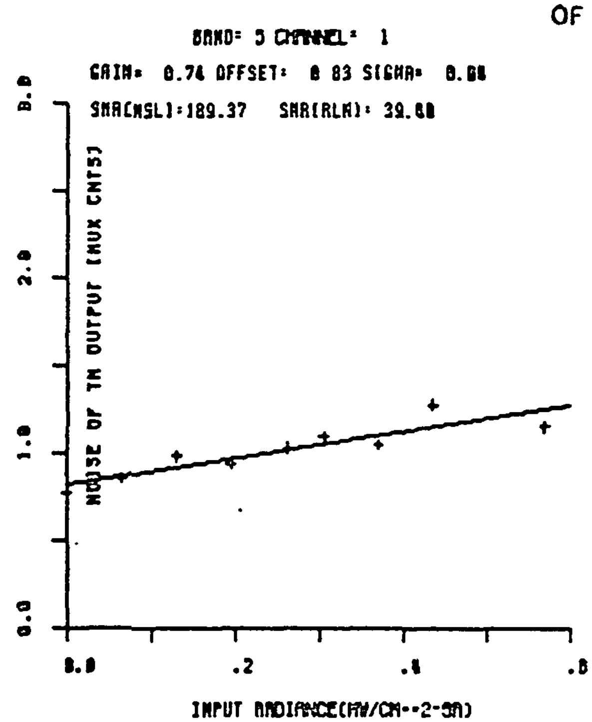

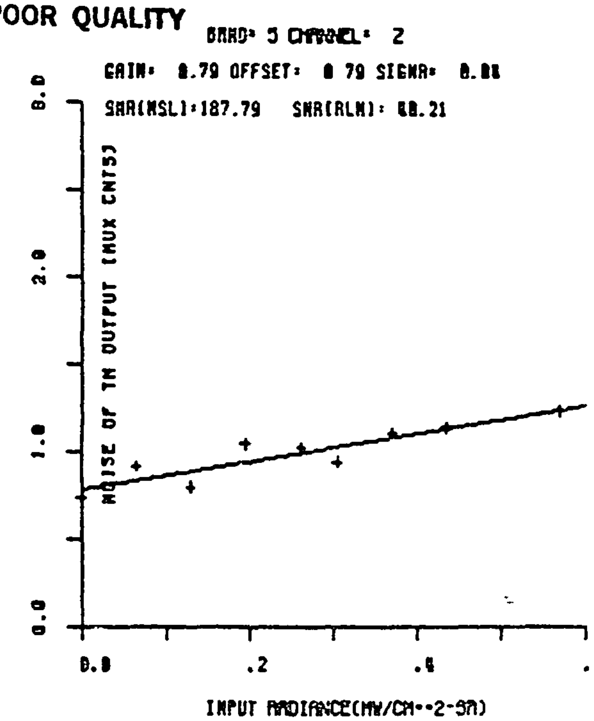

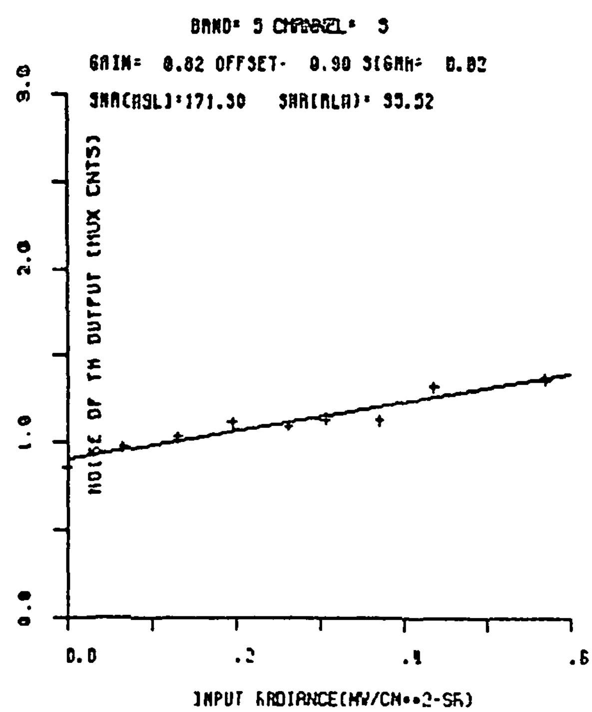

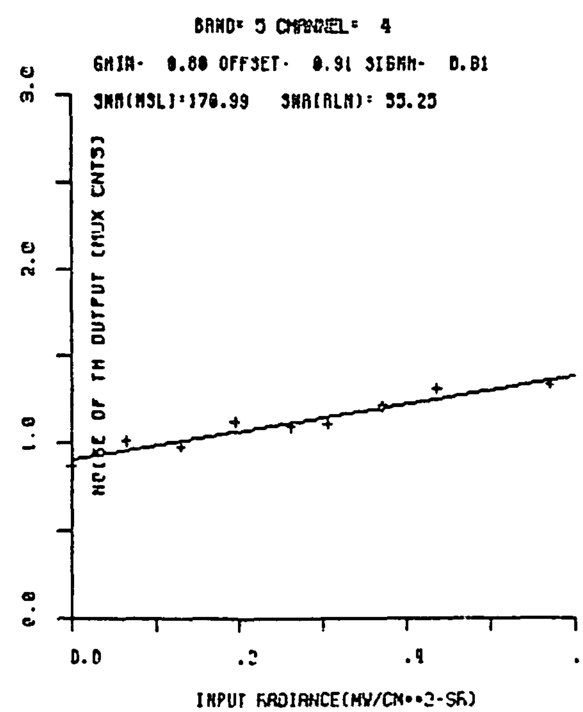

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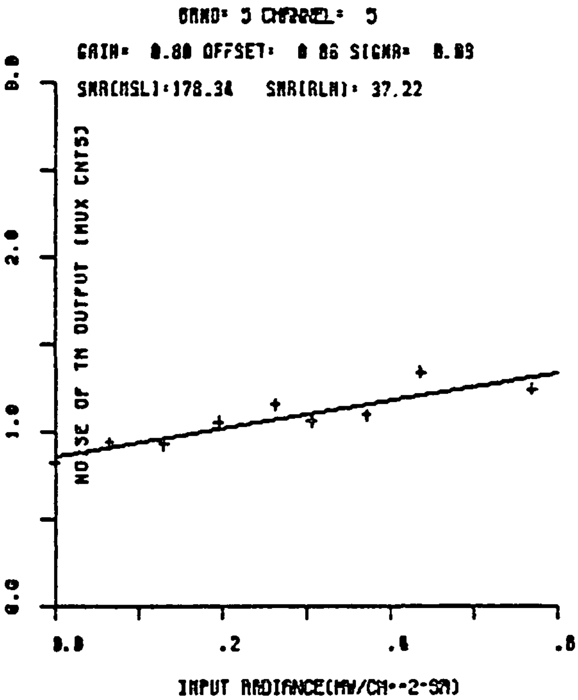
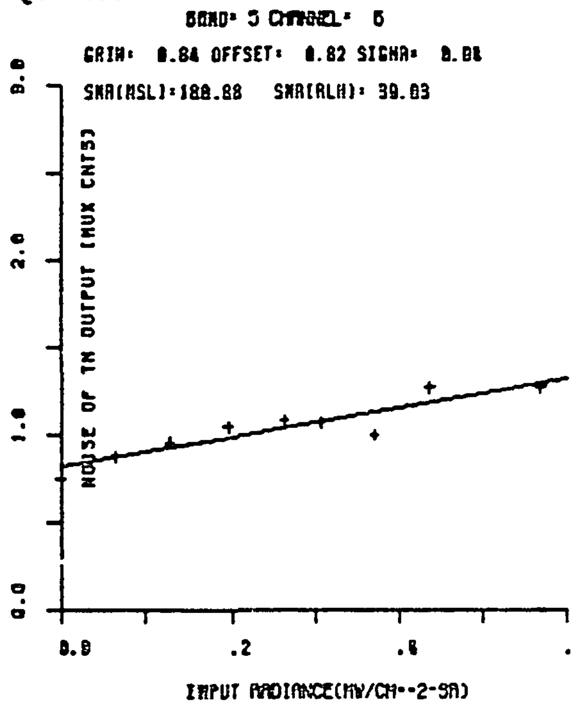
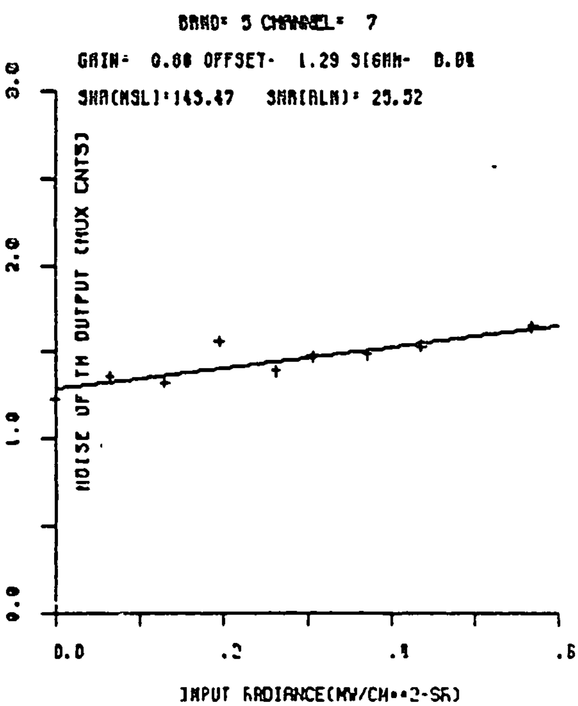
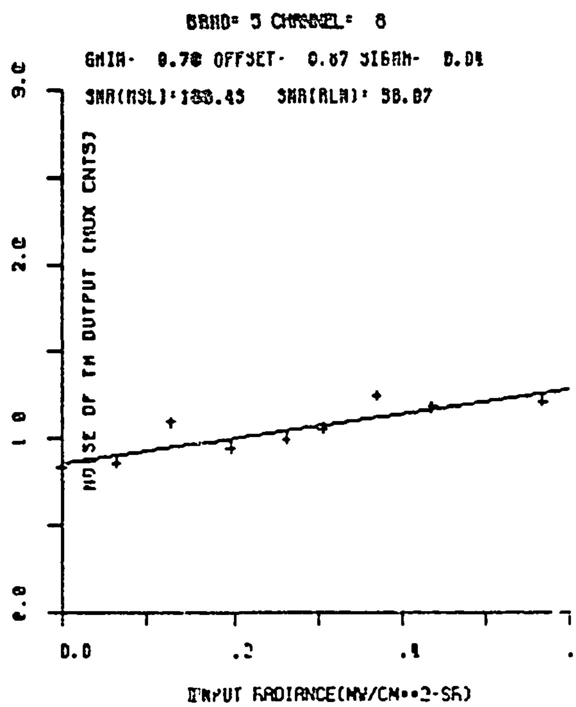
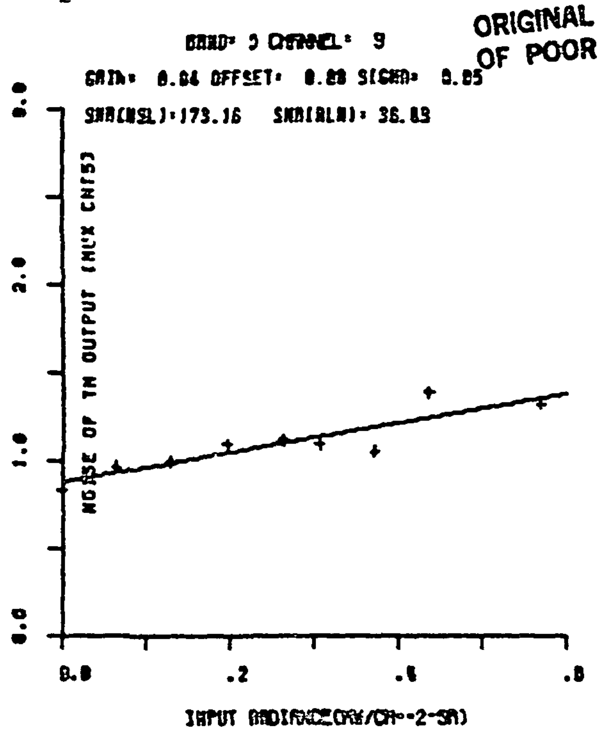
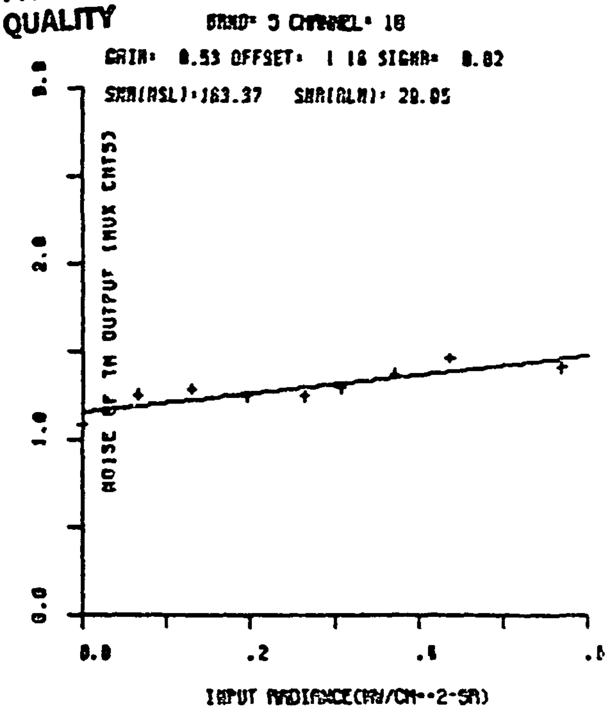


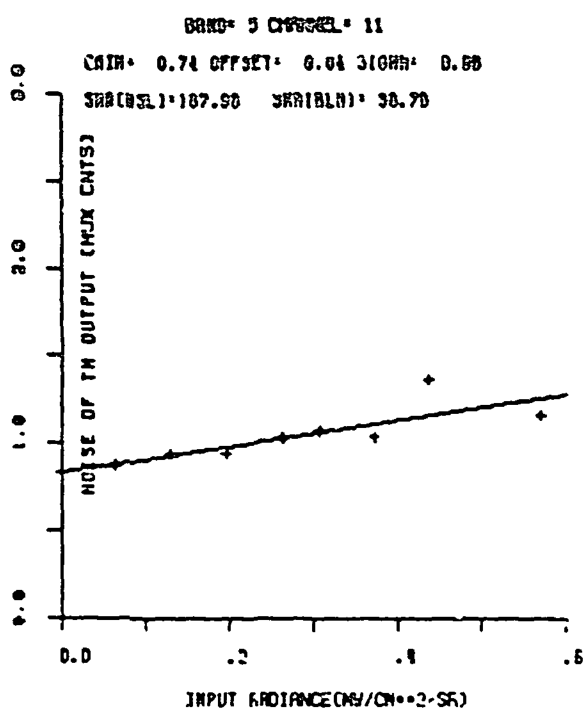


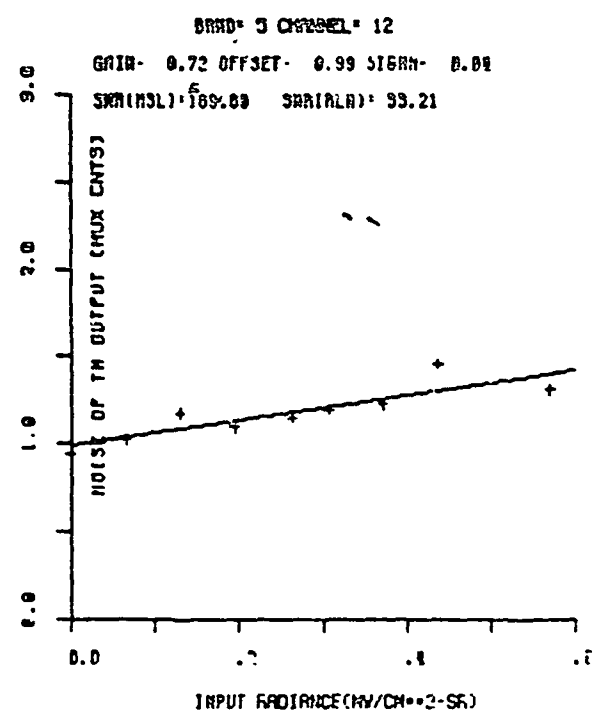


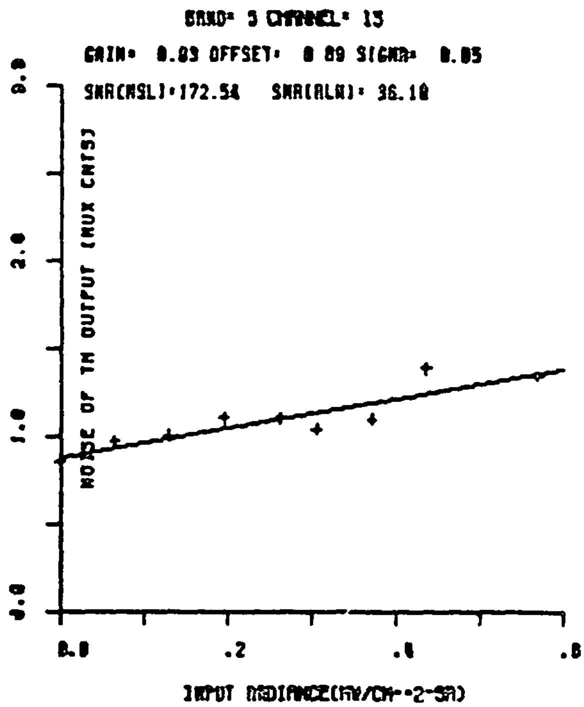


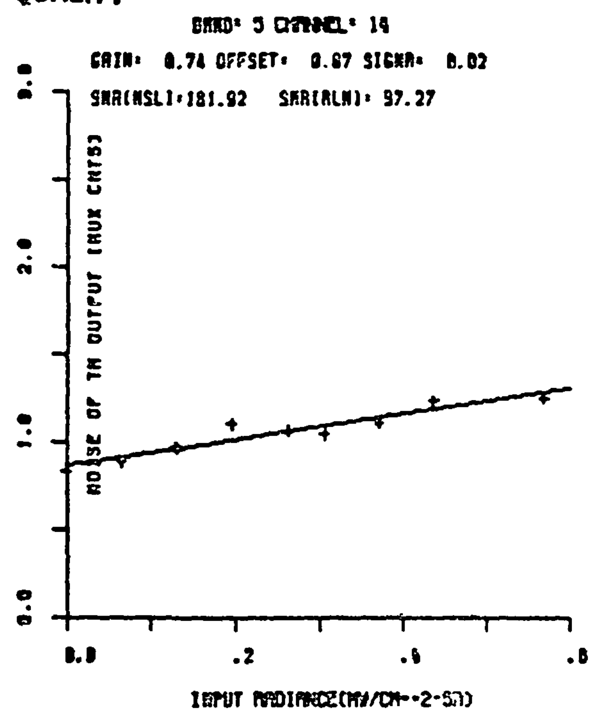

BAND= 5 CHANNEL= 9
GAIN= 0.84 OFFSET= 0.88 SIGMA= 0.05
SNR(MSL)=173.16 SNR(ALM)= 36.83
NOISE OF TM OUTPUT (MUX CNTS)
INPUT RADIANCE(MW/CM**2-SR)

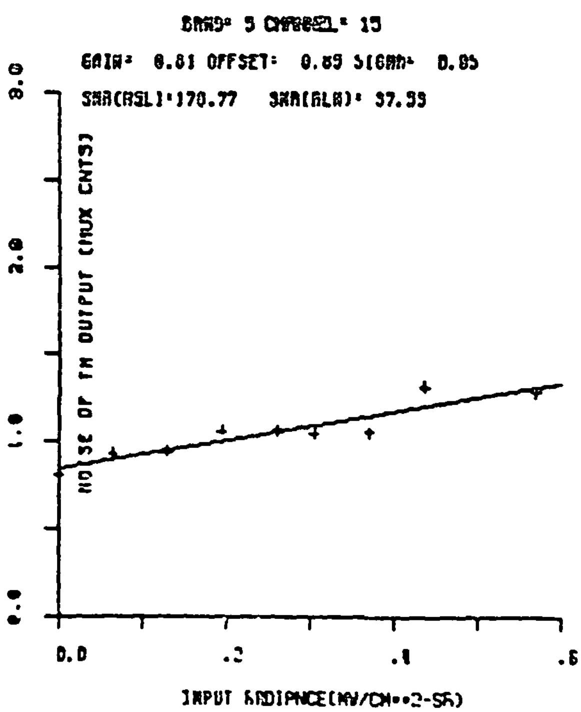

BAND= 5 CHANNEL= 10
GAIN= 0.53 OFFSET= 1.16 SIGMA= 0.02
SNR(MSL)=163.37 SNR(ALM)= 28.05
NOISE OF TM OUTPUT (MUX CNTS)
INPUT RADIANCE(MW/CM**2-SR)

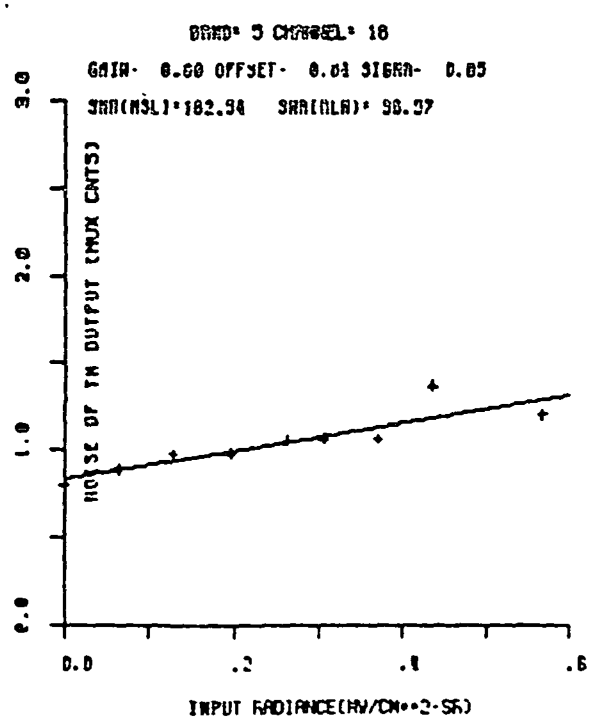

BAND= 5 CHANNEL= 11
GAIN= 0.74 OFFSET= 0.84 SIGMA= 0.08
SNR(MSL)=187.90 SNR(ALM)= 38.70
NOISE OF TM OUTPUT (MUX CNTS)
INPUT RADIANCE(MW/CM**2-SR)


BAND= 5 CHANNEL= 12
GAIN= 0.72 OFFSET= 0.99 SIGMA= 0.09
SNR(MSL)=169.89 SNR(ALM)= 33.21
NOISE OF TM OUTPUT (MUX CNTS)
INPUT RADIANCE(MW/CM**2-SR)


BAND= 5 CHANNEL= 13
GAIN= 0.83 OFFSET= 0.89 SIGMA= 0.05
SNR(MSL)=172.54 SNR(RLN)= 36.10
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.2
.4
.6
INPUT RADIANCE(MW/CM**2-SR)


BAND= 5 CHANNEL= 14
GAIN= 0.74 OFFSET= 0.87 SIGMA= 0.02
SNR(MSL)=181.92 SNR(RLN)= 97.27
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.2
.4
.6
INPUT RADIANCE(MW/CM**2-SR)


BAND= 5 CHANNEL= 15
GAIN= 0.81 OFFSET= 0.89 SIGMA= 0.05
SNR(MSL)=170.77 SNR(RLN)= 37.53
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.2
.4
.6
INPUT RADIANCE(MW/CM**2-SR)


BAND= 5 CHANNEL= 16
GAIN= 0.80 OFFSET= 0.84 SIGMA= 0.05
SNR(MSL)=182.54 SNR(RLN)= 98.57
NOISE OF TM OUTPUT (MUX CNTS)
0.0
1.0
2.0
3.0
0.0
.2
.4
.6
INPUT RADIANCE(MW/CM**2-SR)

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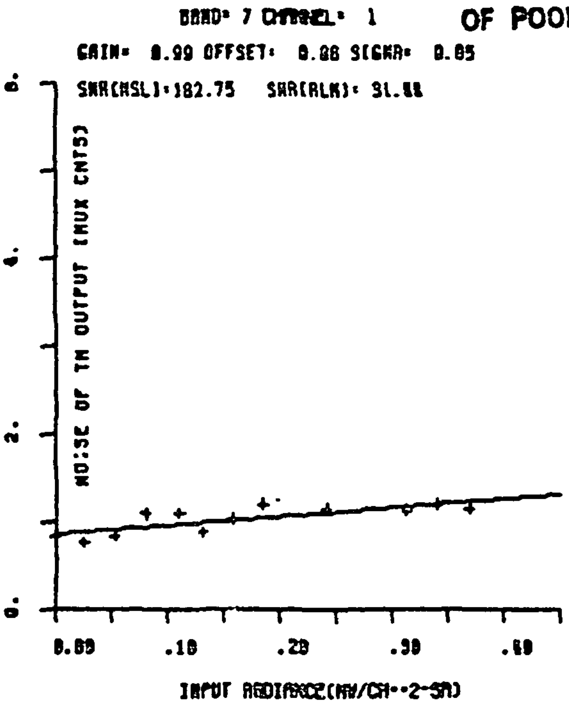

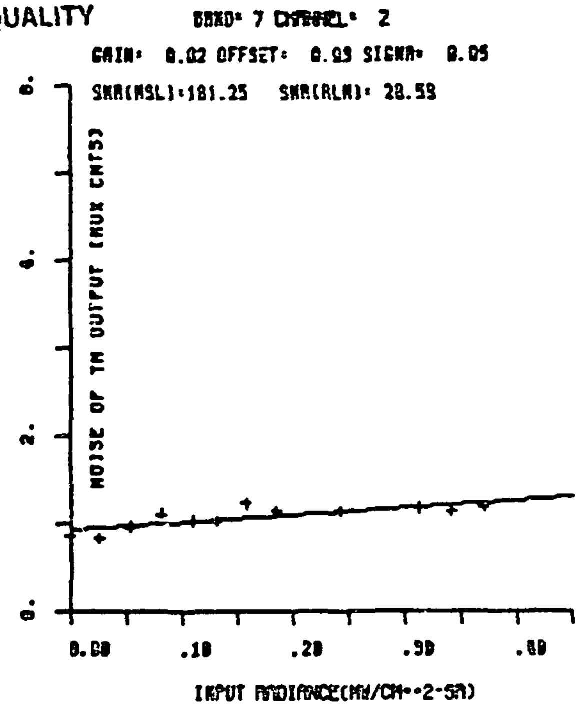

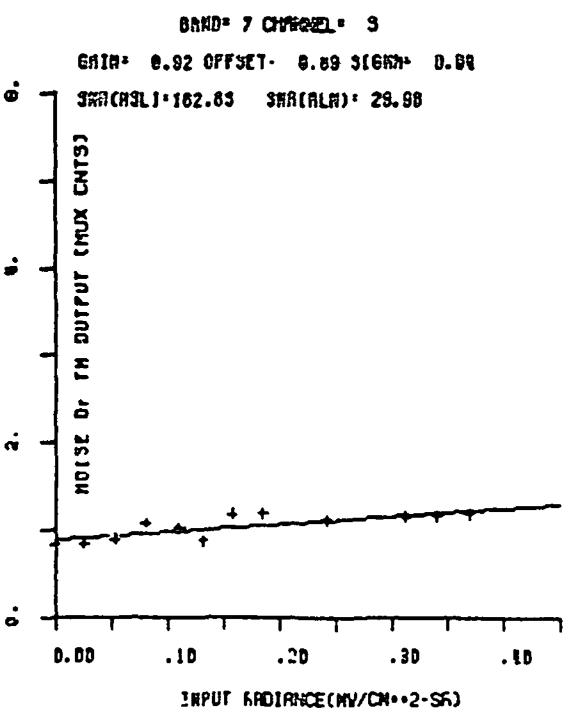

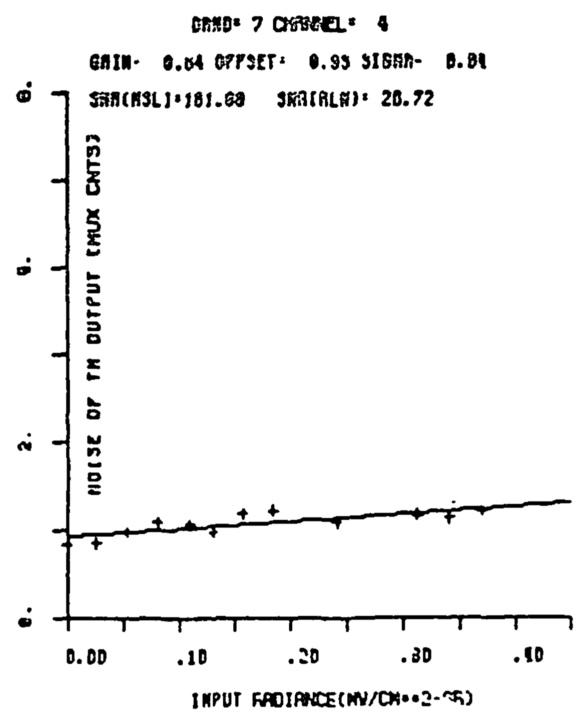

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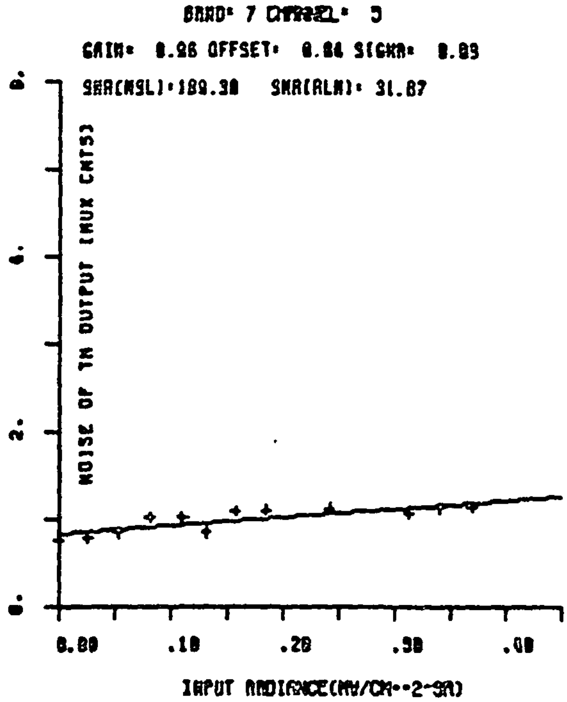

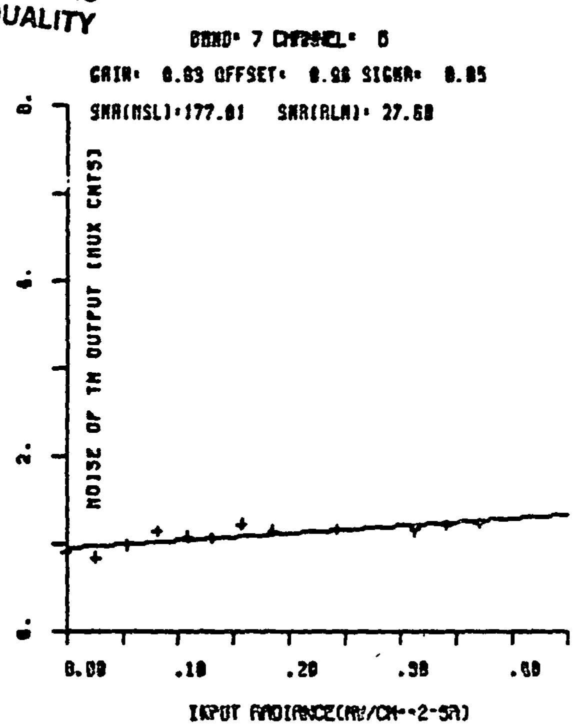

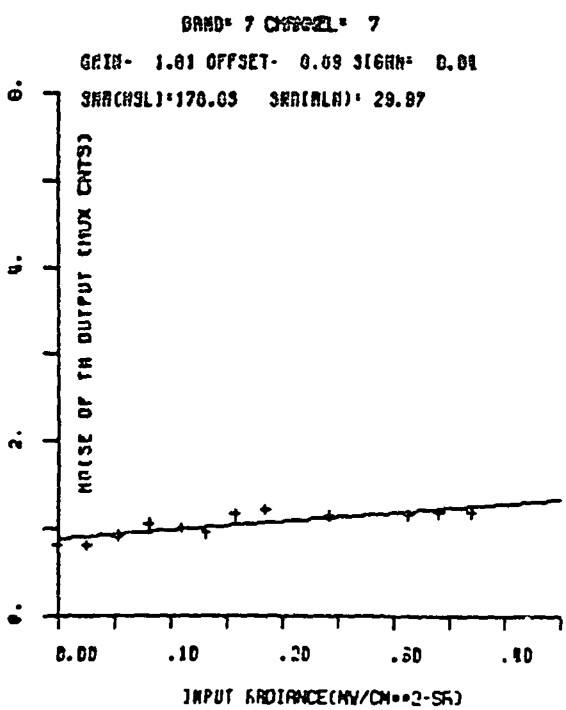

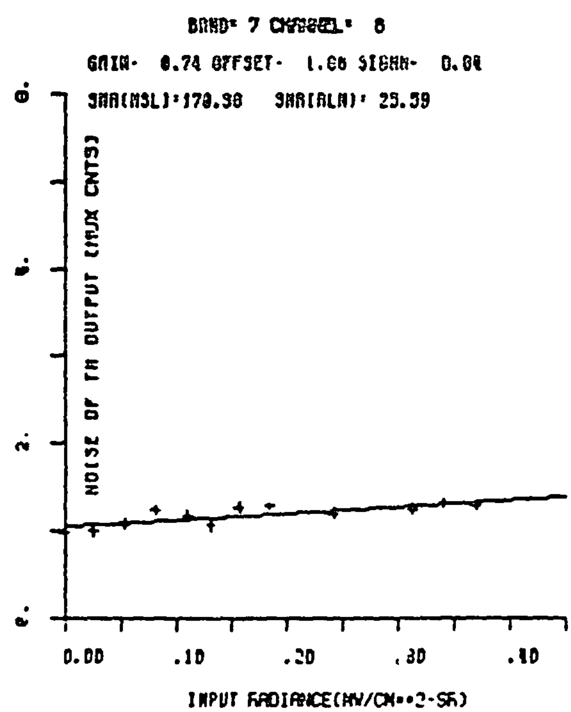

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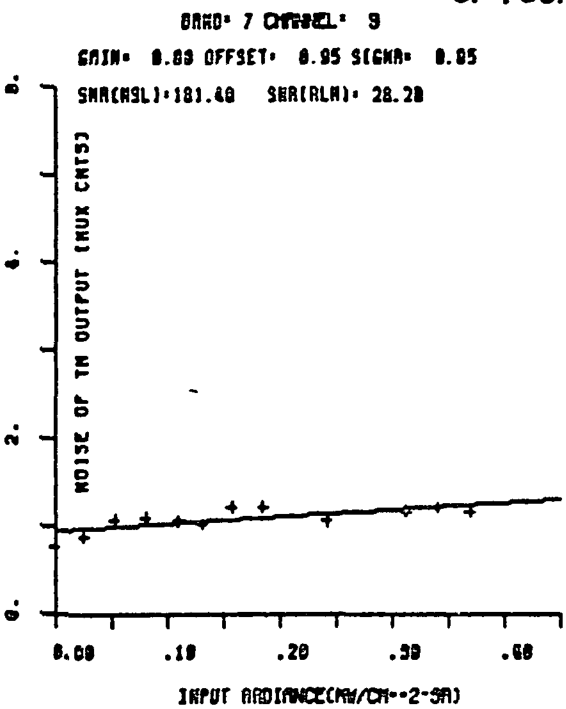

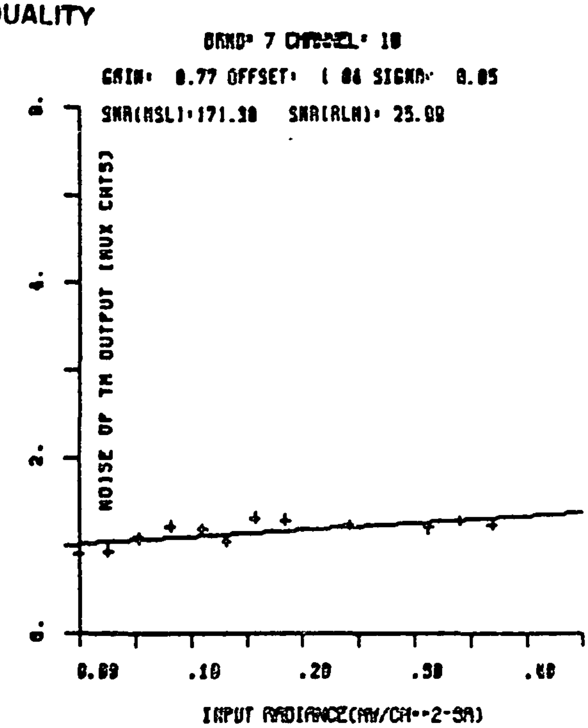

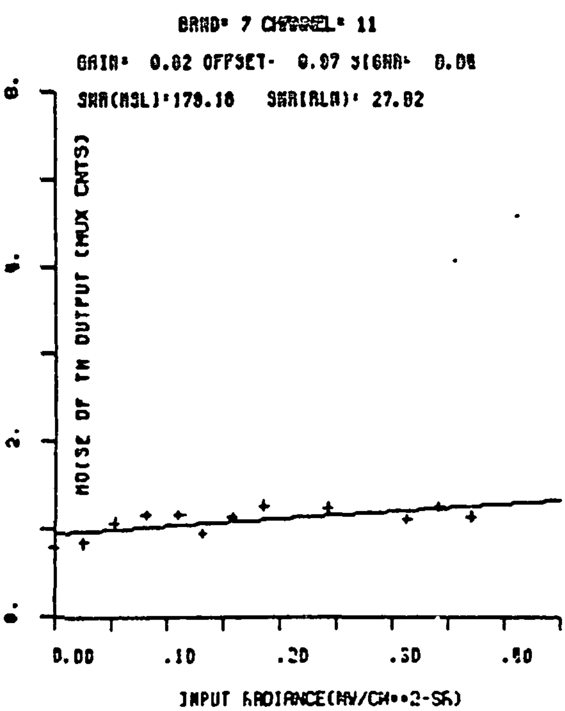

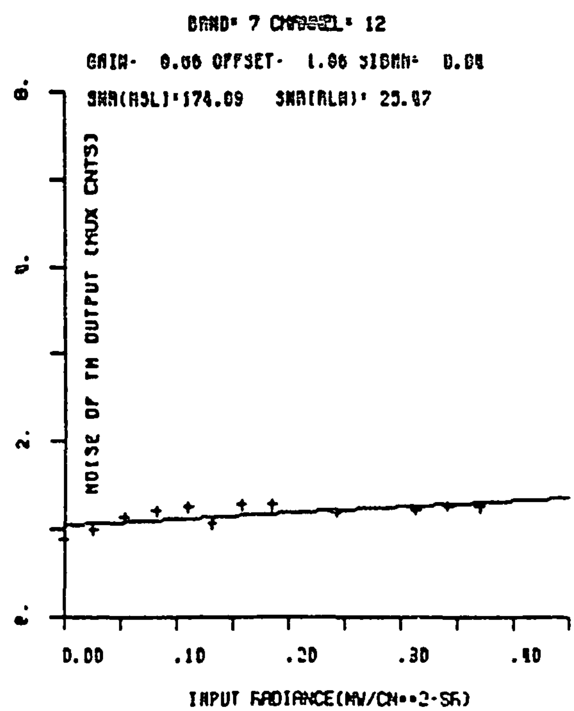

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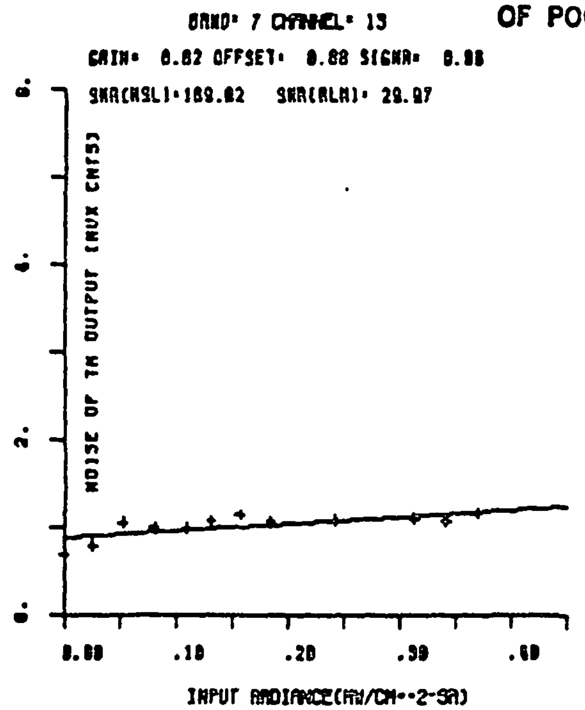

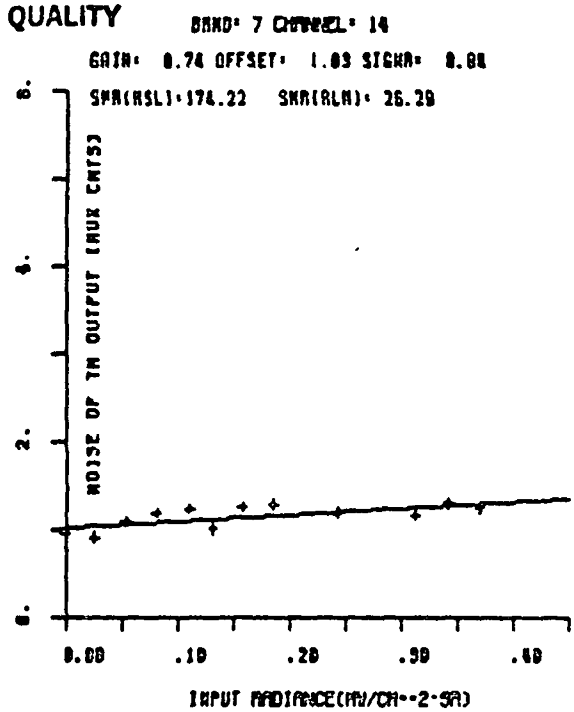

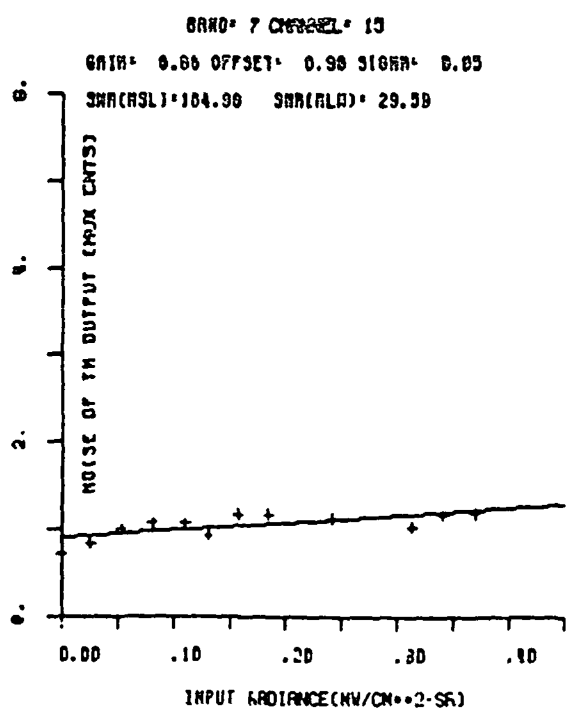

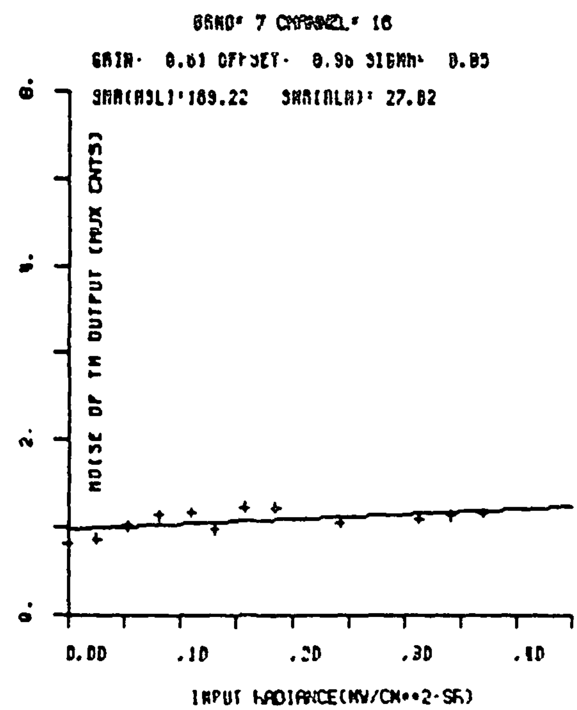

3.2.7 AC22 TEST

Spectral Matching

Test Summary: HS236-8084-1 J. Lansing

Test Specification: TP32015-529 TM Spectral Matching Test Procedure

Reference Documentation: HS236-7873, TM Spectral Matching; M. Grady, 1 March 1982

HS236-1727, Rational for Replacing AC01, Spectral Coverage Test, N. Dougherty, 18 January 1980

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SANTA BARBARA RESEARCH CENTER
A Subsidiary of Hughes Aircraft Company
INTERNAL MEMORANDUM

TO: J. ENGEL CC. L. O'CONNELL DATE: 21 JULY 1982
T. SCIACCA REF: HS236-8084-1
SED 152
SUBJECT: SPECTRAL MATCHING TEST RESULTS FROM: J. LANSING
BLDG: B11 MS: 40
REVISED EXT: 6261

REFERENCE: 1. M. Grady, "TM Spectral Matching," HS236-7873, 1 March 1982
2. N. Dougherty, "Rationale for Replacing AC01, Spectral Coverage Test," HS236-1727, 18 January 1980.

Testing conforming to Reference 1 appeared to give out-of-specification results attributable to spatial non-uniformity in the source rather than spectral response differences. A variant of the test was devised to separate out the spectral response effect. In this test, the same data as before are taken with the filtered source mounted in the collimator and then a second set of data is taken with the spectral filter removed (the signal level is adjusted with neutral density filters). The data are signal levels in MUX counts, which are converted to effective spectral radiance, using gains and offsets from AC02 calbration. To satisfy the spectral matching requirement, the difference between the radiance values with and without the spectral filter should be nearly the same for each channel in a band. The minimum channel difference is subtracted from the maximum channel difference to give an error quantity which is expressed as a percentage of the minimum saturation level.

Another correction to the error quantity is necessary to account for the fact that the difference in spectra for the collimator with and without the filters does not conform to the specified values, as interpreted in Reference 1. M. Grady reviewed the collimator and filter spectral data and provided correction factors as needed. The results are summarized in Table 1. Test 1 and Test 2 were run according to the initial plan with a realignment between the tests to correct a suspected vignetting condition. Test 3 was the variant test just described. The test 3 data were reduced only where necessary, for the bands not within specification. The "test 3 corrected" numbers used the correction factors mentioned above. Band 5 correction was determined to be in a direction to reduce the quantity, which was already small enough that further calculation was dropped. The "Final value" column simply summarizes the rest of the table.

Bands 1 and 4 are outside the specification requirements. Assuming that the tests and analysis described here are valid, the detector arrays and band filters are the items which are possible sources of the variations. These are discussed in some detail in Reference 2

The detectors and filters were fabricated using the latest technology, so it is not known that any improvement could be made. Recommendation: use as is.

Table 1. Spectral matching summary:
Maximum channel-to-channel variation

Band	Test 1	Test 2	Test 3	Test 3 corrected	Final value
		PERCENT			
1	*	0.89	0.80	0.65	0.65
2	0.54	0.45	**		0.45
3	0.30	0.35	**		0.35
4	1.76	1.50	0.62	1.35	1.35
5	*	0.73	0.11		0.11
7	*	0.42	**		0.42

*Bad data
**Data not reduced

J. Lansing

3.2.8 AC07 TEST

SPATIAL COVERAGE

TEST SUMMARY: HS236-8043 J. Campbell

TEST SPECIFICATION: TP32015-514

REFERENCE DOCUMENTATION:

HS236-5610, Thematic Mapper Spatial Coverage Test Description, AC07R, 30 January 1978

HS236-5610-2, Thematic Mapper Spatial Coverage Test Description, AC07R, 13 June 1979

HS236-7454, TM AC07R Test Result Summary, Protoflight Model, 20 May 1981

HS236-7547, Special AC07 Tests, 15 July 1981

HS236-8011, Spatial Coverage, Band 6, 02 June 1982

HS236-8027, Spurious Detector Response Observed during AC07R Spatial Coverage Testing, 15 June 1982

HS236-8031, Investigation of AC07R Test Failure, 15 June 1982

HS236-8004, AC07 Optional Test Configuration - Bands 1-5, and 7 Testing, 27 May 1982

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SANTA BARBARA RESEARCH CENTER
A Subsidiary of Hughes Aircraft Company

INTERNAL MEMORANDUM

TO F. R. Phillips CC Distribution DATE. 29 June 1982

REF. 2221-620
HS236-8043

SUBJECT TM AC07R Test Result Summary, Flight Model Number 1

FROM AC07R Test Team (J. C. Campbell)

BLDG. B11 MAIL STA 78

EXT 6151

References:

1. TP32015-514, Rev. B, Spatial Coverage Test Procedure AC07R, 23 February 1983.
2. HS236-5610, Thematic Mapper Spatial Coverage Test Description, AC07R, 30 January 1978.
3. HS236-5610-2, Thematic Mapper Spatial Coverage Test Description, AC07R, 13 June 1979.
4. HS236-7454, TM AC07R Test Result Summary, Protoflight Model, 20 May 1981.
5. HS236-7547, Special AC07 Tests, 15 July 1981.
6. HS236-8004, AC07 Optional Test Configuration - Bands 1-5, and 7 Testing, 27 May 1982.
7. HS236-8011, Spatial Coverage, Band 6, 02 June 1982.
8. HS236-8027, Spurious Detector Response Observed during AC07R Spatial Coverage Testing, 15 June 1982.
9. HS236-8031, Investigation of AC07R test Failure, 15 June 1982.
10. History Tapes: DO3029, DO3030, DO3031, DO3032 and DO3033, 5 June thru 12 June 1982.
11. BTCE #2 Event Log for 5 June thru 12 June 1982.
12. Failure Reports: FR#5774 and FR#5776.
13. Deviations: D-154 and D-156.

1.0 Introduction

This report summarizes the results of performing the AC07R Spatial Coverage Test on the Thematic Mapper Flight Model Number 1. The test is an ambient collimator level test performed on the assembled T.M. The test is computer controlled using computer commands with telemetry verification.

The test objective is to accurately determine the response of database selected detectors to a narrow slit source illuminating positions on the focal plane whose distances from the detectors vary. Specific attention is given to detector half-width response size and far field effects.

GSFC measurement specifications are given in terms of angular requirements. The along track (X-direction) dimension and across track (Y-direction) dimension is defined for each detector as the angular difference between the points where the detector's response is 50 percent of maximum when sweeping in the respective direction. Maximum half-width dimensions are given as 43.2 microradians for Bands 1 through 4, 46.35 microradians for Bands 5 and 7, and 174.4 microradians for Band 6, the thermal band. The far field requirement is that the measured response be less than one percent of maximum for angular distances equal to or greater than twice the detector width.

2.0 Test Decription

The test is performed at SBRC with the Thematic Mapper mounted on a precision rotary table. The T.M. is aligned to a collimator with the scan line corrector off and scan mirror locked at midscan. The angular orientation of the T.M. is determined and monitored by autocollimating a theodolite on a reference mirror attached to the T.M. However, as the collimator is subject to off axis image degradation, it is necessary to move the T.M. four times during the test. These movements and subsequent orientations are determined and also monitored using the theodolite. The source is projected towards the T.M. through the collimator which uses a computer driven X-Y stepping stage to position the illuminated slit. Interferometric monitoring is used to measure stage movement.

For Bands 1-5 and 7 measurements, a tungsten ribbon filament lamp is used as the source. The lamp and slit are initially mounted together on the stages in a vertical position (for sweeping in the Y-direction). The source and slit are subsequently rotated 90 degrees about a horizontal axis for sweeping the X-direction. The larger input signal needed to resolve far field response is achieved by increasing the lamp current.

For previous Protoflight Band 6 testing, a blackbody source was used. The change from vertical to horizontal scanning was achieved using separate perpendicular slits mounted in a reticle wheel. However, for the current Flight Model Number 1 testing, this part of the procedure was omitted from the test requirements per the conditions described in Deviation Request D-156.

The test configuration was modified from that given in the AC07R test procedure. This was done for convenience and to provide computer controlled T.M. turn-on and Thermal Shutdown enablement. The use of an optional test configuration was requested per Request for Deviation D-154 and is described in reference SBRC Memo HS236-8004. The set-up is a mixed configuration defined as much as possible per HAC configuration drawings 3533100-300-1 and 3533100-300-2 and with reference to released SBRC test procedures. A similar option was used previously for Flight Model IA04 testing.

3.0 Test Results

Test data has been obtained for Bands 1-5 and 7 in the form of reduced data tabulations and field-of-view plots for selected channels and each type of scan (X or Y). Measurements were made on detectors 1, 2, 15 and 16 for Bands 1, 2, 3, 5 and 7. But due to SIU difficulties (resulting in no signal from detector 16), detectors 1, 2, 14 and 15 were used for Band 4. Reduced data tabulations indicate that all detectors (with the possible exception of those for Band 6) exhibit some calculated half-widths in excess of those desired by the specifications. As requested by Deviation D-156 and documented by SBRC referenced Memo HS236-8011, Band 6 IGFOV's sizes were calculated from spot scan data measured at the component level of detector array fabrication. This alternate procedure was used to facilitate schedule by avoiding the repetition of Band 6 test difficulties encountered earlier during Protoflight Band 6 testing, e.g. very small signal levels, thermal insensitivity, and unsolved problems with D.C. restore operation.

Far field response for all Bands is typically greater than the desired 1 percent at least for regions immediately adjacent to the twice detector width field points. In addition, normalization problems were encountered in matching the far field to near field data. In spite of software changes made to correct the problem after it was first discovered during Protoflight testing, residual effects are evident in some of the plots (see Appendix A for plots). Of greater current concern has been the recent observations of spurious secondary peaks in sensitivity well away from the nominal channel centers. Such effects were not seen during previous Protoflight testing. They were first observed on Flight 1 Band 1 detectors during manual scanning of the slit stage and were later found to be present for the other detectors in the prime focal plane array. (Bands 5 and 7 detectors, on the other hand, exhibit no such anomalies.) These discrepancies were recorded on Failure Report FR#5776 and are discussed in SBRC Memo HS236-8027 They were seen initially on Band 1 with magnitudes of up to 10% of peak signal and to a lesser extent for the other Bands in the prime focal plane array. They appear to be

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due to leakage of white light entering thru the +Y half of the telescope entrance aperture and being leaked to the detectors perhaps thru inadequately shielded substrate edges. Later analysis and additional data indicate that the problem is not as severe as originally feared. The maximum effect as seen on Band 1 is reduced to 1 or 2% when spectral shape factors are taken into consideration. This should amount to not more than a few MUX counts for a typical mid-range scene level of the T.M. Correction of the problem at the focal plane would be expected to require disassembly of the telescope and a resulting major program delay. Such drastic action is not being recommended at the present time.

4.0 Discussion and Conclusion

A number of difficulties were encountered during the running of these tests. These may be roughly divided into hardware and software type problems. The former consist of problems with vibration, alignment, temperature and electronics. The latter include problems with command files, databases, and plot normalizations. In addition some evidence exists which indicates that optical effects may be degrading the data by producing raised skirts and rounded off IFOVS. Many difficulties were at least partially resolved before and/or during the testing by modifications of the test setup and/or by corrections to the software. Others were investigated later by means of "special tests" intended to determine their causes.

A. Hardware Problems

Apparent vibration problems were present from the start of the test. A source of what at first appeared to be severe vibration problems turned out to be the "muffin fan" used to cool the TM power supply. Turning the fan off during collects cured this problem.

Later during the lamp calibration portions of the tests, "mechanical" drift problems were encountered in the Y-scan as the location of the peak signal appeared to change with time. During one 20 minute interval, 10 steps of drift (~ 1 IFOV) were observed all in the positive Y-direction.

In addition to vibration and drift, electrical hookup problems arose associated with D.C. restore operation. At two points during the test the equipment failed to work properly making it impossible to collect meaningful data. The initial problem occurred because the scope was inadvertantly hooked up to monitor the reference output from the chopper controller rather than the gate output from the D.C. Restore Module thus resulting in

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a phasing error. A second problem arose when (without our knowledge) the D.C. Restore cable, W5050, was disconnected during a first shift troubleshooting operation and was left unattached. This resulted in a severely distorted square wave signal output at the scope. The source of the problem was eventually revealed, but only after a thorough configuration check and only after considerable frustration and loss of valuable test time.

An additional electrical problem occurred in the form of a complete loss of test area power and telemetry at one point during far field collects. This was traced to the tripping of a control room (pallet) circuit breaker due to the increased lamp source current. Running the lamp at a slightly lower operating level avoided the problem for subsequent collects.

Room environmental effects were ever present in the form of air turbulence and temperature variations. To minimize these effects a plastic tunnel was installed prior to the test completely surrounding the collimator. To reduce turbulence room air handlers were turned off at least one hour prior to testing. The room temperature stabilized at between 69° and 70°F as recorded in the data master. Specific heat sources present in the test setup included the lamp source itself, the laser used with the stage monitor interferometers, and the motors which drive the Aerotech stages and chopper wheel.

Perhaps the most significant thermal problem was associated with internal heating of the T.M. itself. As the test progressed, one of the most closely watched telemetry parameters became the T.M. power supply temperature. We saw a direct correlation between high power supply temperature (approaching an indicated 32°C) and severely distorted data. Early in the test we intentionally let the power supply heat up in order to study the effect as a function of time. As we watched and let the temperature rise to approximately 32°C, the measured Band 7 FOV half-width increased from less than 50 microradians to about 60 microradians. The next evening when we repeated the measurements with the power supply cold (about 22°C), the values were reduced to a reasonable 46 microradians. Band 5 X-scan data was taken at a warm power supply temperature just prior to running Band 7. However, no attempt was made to improve on Band 5 measurements. Only Band 7 (the worst case) was rerun in order to demonstrate that we could improve the measurements by lowering the power supply temperature. Perhaps, given better environmental controls, all measurements could be improved to some extent. This would be particularly true for the Band 5 X-scan.

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After this experience, we modified our procedure to include an approximate one hour cooling off time between data collects using a "Muffin Pan" to dissipate the heat. Good data collects were obtained in this manner.

Alignment problems (or at least uncertainties) arose as the source/slit and T.M. were positioned and repositioned at various points during the test. The source/slit had to be detached from its mount and the lamp removed in order to reposition it each time a change was made between X and Y scans. This resulted in some uncertainty in the alignment position of the filament image on the slit for the various sets of data.

The effect of this possible misalignment was minimized by the addition of metal masking over the opaque portions of the slit (these areas were previously found to be a source of leakage that contributed to severely raised FOV skirts on Protoflight data).

Other areas of only minor concern include source non-uniformity and optical system focus. The lamp filament image was centered on the slit each time the lamp was repositioned and should be quite uniform in intensity over the active slit area. All data was collected at the nominal focal plane of the collimator. Previous IA04R test data indicates that this position is .005 to .006 inch from best focus as determined by MTF. A small degradation (less than 1 microradian image blur) is expected to result from this condition. Another small uncertainty is the focal length of the collimator. The presently used value is 109.225 inch as compared with 109.285 inch as used for the Protoflight.

B. Software Problems

Software problems appeared early in the test. Initial attempts at collects resulted in failure due to an improper version of AC07R software having been installed on BTCE #1 and #2 disks. This caused reverse Aerotech stage control with a movement to relative rather than the desired absolute positions. Files were updated via an ECR to provide correct motion of the stages. In addition, the Data Select Unit appeared to have a marginal "handshake" with the System Test Computer causing an occasional failure to collect. Due to the structure of the command files, a single failure to collect video data during a multicollect formation of a single video file could stop the test and prevent data reduction. Some reattachment of cable connectors and adjustments by a Digital Equipment Corporation service man resulted in satisfactory operation during the remainder of the test. Some work was done to restructure the command files, but the change was never implemented. There was no signal from Band 4 Detector 16. This was due to a known SIU Channel A problem. This difficulty was avoided by making a database change to collect from Band 4 Detector 14 instead. An additional SIU problem was present on Band 5 Detector 1 which required that we cycle the AOTS Band 5 power occasionally in order to get Band 5 Detector 1 to work properly.

C. Conclusion

This report has described the results of running the AC07R Spatial Coverage Test on the T.M. Flight Model Number 1. The test appears to be extremely sensitive to environmental effects such as temperature and air path fluctuations. While an attempt was made to control these factors, it is unclear whether the disappointing test results should be interpreted as measurements of the T.M.'s performance or merely as worst case "lower limits" to its performance. The quality of the test data appears consistent with that obtained from ambient tests on similar instruments. The test procedure and command files were used successfully for Bands 1 thru 5 and 7 and will be ready for future testing. Several problems were successfully resolved during AC07R itself while others needed to be investigated further by supplemental testing. The problem of peaks of spurious sensitivity in the far field region has not been completely resolved, though it is better understood now than when first observed. Its effects are not as severe as originally feared. A close look to inspect for this condition should be included in any future AC07R testing and additional care should be taken in fabrication and masking of any new Prime Focal Plane Arrays. A test for light leaks should be performed at the component level of assembly.

Unless otherwise directed, we will consider the alternate test used for Band 6 to be acceptable for use on subsequent T.M. models. A test procedure change is planned to include this option.

The attached tables summarize the test results in general and help to point out some of the problem areas. Table 1 is a summary of LSF (Field-of-View) half-widths identified by band, channel, and type of scan. Out-of-spec. conditions are identified where they occured. Table 2 is a listing of detector spacings within each array as obtained from the reduced data tabulations. Table 3 is a summary of

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out-of-field response values obtained graphically from the field-of-view response plots. Out-of-field response has been calculated first as the percentage of total out-of-field signal to total in-field signal and then again as an average per IFOV spacing over the total length of the non-zero skirts. Table 4 lists calculated Band 6 IGFOV sizes based upon detector and telescope measurements.

Prepared by: J. C. Campbell
J. C. Campbell, Optics

Concurrence:
C. J. Kent, Optics

Concurrence: D G Brandshaft
D. G. Brandshaft, Systems Analysis

Approval:
G. S. Plews, Director, Systems Test

Approval: J L Engel
J. L. Engel, Manager, Systems Engineering

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TABLE 1.

LSP Half-Widths

Collection Date	Band	Channel	Scan	LSP Width (μr)	In Spec.	Out of Spec.
6/13	1	1	Y	46.29		x
6/11	1	1	X	44.79		x
6/13	1	2	Y	45.25		x
6/11	1	2	X	45.08		x
6/13	1	15	Y	45.98		x
6/11	1	15	X	43.40		x
6/13	1	16	Y	44.33		x
6/11	1	16	X	43.24		x
6/13	2	1	Y	44.49		x
6/11	2	1	X	45.92		x
6/13	2	2	Y	44.61		x
6/11	2	2	X	45.61		x
6/13	2	15	Y	44.69		x
6/11	2	15	X	44.09		x
6/13	2	16	Y	44.67		x
6/11	2	16	X	42.91	x	
6/9	3	1	Y	44.67		x
6/10	3	1	X	44.17		x
6/9	3	2	Y	43.58		x
6/10	3	2	X	43.31		x
6/9	3	15	Y	43.61		x
6/10	3	15	X	44.07		x
6/9	3	16	Y	43.74		x
6/10	3	16	X	42.70	x	

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TABLE 1.

LSF Half-Widths

Collection Date	Band	Channel	Scan	LSF Width (μr)	In Spec.	Out of Spec.
6/9	4	1	Y	44.39		x
6/10	4	1	X	45.65		x
6/9	4	2	Y	45.92		x
6/10	4	2	X	43.78		x
6/9	4	14	Y	45.32		x
6/10	4	14	X	44.27		x
6/9	4	15	Y	44.27		x
6/10	4	15	X	42.94	x	
6/12	5	1	Y	44.80	x	
6/12	5	1	X	51.35		x
6/12	5	2	Y	44.48	x	
6/12	5	2	X	50.46		x
6/12	5	15	Y	44.65	x	
6/12	5	15	X	51.00		x
6/12	5	16	Y	44.45	x	
6/12	5	16	X	49.79		x
6/12	7	1	Y	45.79	x	
6/12	7	1	X	46.74		x
6/12	7	2	Y	45.35	x	
6/12	7	2	X	46.44		x
6/12	7	15	Y	45.36	x	
6/12	7	15	X	46.83		x
6/12	7	16	Y	45.03	x	
6/12	7	16	X	46.92		x

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TABLE 2.

Detector Spacings

Collection Date	Band/ Channels	Distance Between Channels In X-Direction (μ-radians) (Measured)	(Nominal)
6/11	B1/D2, D16	592.37	595.00
6/11	B2/D2, D16	590.14	595.00
6/10	B3/D2, D16	595.78	595.00
6/10	B4,D1, D15	597.05	595.00
6/12	B5/D2, D16	589.50	595.00
6/12	B7/D2, D16	586.72	595.00

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TABLE 3.

Out-of-Field Response
Bands 1-5, and 7

Processing/ Date	Band	Channel	Scan	In-Field Response* (±2 IFOVS)	Out-of-Field Response* (Skirts)	Total Percent	Average (Per IFOV) Percent
6/13	1	2	Y	1115	26	2.3	.22
6/11	1	2	X	1064	62	5.8	.35
6/13	2	2	Y	1058	11	1.0	.28
6/11	2	2	X	1067	29	2.7	.23
6/9	3	2	Y	1080	29	2.7	.42
6/10	3	2	X	1090	37	3.9	.33
6/9	4	2	Y	1057	9	0.9	.55
6/10	4	2	X	1017	8	0.8	.32
6/12	5	2	Y	1118	46	4.1	.58
6/12	5	2	X	1263	44	3.5	.54
6/12	7	2	Y	1137	55	4.8	.53
6/12	7	2	X	1123	37	3.3	.37

*Arbitrary Units (graph paper units)

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Table 4. Band 6 Calculated IGFOV
Based upon detector and telescope measurements

Detector #	HW_y(inch)	HW_x(inch)	Cross Scan $IGFOV_y$	Along Scan $IGFOV_x$
1	.00780		162.5μr	
1		.00820		170.8 μr
2	.00760		158.3μr	
2		.00824		171.7 μr
3	.00786		163.8μr	
3		.00830		172.9 μr
4	.00800		166.7μr	
4		.00832		173.32μr

IGFOV = Detector Half-Width ÷ (EFL_{TM} x Relay Magnification, M_R)

EFL = 95.995

M_R = 0.5

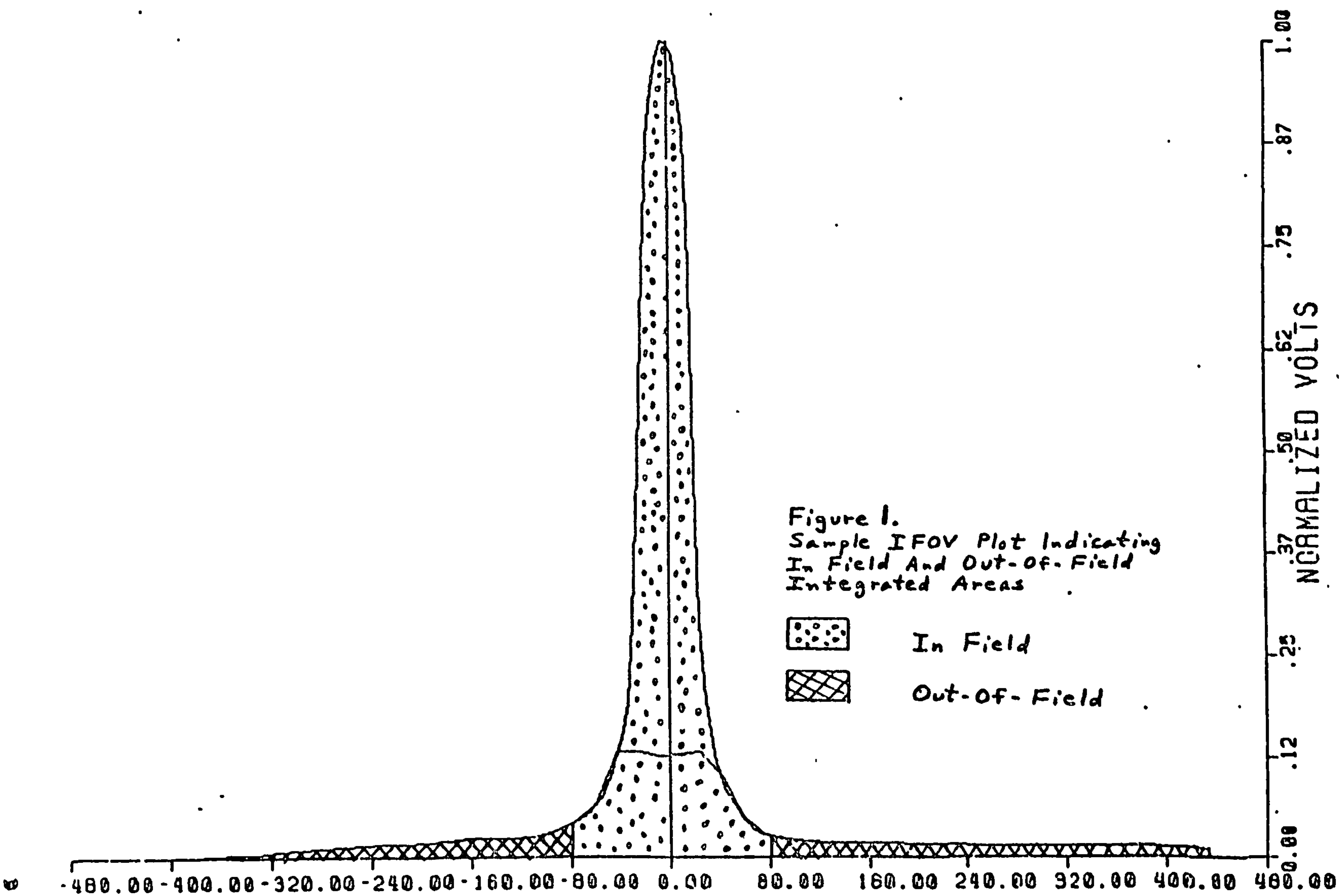
Specification is: IFOV $\leq$ 174.4μr

Accuracy of Measurement: ± 16μr

APPENDIX A

FIELD OF VIEW PLOTS

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 3 CHANNEL 2.



NEAR AND FAR FIELD DATA FOR Y - AXIS. BAND 1 CHANNEL 1

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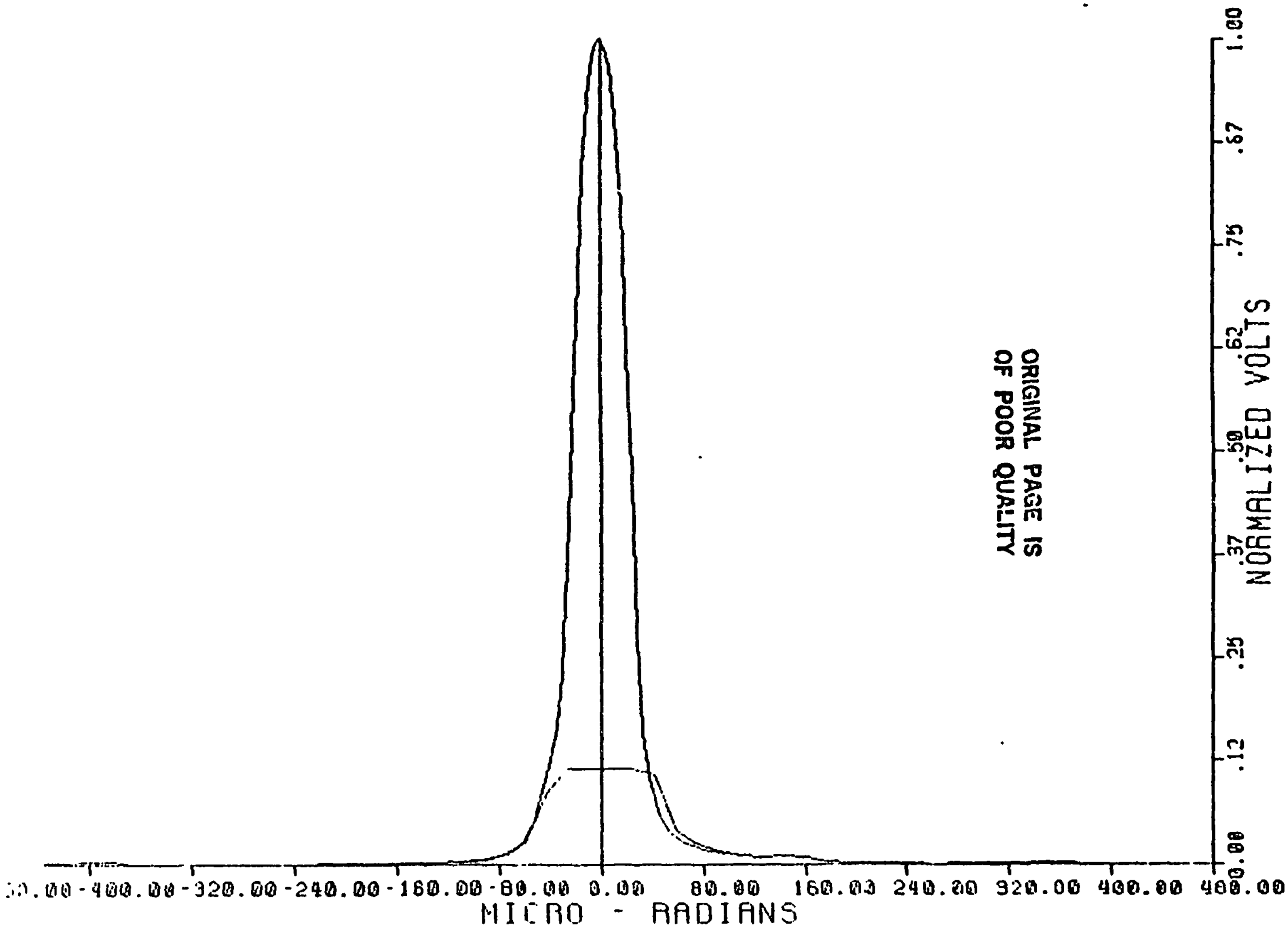

NEAR AND FAR FIELD DATA FOR X - AXIS. BAND 1 CHANNEL 1

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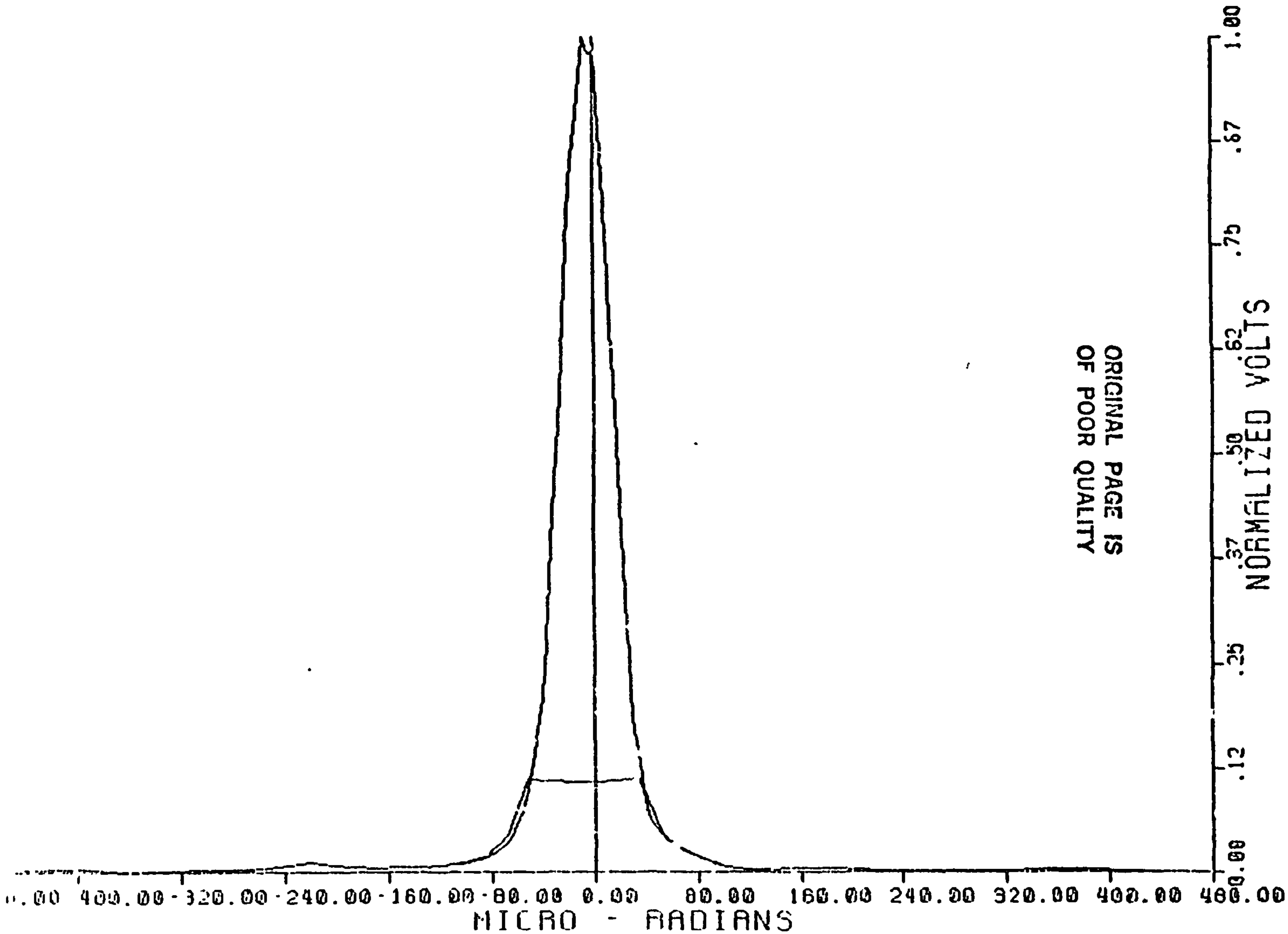

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NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 1 CHANNEL 2

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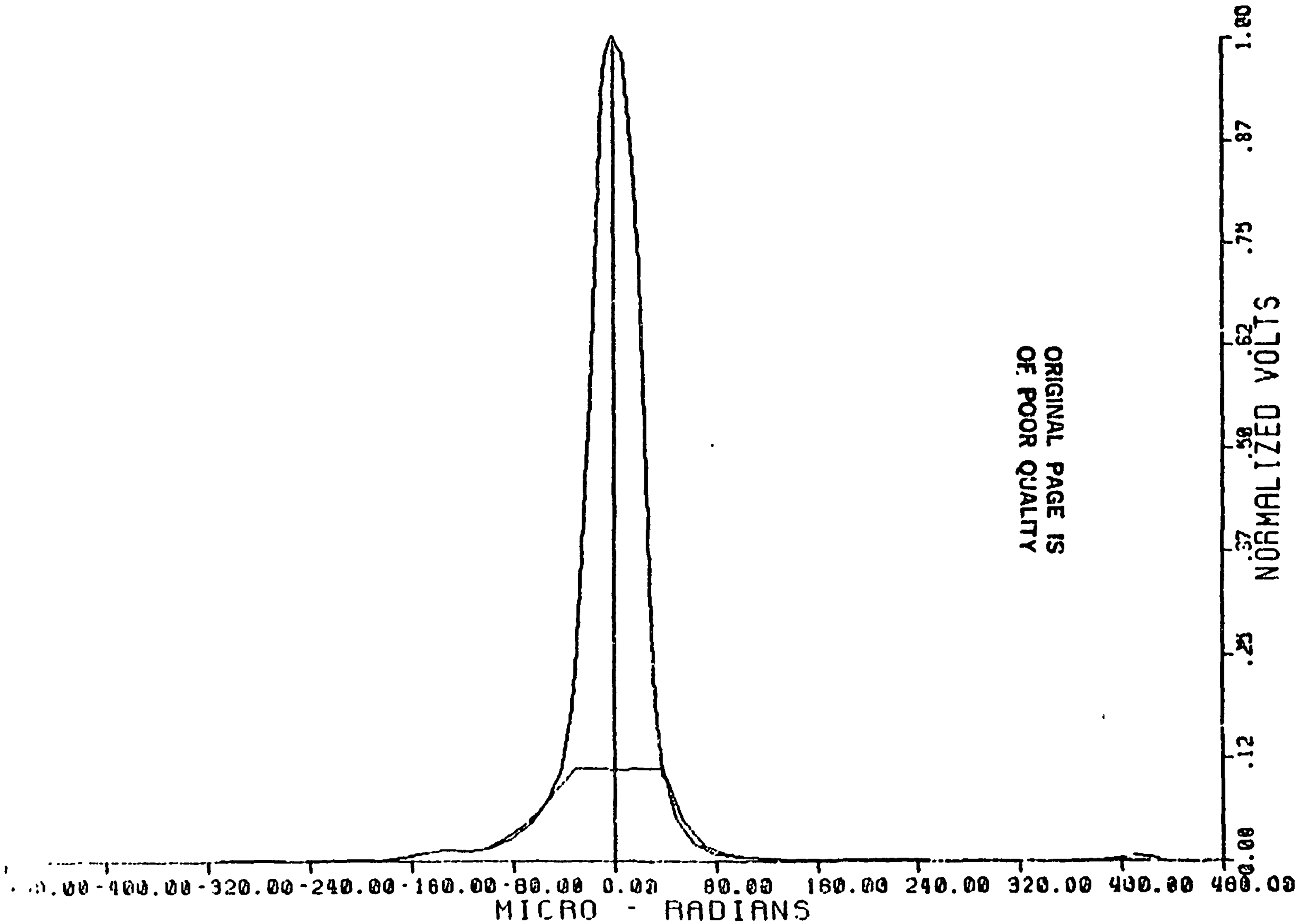

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NEAR AND FAR FIELD DATA FOR X - AXIS, BAND 1 CHANNEL 2

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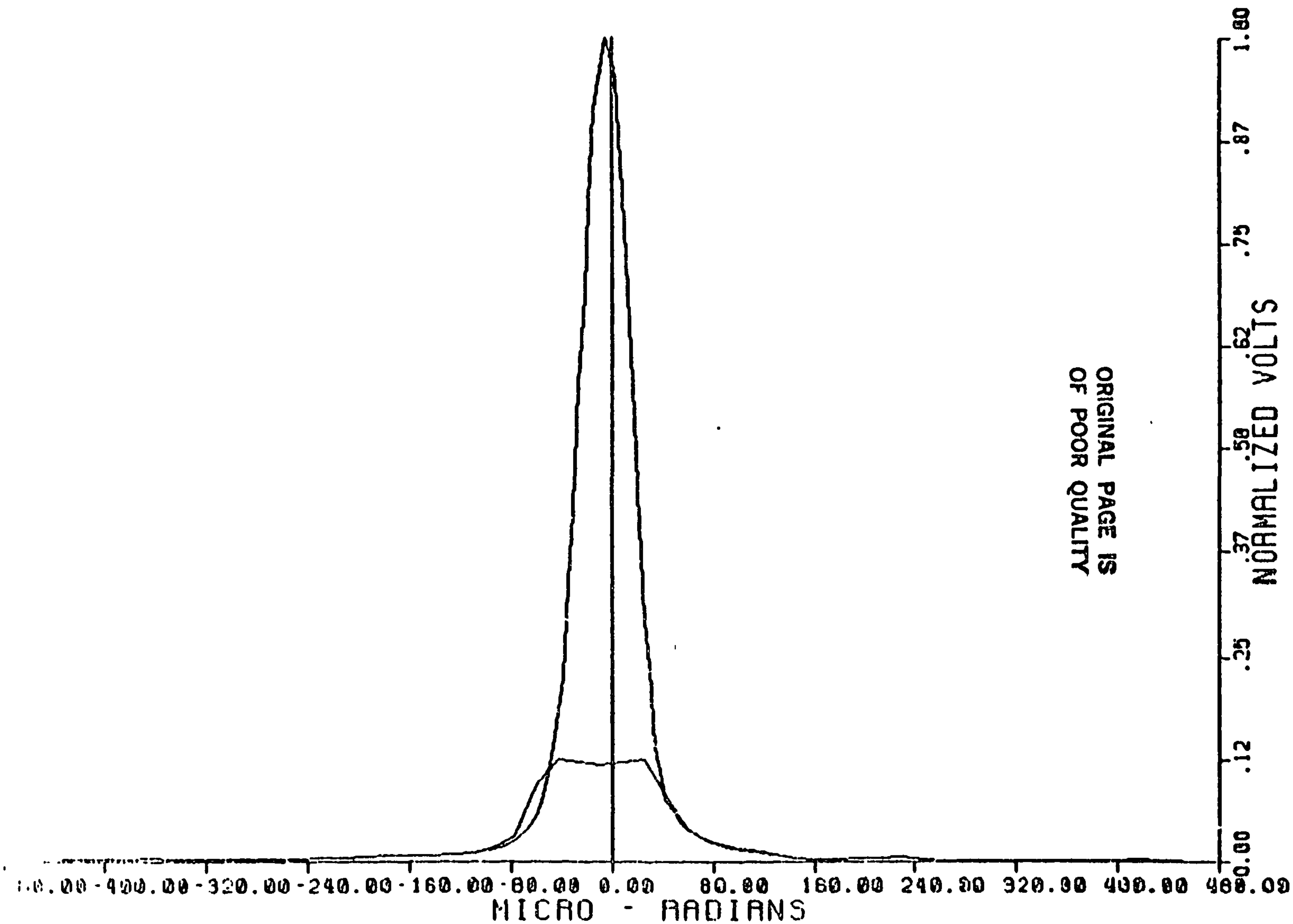

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NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 1 CHANNEL 15

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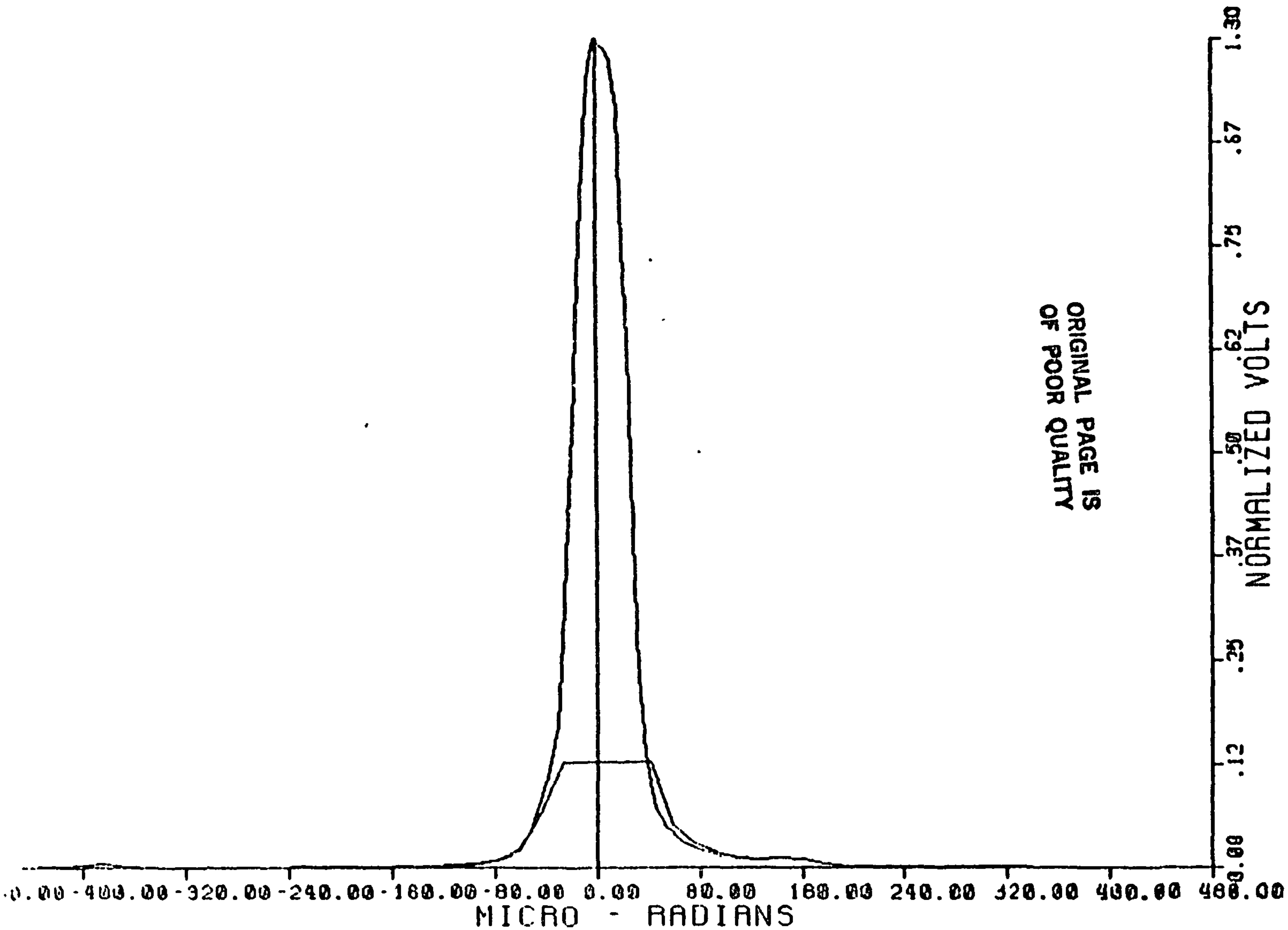

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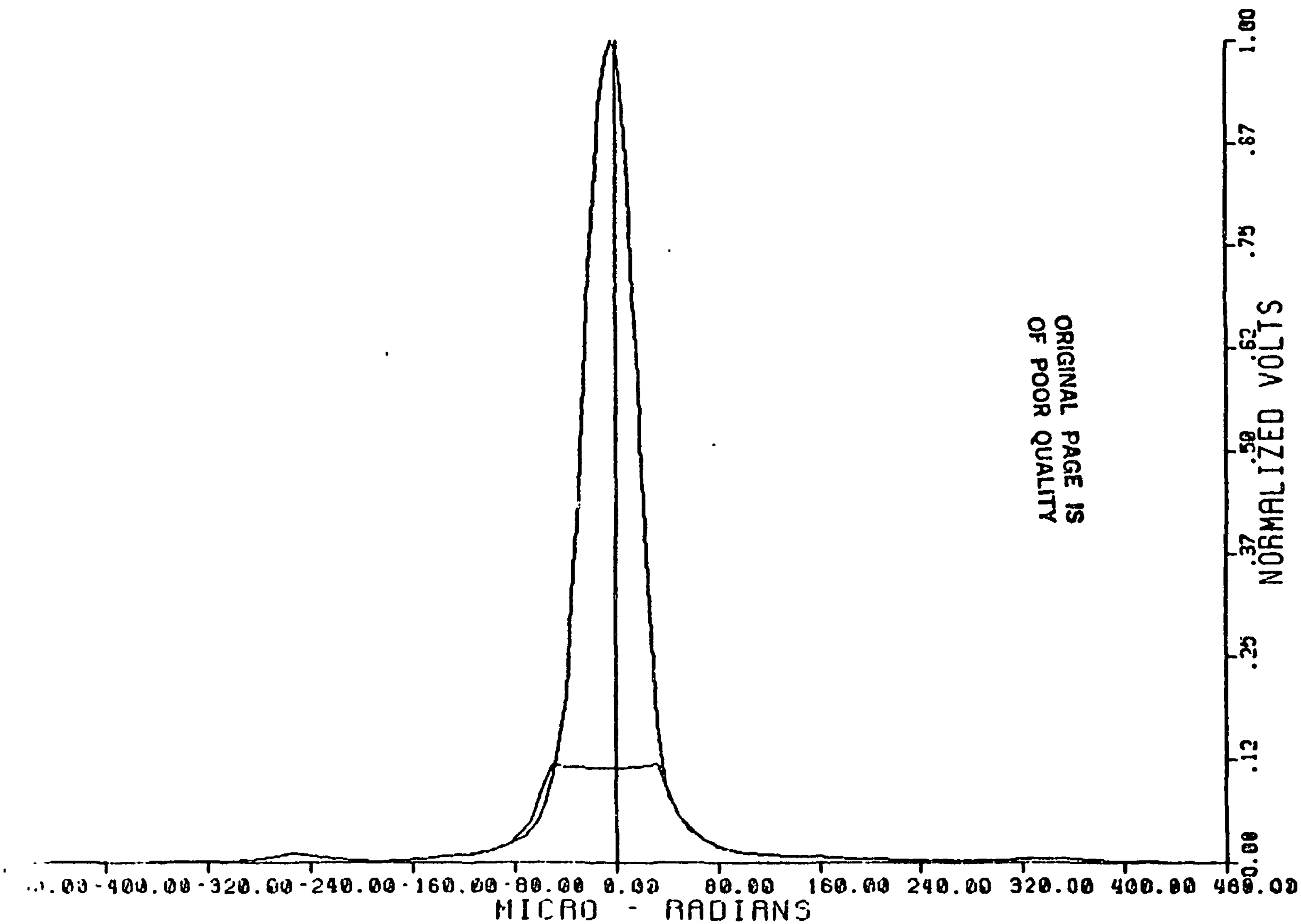

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 1 CHANNEL 16

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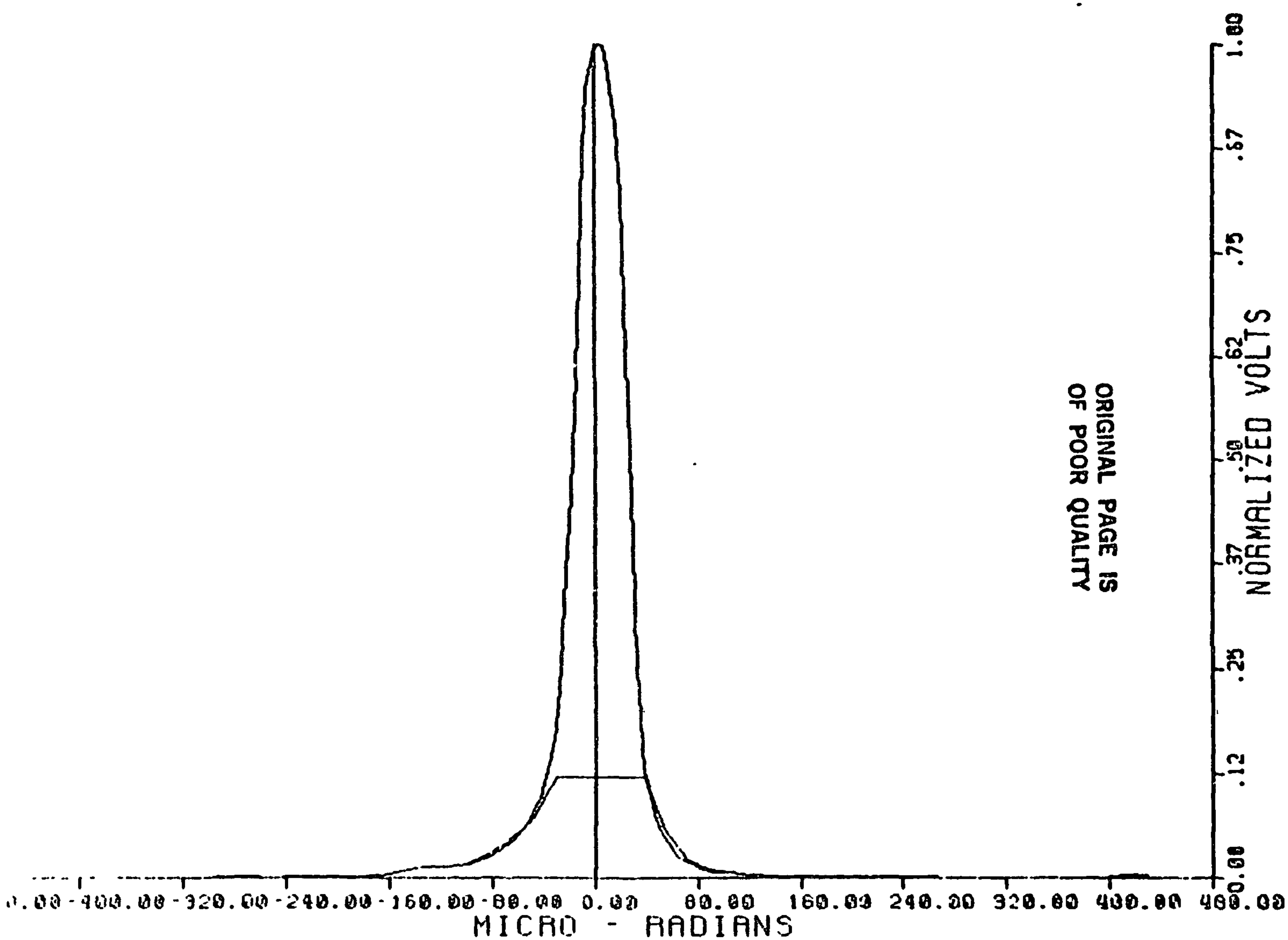

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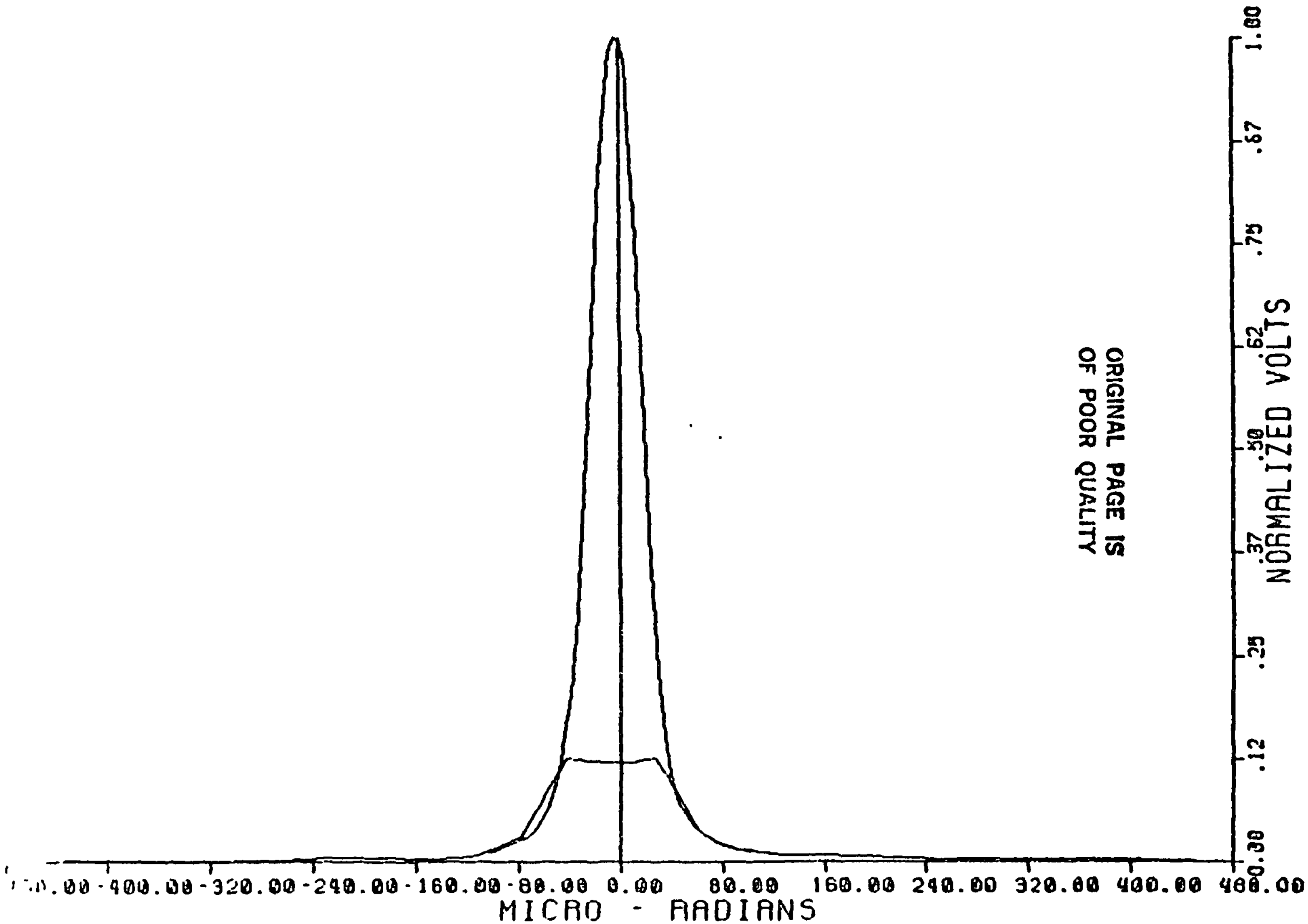

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 2 CHANNEL 1

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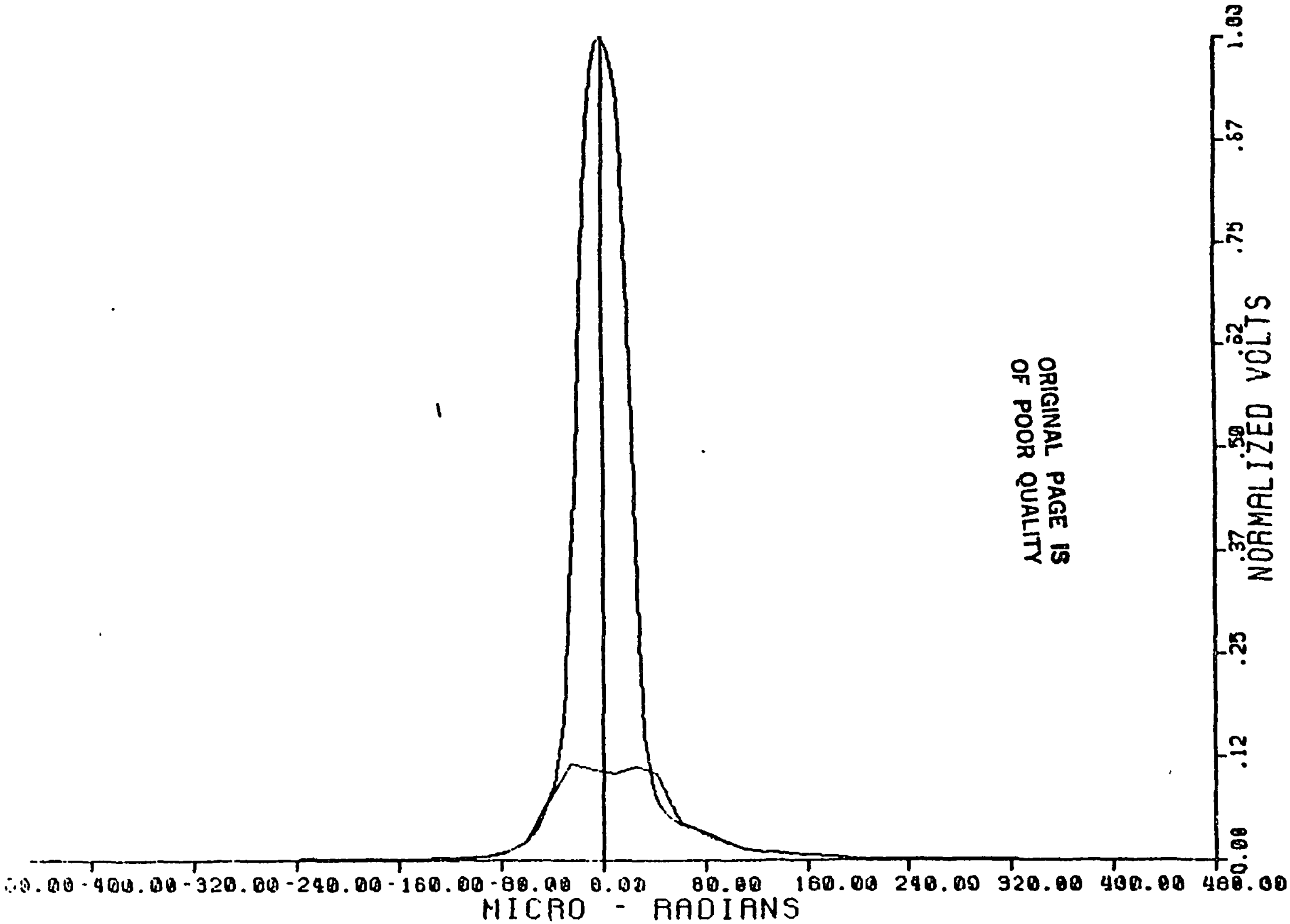

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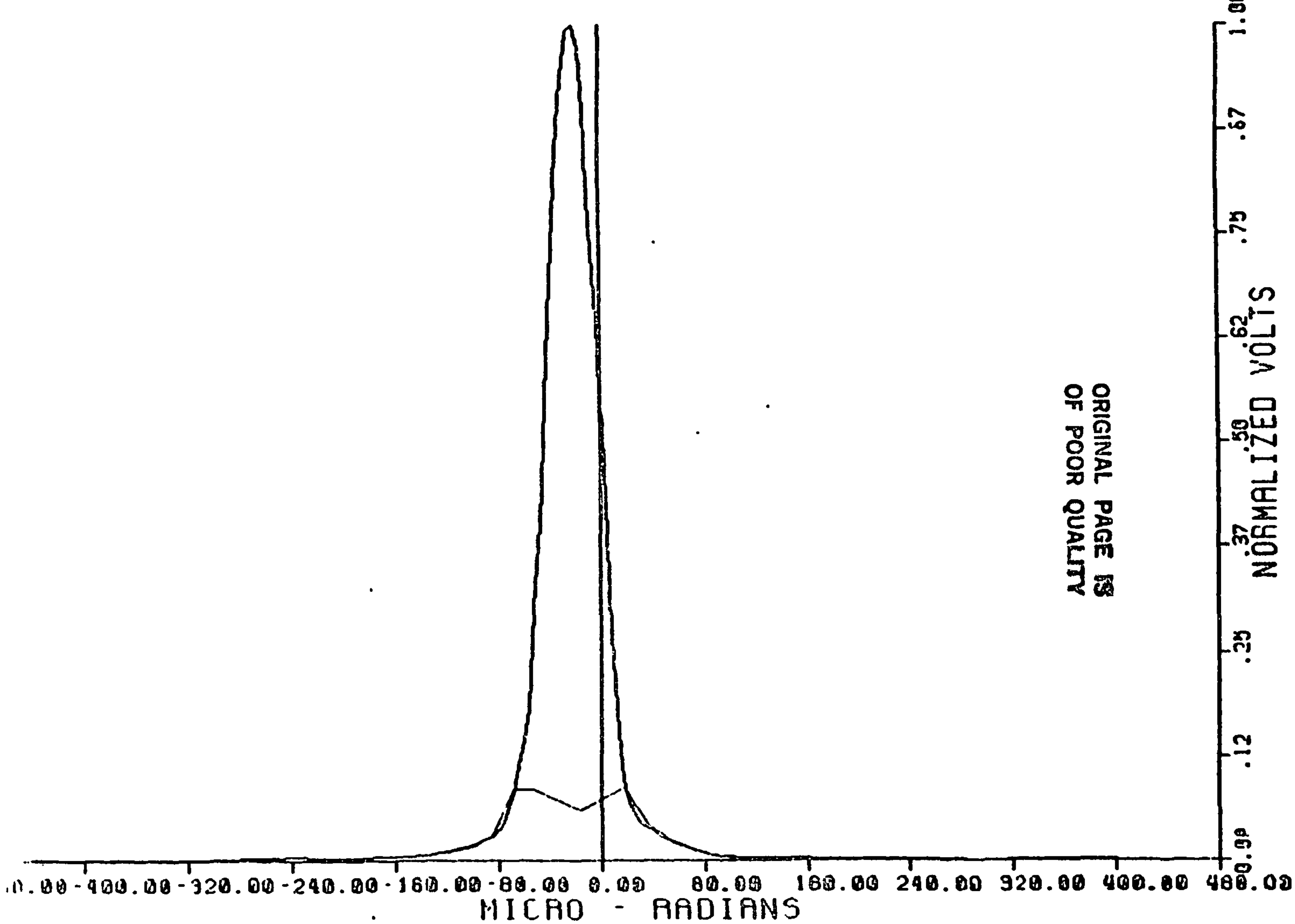

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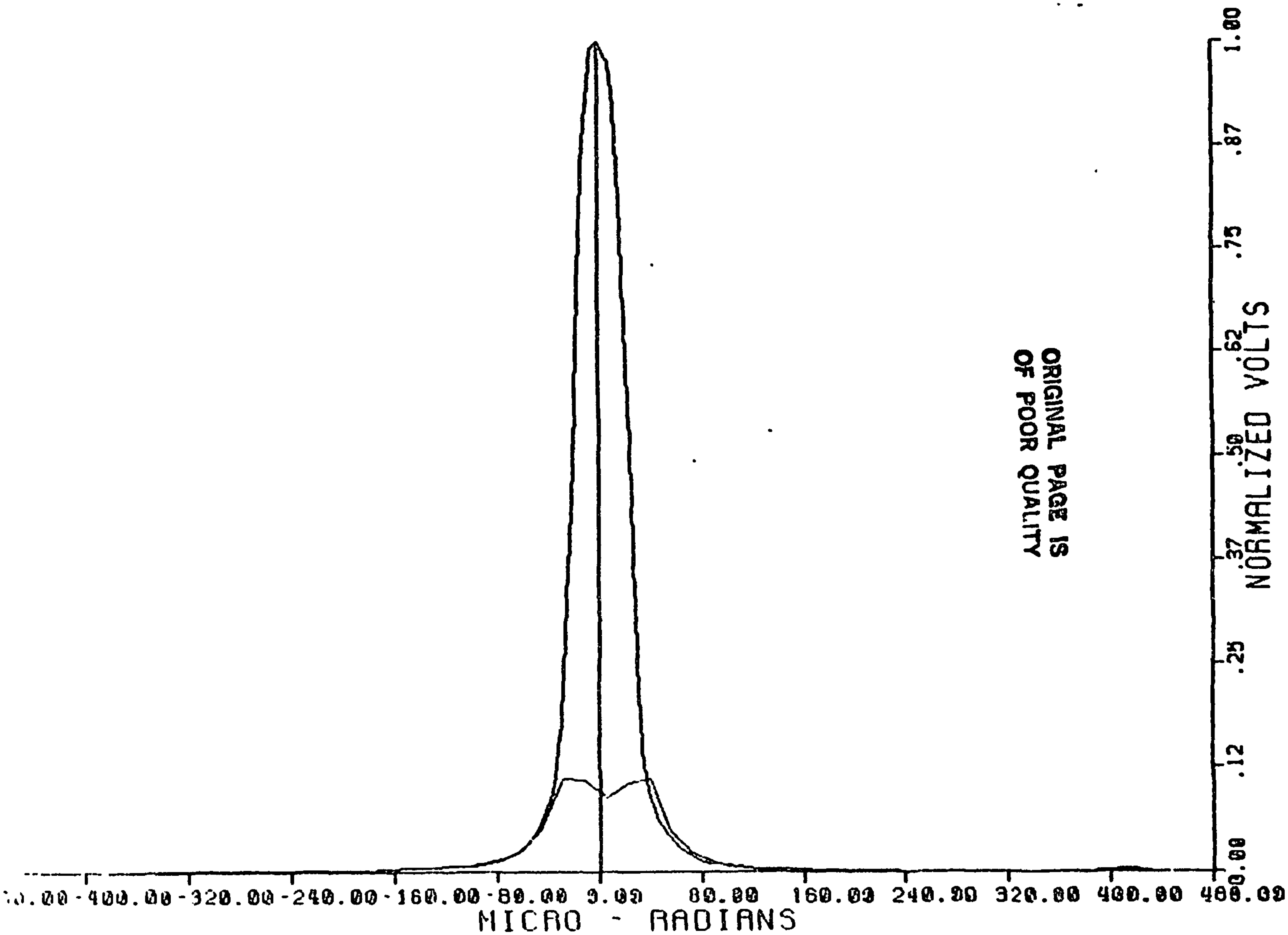

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NEAR AND FAR FIELD DATA FOR X - AXIS. BAND 2 CHANNEL 2

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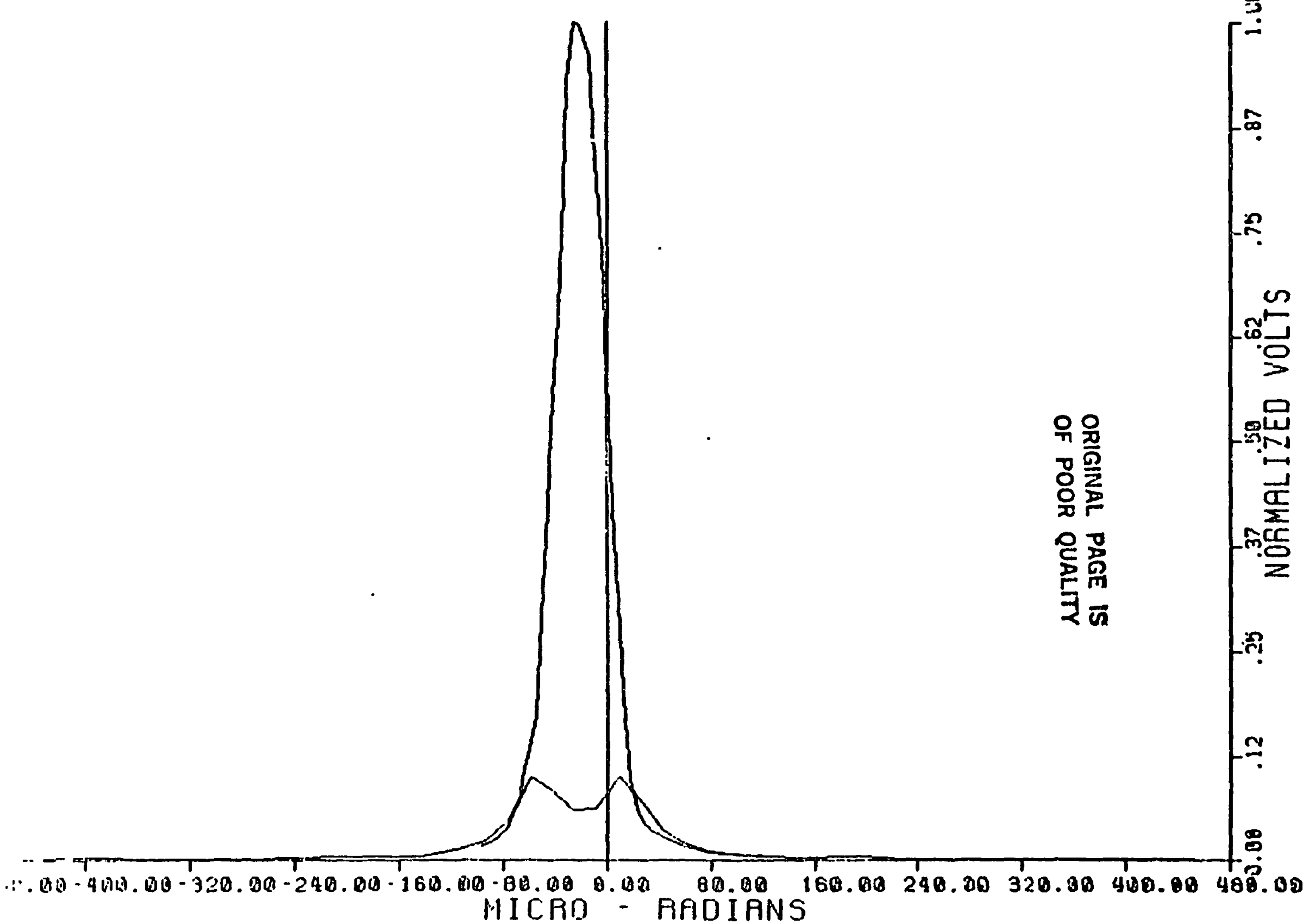

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 2 CHANNEL 15

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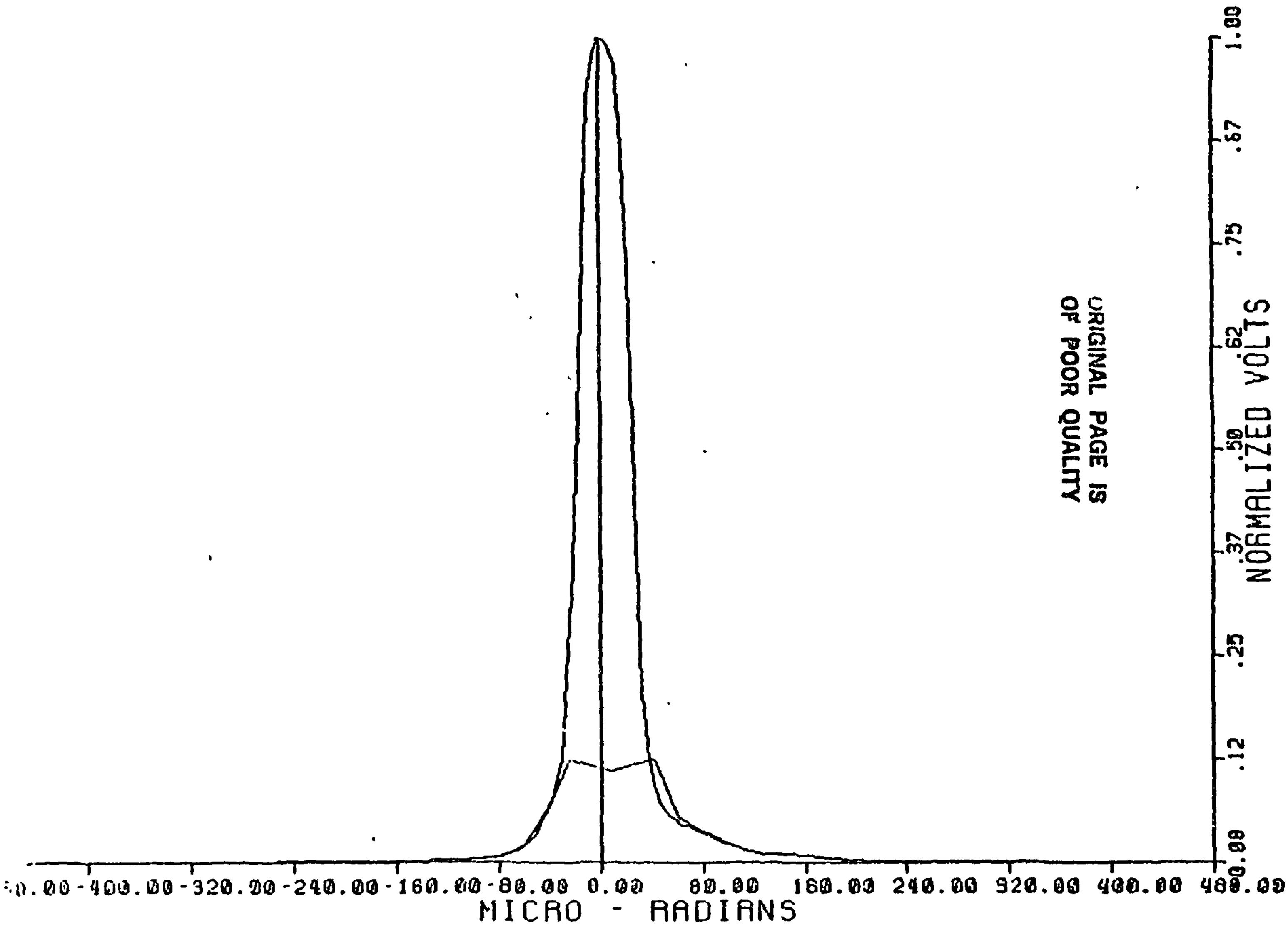

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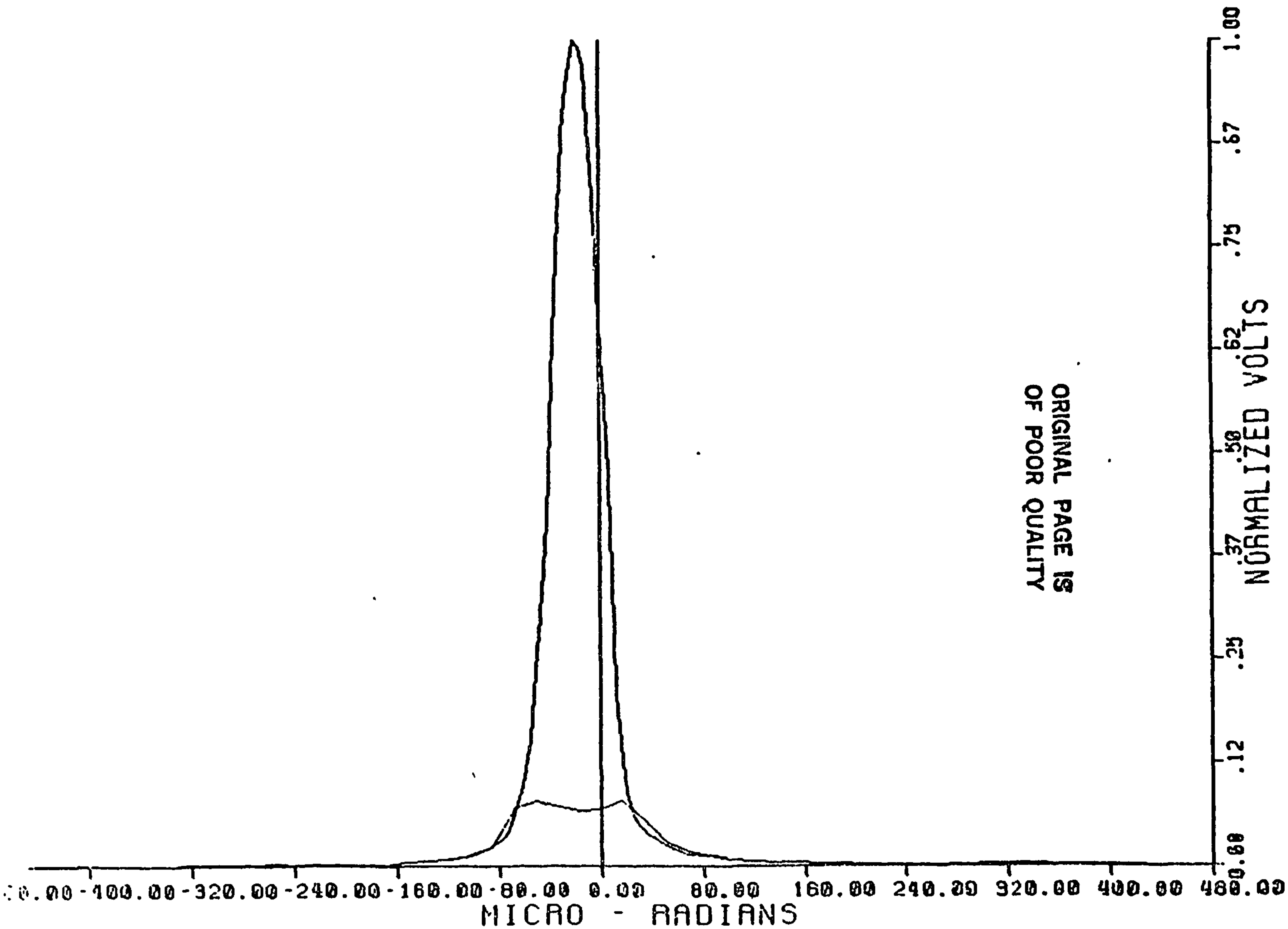

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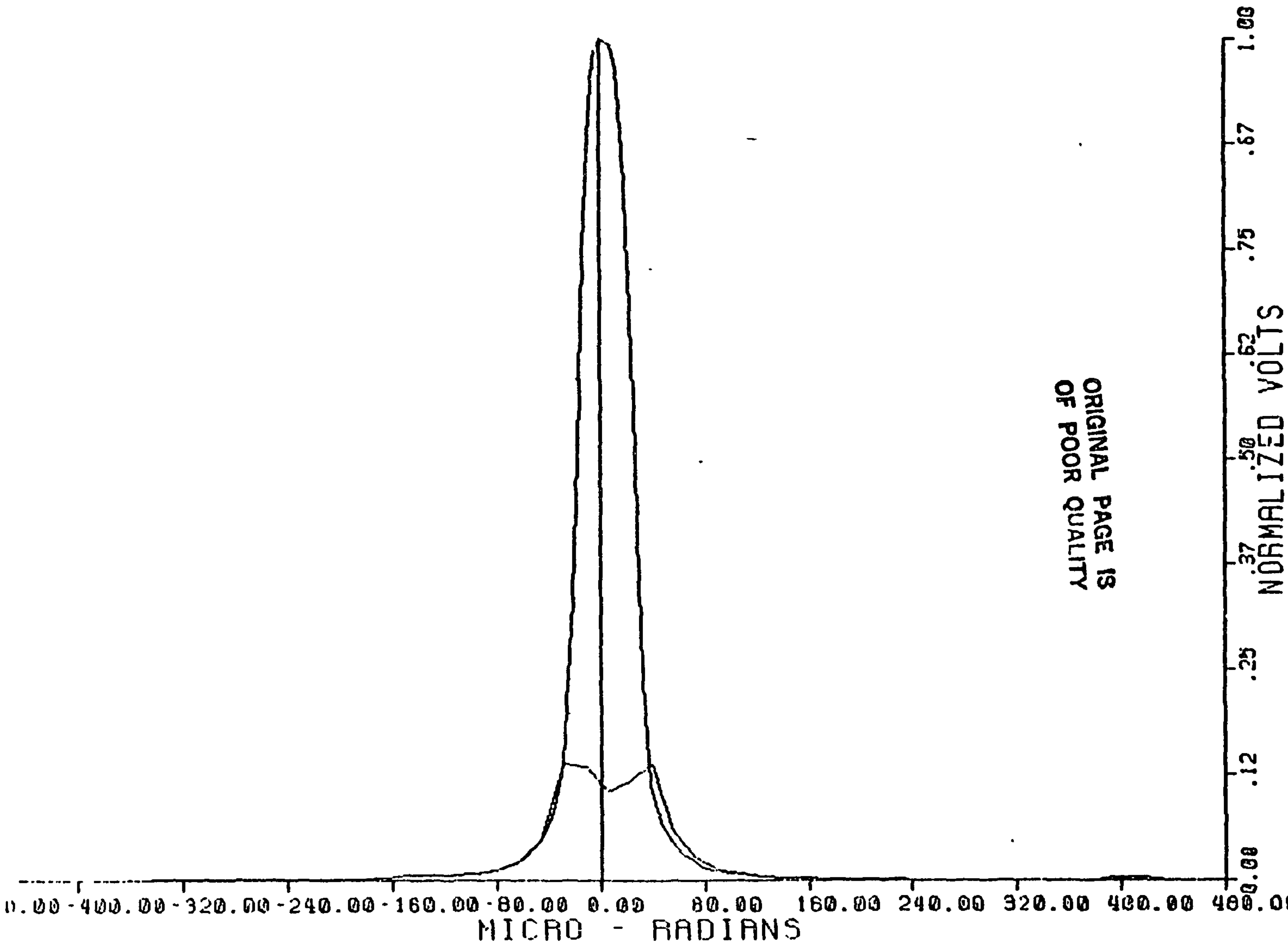

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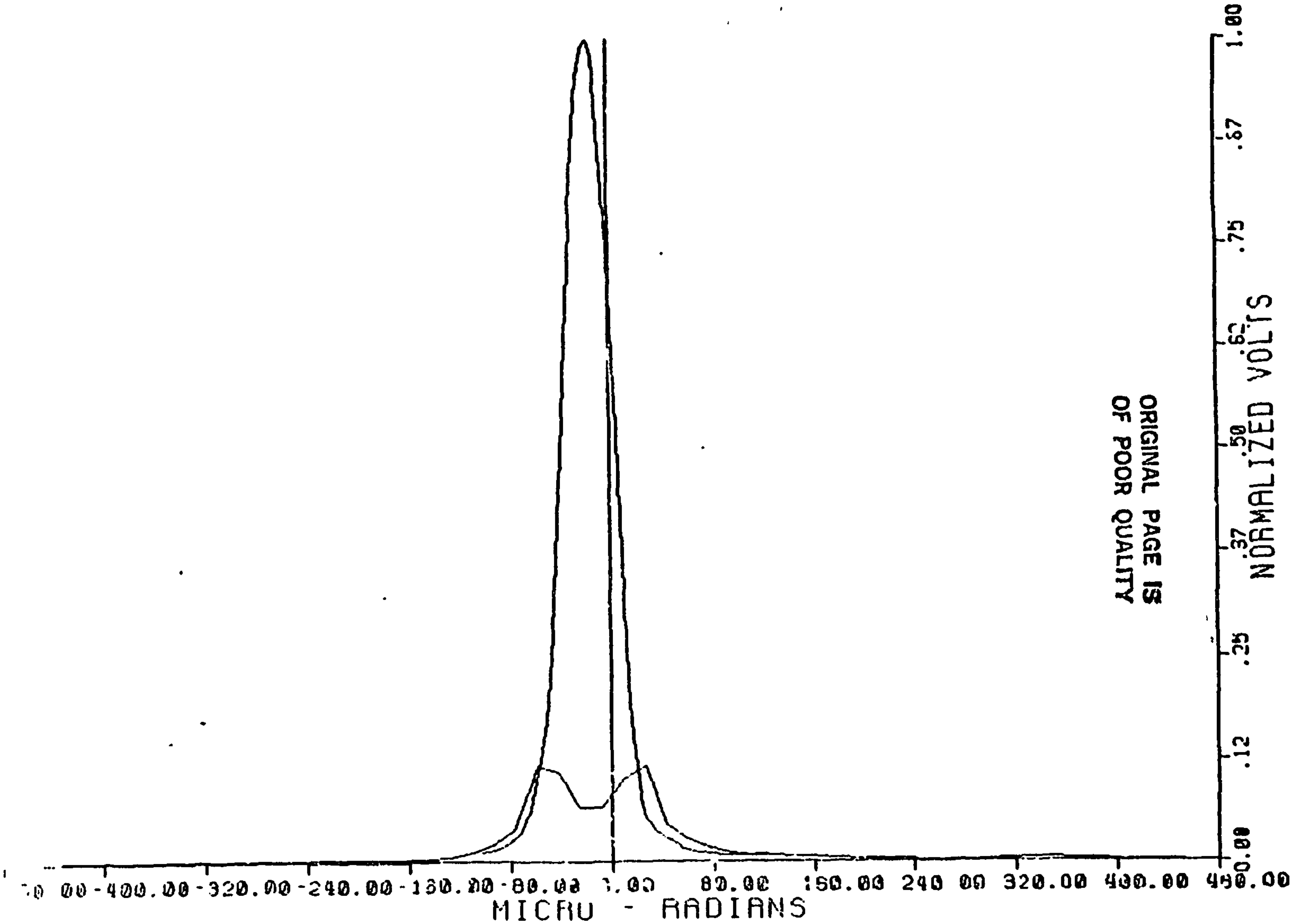

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 3 CHANNEL 1

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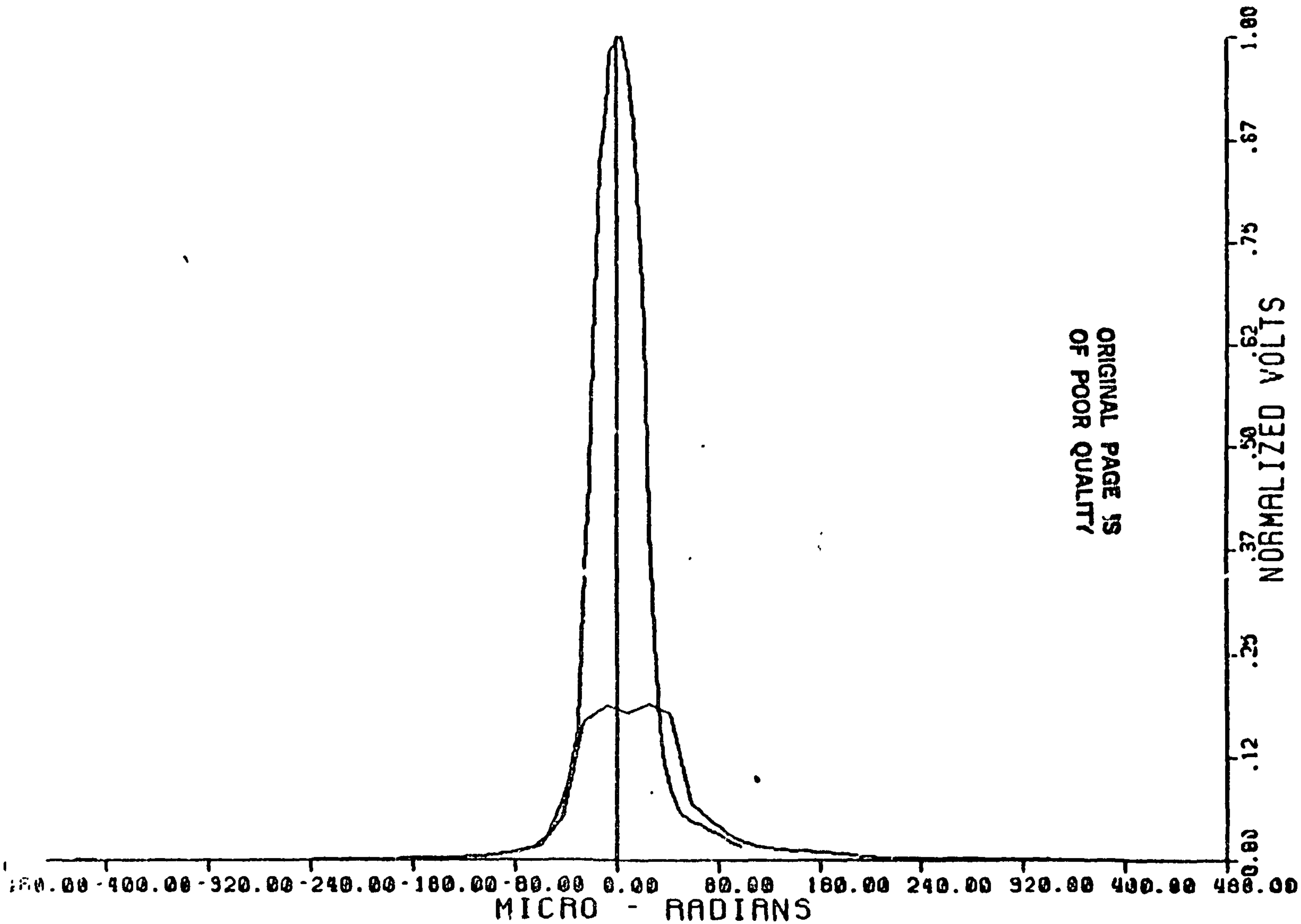

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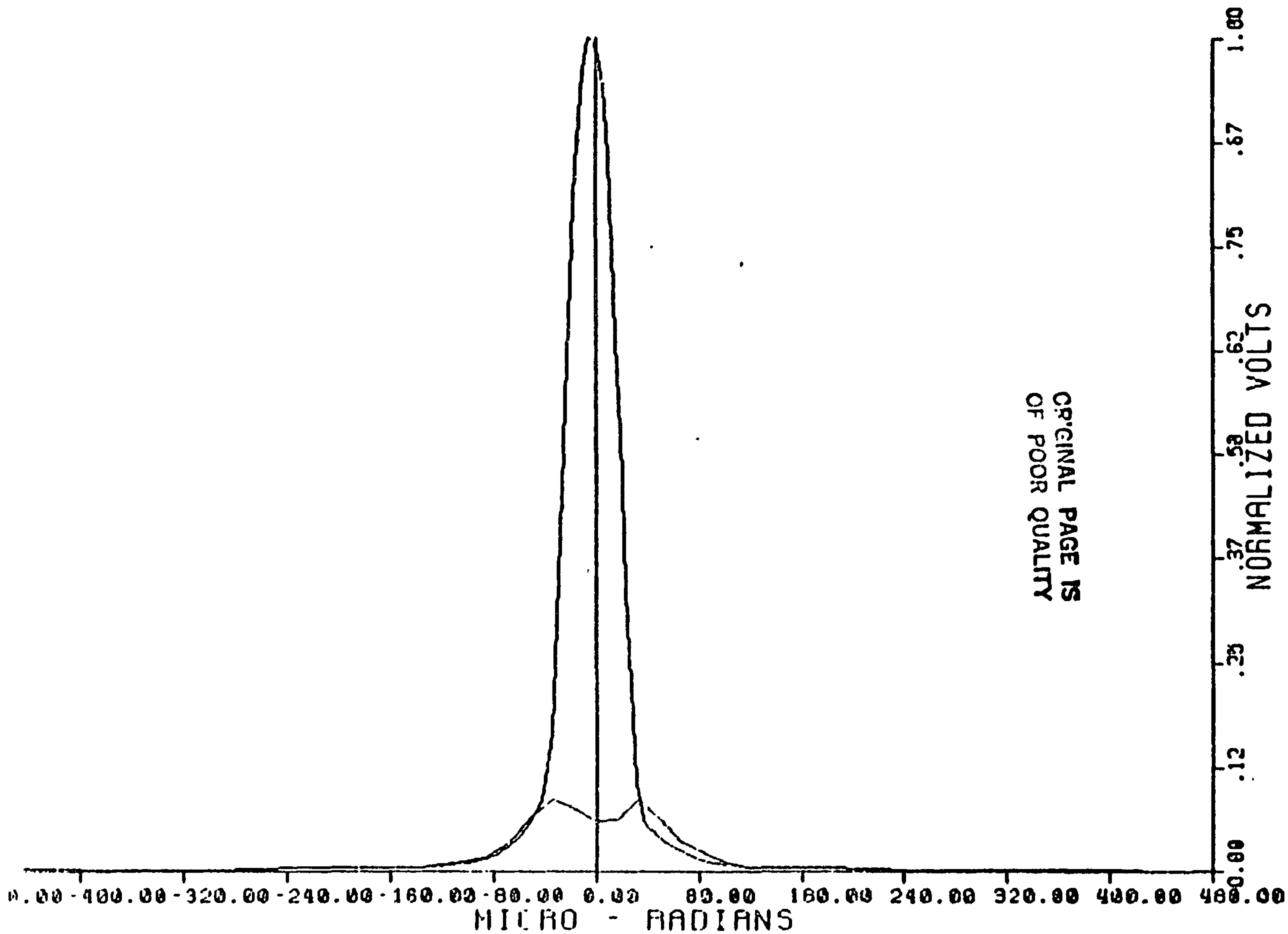

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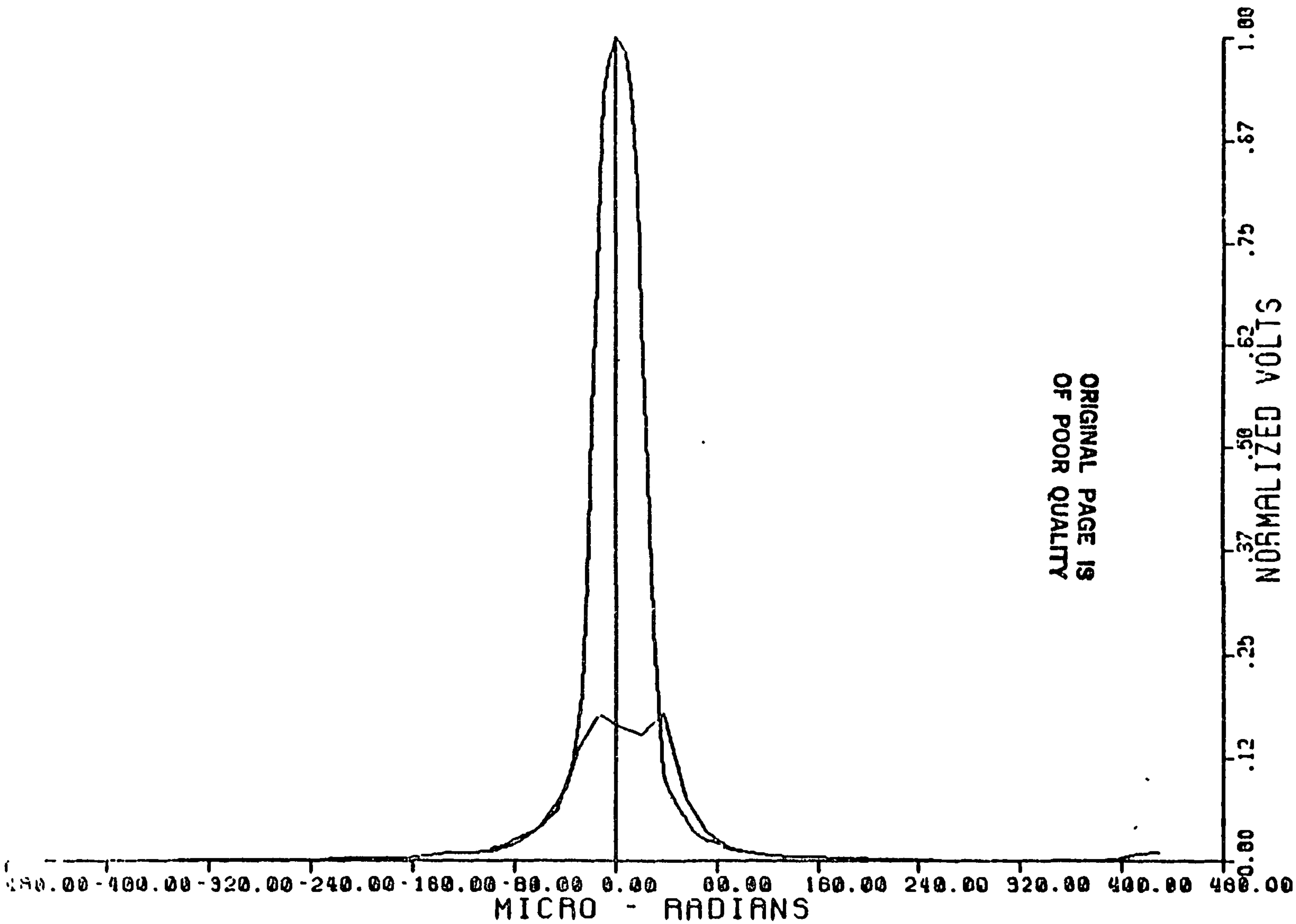

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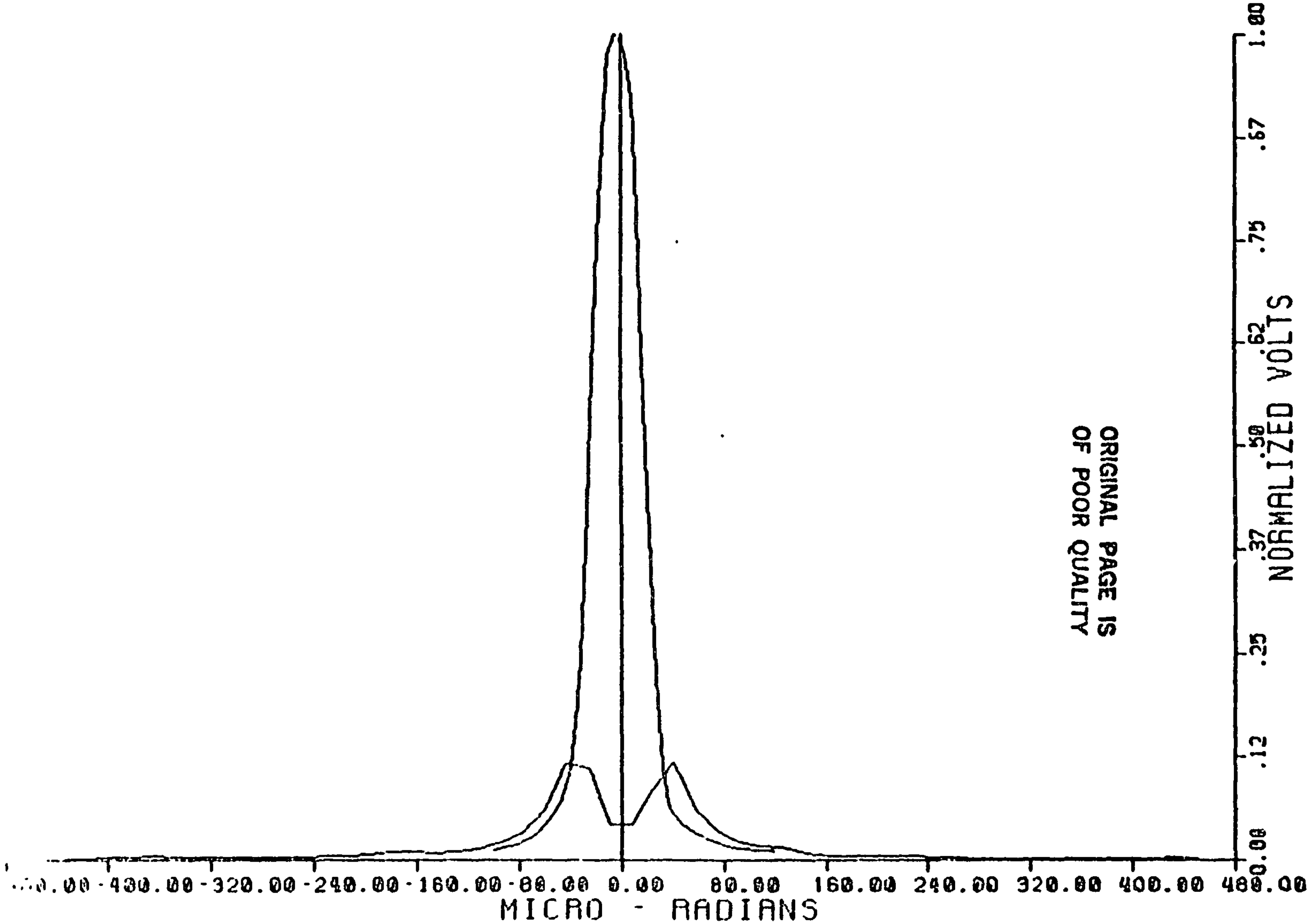

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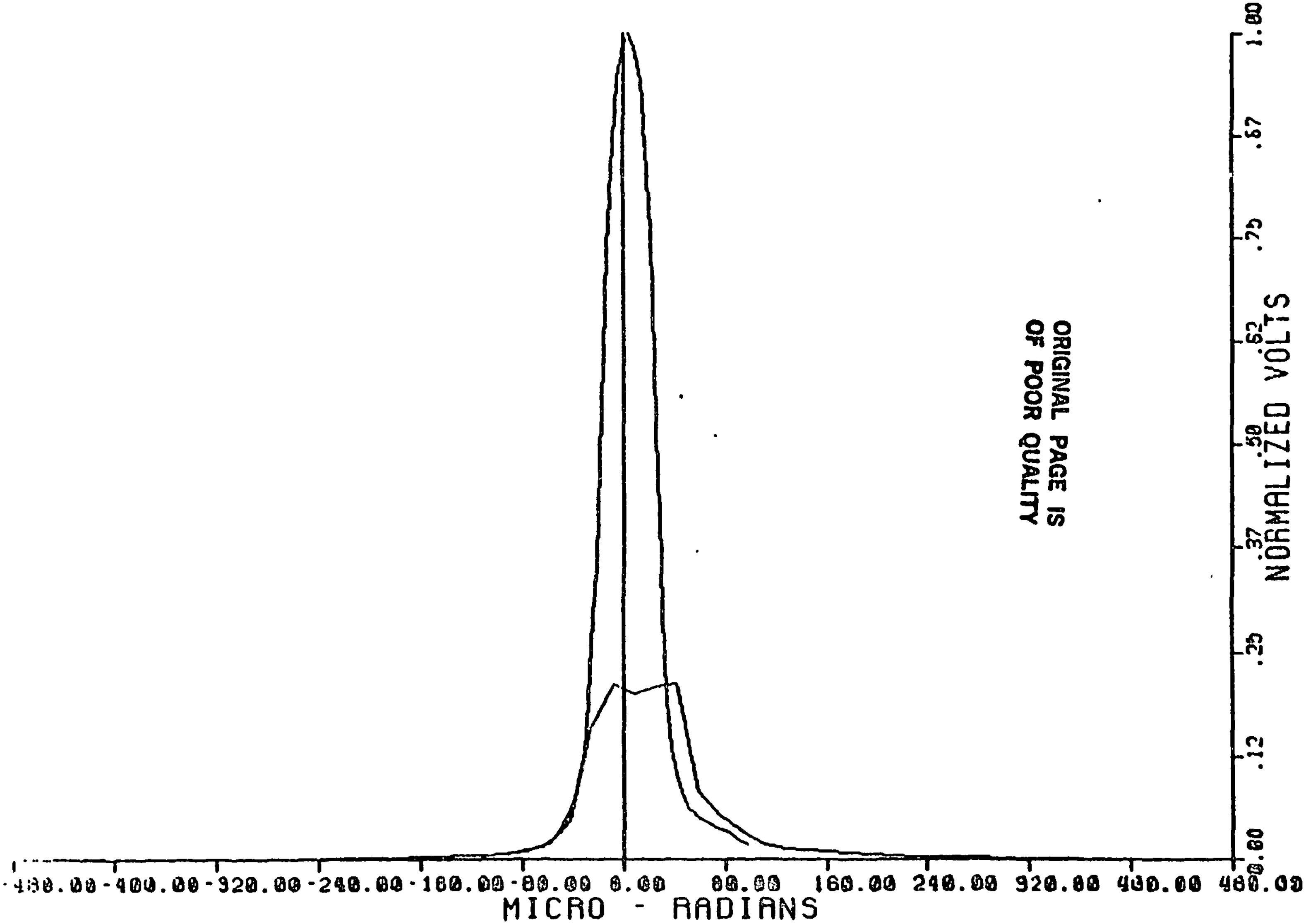

NEAR AND FAR FIELD DATA FOR X - AXIS, BAND 3 CHANNEL 15

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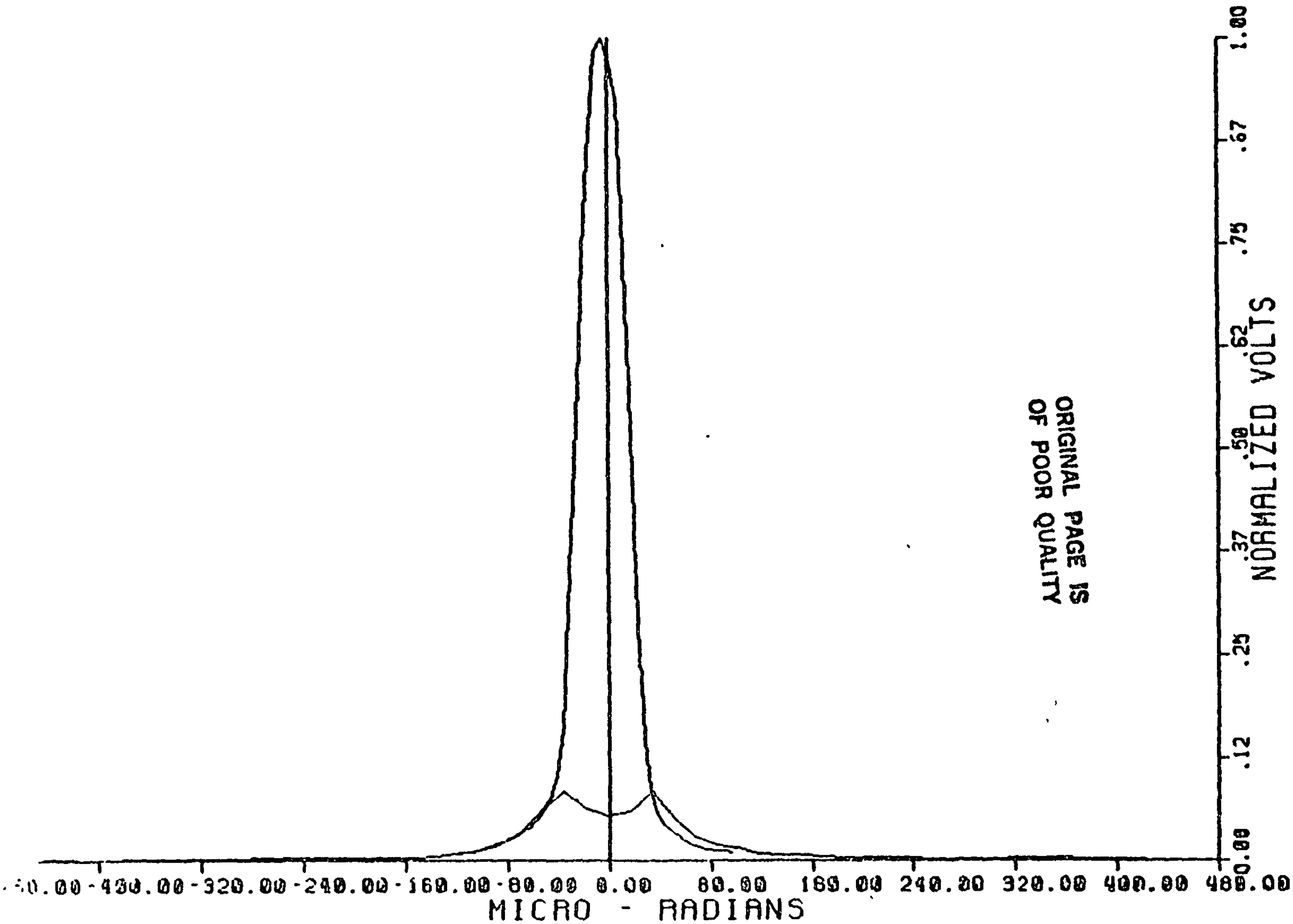

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 3 CHANNEL 16

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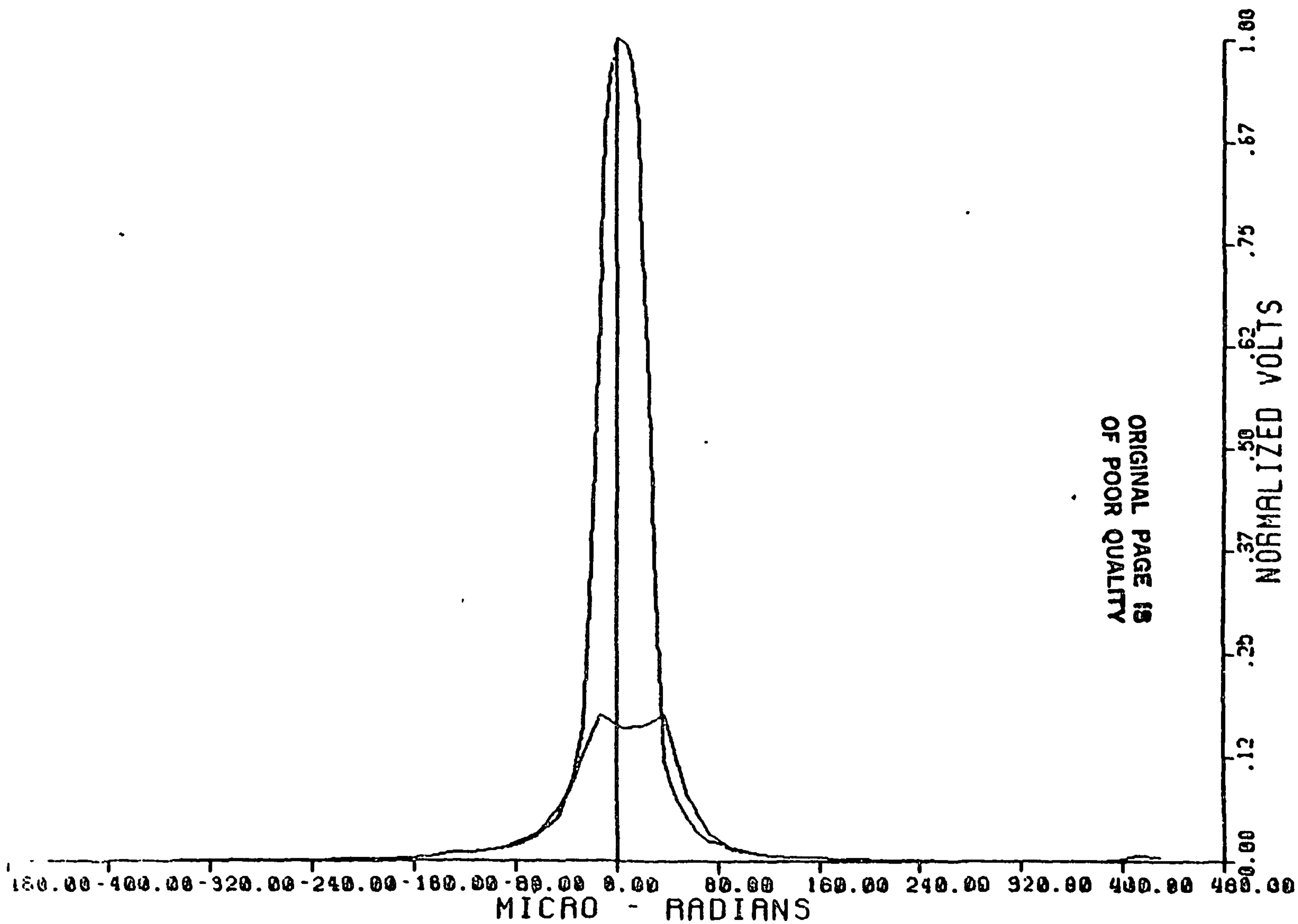

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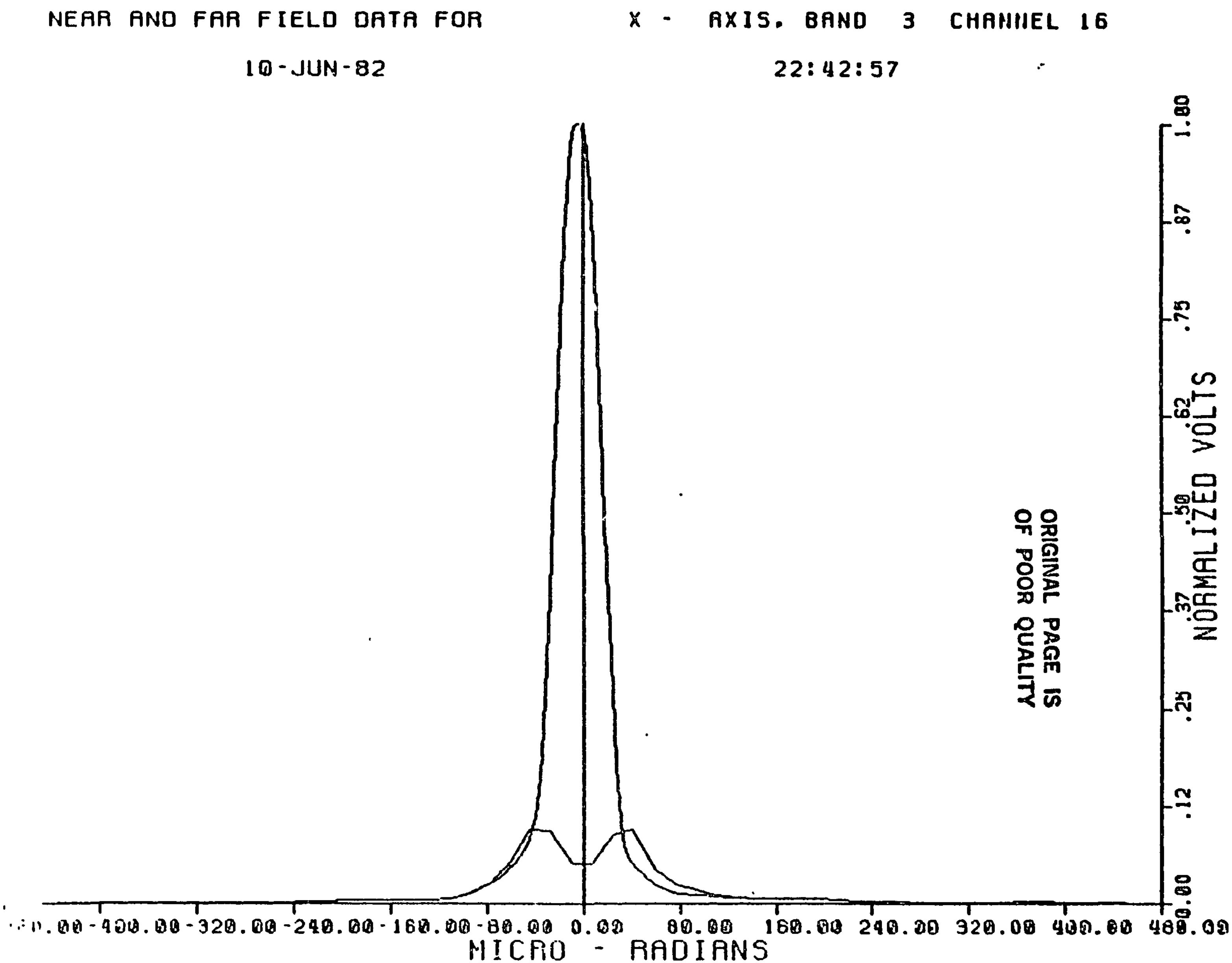
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NEAR AND FAR FIELD DATA FOR Y - AXIS. BAND 4 CHANNEL 1

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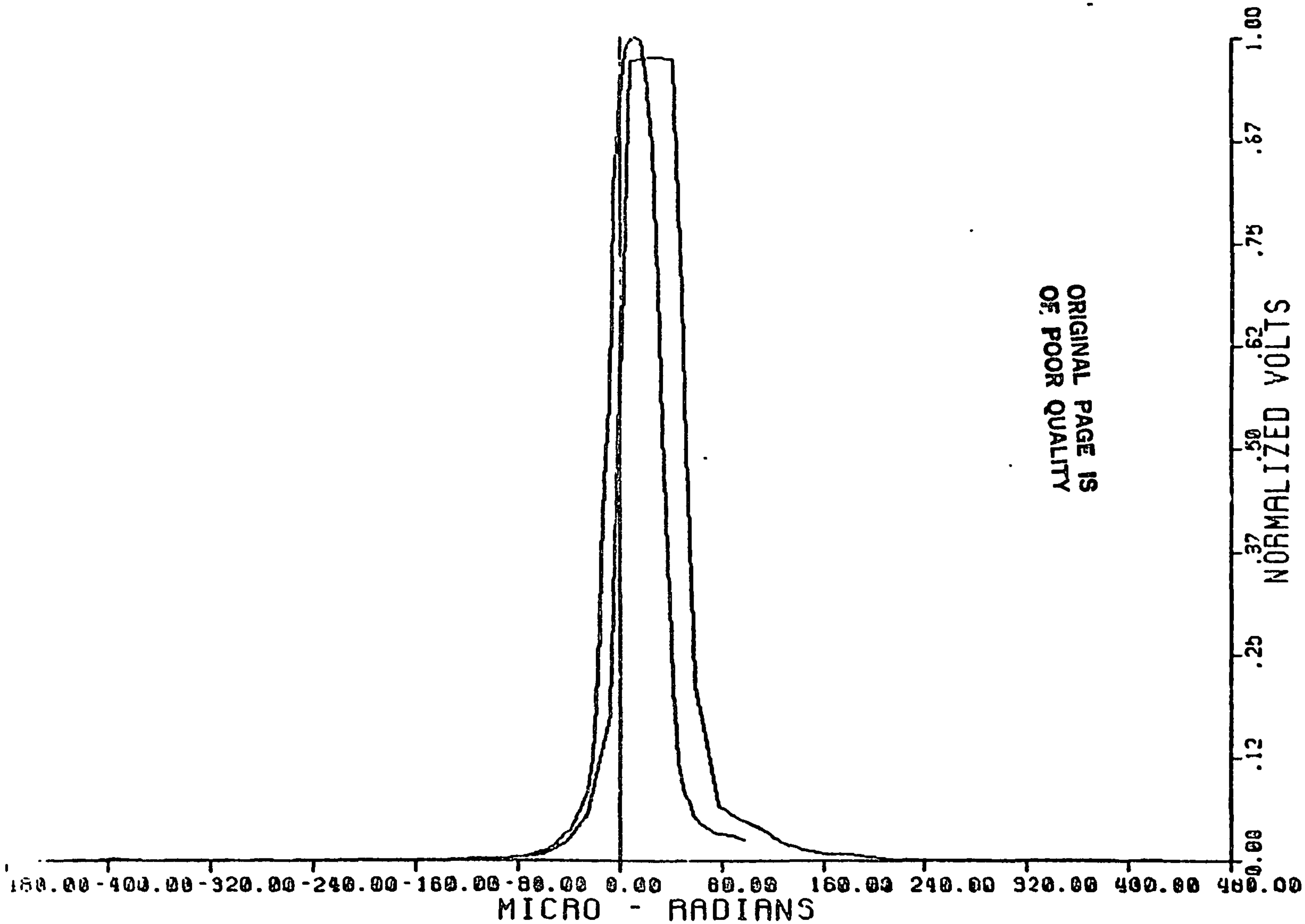

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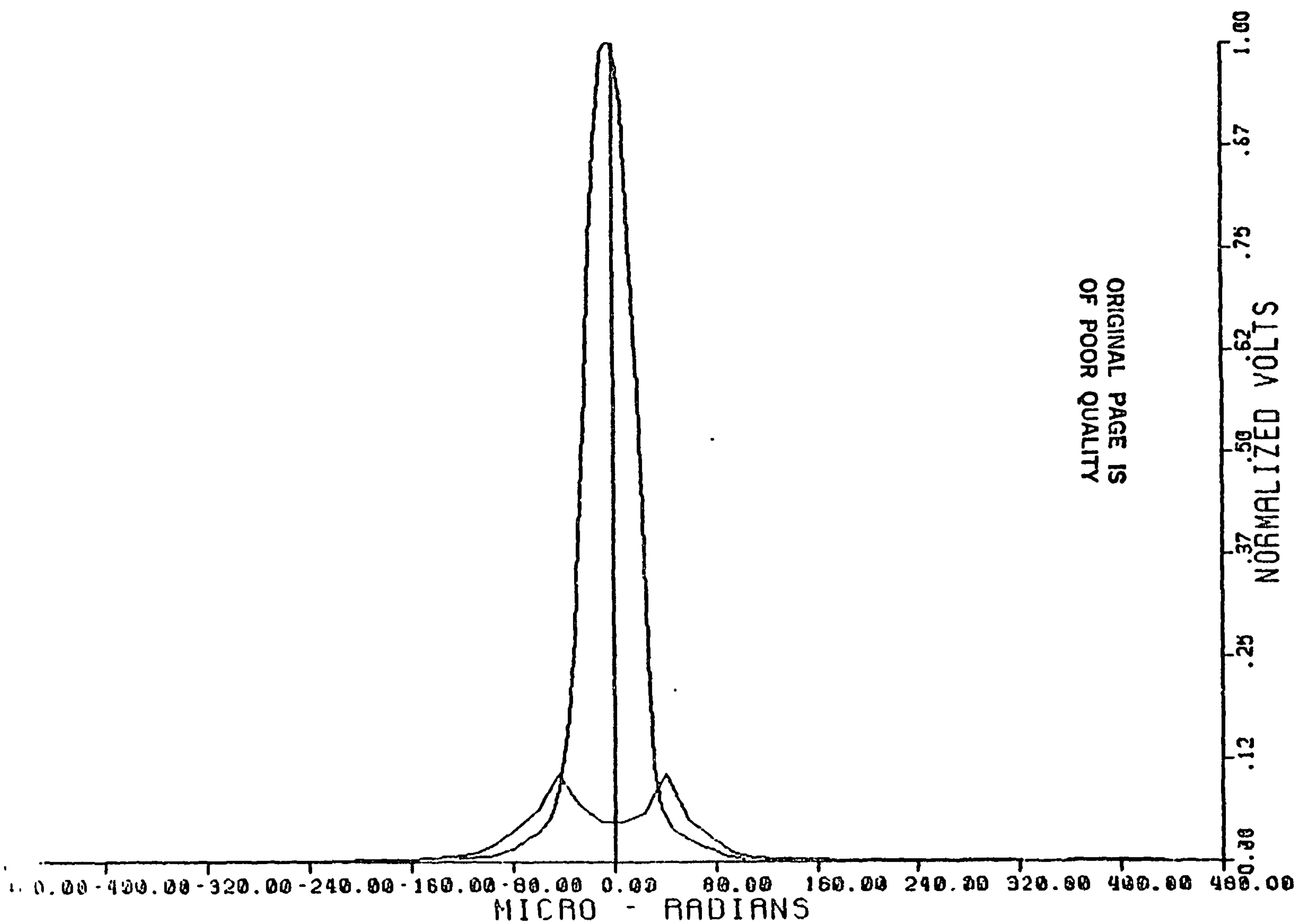

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NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 4 CHANNEL 2

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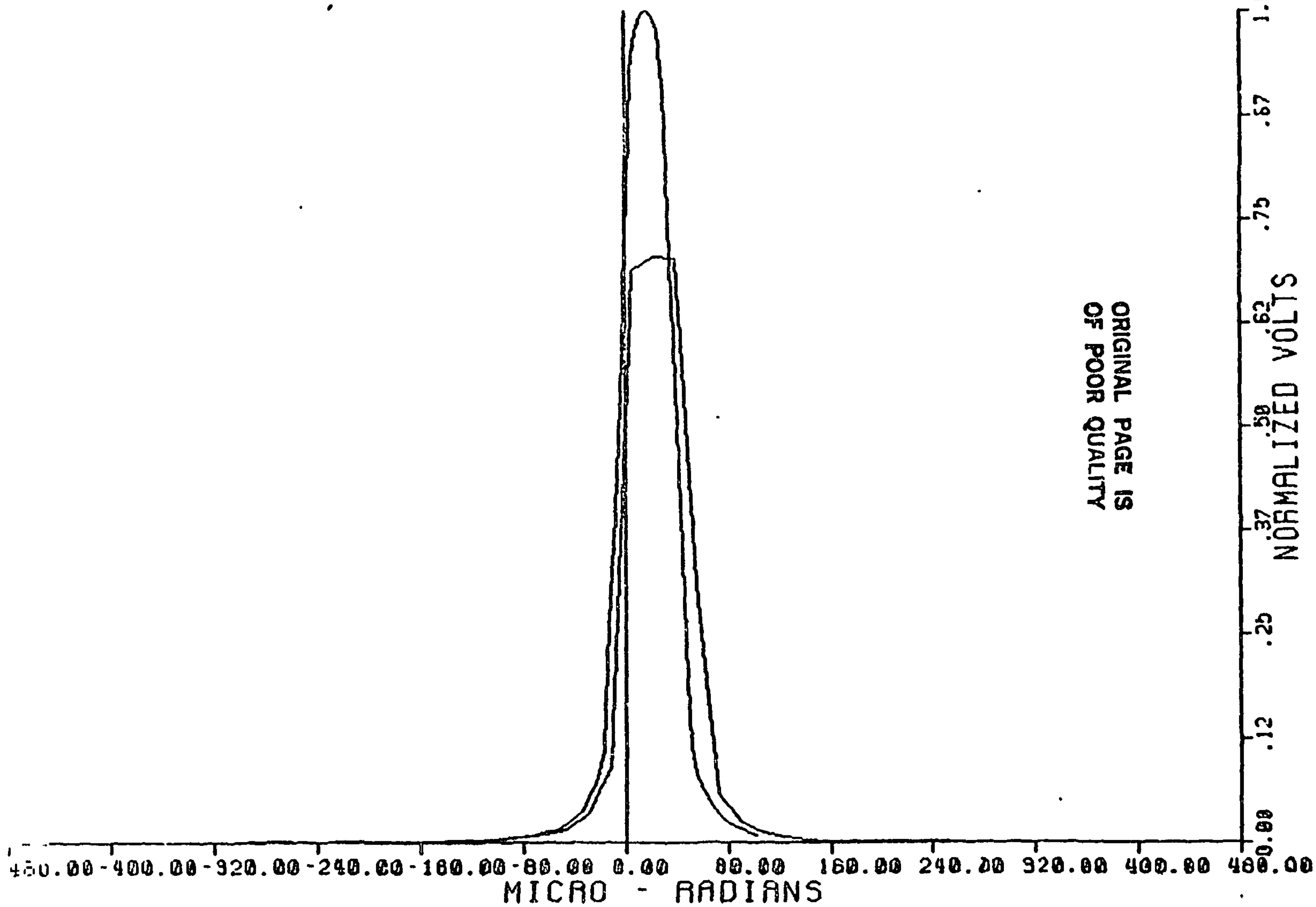

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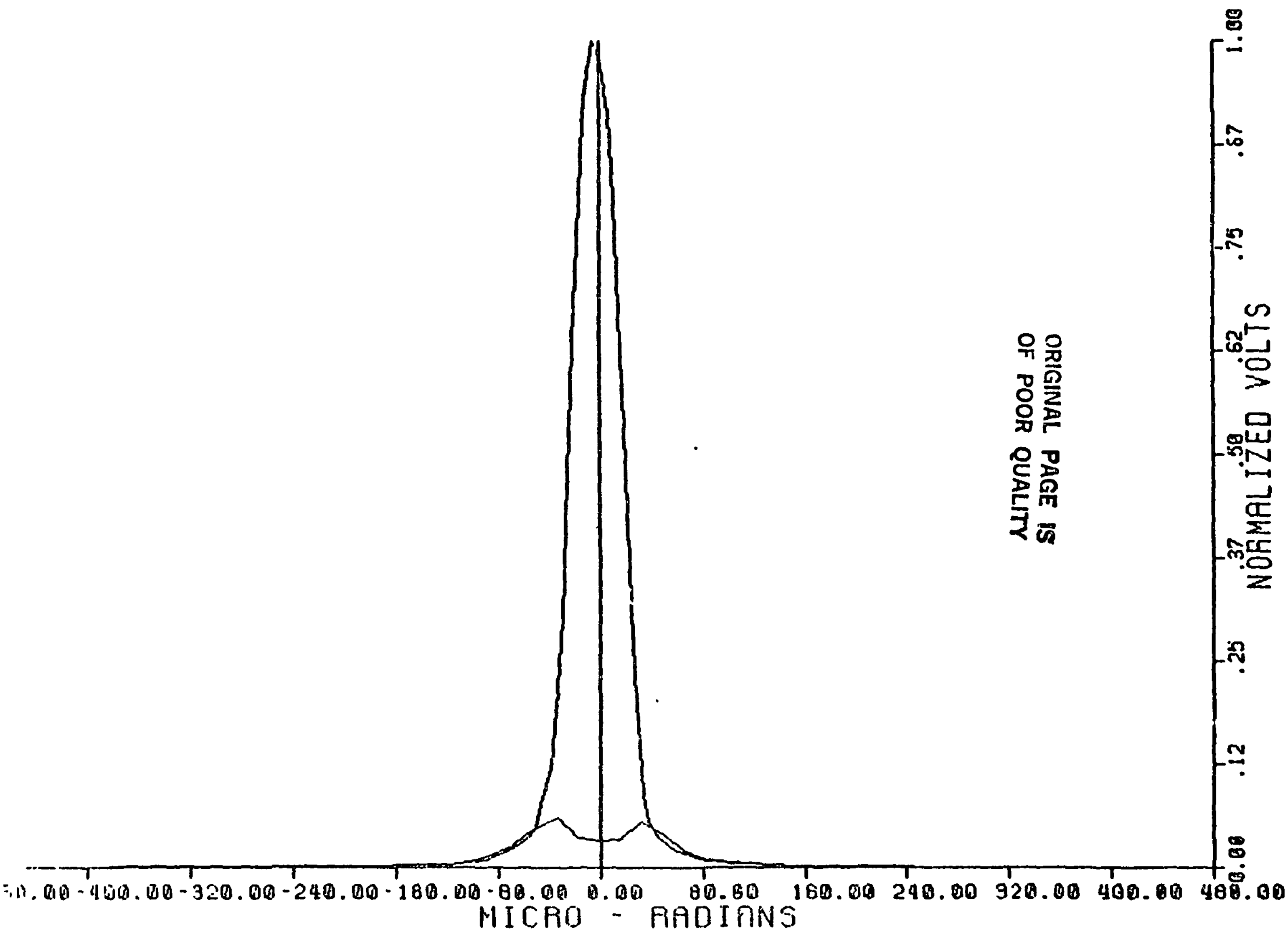

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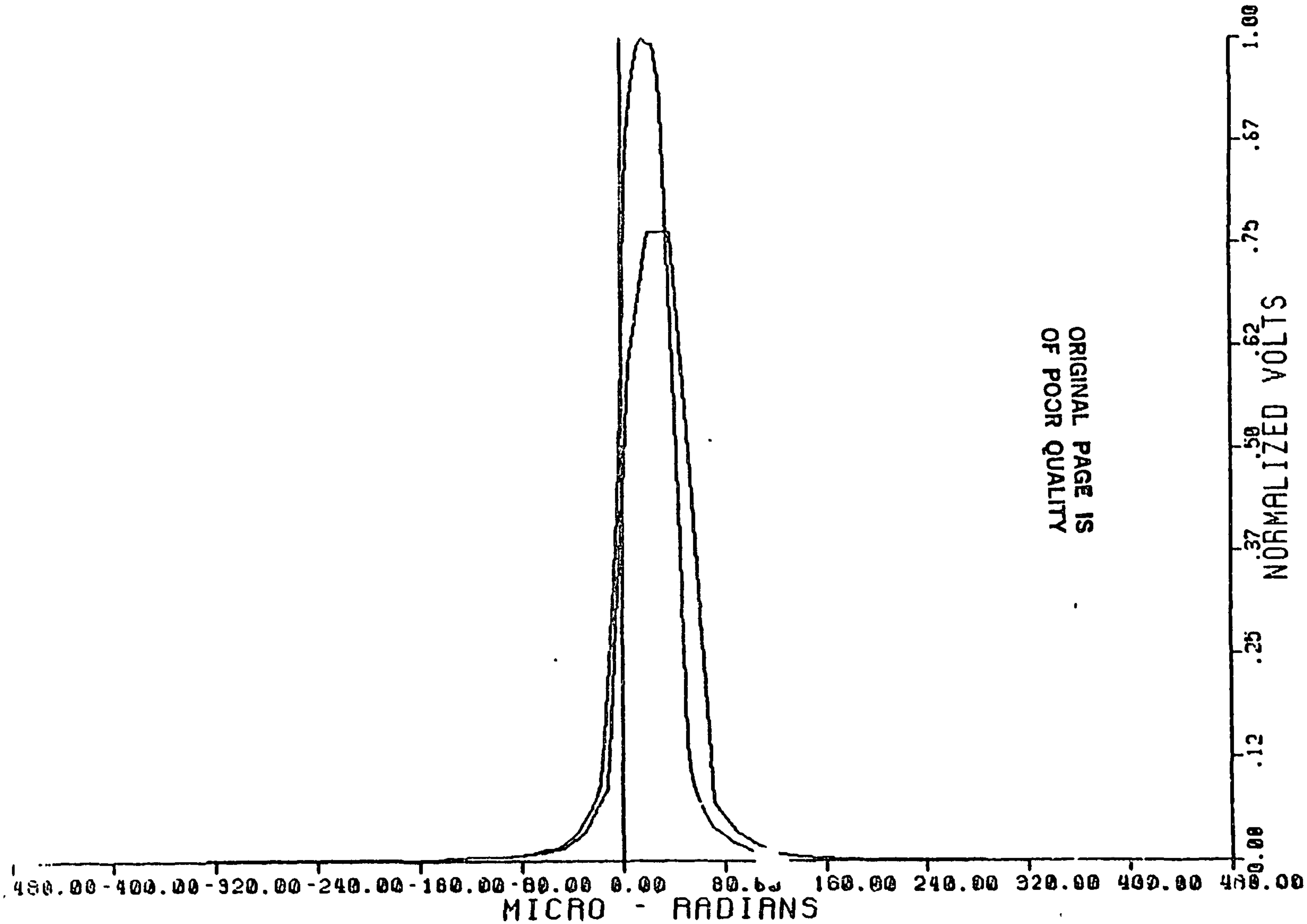

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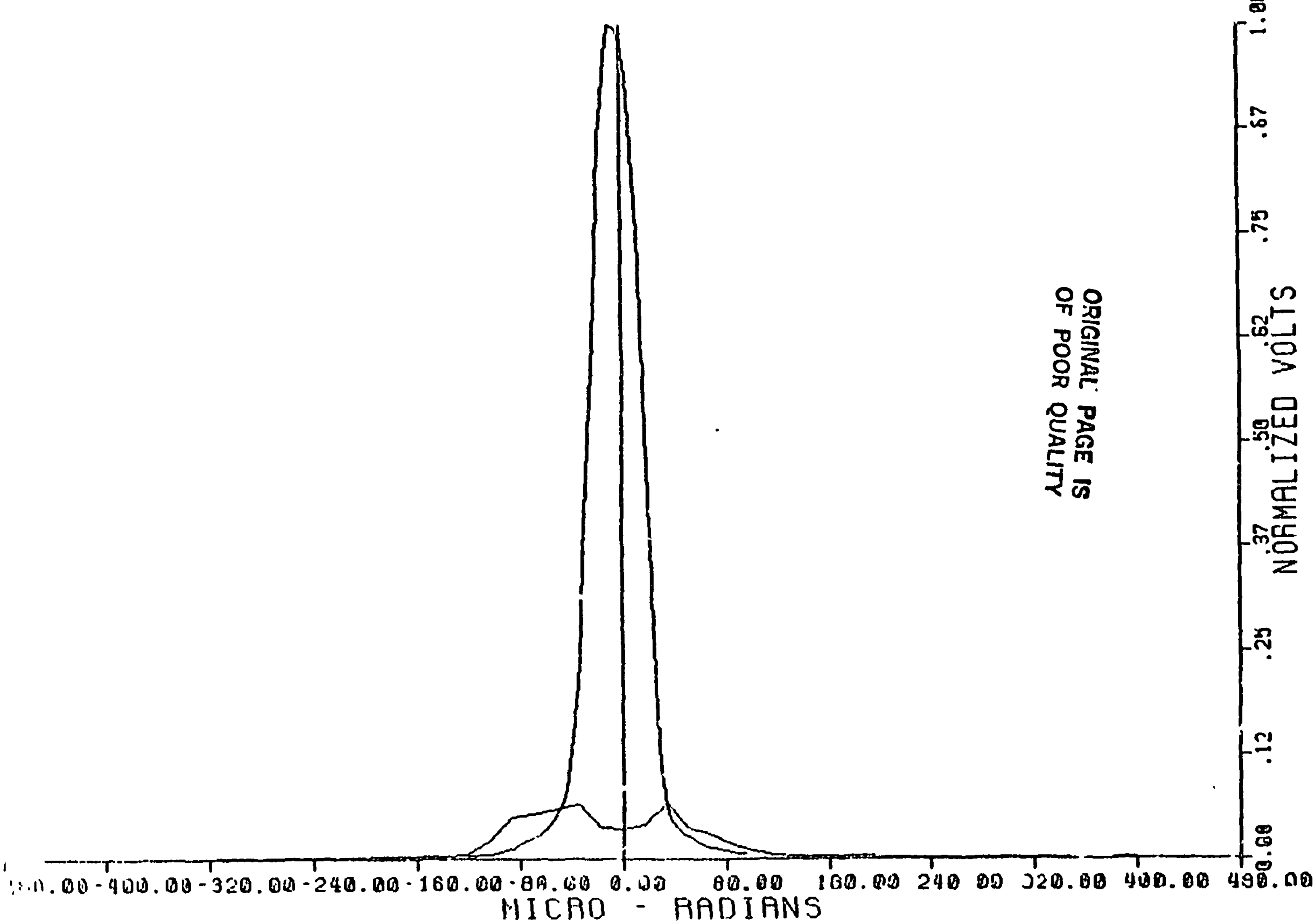

NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 4 CHANNEL 15

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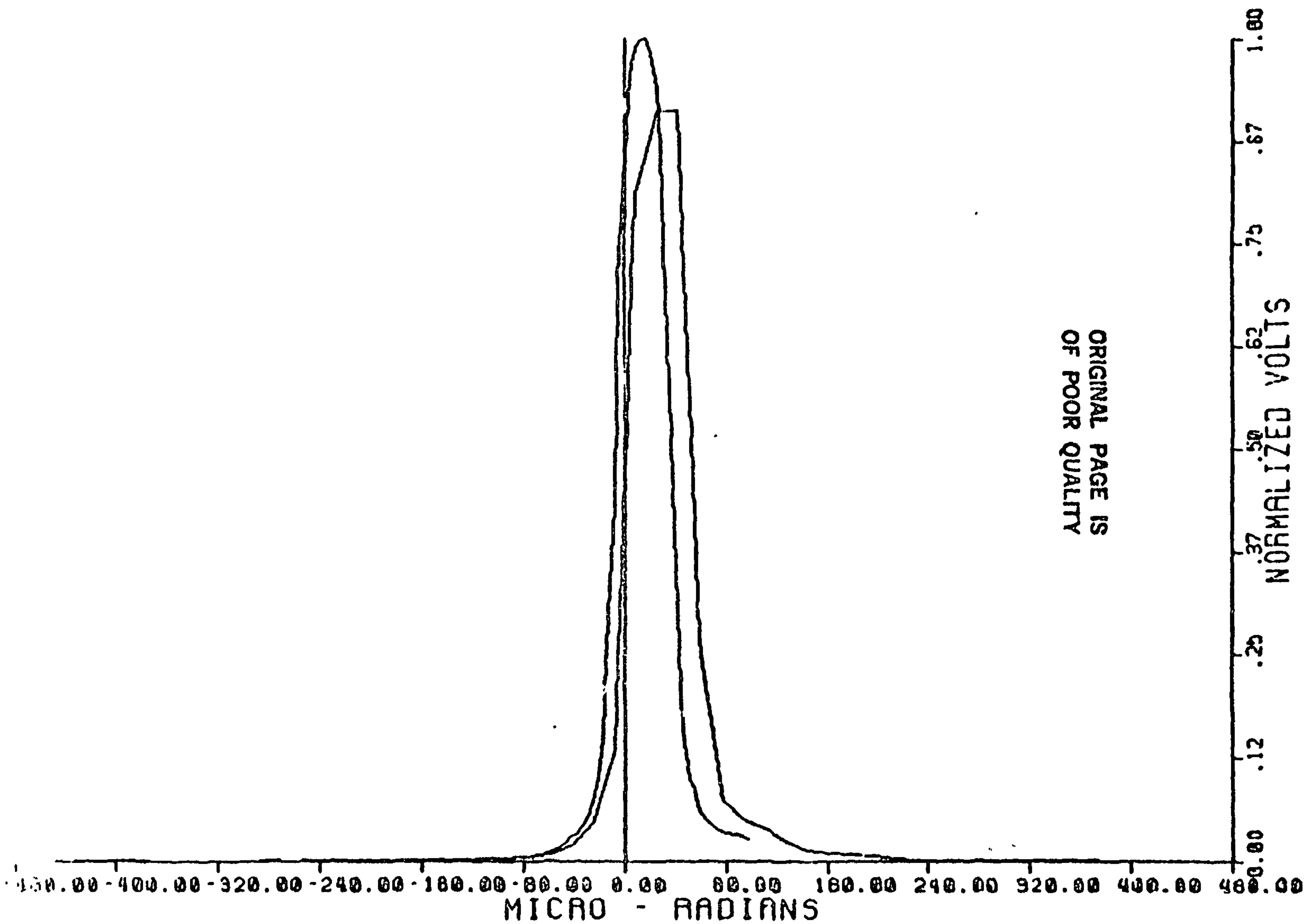

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NEAR AND FAR FIELD DATA FOR X - AXIS, BAND 4 CHANNEL 15

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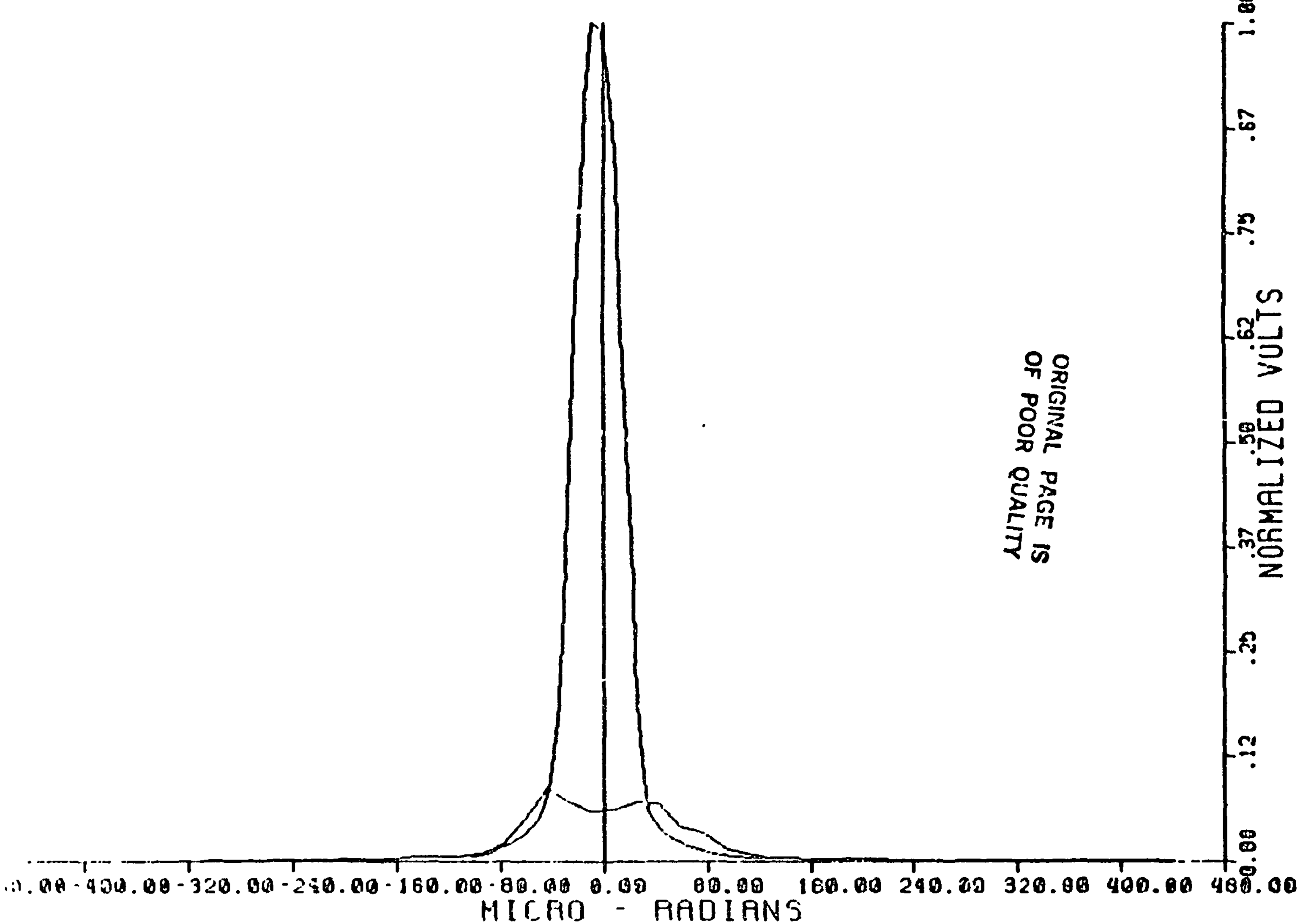

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NEAR AND FAR FIELD DATA FOR Y AXIS, BAND 5 CHANNEL 1

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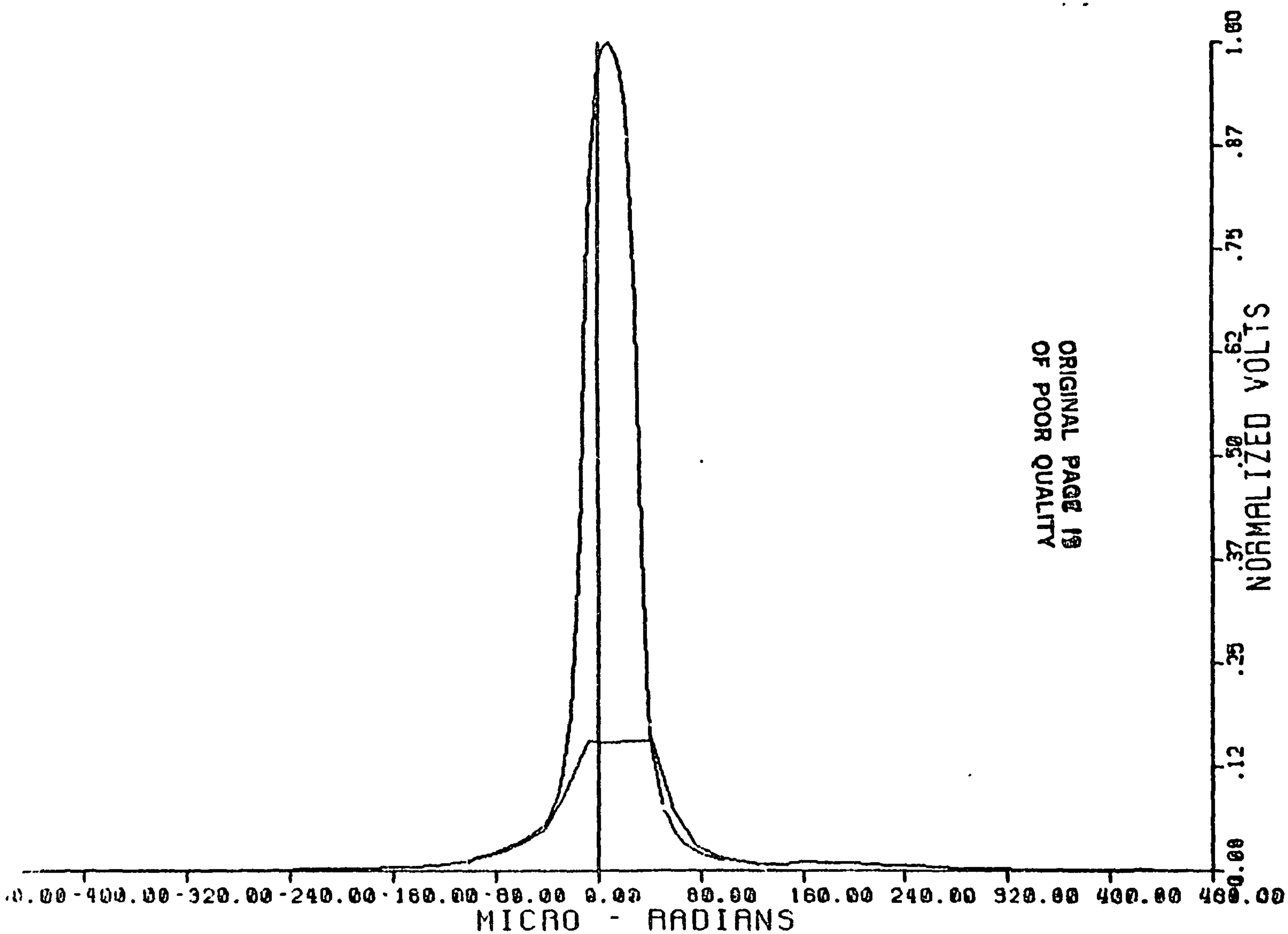

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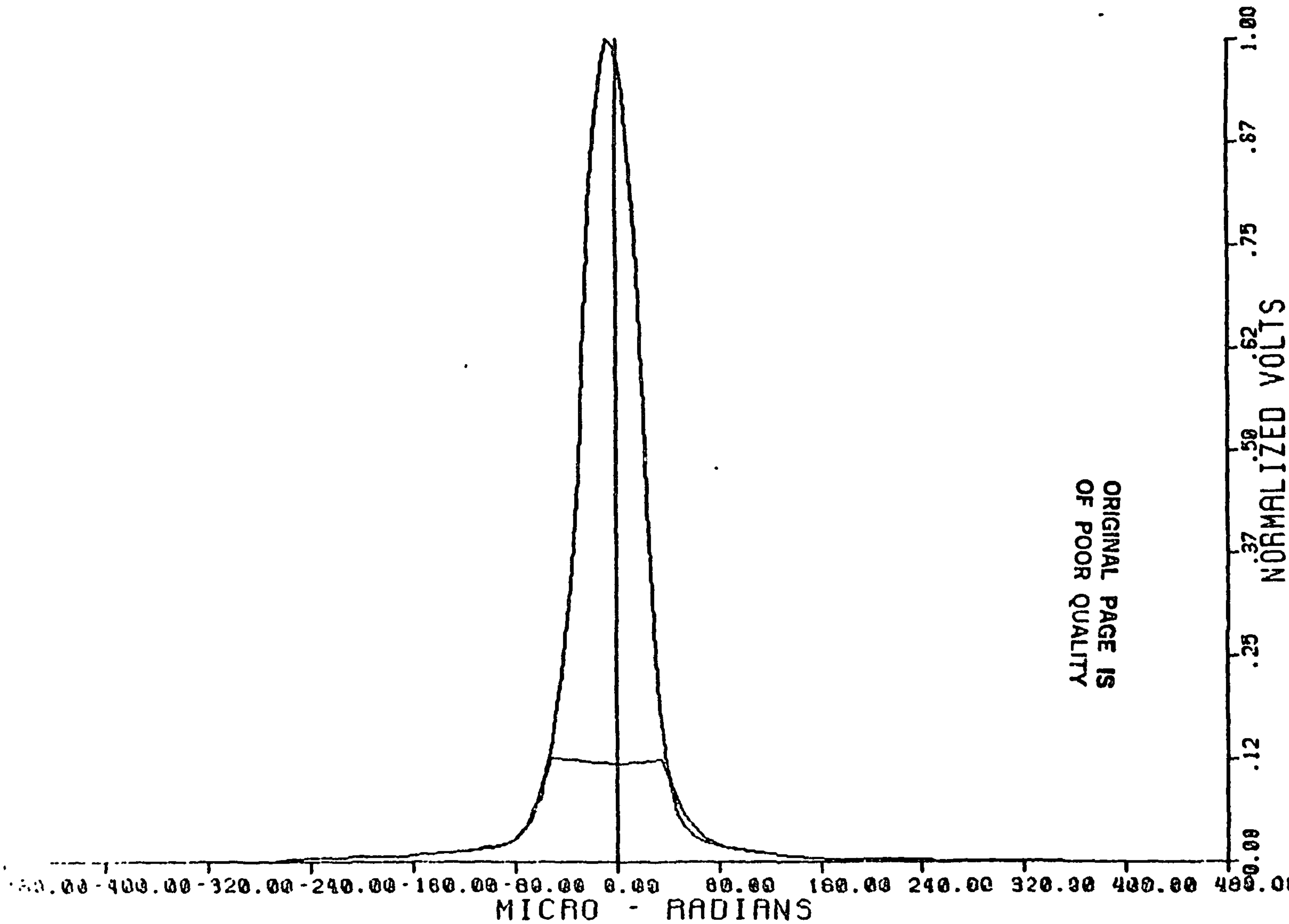

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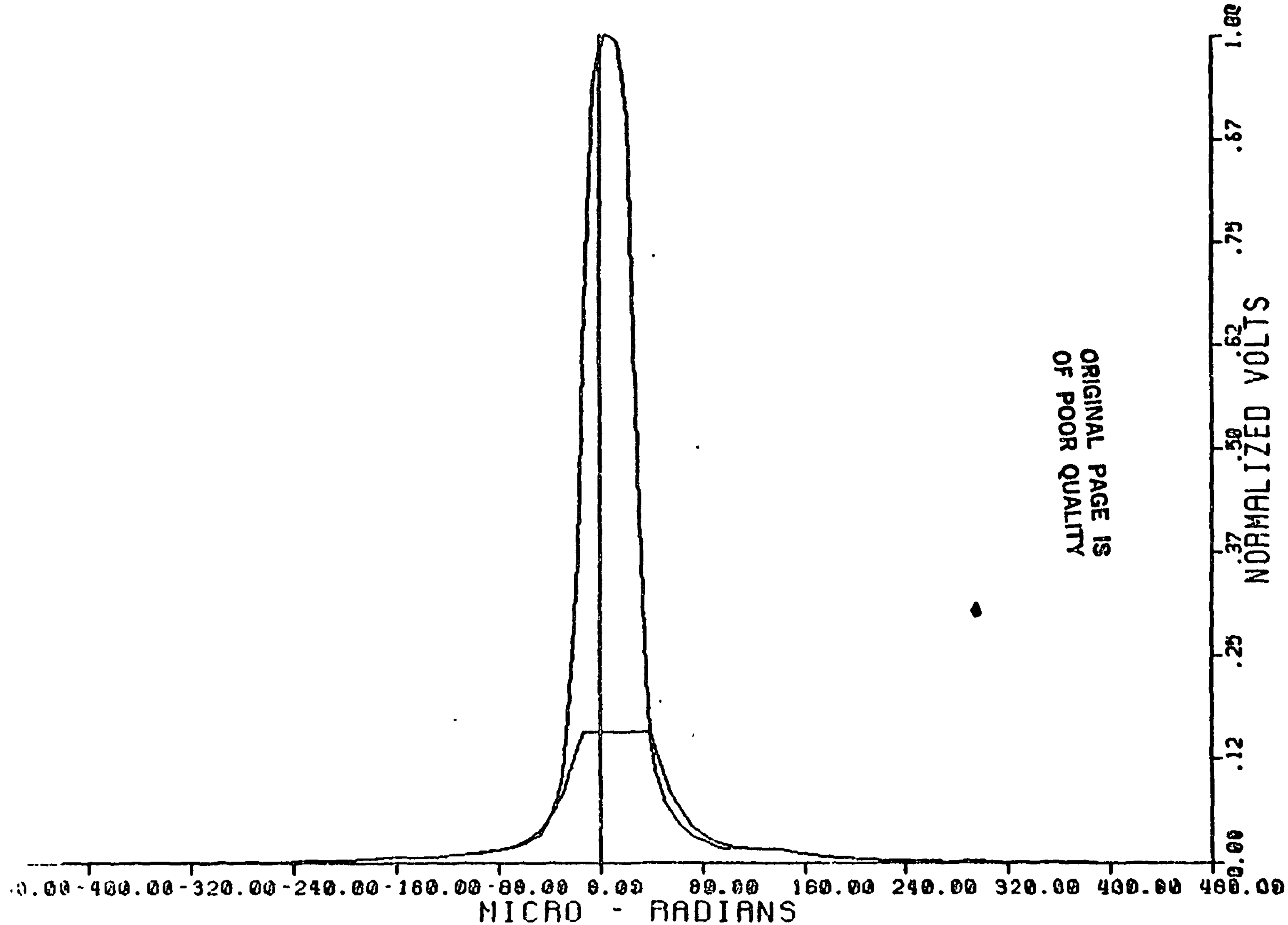

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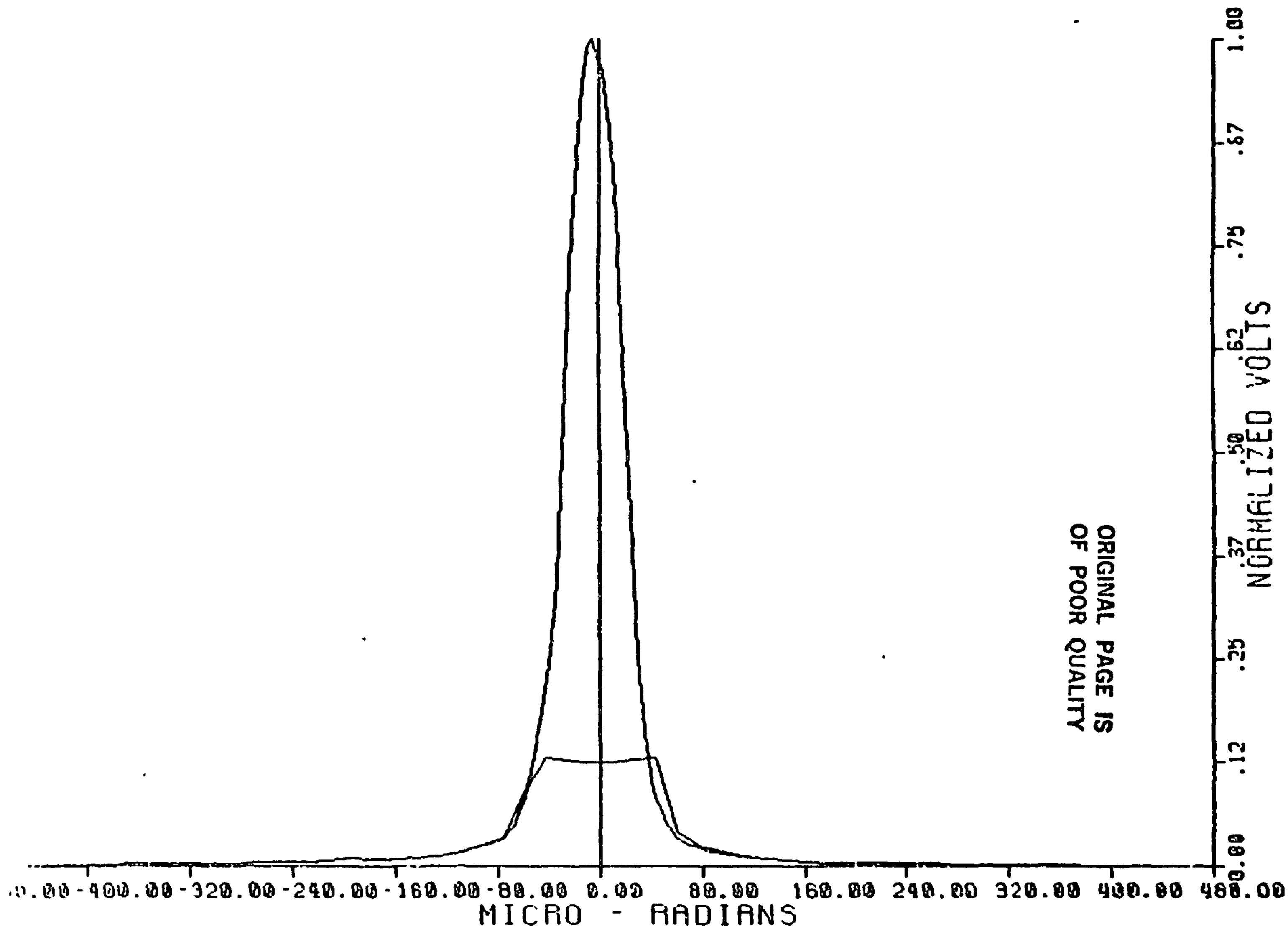

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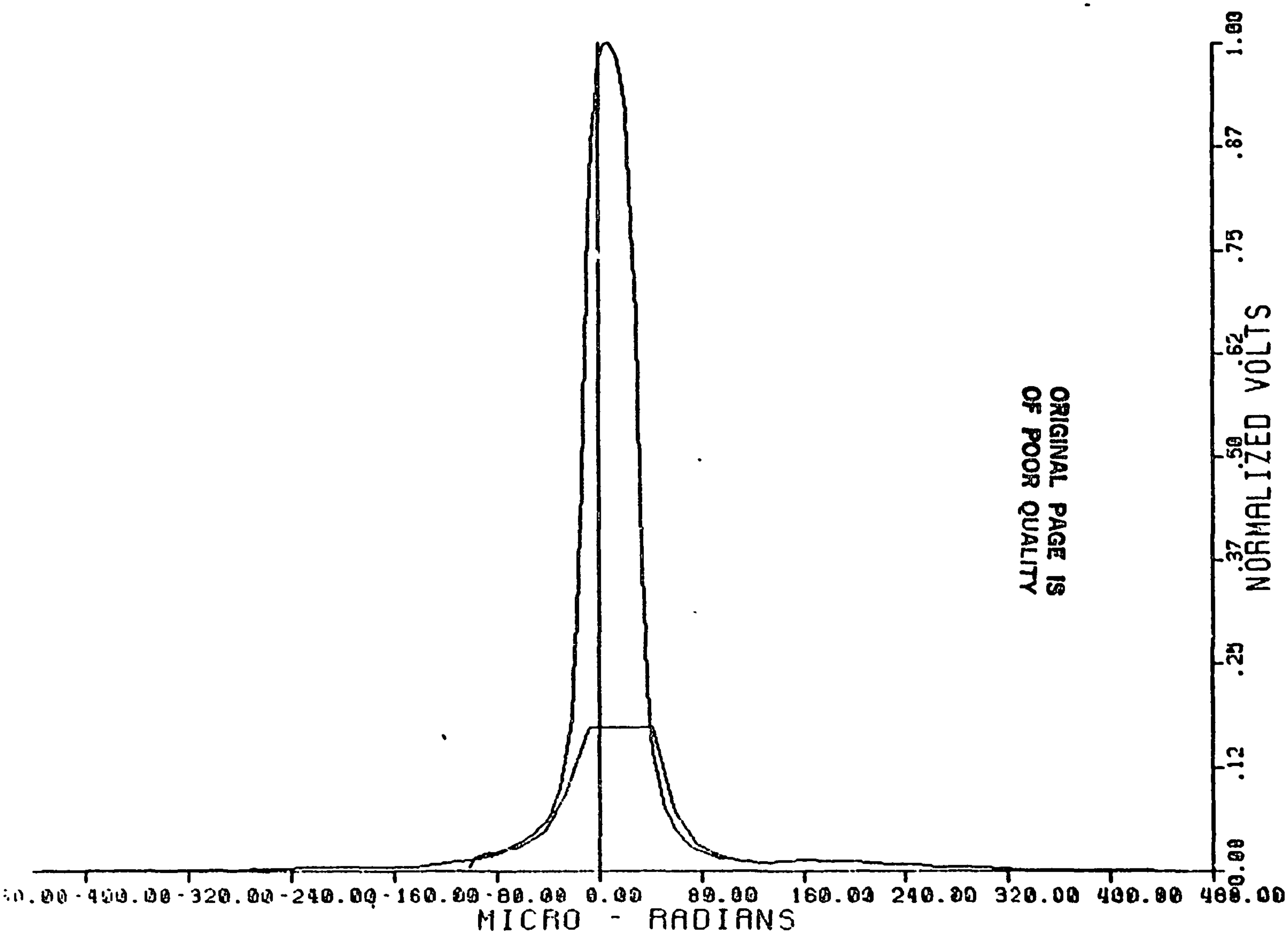

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NEAR AND FAR FIELD DATA FOR X - AXIS. BAND 5 CHANNEL 15

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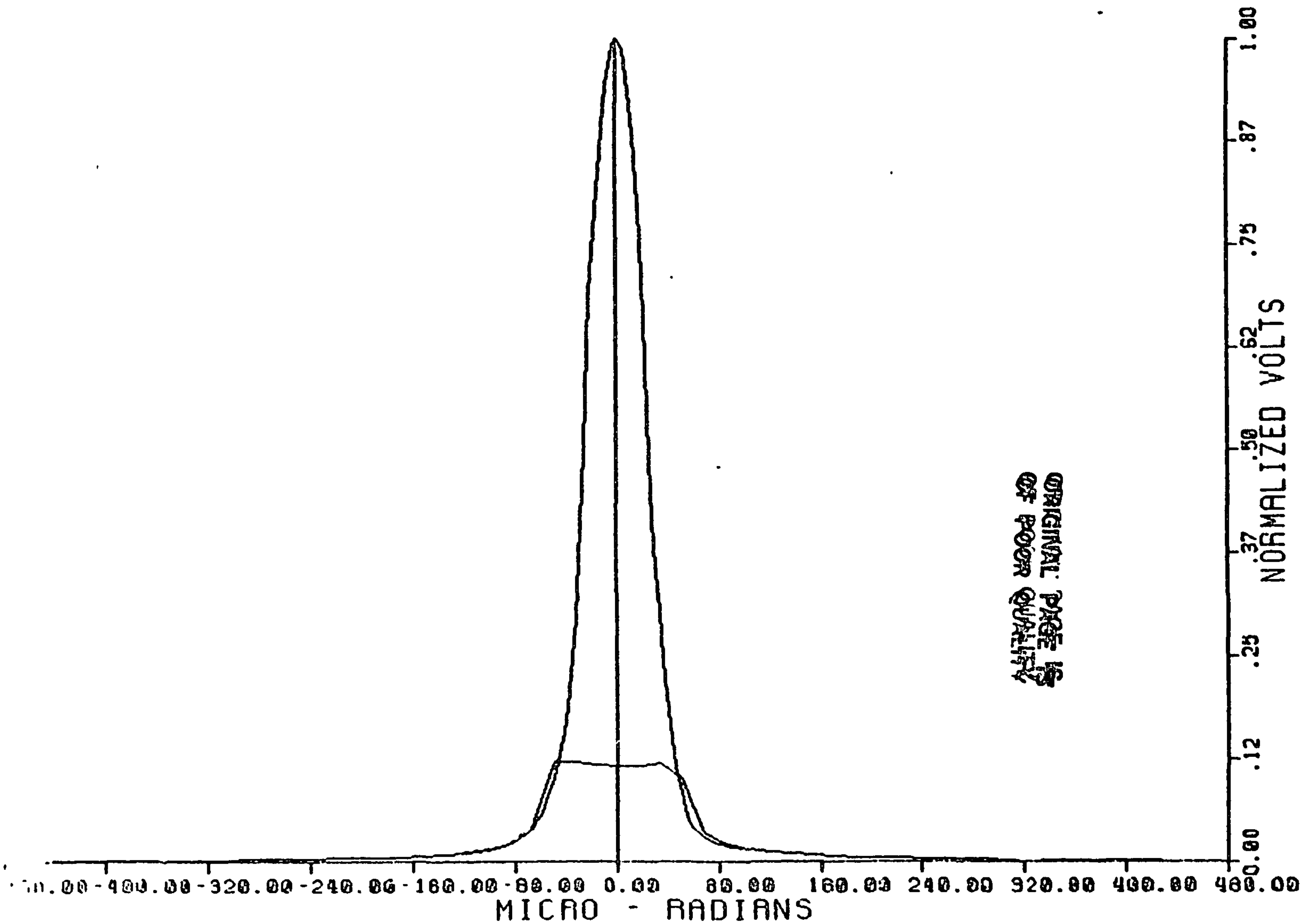

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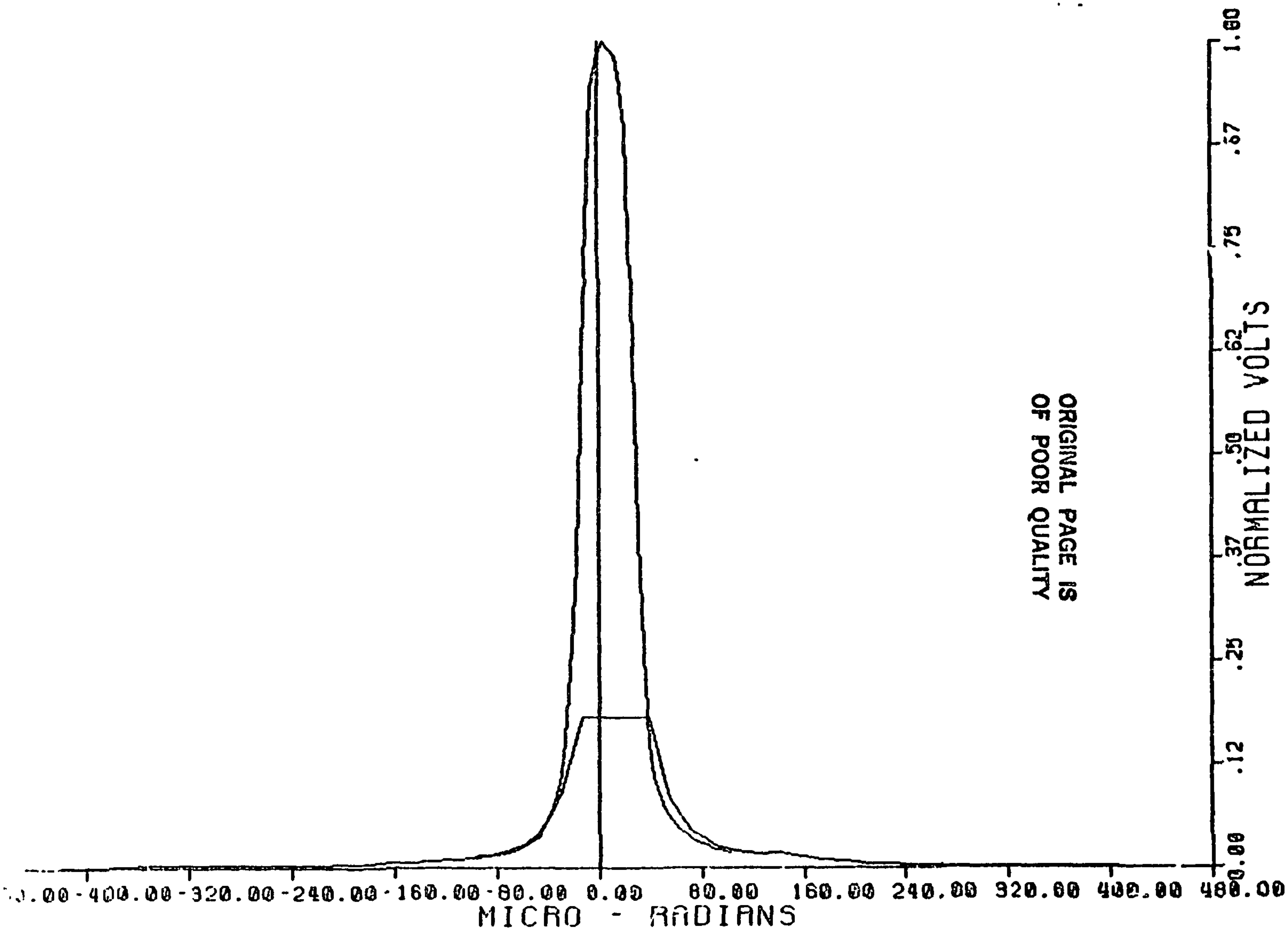

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NEAR AND FAR FIELD DATA FOR X - AXIS. BAND 5 CHANNEL 16

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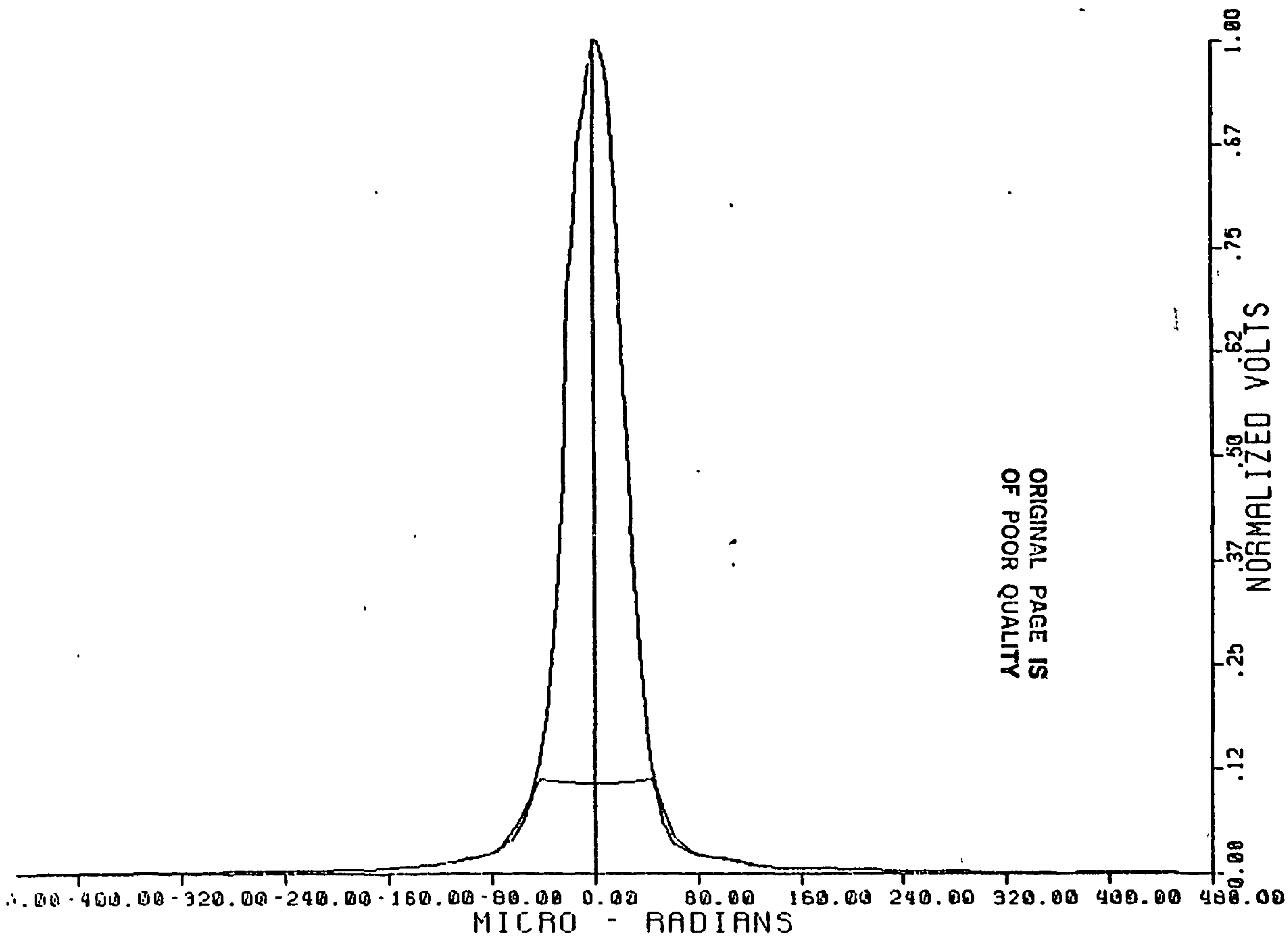

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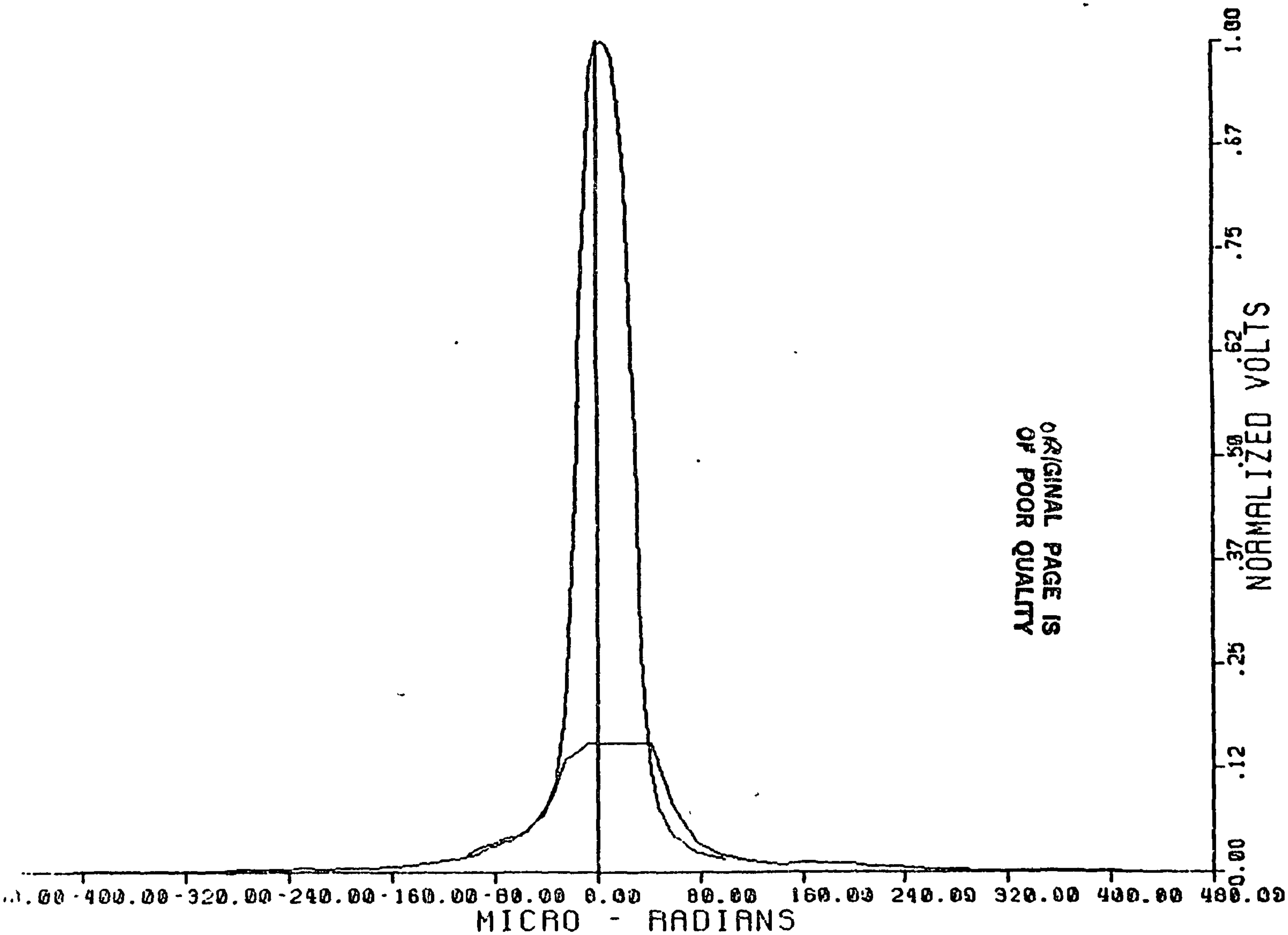

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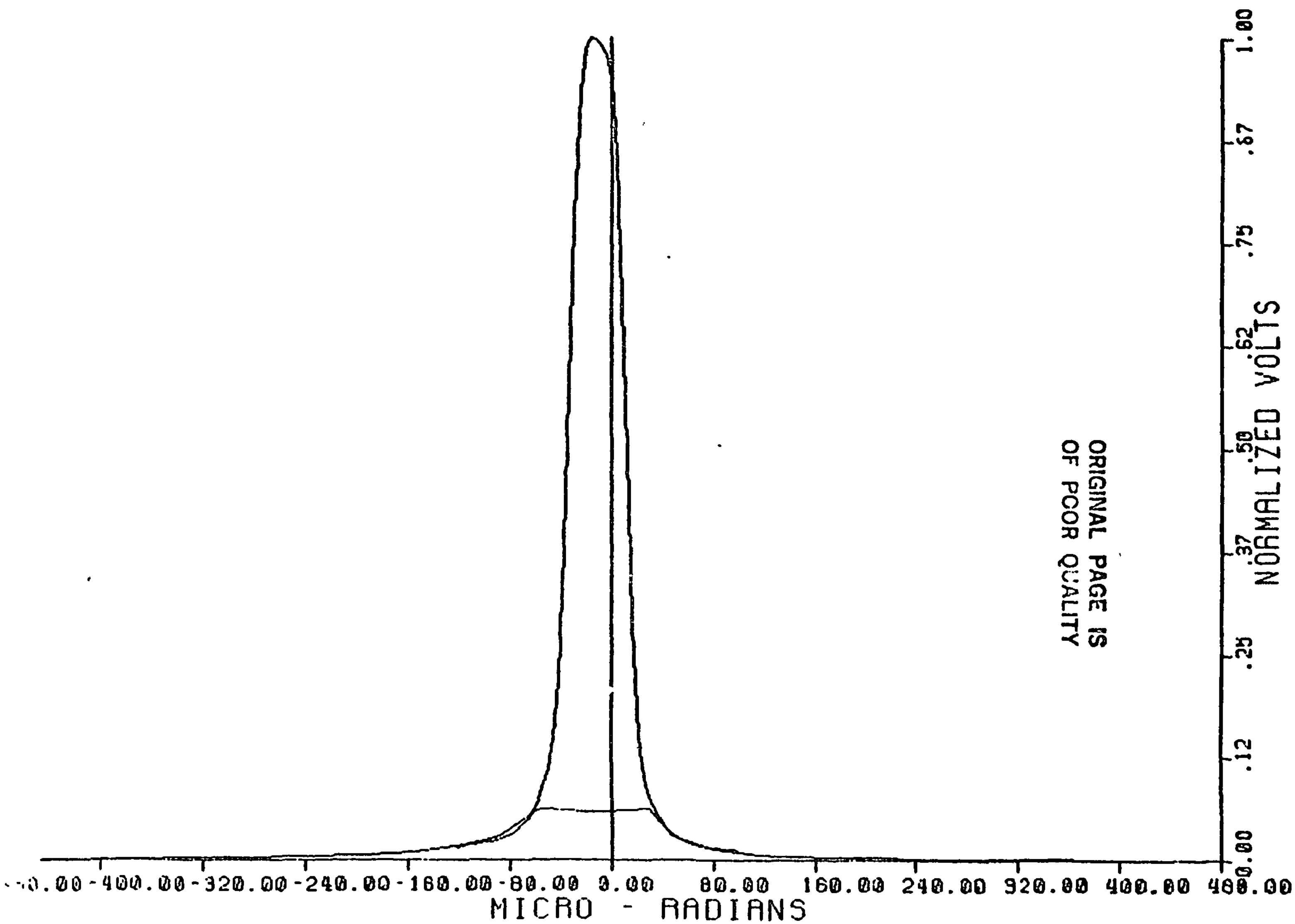

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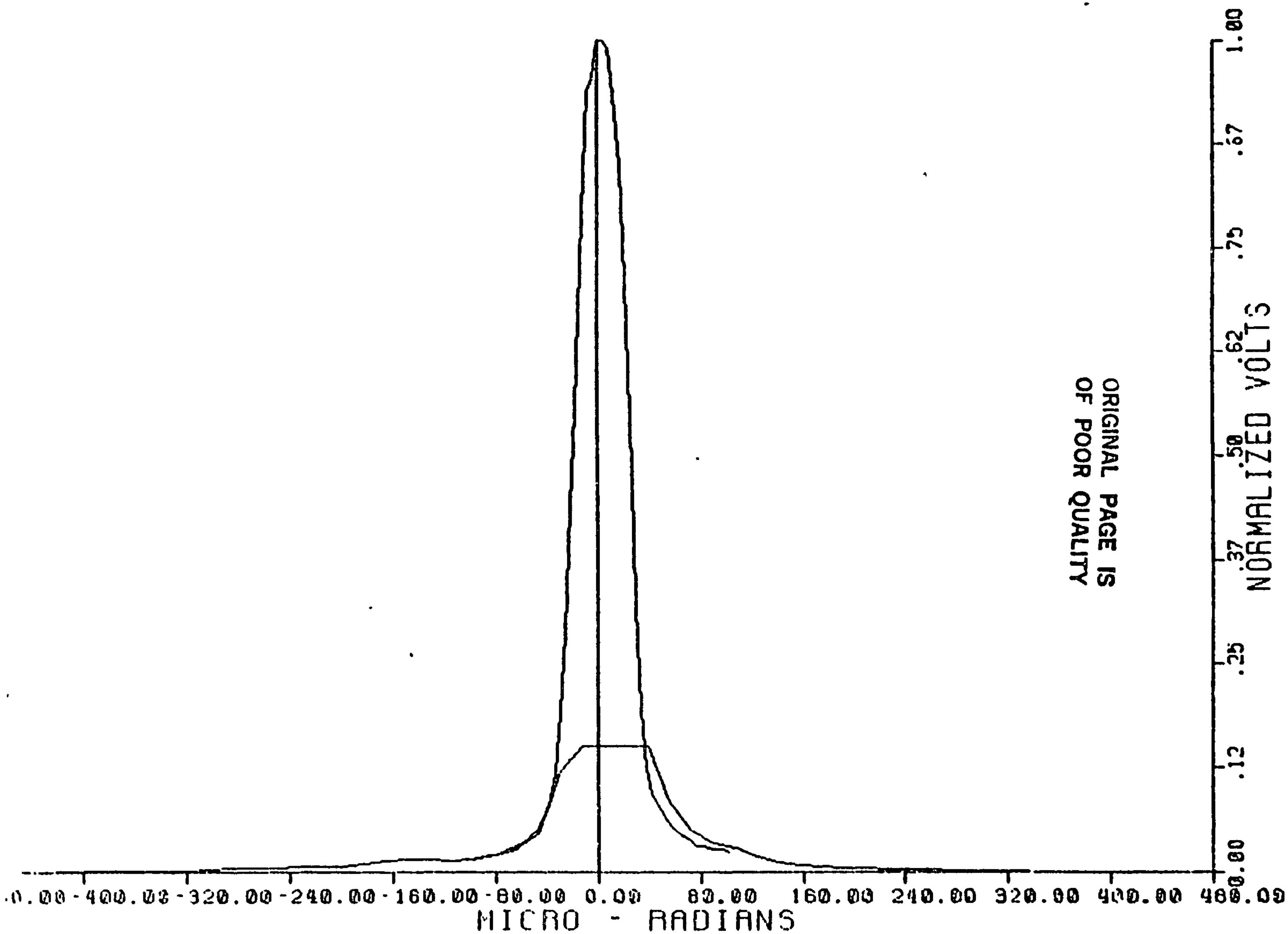
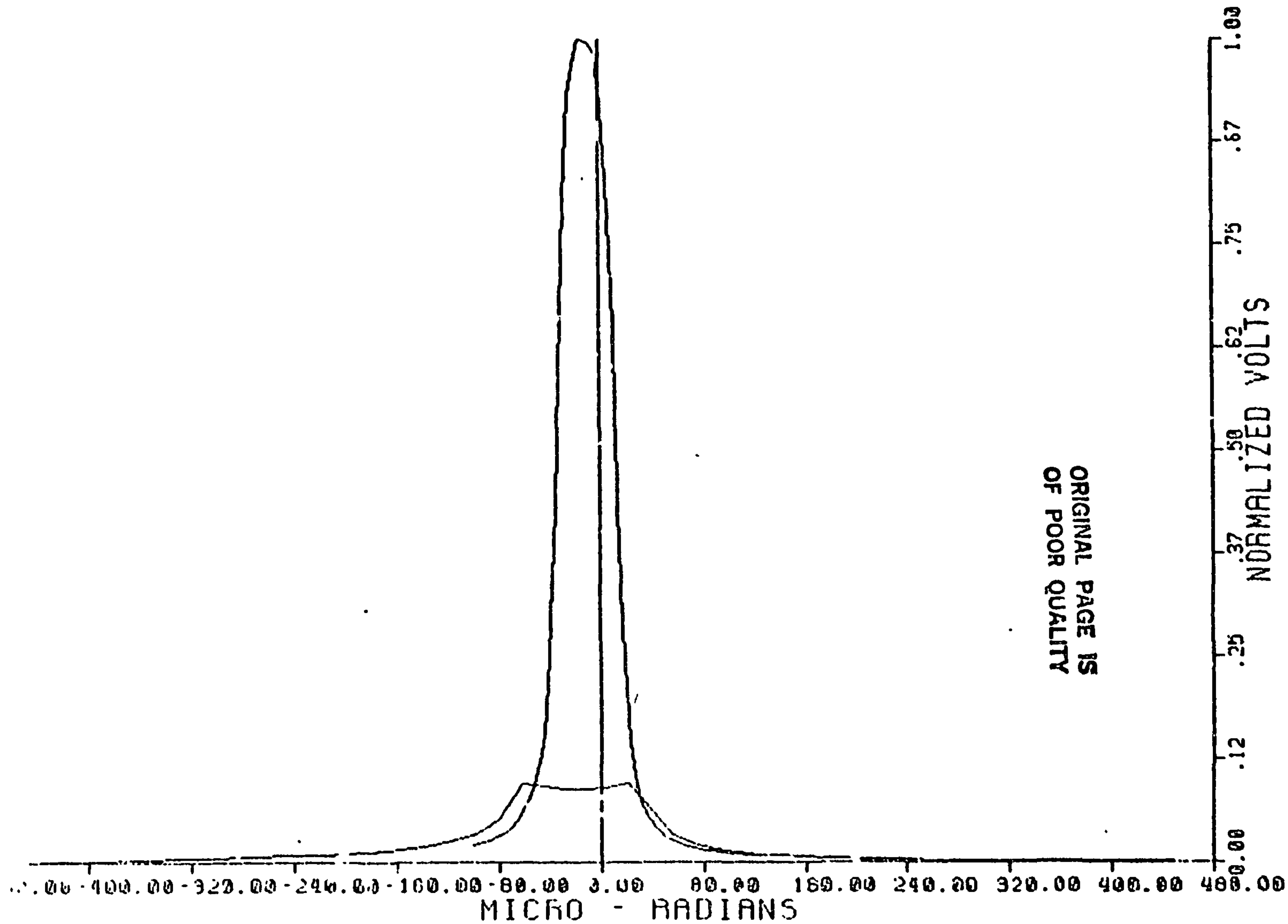


NEAR AND FAR FIELD DATA FOR X AXIS, BAND 7 CHANNEL 2

12-JUN-82 21:11:33



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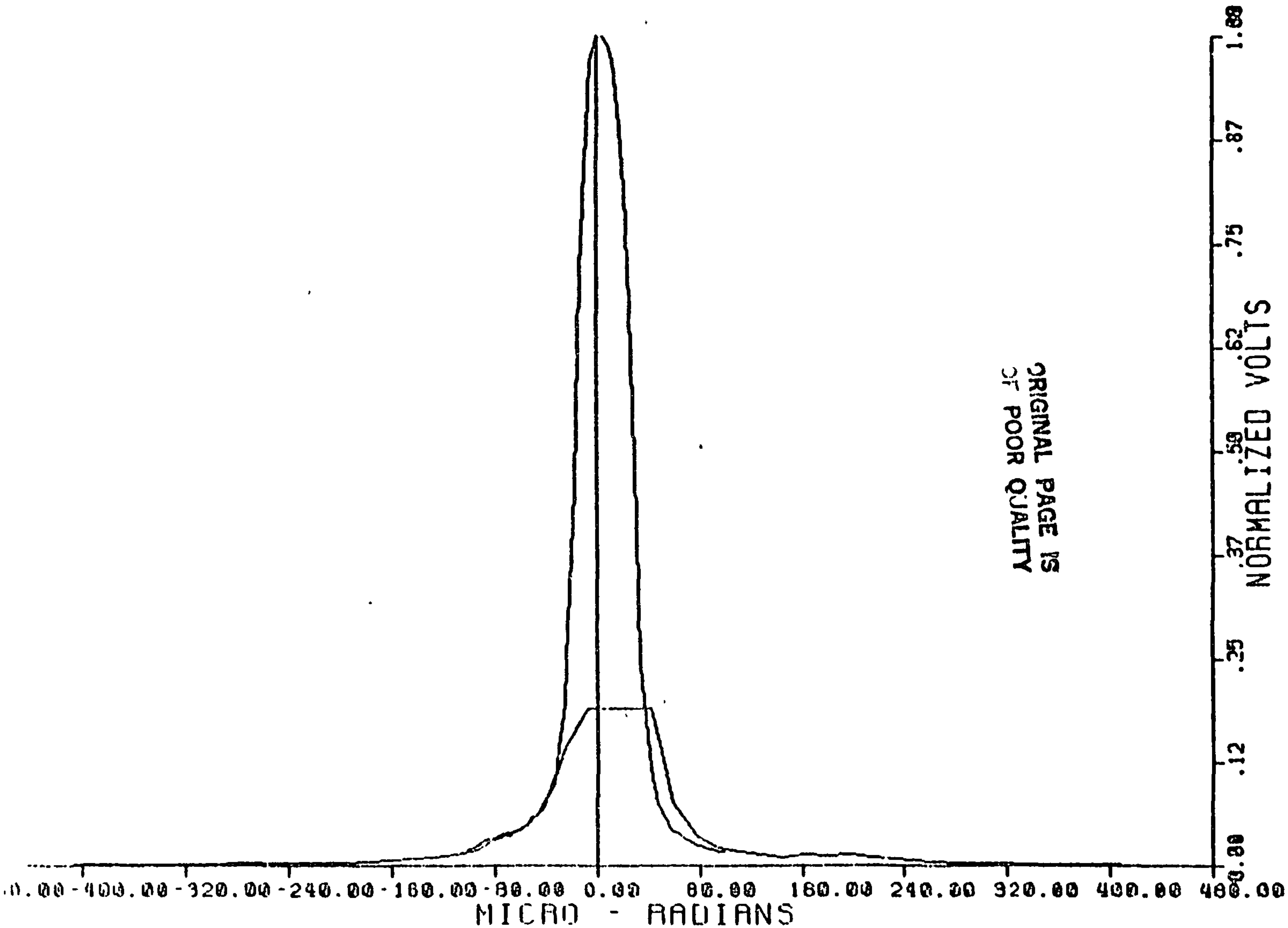
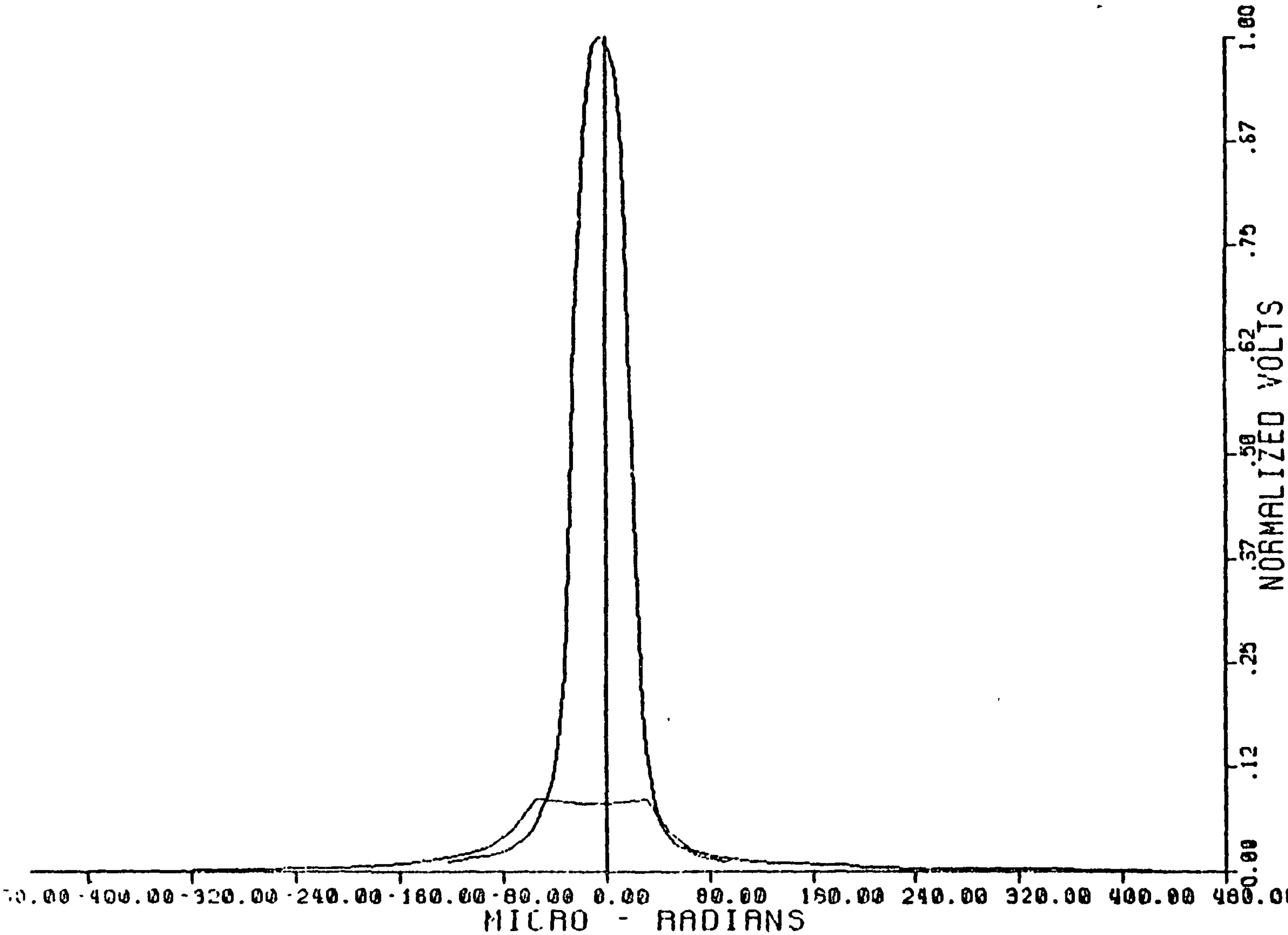
NEAR AND FAR FIELD DATA FOR Y - AXIS. BAND 7 CHANNEL 15

12-JUN-82 22:37:32



NEAR AND FAR FIELD DATA FOR X - AXIS, BAND 7 CHANNEL 15

12-JUN-82 21:16:34



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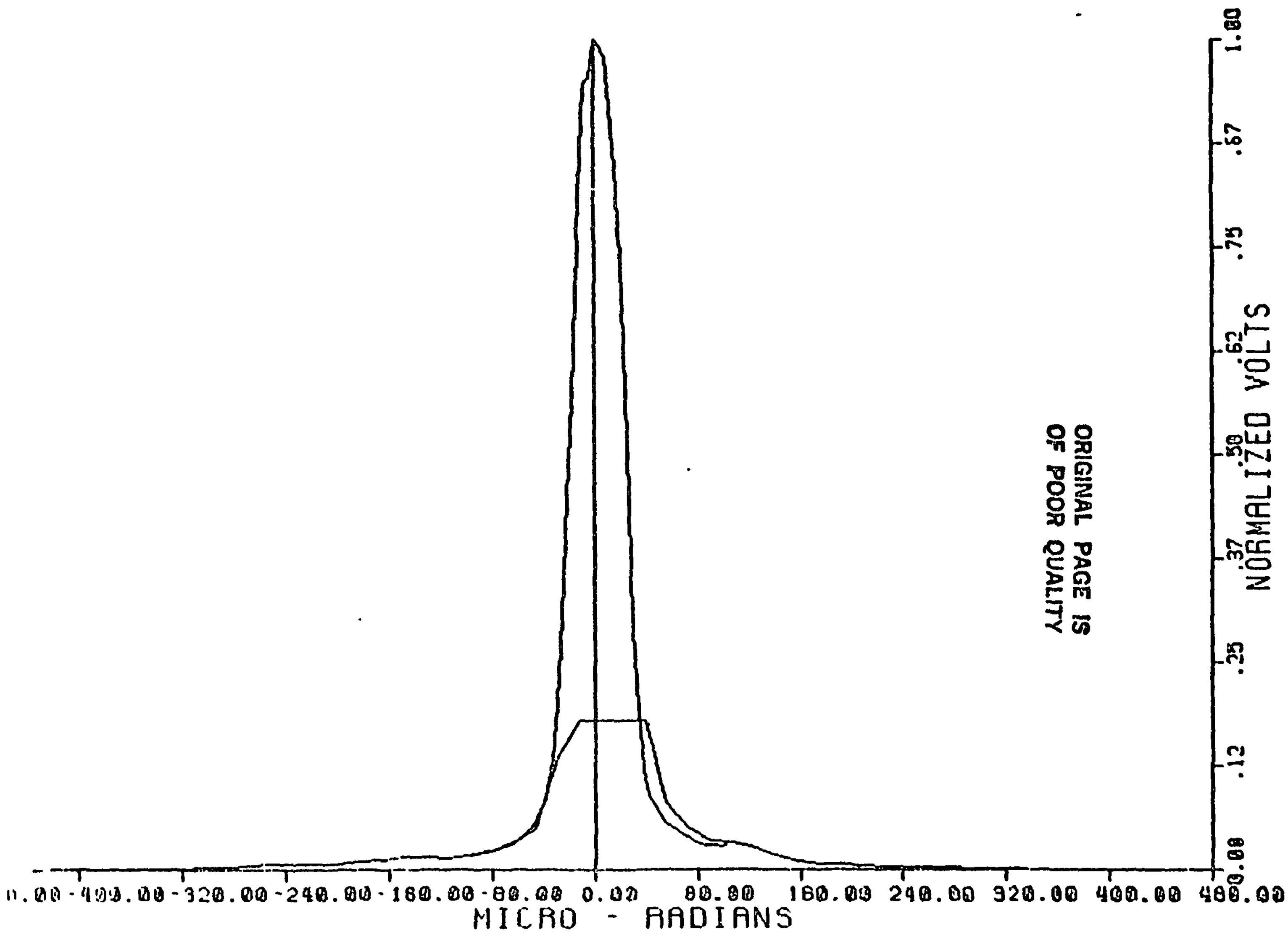
NEAR AND FAR FIELD DATA FOR Y - AXIS, BAND 7 CHANNEL 16

12-JUN-82 22:39:15



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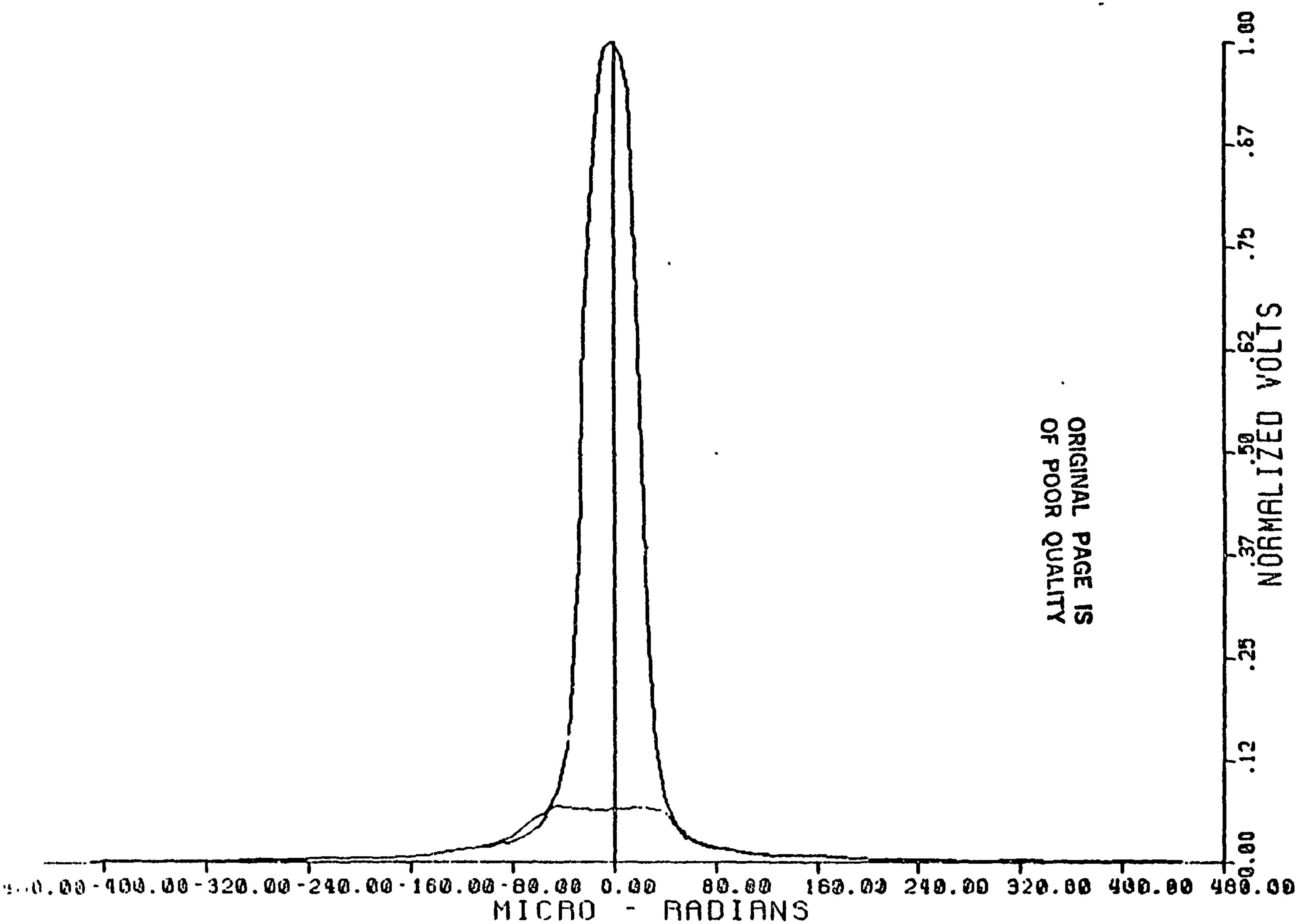
NEAR AND FAR FIELD DATA FOR X - AXIS, BAND 7 CHANNEL 16

12-JUN-82 21:10:41



3.2.9 BL07 TEST

RADIOMETRIC CALIBRATION OF CALIBRATOR

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

3.2.10 BL10 TEST

Band 6 Radiometric Calibration

Test Summary: HS236-8019 J. Lansing

Test Specification: TP32015-518 Radiometric Calibration Band 6

Reference Documentation: HS236-7398-1; BL10 Clarifications; 25 June 1982

HS236-8013; A Band 6 Calibration Problem; 3 June 1982

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SANTA BARBARA RESEARCH CENTER

A Subsidiary of Hughes Aircraft Company

INTERNAL MEMORANDUM

TO: J. Engel　　CC: Loren Linstrom　　DATE: 8/12/82
REF: SED 169
HS236-8109

SUBJECT: BL10 Test Result Summary, Flight 1 Model

FROM: J. Lansing
BLDG: B11　MS: 40
EXT: 6261

Reference: 1. HS236-7398-1, "BL10 Clarifications (Revised), 25 June, 1982.
2. HS236-8013, "A Band 6 Calibration Problem," 3 June, 1982

The band 6 gains were adjusted such that 260K blackbody signals would give zero output and 320K signals, 255 counts output for a cold focal plane assembly (CFPA) temperature of 80K. 80K is the present estimate of CFPA temperature expected in space if the CFPA heater is not used. The responsivity at 80K was estimated by linear extrapolation using slopes of responsivity vs. CFPA temperature derived from the radiative cooler thermal vacuum test, where the CFPA temperatures were 90K, 95K and 105K. This approach is somewhat conservative in that the responsivity is expected to fall below the line as the temperature becomes that low.

The slopes described above were used to calculate design gains which should be used at 95K CFPA, the temperature during BL10. Table 1 shows measurements made after gain adjustment. The measured gain (G) is the difference in signal counts from the two calibrator blackbodies, divided by the difference in effective radiances, calculated by the alternate method described in Ref. 1. The internal gain (G') is the difference in signal counts from the OBC blackbody and the cal shutter divided by the difference in blackbody effective radiances at the temperatures of these sources. The ratio G/G' is shown because it corresponds to the right hand side of equation 6 of ref. 2. The inequality in G'/G between odd and even channels could be due to a slightly different OBC blackbody view factor. The value of the ratio tends to be higher than for the Protoflight TM, which may indicate a larger view factor for the Flight model, a favorable condition for this model.

The average gains from the two sets of data are compared to the design gains in the table, showing the percentage difference. The gains are on the low side, decreasing the chances of saturation at low CFPA temperatures. The channels are well balanced, being within a 2% spread.

The counts observed during cal shutter viewing (dc restore time) are 4 or 5 counts greater than the ideal, or unchanged from the first system test in May.

In summary, all performance monitored by BL10 is satisfactory.

Table 1 F1 BL10 Data Summary

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Parameter No.	Location	Collect 1	2	3	4
64	CFPA	-179.0	-178.8	-179.0	-179.0
49	OBC BB	34.1	34.1	33.9	33.9
52	CAL SHUT FLAG	27.0	27.0	27.0	26.8
213	CALIBR REF BB	51.6	51.3	51.5	51.4
215	CALIBR MTF BB	24.4	24.3	24.1	24.1
250, 251, 253	CALIBR TEL	21.9	21.9	21.9	21.9

CHANNEL	CALIBRATOR BLACKBODIES REFERENCE	MTF	INTERNAL (OBC) BLACKBODY	CAL SHUTTER	GAIN G *	INTERNAL GAIN G' *	G'/G
COLLECT:	1	2	2	2			
		COUNTS					
1	218.1	143.8	182.7	153.5	214.7	303.3	1.41
2	213.3	143.7	183.3	153.6	201.2	308.6	1.53
3	215.0	144.2	181.6	153.7	204.6	290.3	1.42
4	213.2	143.7	184.0	153.6	201.0	316.3	1.57
COLLECT	3	4	4	4			
1	218.3	143.9	183.5	154.5	214.4	302.0	1.41
2	213.6	143.8	184.1	154.4	201.1	309.3	1.54
3	215.6	144.1	182.3	154.5	205.9	289.4	1.41
4	213.6	143.8	184.6	154.4	201.0	315.2	1.57

	DESIGN GAIN *	AVERAGE GAIN *	DIFFERENCE %
1	219.3	214.5	-2.2
2	209.3	201.1	-4.1
3	212.6	205.3	-3.6
4	208.6	201.0	-3.8

*GAINS ARE IN UNITS OF cts/(mW/cm^2 -sr-μm)

3.2.11 BL-12 TEST

COHERENT NOISE

TEST SUMMARY: HS236-8121 J. L. Engel

TEST SPECIFICATION: TP32015-520 COHERENT NOISE MEASUREMENTS

REFERENCE DOCUMENTATION: NONE

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INTERNAL MEMORANDUM

TO. Distribution CC:

DATE: 1 September 1982

REF: HS236-8121 SED-180

FROM: J. L. Engel

SUBJECT. Coherent Noise (BL-12) Test Report F-1

BLDG. B11 MAIL STA. 101

EXT. 6145

Summary

The Coherent Noise of the F-1 Thematic Mapper was evaluated by two methods, the first being a visual estimate from a photographic image, and the second being a numerical analysis of the power spectral density of the data from each signal channel.

No evidence of coherent noise is observable in the photographic images and only channel 7 of band 5 has any significant amount of coherent noise evident in the PSD analysis. A waiver has been submitted (W-168) to allow delivering the TM with this condition existing however the system specification only requires that no coherent noise be observable in the data.

Discussion

With the TM operating in Full Picture Mode the flooding lamp of the calibrator was scanned. Data from minor frames 7-4103 (4096 MF) was collected for 180 consecutive forward scans, one band at a time for bands 1 - 5 and 7.

The flooding lamp produced a ramp of illumination generating the range of levels tabulated in Table I for each band.

Table I. Dynamic Range of BL-12 Data

Band No.	Range of Mux Levels
1	6 - 61
2	5 - 60
3	9 -102
4	6 - 65
5	5 -104
7	7 - 83

(Continued on Page 2)

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Discussion (Continued)

The data for each spectral band was transferred to the Optronics Photorecorder to generate a photographic negative. No evidence of coherent noise was discernible in any of the data. Copies of the photographic images can be reviewed by contacting the author but cannot be reproduced with sufficient clarity by xerography to be included in this report. Positive transparencies of the images were forwarded to Goddard Space Flight Center for evaluation along with a Computer Compatible Tape (CCT) of the raw data.

Data was also collected simultaneously from minor frames 2904-3416 (512 MF) for all channels of bands 1 - 5 and 7. This data was processed using a Fast Fourier Transform program. The tabulated data of noise vs. frequency for each channel of the system was reviewed to determine the magnitude and frequency of any coherent noise in the system. Table II lists the channel number, amplitude and frequency of the largest coherent noise component for each band.

Table II.

Band	Channel	Amplitude (Pk Mux Cnts)	Frequency (Hz)
1	2	.31	9144
2	13	.23	18492
3	5	.26	9144
4	All	≤.10	> 5kHz *
5	7 **	1.06	9144
7	10	.29	9144

* At frequencies less than 5 kHz there are still amplitudes of >.1 due to the ramp of illumination.

** The next highest channel in band 5 is channel 9 with a peak noise value of .36 at 9144 Hz.

Channel 7 of band 5 is the only channel in the system that exhibits a significant amount of coherent noise (>0.5 mux levels peak). An attempt was made to determine how the 9144 Hz noise was getting into the signal path but the efforts were unsuccessful. The noise is not evident in the Band 5 photograph and will probably not be evident in data from orbit. A CCT containing the FFT data was also sent to GSFC for evaluation but at the time of this writing the evaluation is incomplete.

JLE:pg

3.2.12 BL16/17 TEST

Dynamic Square Wave Response

Test Summary: HS236-8134 P. Thurlow

Test Specification: TP32015-522,523

Reference Documentation: HS236-6514; An Alternative MTF Approach - Phased Knife Edge. J.B. Young.

HS236-6514-1; An Alternative MTF Approach- Phased Knife Edge - Addendum. J.B. Young.

HS236-6242; Square Wave Response From Edge Function. P. Thurlow.

HS236-7483; SWR for T.M. Engineering Model Detectors After Deconvolution of Calibrator Blure. P. Thurlow.

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INTERNAL MEMORANDUM

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TO: J. Engel

CC:

DATE: 20 Sept 1982

REF: HS236-8134

FROM: P. Thurlow

BLDG. B11 MAIL STA. 78

EXT. 1725

SUBJECT: Summary of B1 16/17 Results (SWR) for F-1 Mapper in Thermal Vacuum

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References:

1. An Alternative MTF Approach - Phased Knife Edge, 3 Dec. 1979, HS236-6514
2. An Alternative MTF Approach - Phased Knife Edge Addendum, 10 Dec 1979, HS236-6514-1
3. SWR for T.M. Engineering Model Detectors after Deconvolution of Calibrator Blur, 5 June 1981, HS236-7483
4. Square Wave Response from Edge Function, 21 May 1982, HS236-6242

The attached printouts show along-scan SWR for all F-1 detectors as a function of spatial frequency. The SWR are average values obtained from 20 knife edges in bands 1-5 and 7; and 100 knife edges in band 6. Knife edges were obtained using a "phased edge reticle" as described in HS236-6514. SWR were obtained by convolving the knife edge response functions with computer-generated bar patterns as described in HS236-6242. Due to the short collect period per knife-edge, (the order of 1.5×10^{-3} second), it is not expected that the edge functions are distorted by instrument vibration. Table I shows the printout SWR data per band, averaged over all detectors. Standard deviations of these averages are also tabulated.

Comparative SWR data from earlier F-1 mapper measurements in air are not shown. SWR data taken in air is of doubtful accuracy, since scan mirror velocity variations caused by air drag and buffeting have been observed to cause serious distortions in shape of the knife edges.

Table II, column 1 shows the band averaged SWR from Table I, but corrected for effect of image blur contributed by calibrator 2. This tabluation reflects effective SWR values in orbit, with the mapper looking at a non-blurred ground scene. The Table II SWR's are enhanced by a factor of 1/.92 over Table I SWR's, where .92 is the measured MTF of calibrator 2. As noted in HS236-7483, use of MTF for blur deconvolution produces a minimum possible SWR enhancement value as compared to a more detailed spot size analysis. The Table II SWR values are therefore conservative.

Table II, column 2 shows estimated SWR with the ground scene image in sharpest focus at the TM focal planes. This is a condition which will not exist in orbit, but is included to indicate the TM potential performance at minimum blur size.

Values of SWR at sharpest focus are derived from measured SWR in the following way:

SWR was measured in thermal vacuum with the calibrator-2 reticle located 25 mils inboard of the calibrator focal plane. This placed the reticle image focus at TM 7.95 mils outboard of the focal plane arrays. The purpose of this was to simulate in-orbit focus conditions where an estimated 35×10^{-6} inch/inch graphite-epoxy shrinkage is expected to produce a 7.7 mil outboard shift of the scene image away from the TM focal plane arrays.

The effect on SWR of this approximately 8 mils of image defocus can be estimated from IA01 data shown in Figure 1. The plotted data shows F-1 cross-track MTF as a function of Z axis location of the collimator reticle. With no TM shrinkage, and ideal shimming of the focal planes, a maximum MTF of .45 would be achieved at a Z = +9 mil location of the collimator reticle. With use of a compromise shim thickness to avoid excessive degradation of along-track MTF, the TM focus is shifted outboard of the focal planes by about 2.33 mils, corresponding to a shift of the collimator reticle of -3 mils ΔZ. This shift would place the reticle at Z = +6 prior to the BL 16/17 SWR measurement. This produces a measured MTF of about .448. The additional TM defocus of 8 mils is equivalent to a ΔZ = 10.3 mil shift of the collimator reticle, which would place the reticle at Z = -4 mills on the graph, with MTF = .426. The expected SWR at sharpest focus, SWR_{max}, in relation to de-convolved SWR in column ⊥ is, therefore, approximately:

$$SWR_{max} = SWR\left(\frac{.450}{.426}\right) = 1.05\ SWR$$

P. Thurlow

P. Thurlow

/vs

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TABLE I

TM F-1 SQUARE WAVE RESPONSE AT 30 METER BAR SWR AVERAGE PER BAND AND STANDARD DEVIATION

BAND	AVERAGE SWR	STANDARD DEVIATION
1	.416	.0078
2	.412	.0128
3	.391	.0075
4	.395	.0141
5	.439	.0250
7	.424	.0145
6	.427(@ 120 meter bar)	.0132

TABLE 2

BAND	SWR AFTER CALIBRATOR 2 BLUR DECONVOLUTION	SWR AFTER DECONVOLUTION AND CORRECTION TO SHARPEST FOCUS
1	.452	.475
2	.447	.469
3	.425	.446
4	.429	.450
5	.477	.500
7	.461	.484
6	.464	.487

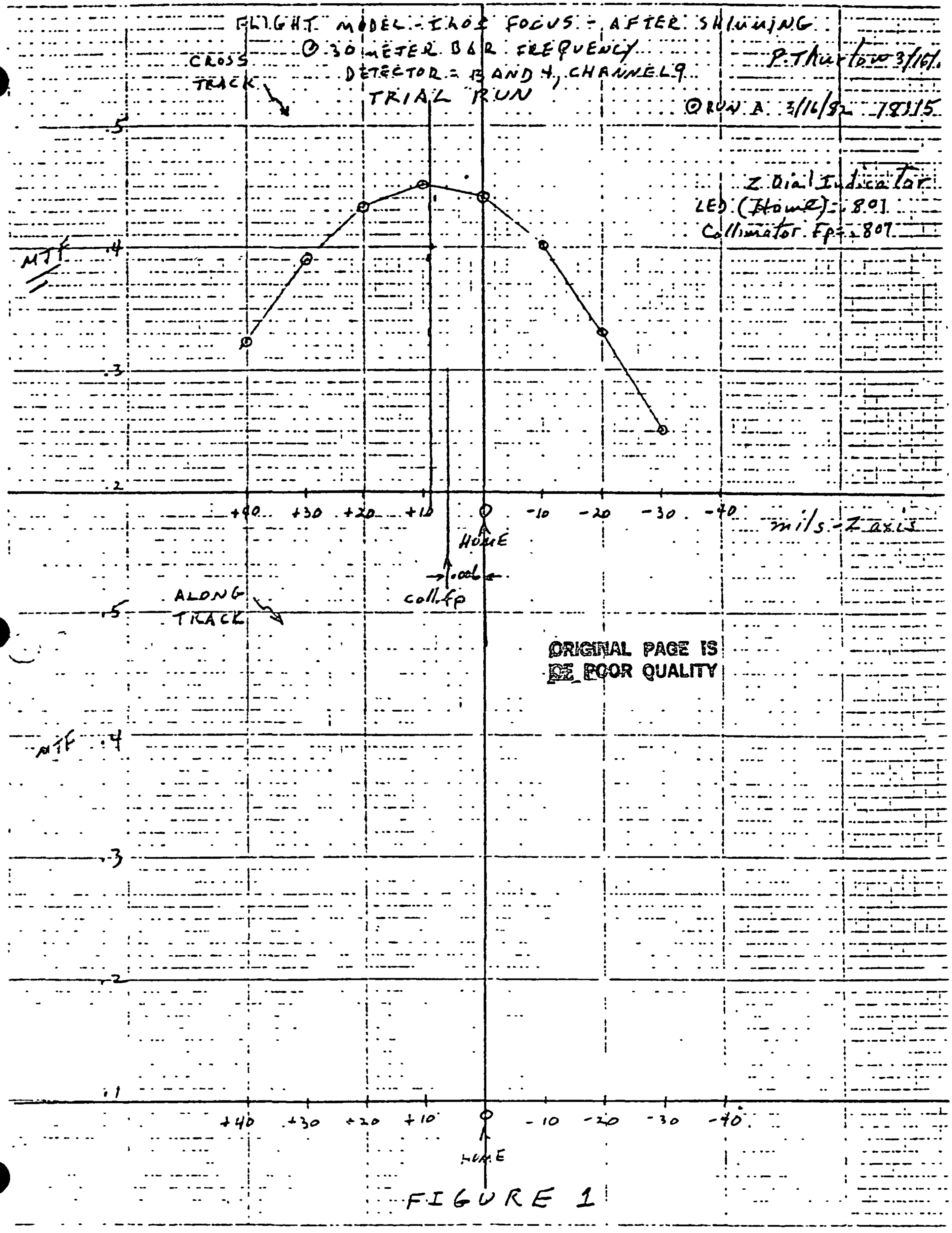
FLIGHT MODEL - IRO? FOCUS - AFTER SHIMMING
@ 30 METER BAR FREQUENCY
DETECTOR = BAND 4, CHANNEL 9
TRIAL RUN
P. Thurlow 3/16/
@ RUN A 3/16/82 78115
CROSS TRACK
ALONG TRACK
Z Dial Indicator
LED (Home) .801
Collimator Fp = .807
MTF
HOME
coll. fp
mils - Z axis
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FIGURE 1

PHASED KNIFE EDGE

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:41:51

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BAND NUMBER = 1
SPATIAL FREQUENCY = 0.705E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.141E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.392E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9977	0.9972	0.9967	0.9975	0.9963	0.9969	0.9960	0.9966	0.9985	0.9960	0.9966	0.9969	0.9981	0.9981	0.9932	0.9976
[illegible]	0.0028	0.0028	0.0031	0.0019	0.0034	0.0037	0.0065	0.0040	0.0015	0.0039	0.0052	0.0024	0.0024	0.0018	0.0099	0.0023

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.598E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9973	0.9470	0.9954	0.9827	0.9942	0.9628	0.9350	0.9568	0.9743	0.9750	0.9608	0.9864	0.9737	0.9487	0.9222	0.9721
[illegible]	0.0161	0.0212	0.0056	0.0219	0.0121	0.0214	0.0248	0.0237	0.0175	0.0197	0.0259	0.0181	0.0196	0.0255	0.0177	0.0237

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.784E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.8302	0.7794	0.8496	0.8199	0.8477	0.7801	0.7706	0.7947	0.7942	0.8017	0.7850	0.8024	0.7896	0.7549	0.7271	0.7721
[illegible]	0.0270	0.0249	0.0293	0.0261	0.0219	0.0350	0.0244	0.0144	0.0255	0.0284	0.0301	0.0324	0.0220	0.0257	0.0232	0.0259

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.882E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.7297	0.6899	0.7454	0.7109	0.7361	0.6913	0.6784	0.6966	0.7075	0.7066	0.6935	0.6994	0.6931	0.6576	0.6402	0.6690
[illegible]	0.0204	0.0241	0.0193	0.0183	0.0203	0.0255	0.0151	0.0244	0.0204	0.0169	0.0201	0.0307	0.0231	0.0180	0.0277	0.0245

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.101E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.6013	0.5818	0.6102	0.5858	0.5955	0.5717	0.5697	0.5819	0.5958	0.5916	0.5822	0.5659	0.5884	0.5511	0.5609	0.5501
[illegible]	0.0226	0.0232	0.0176	0.0258	0.0163	0.0215	0.0151	0.0213	0.0190	0.0249	0.0205	0.0193	0.0191	0.0237	0.0286	0.0176

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.104E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5685	0.5452	0.5776	0.5516	0.5584	0.5349	0.5308	0.5518	0.5652	0.5632	0.5535	0.5417	0.5557	0.5307	0.5251	0.5216
[illegible]	0.0200	0.0179	0.0161	0.0234	0.0169	0.0187	0.0126	0.0197	0.0182	0.0217	0.0188	0.0174	0.0206	0.0171	0.0242	0.0173

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.118E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.4149	0.4089	0.4209	0.4127	0.4059	0.4093	0.4042	0.4217	0.4310	0.4278	0.4199	0.4114	0.4228	0.4230	0.4075	0.4128
[illegible]	0.0222	0.0183	0.0212	0.0238	0.0232	0.0289	0.0232	0.0263	0.0157	0.0250	0.0201	0.0228	0.0200	0.0214	0.0198	0.0222

.4159
σ = .0078

BAND NUMBER = 1
SPATIAL FREQUENCY = 0.141E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.2231	0.2248	0.2166	0.2279	0.2162	0.2333	0.2390	0.2391	0.2558	0.2748	0.2638	0.2579	0.2739	0.2580	0.2698	0.2420
[illegible]	0.0158	0.0278	0.0224	0.0320	0.0396	0.0312	0.0240	0.0436	0.0313	0.0353	0.0453	0.0417	0.0369	0.0350	0.0352	0.0268

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:42:15

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.705E-03

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVESMR:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGSMR:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.141E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVESMR:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGSMR:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.392E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVESMR:	0.9992	0.9988	0.9976	0.9974	0.9952	0.9974	0.9986	0.9969	0.9992	0.9975	0.9980	0.9963	0.9982	0.9975	0.9979	0.9982
SIGSMR:	0.0009	0.0012	0.0037	0.0017	0.0041	0.0020	0.0017	0.0024	0.0012	0.0070	0.0021	0.0041	0.0019	0.0026	0.0014	0.0022

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.588E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVESMR:	0.9742	0.9838	0.9868	0.9870	0.9976	0.9892	0.9695	0.9932	0.9741	0.9870	0.9889	0.9810	0.9547	0.9836	0.9806	0.9925
SIGSMR:	0.0137	0.0103	0.0133	0.0155	0.0105	0.0121	0.0120	0.0095	0.0134	0.0148	0.0118	0.0127	0.0198	0.0151	0.0160	0.0108

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.784E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVESMR:	0.8151	0.8292	0.8451	0.8417	0.8433	0.8530	0.8152	0.8597	0.8319	0.8278	0.8444	0.8450	0.8022	0.8185	0.8085	0.8249
SIGSMR:	0.0251	0.0137	0.0191	0.0165	0.0236	0.0192	0.0137	0.0176	0.0219	0.0192	0.0188	0.0258	0.0217	0.0224	0.0261	0.0163

ORIGINAL PAGE IS
OF POOR QUALITY

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.882E-02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.7112	0.7291	0.7353	0.7413	0.7383	0.7478	0.7161	0.7546	0.7362	0.7279	0.7426	0.7363	0.7082	0.7250	0.7229	0.7349
[illegible]	0.0177	0.0175	0.0168	0.0148	0.0239	0.0147	0.0123	0.0124	0.0166	0.0159	0.0149	0.0123	0.0170	0.0147	0.0157	0.0134

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.101E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5592	0.5718	0.5879	0.5850	0.5811	0.6016	0.5773	0.6134	0.5930	0.5862	0.6007	0.6097	0.5859	0.6181	0.5896	0.6179
[illegible]	0.0127	0.0156	0.0179	0.0108	0.0197	0.0128	0.0128	0.0173	0.0164	0.0185	0.0127	0.0156	0.0195	0.0141	0.0171	0.0112

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.104E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5282	0.5387	0.5550	0.5496	0.5456	0.5683	0.5443	0.5803	0.5603	0.5505	0.5676	0.5783	0.5536	0.5869	0.5549	0.5837
[illegible]	0.0144	0.0161	0.0147	0.0104	0.0197	0.0128	0.0138	0.0166	0.0166	0.0226	0.0138	0.0120	0.0166	0.0124	0.0193	0.0136

ORIGINAL PAGE IS
OF POOR QUALITY

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.118E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.3900	0.4013	0.4184	0.4076	0.3946	0.4186	0.4078	0.4265	0.4205	0.4029	0.4043	0.4318	0.4138	0.4349	0.4022	0.4254
[illegible]	0.0134	0.0184	0.0210	0.0194	0.0124	0.0131	0.0188	0.0168	0.0161	0.0159	0.0155	0.0107	0.0147	0.0140	0.0165	0.0138

.4125
σ = .0128

BAND NUMBER = 2
SPATIAL FREQUENCY = 0.141E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.2115	0.2166	0.2309	0.2158	0.2027	0.2389	0.2291	0.2318	0.2278	0.2188	0.2067	0.2474	0.2327	0.2506	0.2188	0.2399
[illegible]	0.0168	0.0220	0.0206	0.0170	0.0218	0.0111	0.0134	0.0222	0.0190	0.0165	0.0198	0.0170	0.0152	0.0325	0.0269	0.0357

PHASED KNIFE EDGE

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:43: 7

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.705E-03

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGSNR:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.141E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGSNR:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.392E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.9986	0.9964	0.9959	0.9971	0.9981	0.9976	0.9959	0.9969	0.9980	0.9971	0.9968	0.9963	0.9974	0.9964	0.9970	0.9953
SIGSNR:	0.0015	0.0028	0.0039	0.0018	0.0018	0.0021	0.0033	0.0020	0.0021	0.0027	0.0022	0.0034	0.0022	0.0028	0.0027	0.0033

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.588E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.9500	0.9845	0.9958	0.9807	0.9730	0.9442	0.9916	0.9713	0.9720	0.9574	0.9651	0.9816	0.9569	0.9589	0.9817	0.9674
SIGSNR:	0.0159	0.0130	0.0053	0.0114	0.0163	0.0176	0.0076	0.0121	0.0134	0.0159	0.0128	0.0133	0.0174	0.0159	0.0145	0.0146

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.784E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.7061	0.9251	0.8512	0.9216	0.8209	0.7838	0.8378	0.8155	0.8201	0.7904	0.8056	0.8186	0.7815	0.7963	0.7884	0.7857
SIGSNR:	0.0215	0.0136	0.0093	0.0150	0.0180	0.0179	0.0147	0.0125	0.0195	0.0152	0.0110	0.0245	0.0176	0.0165	0.0343	0.0229

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BAND NUMBER = 3
SPATIAL FREQUENCY = 0.882E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.6956	0.7134	0.7391	0.7184	0.7155	0.6792	0.7360	0.7151	0.7228	0.6944	0.7038	0.7217	0.6900	0.7026	0.7254	0.6988
SIGMA:	0.0133	0.0112	0.0148	0.0114	0.0216	0.0194	0.0176	0.0111	0.0127	0.0186	0.0099	0.0175	0.0152	0.0131	0.0288	0.0131

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.101E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.5475	0.5696	0.5816	0.5773	0.5716	0.5427	0.5945	0.5870	0.5828	0.5632	0.5765	0.5963	0.5804	0.5758	0.6032	0.5837
SIGMA:	0.0156	0.0115	0.0137	0.0110	0.0152	0.0106	0.0202	0.0162	0.0237	0.0129	0.0170	0.0201	0.0190	0.0115	0.0139	0.0121

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.104E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.5187	0.5127	0.5444	0.5419	0.5374	0.5100	0.5552	0.5517	0.5481	0.5306	0.5389	0.5617	0.5450	0.5430	0.5729	0.5528
SIGMA:	0.0150	0.0092	0.0149	0.0118	0.0111	0.0105	0.0184	0.0190	0.0209	0.0112	0.0172	0.0248	0.0180	0.0129	0.0148	0.0154

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.118E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.3895	0.3847	0.3886	0.3984	0.3954	0.3852	0.3942	0.3942	0.3997	0.3832	0.3762	0.3881	0.3881	0.3937	0.4040	0.4007
SIGMA:	0.0162	0.0136	0.0171	0.0116	0.0132	0.0160	0.0149	0.0146	0.0177	0.0127	0.0156	0.0134	0.0166	0.0160	0.0217	0.0213

.3910
σ = .0075

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.141E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.2234	0.1970	0.2006	0.2035	0.2263	0.2079	0.1933	0.2065	0.1989	0.1987	0.1867	0.1888	0.2095	0.2150	0.2329	0.2290
SIGMA:	0.0156	0.0182	0.0215	0.0201	0.0170	0.0267	0.0237	0.0238	0.0164	0.0144	0.0238	0.0321	0.0338	0.0403	0.0464	0.0454

PHASED KNIFE EDGE

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:43:15

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.705E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.141E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.392E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9976	0.9961	0.9961	0.9967	0.9977	0.9957	0.9983	0.9976	0.9982	0.9975	0.9969	0.9974	0.9977	0.9962	0.9967	0.9951
[illegible]	0.0020	0.0022	0.0021	0.0017	0.0022	0.0029	0.0017	0.0023	0.0022	0.0020	0.0024	0.0025	0.0020	0.0029	0.0026	0.0030

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.588E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9726	0.9948	0.9896	0.9935	0.9590	0.9982	0.9745	0.9712	0.9542	0.9910	0.9835	0.9862	0.9388	0.9930	0.9677	0.9969
[illegible]	0.0095	0.0065	0.0088	0.0070	0.0110	0.0039	0.0105	0.0151	0.0100	0.0099	0.0113	0.0114	0.0217	0.0067	0.0125	0.0047

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.784E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.8114	0.9618	0.8535	0.8561	0.8177	0.8741	0.8343	0.8216	0.8069	0.8371	0.8256	0.8302	0.7823	0.8222	0.7660	0.8015
[illegible]	0.0163	0.0157	0.0192	0.0133	0.0162	0.0155	0.0129	0.0245	0.0180	0.0200	0.0195	0.0175	0.0238	0.0233	0.0345	0.0292

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BAND NUMBER = 4
SPATIAL FREQUENCY = 0.882E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.7284	0.7602	0.7581	0.7591	0.7248	0.7830	0.7404	0.7292	0.7240	0.7446	0.7308	0.7382	0.6860	0.7372	0.6998	0.7163
SIGSNR:	0.0152	0.0162	0.0176	0.0146	0.0118	0.0133	0.0120	0.0152	0.0139	0.0228	0.0184	0.0155	0.0140	0.0211	0.0308	0.0212

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.101E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.5741	0.6033	0.5954	0.6015	0.5700	0.6278	0.5941	0.5840	0.5852	0.5986	0.5945	0.6059	0.5620	0.6183	0.5843	0.5998
SIGSNR:	0.0103	0.0105	0.0141	0.0124	0.0164	0.0110	0.0135	0.0143	0.0140	0.0098	0.0082	0.0083	0.0097	0.0095	0.0069	0.0104

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.104E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.5366	0.5637	0.5555	0.5635	0.5335	0.5879	0.5578	0.5447	0.5485	0.5616	0.5561	0.5705	0.5300	0.5840	0.5525	0.5701
SIGSNR:	0.0090	0.0097	0.0144	0.0130	0.0170	0.0105	0.0149	0.0128	0.0129	0.0095	0.0102	0.0095	0.0097	0.0081	0.0074	0.0097

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.118E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.3622	0.4048	0.3811	0.3903	0.3852	0.4107	0.3984	0.3704	0.3901	0.3903	0.3880	0.4080	0.3861	0.4267	0.4038	0.4132
SIGSNR:	0.0111	0.0161	0.0102	0.0125	0.0111	0.0167	0.0129	0.0152	0.0104	0.0121	0.0121	0.0147	0.0104	0.0117	0.0102	0.0158

.3955
σ = .0141

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.141E-01

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVGSNR:	0.1910	0.1984	0.1750	0.1852	0.1917	0.1888	0.1958	0.1664	0.1882	0.1902	0.1900	0.2037	0.2226	0.2306	0.2393	0.2418
SIGSNR:	0.0206	0.0262	0.0245	0.0232	0.0162	0.0171	0.0157	0.0170	0.0094	0.0148	0.0311	0.0279	0.0200	0.0403	0.0431	0.0388

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:43:25

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.705E-03

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGMA:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.141E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIGMA:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.392E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.9967	0.9961	0.9964	0.9962	0.9962	0.9956	0.9961	0.9967	0.9946	0.9956	0.9953	0.9968	0.9957	0.9972	0.9964	0.9972
SIGMA:	0.0031	0.0048	0.0026	0.0036	0.0037	0.0035	0.0037	0.0030	0.0045	0.0036	0.0042	0.0041	0.0034	0.0026	0.0032	0.0030

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.588E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.9514	0.9208	0.9722	0.9800	0.9739	0.9891	0.9899	0.9592	0.9895	0.9817	0.9972	0.9976	0.9874	0.9484	0.9566	0.9248
SIGMA:	0.0185	0.0229	0.0175	0.0191	0.0167	0.0127	0.0133	0.0236	0.0151	0.0255	0.0043	0.0024	0.0164	0.0191	0.0246	0.0180

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.784E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVERAGE:	0.8227	0.8084	0.8106	0.8607	0.8288	0.8321	0.8440	0.7810	0.8120	0.8043	0.8467	0.8898	0.8169	0.7451	0.7575	0.7266
SIGMA:	0.0304	0.0212	0.0331	0.0298	0.0350	0.0429	0.0391	0.0495	0.0382	0.0515	0.0395	0.0519	0.0401	0.0364	0.0407	0.0352

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BAND NUMBER = 5
SPATIAL FREQUENCY = 0.882E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.7357	0.7151	0.7455	0.7713	0.7511	0.7650	0.7697	0.7216	0.7444	0.7282	0.7742	0.8080	0.7333	0.6843	0.7074	0.6638
[illegible]	0.0247	0.0186	0.0186	0.0226	0.0228	0.0343	0.0319	0.0354	0.0343	0.0507	0.0392	0.0444	0.0364	0.0371	0.0469	0.0360

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.101E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.6167	0.5806	0.6323	0.6302	0.6253	0.6562	0.6763	0.6259	0.6466	0.6324	0.6749	0.7206	0.6414	0.6108	0.6209	0.5962
[illegible]	0.0183	0.0206	0.0157	0.0249	0.0239	0.0210	0.0308	0.0236	0.0294	0.0228	0.0329	0.0322	0.0251	0.0260	0.0215	0.0276

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.104E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5797	0.5474	0.5962	0.5848	0.5852	0.6205	0.6178	0.5924	0.6103	0.6026	0.6421	0.6862	0.6103	0.5842	0.5877	0.5658
[illegible]	0.0185	0.0210	0.0166	0.0266	0.0206	0.0154	0.0239	0.0218	0.0227	0.0208	0.0267	0.0289	0.0206	0.0191	0.0195	0.0228

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.118E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.4260	0.4209	0.4183	0.4214	0.4107	0.4249	0.4315	0.4170	0.4438	0.4594	0.4708	0.5168	0.4472	0.4391	0.4425	0.4272
[illegible]	0.0235	0.0189	0.0189	0.0205	0.0190	0.0190	0.0263	0.0332	0.0281	0.0634	0.0214	0.0254	0.0271	0.0232	0.0281	0.0239

.438
σ .025

BAND NUMBER = 5
SPATIAL FREQUENCY = 0.141E-0.

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.2629	0.2678	0.2492	0.2434	0.2355	0.2570	0.2676	0.2513	0.2768	0.3079	0.3025	0.3309	0.2879	0.2910	0.3016	0.3145
[illegible]	0.0258	0.0189	0.0371	0.0340	0.0361	0.0379	0.0472	0.0485	0.0563	0.0770	0.0499	0.0522	0.0455	0.0501	0.0531	0.0381

PHASED KNIFE EDGE

KNIFE EDGE REPORT

VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 17:29: 7

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.100E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000												
[illegible]	0.0000	0.0000	0.0000	0.0000												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.178E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000												
[illegible]	0.0000	0.0000	0.0000	0.0000												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.400E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000												
[illegible]	0.0000	0.0000	0.0000	0.0000												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.600E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000												
[illegible]	0.0000	0.0000	0.0000	0.0000												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.800E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9979	0.9997	0.9971	0.9997												
[illegible]	0.0048	0.0011	0.0069	0.0014												

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BAND NUMBER = 6
SPATIAL FREQUENCY = 0.100E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9838	0.9867	0.9821	0.9944												
[illegible]	0.0184	0.0168	0.0258	0.0105												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.147E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVG. [illegible]	0.9969	0.9745	0.9753	0.9242												
SIG. [illegible]	0.0276	0.0326	0.0353	0.0293												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.196E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.7537	0.7634	0.7115	0.7733												
[illegible]	0.0250	0.0273	0.0281	0.0290												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.200E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AVG. [illegible]	0.7509	0.7195	0.7062	0.7598												
SIG. [illegible]	0.0251	0.0267	0.0294	0.0277												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.250E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5770	0.6020	0.5557	0.5971												
[illegible]	0.0218	0.0288	0.0285	0.0280												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.294E-02

DET:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.4241	0.4351	0.4072	0.4434												
SIG. [illegible]	0.0231	0.0231	0.0243	0.0306												

.4275
σ=.013

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BAND NUMBER = 6
SPATIAL FREQUENCY = 0.350E-02

T:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.2406	0.2940	0.2495	0.2703												
[illegible]	0.0284	0.0294	0.0307	0.0281												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.400E-02

T:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.1624	0.1708	0.1652	0.1916												
[illegible]	0.0272	0.0331	0.0320	0.0320												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.450E-02

T:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.1280	0.1076	0.1206	0.1720												
[illegible]	0.0270	0.0289	0.0328	0.0284												

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.500E-02

T:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.1226	0.1165	0.1437	0.1191												
[illegible]	0.0269	0.0296	0.0278	0.0322												

PHASED KNIFE EDGE

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SEP-82
VIDEO FILE CREATION TIME: 15:43:36

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.705E-03

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.141E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.392E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9967	0.9977	0.9985	0.9971	0.9900	0.9970	0.9952	0.9976	0.9966	0.9942	0.9968	0.9978	0.9960	0.9962	0.9966	0.9965
[illegible]	0.0060	0.0029	0.0011	0.0038	0.0024	0.0010	0.0043	0.0027	0.0030	0.0063	0.0031	0.0028	0.0035	0.0051	0.0031	0.0033

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.588E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.9307	0.9192	0.9378	0.9626	0.9446	0.9757	0.9757	0.9802	0.9667	0.9718	0.9655	0.9761	0.9539	0.9814	0.9409	0.9180
[illegible]	0.0256	0.0227	0.0211	0.0223	0.0217	0.0191	0.0231	0.0219	0.0267	0.0272	0.0253	0.0243	0.0173	0.0189	0.0251	0.0267

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.784E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	[illegible]	0.7651	0.8106	0.8367	0.8191	0.8594	0.9363	0.8550	0.8048	0.8442	0.8040	0.8492	0.7951	0.8386	0.7822	0.7694
[illegible]	[illegible]	0.1108	0.0277	0.0318	0.0229	0.0275	0.0309	0.0311	0.0522	0.0376	0.0444	0.0314	0.0340	0.0352	0.0384	0.0275

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BAND NUMBER = 7
SPATIAL FREQUENCY = 0.882E-02

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.7402	0.7003	0.7152	0.7614	0.7351	0.7735	0.7520	0.7772	0.7216	0.7707	0.7190	0.7681	0.7169	0.7587	0.6924	0.6768
[illegible]	0.0171	0.0492	0.0251	0.0331	0.0182	0.0258	0.0339	0.0257	0.0495	0.0344	0.0342	0.0294	0.0360	0.0258	0.0272	0.0216

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.101E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5780	0.5711	0.5862	0.6010	0.5848	0.6219	0.6237	0.6352	0.6231	0.6405	0.6305	0.6278	0.6135	0.6507	0.5813	0.5727
[illegible]	0.0352	0.0227	0.0271	0.0192	0.0139	0.0242	0.0261	0.0306	0.0157	0.0214	0.0209	0.0265	0.0234	0.0208	0.0235	0.0175

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.104E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.5426	0.5316	0.5447	0.5662	0.5490	0.5944	0.5875	0.5920	0.5894	0.5938	0.5976	0.5896	0.5758	0.6072	0.5495	0.5439
[illegible]	0.0335	0.0202	0.0250	0.0240	0.0251	0.0238	0.0233	0.0315	0.0175	0.0208	0.0211	0.0259	0.0224	0.0216	0.0262	0.0181

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.118E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.4124	0.3963	0.4185	0.4387	0.4123	0.4503	0.4300	0.4279	0.4201	0.4383	0.4307	0.4269	0.4287	0.4328	0.4091	0.4046
[illegible]	0.0310	0.0251	0.0210	0.0217	0.0210	0.0320	0.0285	0.0239	0.0193	0.0282	0.0269	0.0224	0.0308	0.0225	0.0285	0.0214

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.141E-01

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[illegible]	0.2394	0.2656	0.2439	0.2495	0.2514	0.2519	0.2377	0.2484	0.2310	0.2633	0.2395	0.2429	0.2352	0.2469	0.2447	0.2634
[illegible]	0.0350	0.0373	0.0198	0.0260	0.0257	0.0278	0.0253	0.0220	0.0243	0.0300	0.0202	0.0240	0.0208	0.0190	0.0203	0.0273

3.2.13 BL19/20 TEST

BAND-TO-BAND REGISTRATION, GEOMETRIC
ACCURACY, SELF INDUCED VIBRATION

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

3.3 THERMAL VACUUM TESTS

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

3.4 EMI/EMC TESTS

Test Summary: HS236-8092 Y. Ban

Test Specification: TP32015-622/629

Reference Documentation: None

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SANTA BARBARA RESEARCH CENTER
A Subsidiary of Hughes Aircraft Company

INTERNAL MEMORANDUM

TO: J. L. Engel

CC: See Distribution attached

DATE: 2 August 1982

REF: HS236-8092
SED-161

FROM: Yas Ban

SUBJECT: EMI/EMC Test
TM Flight Model

BLDG. B11 MAIL STA. 101

EXT. 6379

Introduction:

The Flight Model Thematic Mapper was tested for Conducted Emissions and Conducted Susceptibility at the Santa Barbara Research Center (SBRC) facilities on the 20th and 21st of July 1982. EMI tests previously conducted with the Protoflight Mapper involving the detection of interference emanations from the similar instrument were not performed with the Flight Model. A deviation discussing the above deletion was effected on April 6, 1982. Concurrence with this deviation was given by General Electric and NASA (note that D-145 was superceded by D-158 dated June 7, 1982).

Although not specifically stipulated in the first deviation, it was deemed prudent to eliminate section CS06 from the test, with NASA's concurrence. As a note for clarity, CS06 is the name of the section of the EMI/EMC test procedure which describes the test which injects 28V spikes on the "hot" and return lines of the TM power. This test was previously conducted with only the Engineering Model Thematic Mapper and was not performed during the Protoflight TM EMI test.

Subject:

The subject EMI/EMC tests conducted with the Flight Model Thematic Mapper were restricted to the Conducted Emissions (parts CE01 and CE03) and the Conducted Susceptibility (parts CS01 and CS02). The discussion which follows summarizes the results of these tests.

1. CE01:

   No narrowband, i.e., 20 Hz thru 20 kHz, emissions detected.

2. CE03:

   All emanations detected with a 20 kHz thru 150 kHz RF injection were well below the specification limits.

(Continued on Page 2)

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Subject (Continued):

3. CS01:

With RF injection into the first 28V positive lines then subsequently into the 28V returns for J-18, J-19 and J-24, the TM susceptibility signatures were essentially the same. Eight (8) kHz filters were installed between the injection source and the TM.

a. *Five (5) counts of noise was observed at an injection frequency of 20 kHz thru 25 kHz. The recovery threshold was noted at 1.3 VP-P.

b. *Five (5) to six (6) counts of noise was observed at an injection frequency of 25 kHz thru 35 kHz. The recovery threshold occurred at 1.1 VP-P.

c. *Five(5) counts of noise was encountered at 35 kHz thru 40 kHz. The recovery threshold was noted at 1.4 VP-P.

**No other indication of Mapper susceptibility was evidenced throughout the CS01 frequency sweep from 20 Hz thru 50 kHz.

4. CS02:

**With RF injection as previously discussed (power and return leads) for the frequency range from 50 kHz thru 150 kHz, no coherent or random susceptibility interference signatures were observed. Again eight (8) kHz filters were inserted between the injection source and the Thematic Mapper.

* DC restoration offset, i.e., MUX count, included in indicated noise count. Observations were made monitoring Band 1 Detector 9.

**The CS01 and CS02 tests were repeated due to uncertainties encountered during the initial run. Prior to the conduct of the second run the grounding configuration was rechecked, cables in the near vicinity of the test setup were reaccommodated to preclude stray pick-up and/or crosstalk and the injection level was monitored by the operator to assure a 1.5 VP-P RF signal. Test results reported in this memo are from data acquired during the second run (where a more positive assurance regarding the appropriate configuration, proper testing procedures and an improved monitoring capability could be rendered).

(Concluded on Page 3)

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Conclusion:

For the abbreviated EMI tests conducted, data taken and its associated evaluation reveal no particular area of "out of spec conditions." Although susceptibility was experienced at injection frequencies, 20 kHz thru 40 kHz, the signatures depicting these susceptibilities were extremely low in magnitude (5 to 6 counts maximum) and recovered within the specified 1.0 VP-P threshold. Susceptibility and emissions for the Flight TM compare quite favorably with the Protoflight Model.

YB:pg

3.5 MASS PROPERTIES

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION