

SEPT 1982

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HS 286-001936
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THEMATIC MAPPER

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(E83-10262) THEMATIC MAPPER FLIGHT MODEL
PRESHIPMENT REVIEW DATA PACKAGE, VOLUME 3,
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THEMATIC MAPPER

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

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THEMATIC MAPPER
FLIGHT MODEL
PRESHIPMENT REVIEW
VOLUME III
SYSTEM DATA
TABLE OF CONTENTS

	<u>SECTION</u>
3.0 SYSTEMS INTEGRATION AND TEST	
Vibration and Acoustical Noise Tests	3.1
Integration Tests. Introduction	3.2
IA01 TEST - Bands 1 to 4 Coarse & Fine Focus. Interconnect Verification Test.	3.2.1
IA03 TEST - Bands 5 and 7 Coarse Focus and Baffle Check.	3.2.2
IA04 TEST - Focus Verification, Rotational Alignment & Band-to-Band Regis- tration.	3.2.3
IA06 TEST - Verification Telescope Orientation to SMA Pivot Axis.	3.2.4
IA07 TEST - Electronic Module Integration	3.2.5
AC02 TEST - Radiometric Calibration	3.2.6
AC22 TEST - Spectral Matching	3.2.7
AC07 TEST - Spatial Coverage	3.2.8
BL07 TEST - Radiometric Calibration of Calibrator	3.2.9
BL10 TEST - Radiometric Calibration - Band 6	3.2.10
BL12 TEST - Coherent Noise	3.2.11
BL16/17 TEST - Dynamic Square Wave Response	3.2.12
BL19/20 TEST - Band-toBand Registration, Geometric Accuracy, Self Induced Vibration	3.2.13
Thermal Vacuum Tests	3.3
EMI/EMC	3.4
Mass Properties	3.5

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OF POOR QUALITY

THEMATIC MAPPER
FLIGHT MODEL
PRESHIPMENT REVIEW
VOLUME III
SYSTEM DATA
TABLE OF CONTENTS
(Continued)

	<u>SECTION</u>
4.0 LIENS	
Summary of Liens	4.0
Failure Reports	4.1
Requests for Deviation/Waiver	4.2
Engineering Change Proposal Status	4.3
Non-Conforming Material Report	4.4

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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)

BLDO: 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, E03020, D03021 and D03044.
6. System Test Computer Log Books #1 - #3 (23 MAR 1982 thru 10 JULY 1982)

INTRODUCTION:

IAO7R 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) IAO7R 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 irreversible 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 occurred, and was repaired then remeasured, readings before the retest are not given. Only the most recent data is presented for a given parameter.

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

16-SEP-82

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 T1 power supply in cables W5018 and W5019 was checked on the T1 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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H5236-8129

16-SEP-82

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.

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/Kepeco 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	5.2.8.1.2.3 5.2.8.2.35
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+/-FGV (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 symmetry 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		CALCULATED MEASURED VALUE	VALUE
	SME 1	SME 2		
0 Deg Ref. to P2 (Transition)	--X- ----	---- --X-	4.92+/-0.68 ms	5.20 ms 5.20 ms
0 Deg Ref. to P5 (Transition)	--X- ----	---- --X-	5.31+/-0.80 ms	5.40 ms 5.40 ms
0 Deg. Ref. (P2P3 turnaround) to 0 Deg Ref. (P5P0 turnaround)	--X- ----	---- --X-	71.46+/-2.0 ms	71.0 ms 72.2 ms
0 Deg. Ref. (P5P0 Turnaround) to 0 Deg Ref (P2P3 turnaround)	--X- ----	---- --X-	71.46+/-0.50 ms	72.0 ms 71.8 ms
DC Restore Trailing Edge (P2P3 Turnaround) to 0 Deg Ref.	--X- ----	---- --X-	0.00+/-0.17 ms	0.00 ms 0.00 ms
DC Restore Leading Edge (P5P0 turnaround) to 0 Deg. Ref.	--X- ----	---- --X-	0.00+/-0.10 ms	0.00 ms 0.00 ms
DC Restore Width	--X- ----	---- ----	3.00+/-0.15 ms	2.90 ms 2.80 ms
P2 to P3 (Turnaround Interval)	--X- ----	---- --X-	10.60 to 10.90	10.80 ms 10.80 ms
P5 to P0 (Turnaround Interval)	--X- ----	---- --X-	10.60 to 10.90	10.80 ms 10.80 ms
0 Deg Ref to Q2	--X- ----	BUMPER SME1 ---- --X-	MCDE SME2 ---- --X-	4.97+/-0.68 5.0 ms 5.1 ms

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16-SEP-82

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

PSEUDO SAM PULSES WITH SMA LOCKED

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

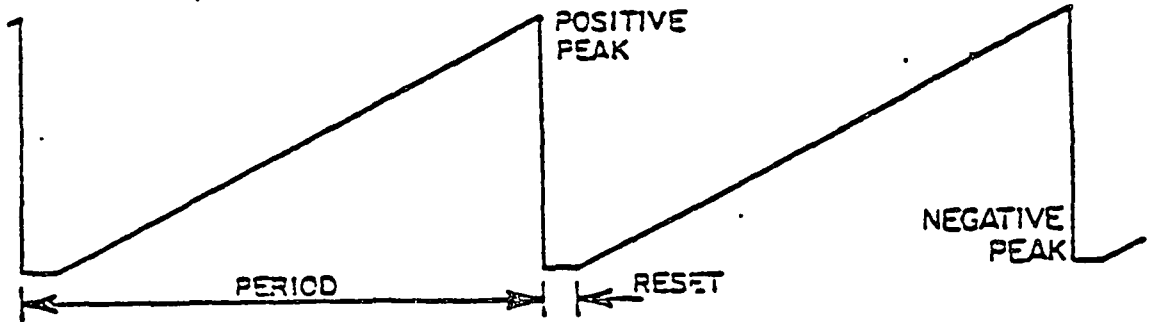
TABLE IV
REDUNDANT SHUTTER TIMING MEASUREMENTS

FUNCTION	MODE		CALCULATED VALUE	MEASURED VALUE	REMARKS
	SME 1 SAM	SME 2 SAM			
0 Deg. Ref. to P2 (Transition)	--X--	-----	5.35+/-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	
	SME 1 BUMPER	SME 2 BUMPER			
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	

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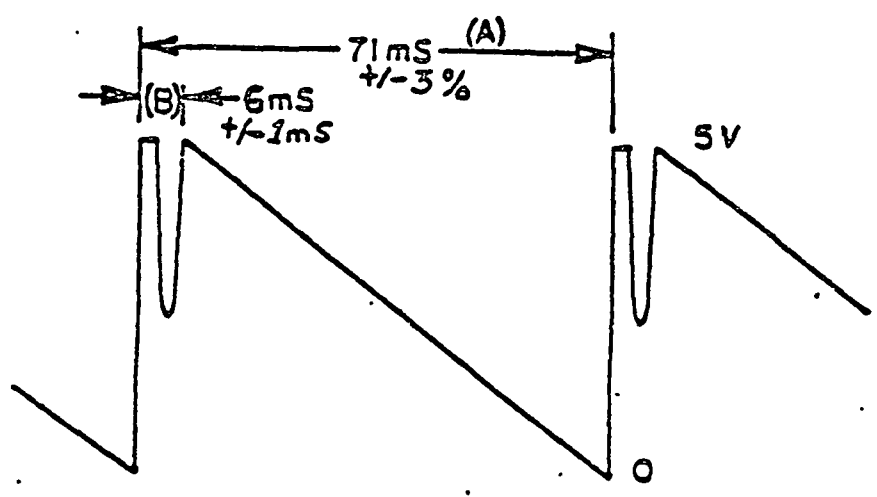
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		SLC #1	SLC #2
		-----	-----
Period	71 ± 3% ms	71.5 ms	72.30 ms
Reset	5.00 ns ± 5.0 ms	5.00 ns	5.00 ns
Neg Peak	-2V ± 0.5V	-2.10V	-2.20V
Pos Peak	+2V ± 0.5V	+1.90V	+1.90V

FIGURE 1 SLC INTEGRATOR WAVEFORM



SLC #1

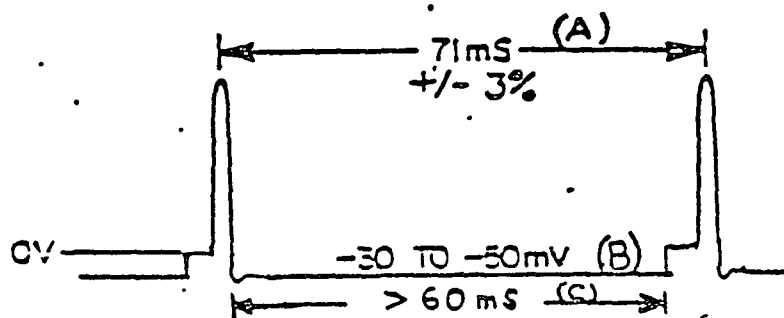
SLC #2

72.00 ms
6.00 ms

72.00 ms
6.00 ms

FIGURE 2 SLC TORQUE CURRENT WAVEFORM

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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.DSL. 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 checked 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 were 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 milliseconds. 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.

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

HS236-8129

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

<u>FUNCTION</u>	<u>AMPS</u>
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

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16-SEP-82

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 DATE: 5/1/82 TIME: 1550
Power Supply 1 Turn ON with P/S Filter Installed (318/51)



TRACES:

1. 7/51 current at J18 waveform

2. _____

3. _____

4. _____

SYNCH: 2amps/10mv

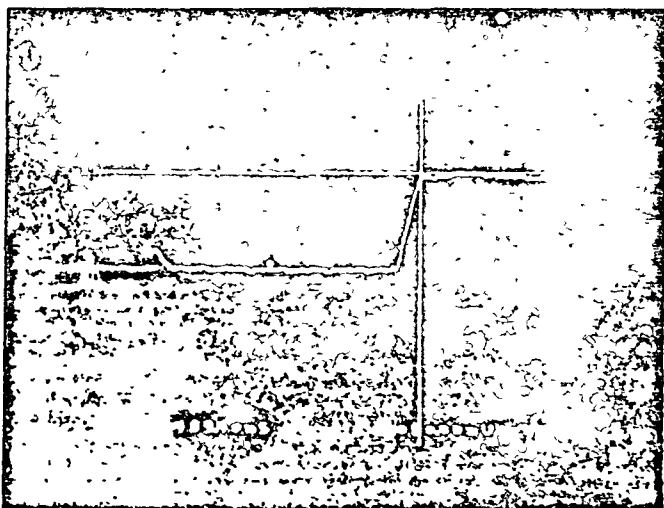
HORIZ. TIME: 50ms sec/PT

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 DATE: 5/1/82 TIME: 1555
Power Supply One - Turn ON w/ P/S Filter INSTALLED



TRACES:

1. 7/51 current at J18 waveform

2. _____

3. _____

4. _____

SYNCH: 2amps/10mv

HORIZ. TIME: 200ms sec/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: -

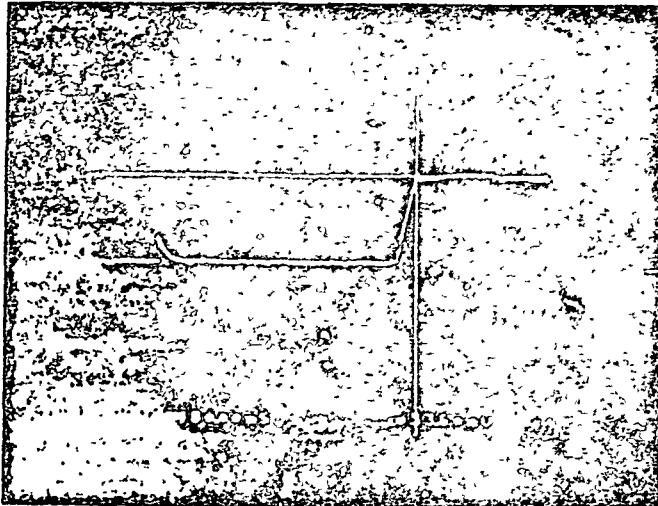
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.11.9

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile - Picture Mode - 28V
Power Supply ONE Turn ON with 2/5 Filter Installed at 5/18/82

DATE: 5/18/82 TIME: 1530



TRACES:

1. 2/5 current at 518 waves

2. _____

3. _____

4. _____

SYNC: 2amps/10mV

HORIZ. TIME: 200µs SEC/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

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POLAROID PRINT DATA CARD

PROC. BK _____ REV _____

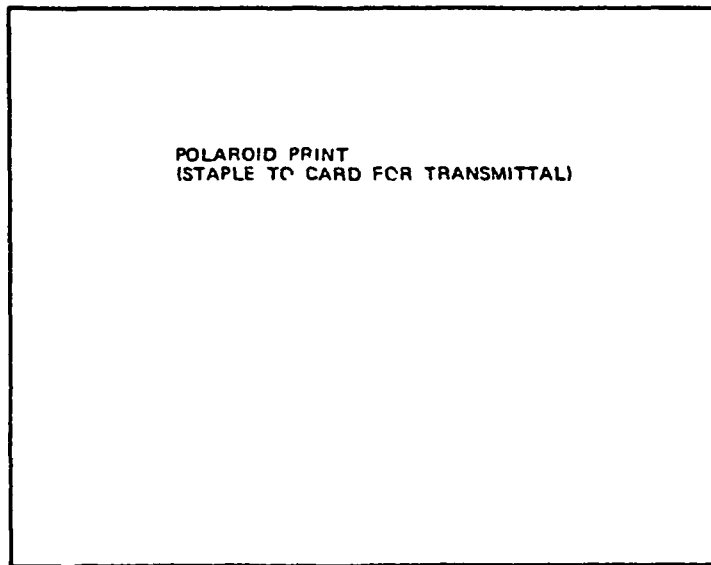
DATA STORAGE NO. _____

TEST TECHNIQUE _____ SUB-STEP _____

DATA REF. NO _____

TEST DESCRIPTION. _____

DATE. _____ TIME. _____



TRACES:

1. _____

2. _____

3. _____

4. _____

SYNC _____

HORIZ. TIME _____

NOTE USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

POLAROID PRINT DATA CARD

PROC. BK: TP34015-537 REV: -

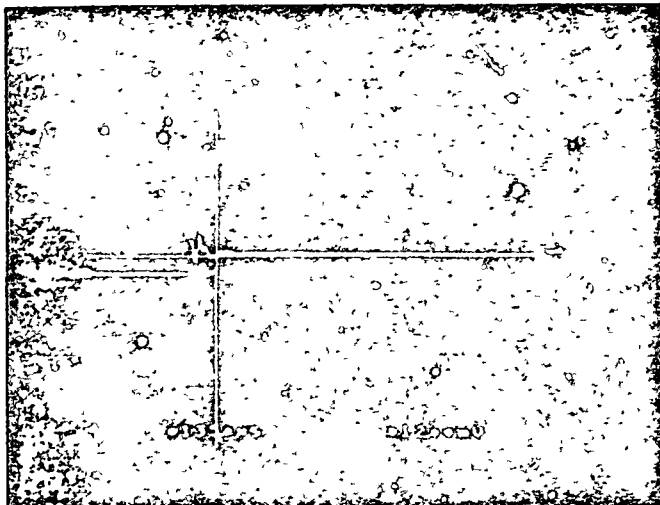
TEST TECHNIQUE: _____ SUB-STEP 52.113.9

TEST DESCRIPTION: Power Profile - Pic Mode 85V
Power Supply 2 Turn ON

DATA STORAGE NO: _____

DATA REF. NO: _____

DATE: 5/11/82 TIME: _____



TRACES:

1. P/S current at J18
waveform

2. _____

3. _____

4. _____

SYNCH: 500 us / PT

HORIZ TIME: 20 / div / 10 mV

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

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POLAROID PRINT DATA CARD

PROC. BK: TP34015-532 REV: _____

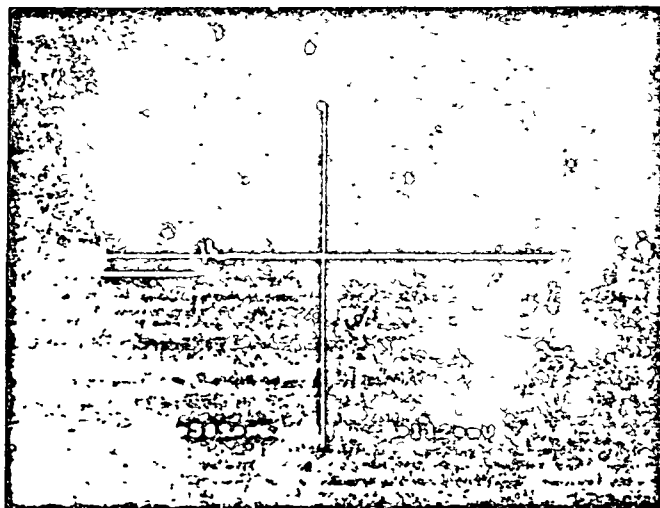
TEST TECHNIQUE: _____ SUB-STEP 52.113.9

TEST DESCRIPTION: Power Profile - Picture mode 28V
Power Supply 2 Turn ON

DATA STORAGE NO: _____

DATA REF. NO: _____

DATE: 5/11/82 TIME: _____



TRACES:

1. P/S 2 current at J18
waveform

2. _____

3. _____

4. _____

SYNCH: 500 us / PT

HORIZ TIME: 20 / div / 10 mV

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

POLAROID PRINT DATA CARD

PROC. BK: TP 32015 - 532 REV: _____

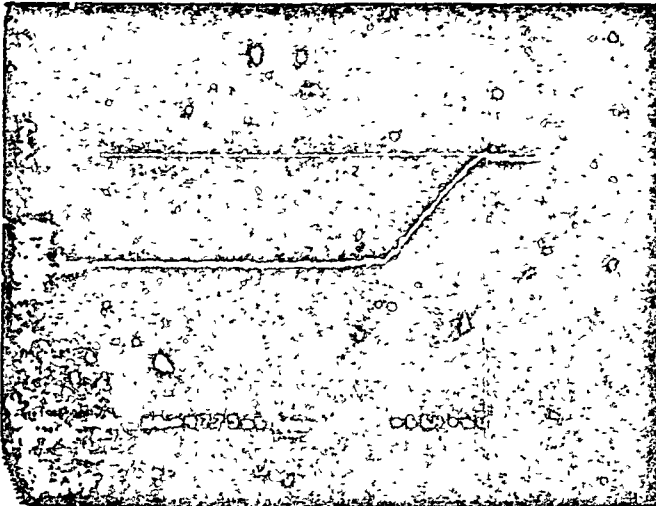
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 52-11.13.9

DATA REF. NO: _____

TEST DESCRIPTION Power Profile - Picture mode 88V
Power supply 1 Turn ON

DATE: 5/11/82 TIME: _____



TRACES:

1. P/S 1 current at JIP wear

2. _____

3. _____

4. _____

SYNO: 2amps/10mV

HORIZ. TIME: 50 uS/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: _____

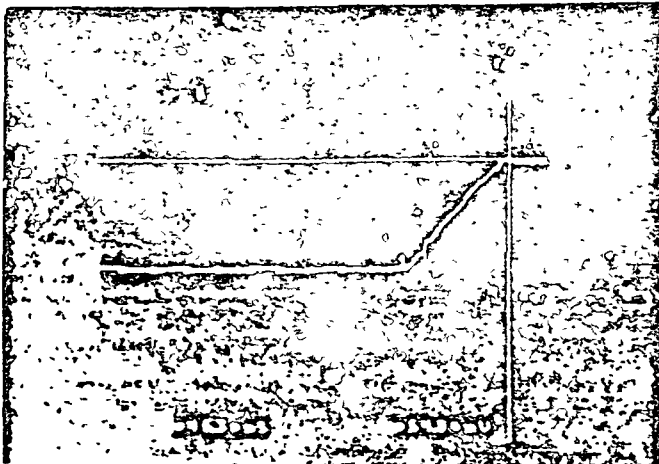
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP _____

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 JIP wear

2. _____

3. _____

4. _____

SYNO: 2amps/10mV

HORIZ. TIME: 50 uS/PT

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: --

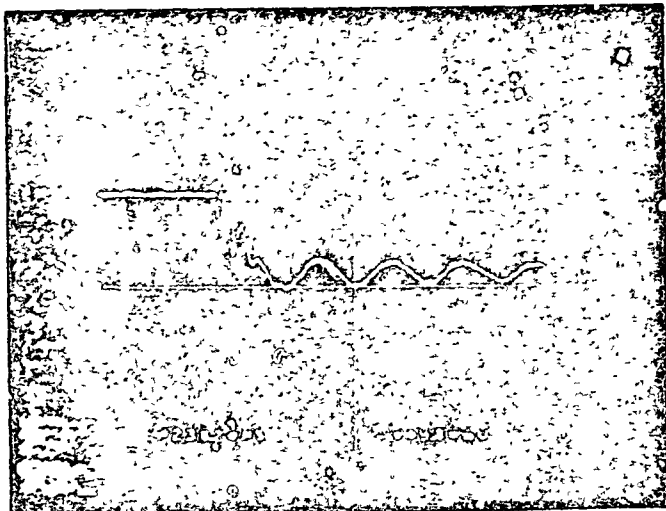
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.9

DATA REF. NO: _____

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

DATE: 7/11/82 TIME: _____



TRACES:

1. PS 2 current at J18
waveform

2. _____

3. _____

4. _____

SYNC: 2amps/10mV

HORIZ. TIME: 200ns/div

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: --

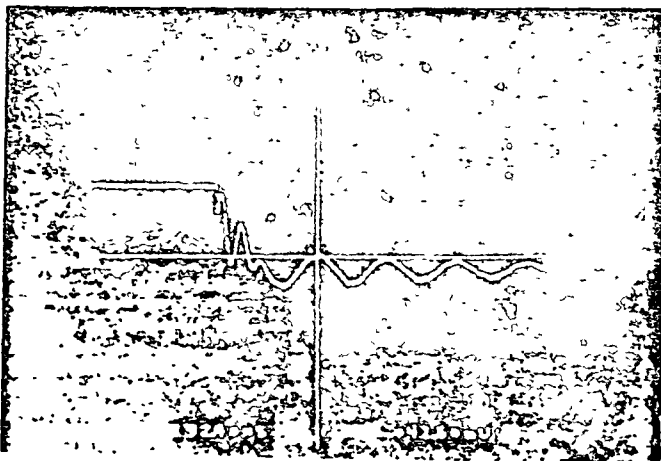
DATA STORAGE NO _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.9

DATA REF. NO: _____

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

DATE: 7/11/82 TIME: _____



TRACES:

1. PS 2 current at J18

2. _____

3. _____

4. _____

SYNC: 2amps/10mV

HORIZ. TIME: 200ns/div

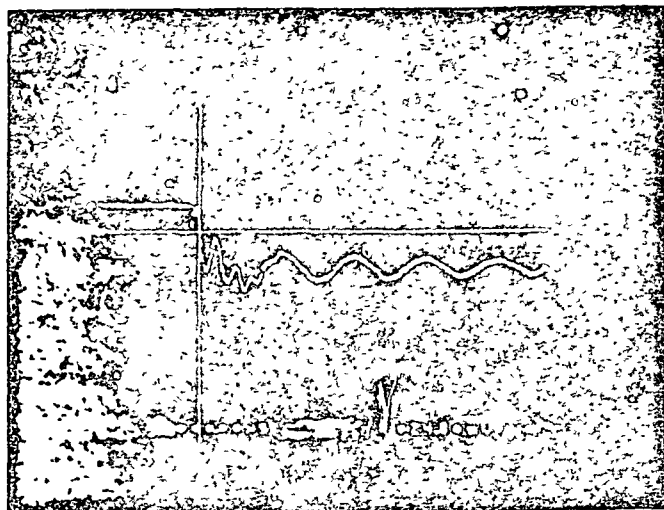
POLAROID PRINT DATA CARD

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 35V DATE: 5/11/82 TIME:

Power supply 1 Turn OFF



TRACES:

1. P/S 1 current at 518 wears

2.

3.

4.

SYNG: 2 amps / 10mV

HORIZ TIME: 200us / PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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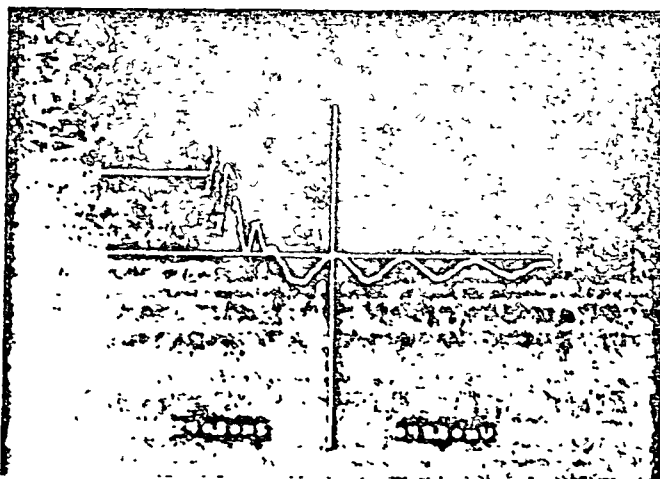
POLAROID PRINT DATA CARD

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 518 wears

2.

3.

4.

SYNG: 2 Amps / 10 mV

HORIZ TIME: 200us / PT

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

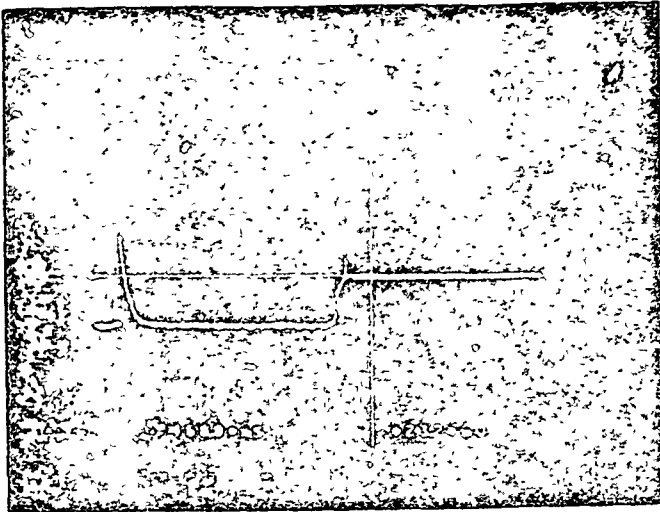
TEST TECHNIQUE: _____ SUB-STEP 5.211.124

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

DATA STORAGE NO: _____

DATA REF. NO: _____

DATE: 5/1/82 TIME: _____



TRACES:

1. P/S 2 current at 518
microamps

2. _____

3. _____

4. _____

SYNCH: Quint - 1.44A @ 437m sec

HORIZ TIME: PL - 176A @ 420.8m sec

PS - 2.88A @ 40m sec

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: _____ REV: _____

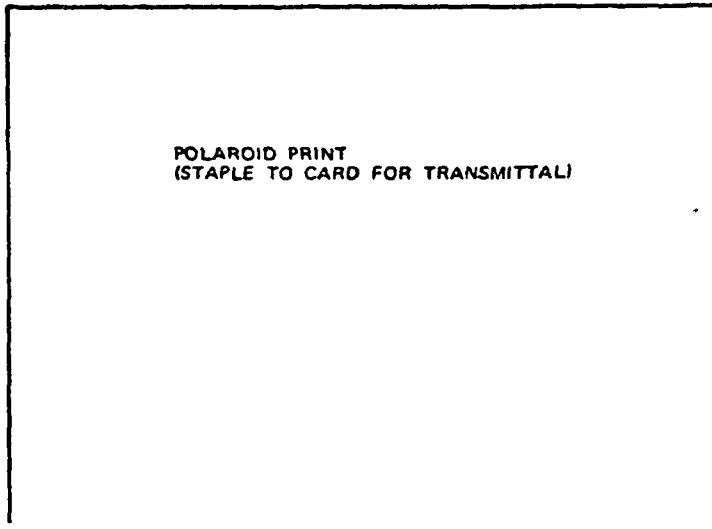
TEST TECHNIQUE _____ SUB-STEP _____

TEST DESCRIPTION _____

DATA STORAGE NO _____

DATA REF. NO _____

DATE: _____ TIME: _____



POLAROID PRINT
(STAPLE TO CARD FOR TRANSMITTAL)

TRACES:

1. _____

2. _____

3. _____

4. _____

SYNCH _____

HORIZ TIME _____

POLAROID PRINT DATA CARD

PROC. BK: TP3205-532 REV: _____

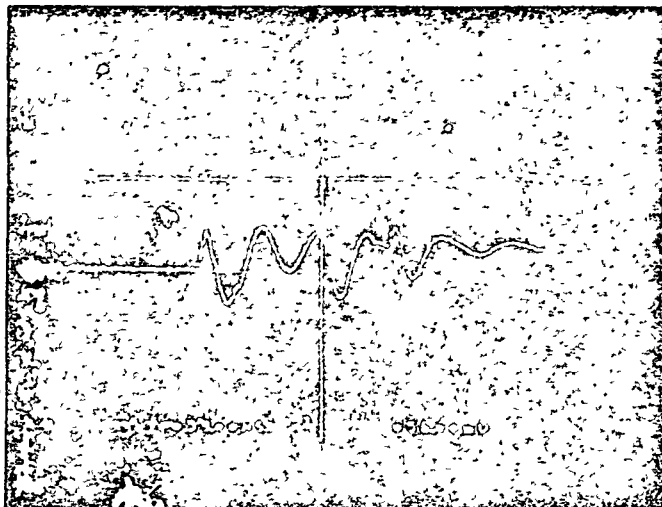
TEST TECHNIQUE: _____ SUB-STEP _____

TEST DESCRIPTION: Power Profile 35V Turn ON
Power supply #1 Picture Mode

DATA STORAGE NO: _____

DATA REF. NO: _____

DATE: 5/11/82 TIME: _____



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TRACES:

1. Power Supply ON current
at J18 wave generator

2. _____

3. _____

4. _____

SYNC: INTERNAL

HORIZ TIME: 100 μ SEC PT

2 Amps/10mV

NOTE USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENT

POLAROID PRINT DATA CARD

PROC. BK: TP3205-532 REV: _____

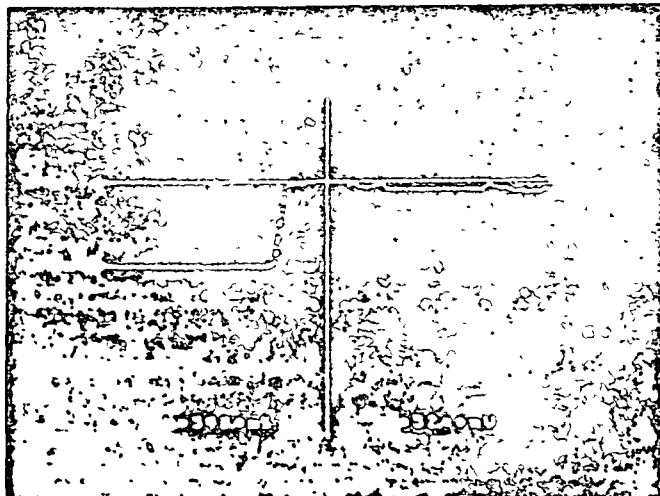
TEST TECHNIQUE _____ SUB-STEP _____

TEST DESCRIPTION: Power Profile Pic. Mode 35V
Power Supply #1 Turn ON

DATA STORAGE NO: _____

DATA REF. NO: _____

DATE: _____ TIME: _____



TRACES

1. Power Supply 1 current at
J18 wave generator

2. _____

3. _____

4. _____

SYNC: _____

HORIZ TIME 2ms/PT

2 Amps/10mV

POLAROID PRINT DATA CARD

PROC. BK: TP92015-532 REV: _____

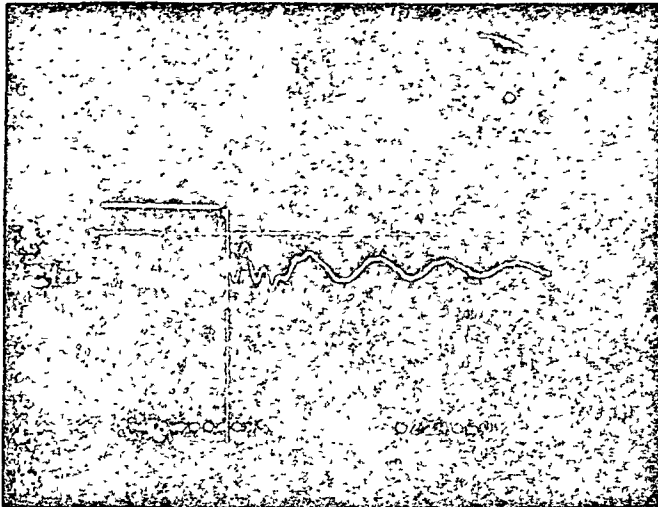
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP _____

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Pic. Mode 35V
Power Supply 72 Turn OFF

DATE: 5/1/72 TIME: _____



TRACES:

1. Power Supply 1 current at
518 measurement

2. _____

3. _____

4. _____

SYNC: _____

HORIZ TIME: 200 nsec / PT

2 Amps / 10 mV

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK. TP92015-532 REV: _____

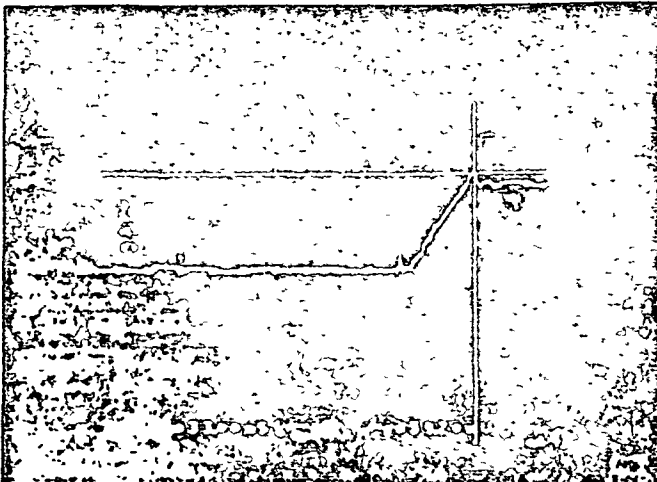
DATA STORAGE NO: _____

TEST TECHNIQUE. _____ SUB-STEP _____

DATA REF. NO: _____

TEST DESCRIPTION. Power Profile Pic. Mode 35V
Power Supply 1 Turn Off

DATE: _____ TIME: _____



TRACES:

1. Power Supply 1 current at
518 measurement

2. _____

3. _____

4. _____

SYNC: _____

HORIZ TIME: 50 nsec / PT

2 AMPS / 10 mV

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

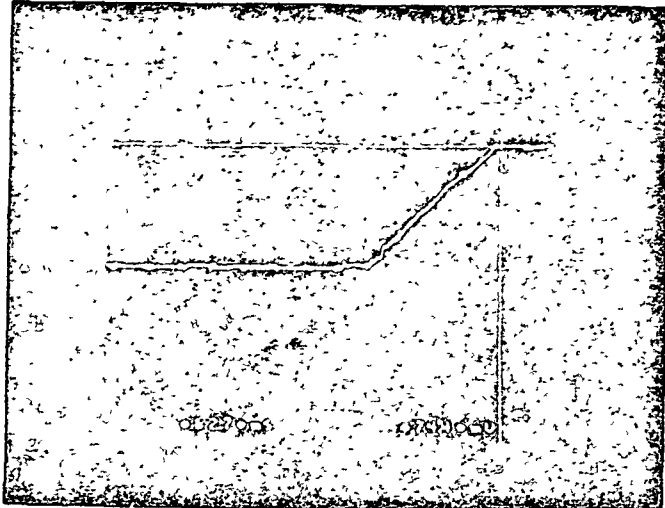
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP _____

DATA REF. NO: _____

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

DATE: _____ TIME: _____



TRACES:

1. P/S 1 current at J1P wear

2. _____

3. _____

4. _____

SYNG: 2 amp/10 mV

HORIZ TIME: 500 us/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

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

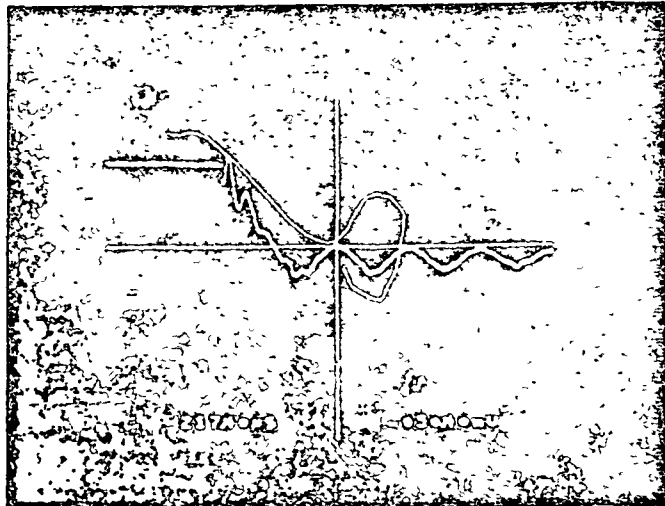
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP _____

DATA REF. NO: _____

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

DATE: _____ TIME: _____



TRACES:

1. P/S 1 current at J1P wear

2. _____

3. _____

4. _____

SYNG: 2 amp/10 mV

HORIZ TIME: 200 ns/PT

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: _____

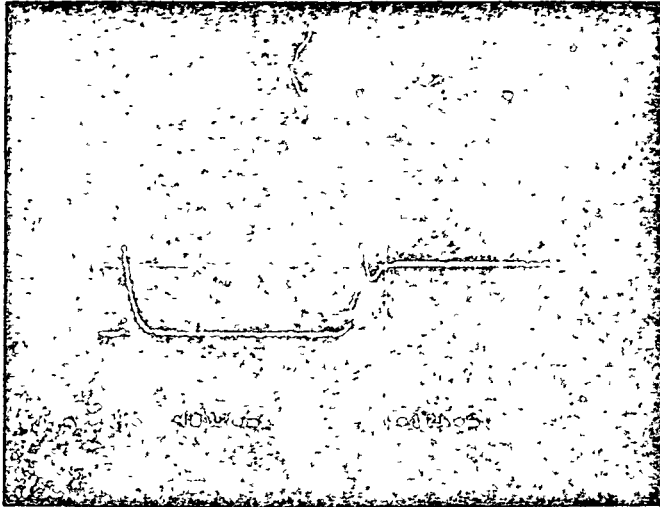
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.11.9

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Outgas Mode 30V
Power Supply #1 Turn ON

DATE: 5/10/82 TIME: _____



TRACES:

1. Power Supply #1 current at
J18 waveform

2. _____

3. _____

4. _____

SYNC 2.0 Amps @ 490 usec

HORIZ. TIME: 3.2 Amps @ 438 usec

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: _____

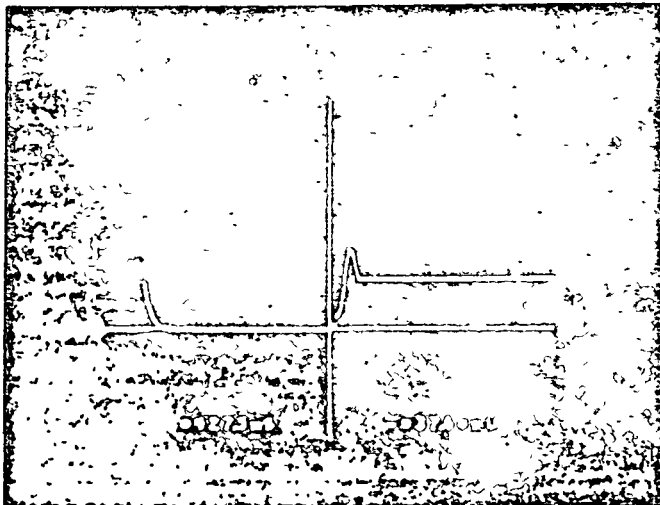
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.11.9

DATA REF. NO: _____

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

DATE: 5/10/82 TIME: _____



TRACES:

1. Power Supply #1 current at
J18 waveform

2. _____

3. _____

4. _____

SYNC Current ~ 3.0A @ 495 usec

HORIZ. TIME PK = 4.72 Amp. @ 473.0

NOTE: USE REVERSE SIDE OF CARD FOR

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

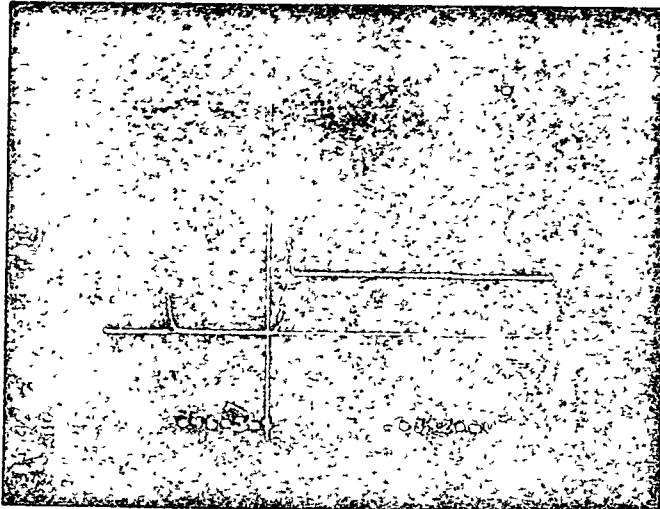
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.1.9

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Outgas mode 23V
Power supply #1 Turn ON

DATE: 5/14/85 TIME: _____



TRACES:

1. Power supply one current
at J18 measures

2. _____

3. _____

4. _____

SYNC: Present = 1.6 Amp @ 5%

HORIZ TIME: PK = 5.9% Amp @ 5%

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENT

ORIGINAL PAGE IS
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POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

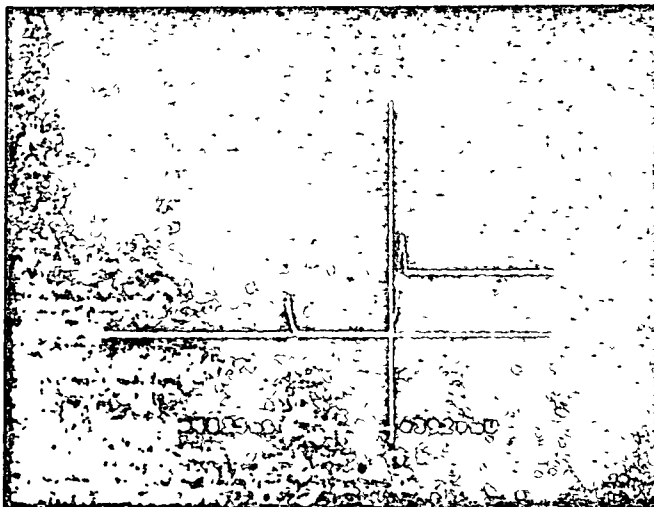
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.1.9

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Outgas mode 23V
Power supply #2 Turn ON

DATE: _____ TIME: _____



TRACES:

1. Power supply 2 current
J18 measures

2. _____

3. _____

4. _____

SYNC: Present = 4.04 Amp @ 5

HORIZ TIME: PK = 6.0% Amp @ 5%

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENT

POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: _____

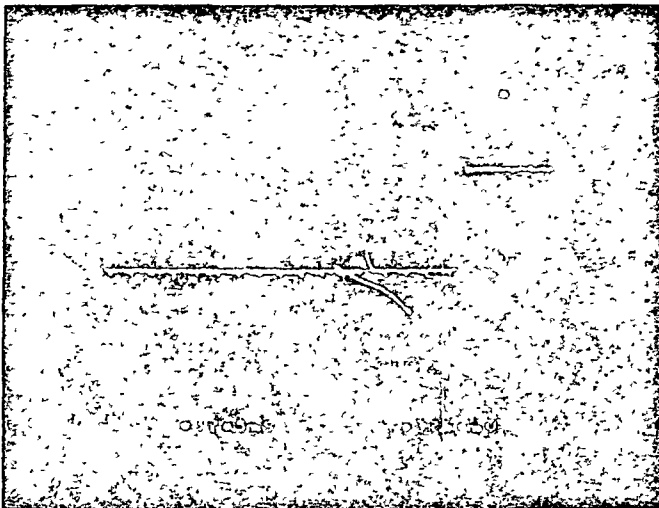
DATA STORAGE NO: _____

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: 5/14/82 TIME: _____



TRACES:

1. Power supply 2 current at
the J18 measure.

2. _____

3. _____

4. _____

AVG: Current 3.14 Amp @ 540m
HORIZ TIME: PK 4.50 amp @ 4.50
4.98

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

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POLAROID PRINT DATA CARD

PROC. BK: TP32015-532 REV: _____

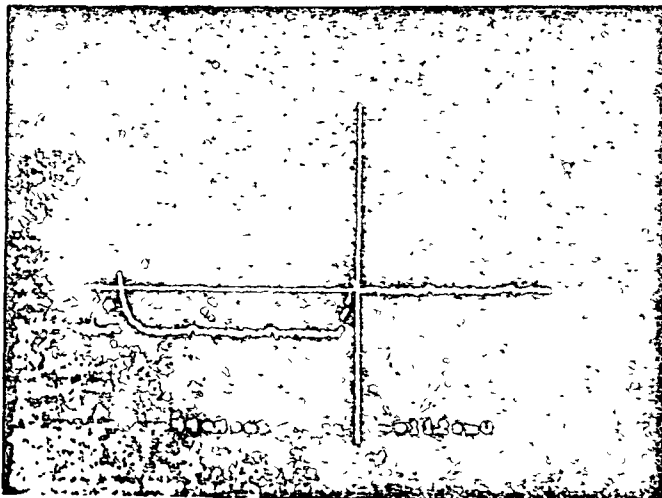
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.11.9

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Outgas mode 35V
Power supply #2 Turn On

DATE: 5-14/82 TIME: _____



TRACES:

1. Power supply 2 current at
J18 measure

2. _____

3. _____

4. _____

AVG: 2.64 amp @ 440m sec
HORIZ TIME: 3.65 amp @ 4.05 msec
PK: 3.92 amp @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENTS

IA07 (II)

POLAROID PRINT DATA CARD

PROC. BK. TP32015-532 REV: _____

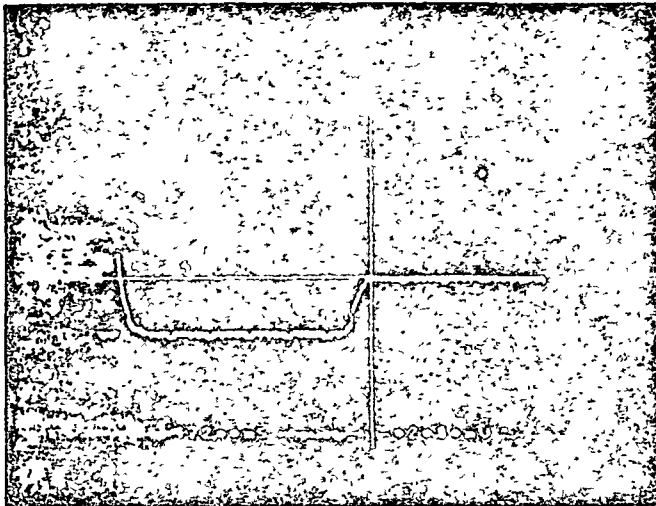
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.12.4

DATA REF. NO: _____

TEST DESCRIPTION: Power Pedals - Interm. Stdy 28V
Power supply #1 Turn ON

DATE: 5/10/62 TIME: _____



TRACES:

1. P/S 2 current at J18
was over.

2. _____

3. _____

4. _____

~~SYNCH~~ Quiescent = 1.66A @ 472 mV

~~HORIZ TIME~~ PK = 3.76A @ 0 mV

NOTE: USE REVERSE SIDE OF CARD FOR ADDITIONAL ENGINEERING COMMENT

ORIGINAL PAGE IS OF POOR QUALITY

POLAROID PRINT DATA CARD

PROC. BK. TP32015-532 REV: _____

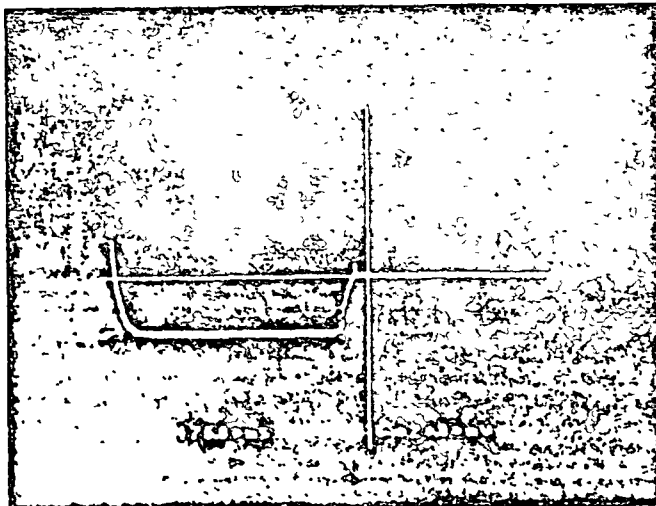
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.12.4

DATA REF. NO: _____

TEST DESCRIPTION: Power Pedals - Interm. Stdy 28V
Power supply #2 Turn ON

DATE: 5/10/62 TIME: _____



TRACES:

1. P/S 2 current at J18
was over.

2. _____

3. _____

4. _____

~~SYNCH~~ Quiescent = 1.76A @ 459 mV

~~HORIZ TIME~~ PK = 2.0A @ 453 mV

PK = 2.84 @ 0 mV

POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

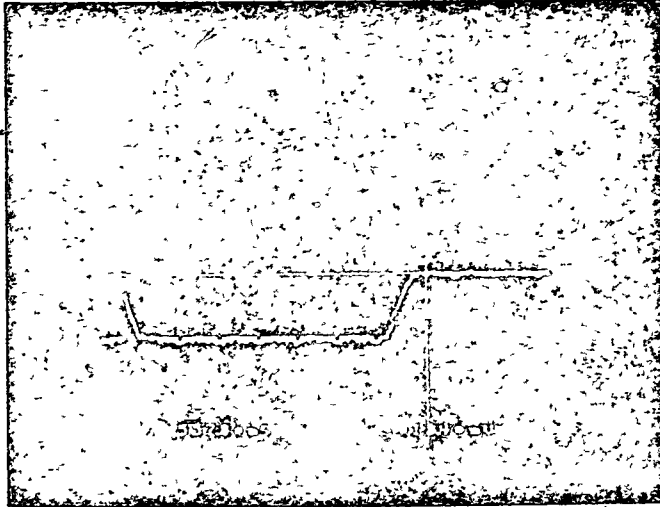
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.12.4

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Interm. Study 23V
Power supply #1 Turn ON

DATE: 5/10/82 TIME: _____



TRACES:

1. Power supply 1 current
J18 measure

2. _____

3. _____

4. _____

Quiescent
Current 1.994 @ 530 msec

HORIZ TIME PK = 2.08 amp @ 535

PK = 1.994 @ 530 msec

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENT

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POLAROID PRINT DATA CARD

PROC. BK: TP 32015-532 REV: _____

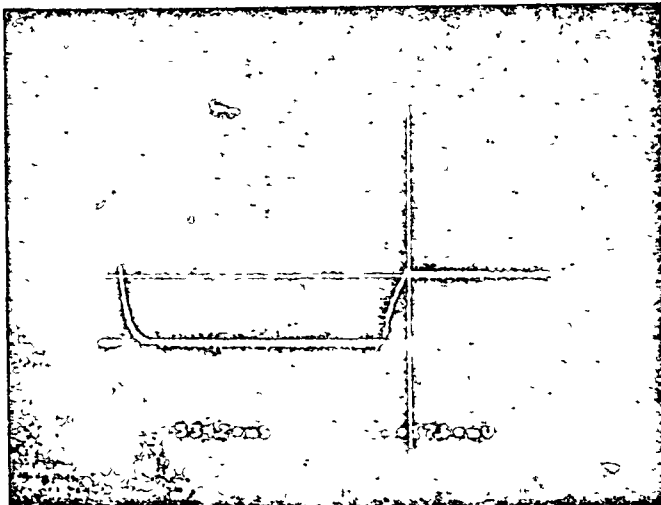
DATA STORAGE NO: _____

TEST TECHNIQUE: _____ SUB-STEP 5.2.11.12.4

DATA REF. NO: _____

TEST DESCRIPTION: Power Profile Interm. Study 23V
Power supply #2 Turn ON

DATE: 5/10/82 TIME: _____



TRACES:

1. P/S 2 current at J18
measure

2. _____

3. _____

4. _____

Quiescent
Current 2.0 amp @ 552 msec

HORIZ TIME PK = 2.16 amp @ 52

PK = 2.40 amp @ 0 msec

NOTE: USE REVERSE SIDE OF CARD FOR
ADDITIONAL ENGINEERING COMMENT

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

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16-SEP-92

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).

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16-SEP-82

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

MINOR FRAME	WORD 6 (B 1 SENSOR 1)	LEVEL	WORD 97 (B 2 SENSOR 16)	LEVEL	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.

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16-EE-32

TABLE 1
FLIGHT ONBOARD CALIBRATOR DATA
13 APRIL 1981

TEMPERATURE	SPECIFIED RADIANCE		BAND 1		BAND 2		BAND 3		BAND 4		BAND 5		BAND 6	
	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS	FWD LEVELS	REVERSE LEVELS
1	1.2	1.2	1.15	1.20	1.22	1.23	1.25	1.23	1.20	1.18	1.15	1.12	1.10	1.08
2	1.79	1.79	1.68	1.80	1.84	1.86	1.91	1.88	1.82	1.75	1.68	1.62	1.58	1.55
3	2.3	2.3	2.14	2.30	2.36	2.39	2.44	2.41	2.32	2.22	2.12	2.05	1.98	1.92
4	2.9	2.9	2.63	2.80	2.86	2.89	2.94	2.91	2.80	2.68	2.58	2.50	2.42	2.35
5	3.5	3.5	3.15	3.30	3.36	3.39	3.44	3.41	3.28	3.14	3.02	2.92	2.82	2.75
6	4.1	4.1	3.64	3.80	3.86	3.89	3.94	3.91	3.76	3.60	3.46	3.34	3.24	3.15
7	4.7	4.7	4.14	4.30	4.36	4.39	4.44	4.41	4.24	4.06	3.90	3.76	3.64	3.55
8	5.3	5.3	4.63	4.80	4.86	4.89	4.94	4.91	4.72	4.52	4.36	4.20	4.08	3.98

NOTE: Cold focal plane temperature was 175 deg C.
Bands 3 and 7 readings are from a collection
of 3 scans the average for Forward &
Reverse scans.

HS236-8129

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16-SEP-82

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).

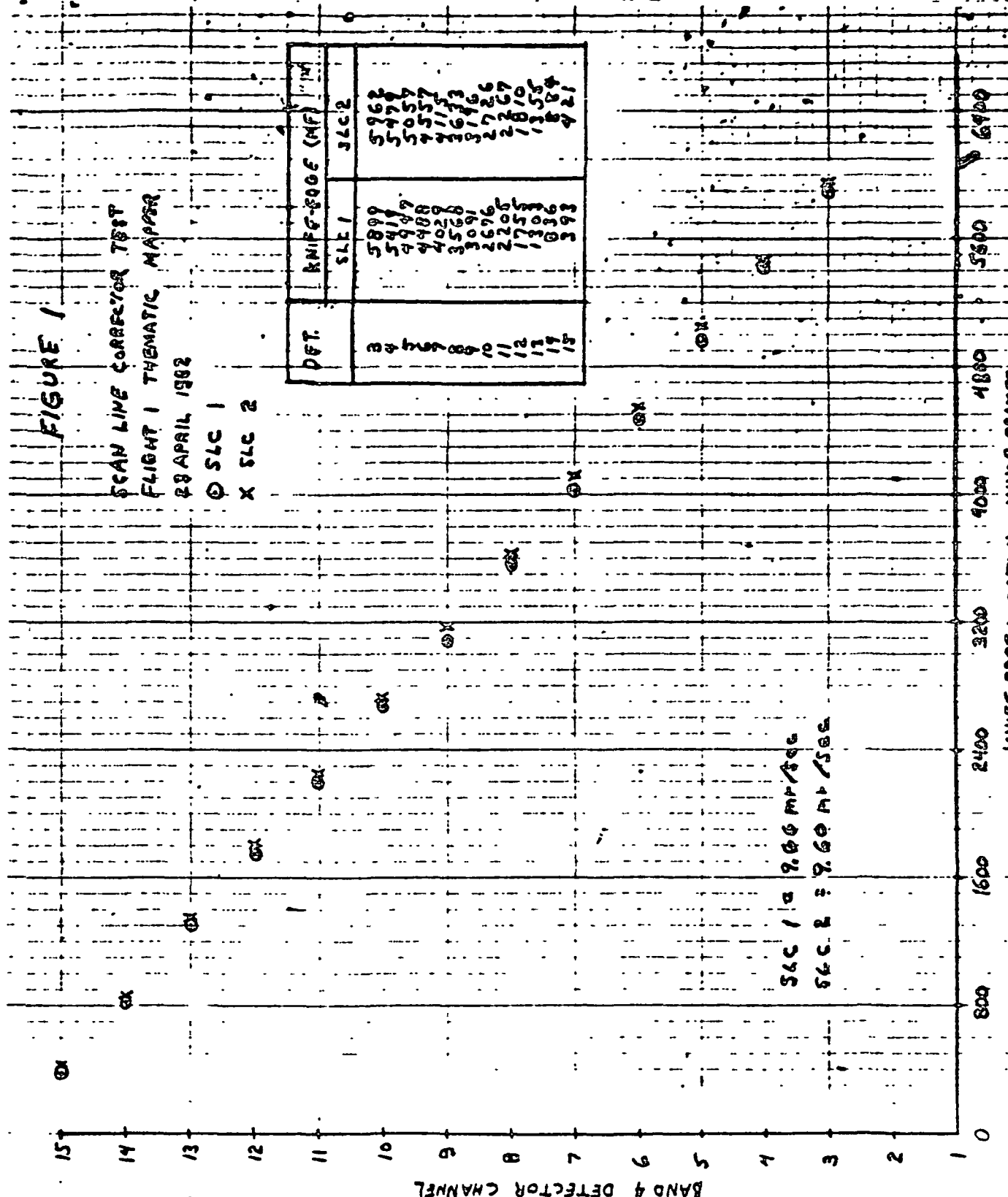
FIGURE 1

SCAN LINE CORRECTOR TEST
 FLIGHT 1 THEMATIC MAPPER

28 APRIL 1982

⊙ SLC 1

X SLC 2



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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
A Subsidiary of Hughes Aircraft Company
INTERNAL MEMORANDUM

CDMO DATA CENTER
DO NOT REMOVE

TO: J. Engel CC: J. Barker (GSFC) DATE: 8-9-82
 O. Weinstein REF: SED 166
 HS236-8101

SUBJECT: TM ACO2R Test Result Summary, FROM: J. Lansing
 J. Walker
 BLDQ: 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 ACO2R.
2. [322, 5]A02A1.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 [322, 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]AC02AL00.L00, [322, 1] TLML00.L00 (for D & E collects)
12. [322, 1]AC02SFLO0.L00. 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]INDEXSF.IVF and [322, 5]INDEXSF.RED (July 13, 82) Backup mode OBC Calibration.
15. [322, 5]INDEX0.IVF and [322, 5]INDEX0.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]GSM LISDB.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/cm²-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	11.0033	78.1966	144.4557
3	17.0490	8.2579	10.6681	11.0098	78.6530	145.6574
4	16.8054	8.249	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	144.5238
7	17.0214	8.2507	10.5133	11.0399	78.1153	146.0927
8	16.8433	8.3392	10.6861	11.1361	79.5489	145.6728
9	16.8933	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	1.8667	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

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

SIGNAL NOISE

INDEX G
SIGNAL TO NOISE RATIO

BAND/ CHANNEL	CALCULATED VALUES		SPEC VALUES		CHANNELS OUT OF SPEC		CALCULATED VALUES		CALCULATED VALUES	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
1/1	59.811	142.656	32	85			69.992	243.777	1.170	1.709
1/2	59.416	145.692	32	85			69.354	242.501	1.167	1.665
1/3	59.921	142.617	32	85			70.108	245.360	1.170	1.718
1/4	54.690	133.302	32	85			69.113	241.874	1.014	1.614
1/5	64.523	143.339	32	85			70.259	246.197	1.089	1.718
1/6	59.767	142.827	32	85			69.107	241.587	1.156	1.691
1/7	65.210	151.104	32	85			69.881	244.892	1.072	1.621
1/8	56.546	136.217	32	85			69.421	242.575	1.228	1.781
1/9	63.100	148.984	32	85			69.263	242.945	1.094	1.631
1/10	61.641	147.096	32	85			69.626	243.920	1.130	1.658
1/11	61.175	144.124	32	85			69.591	244.310	1.138	1.695
1/12	59.707	143.461	32	85			69.386	243.199	1.113	1.647
1/13	62.324	147.681	32	85			69.008	241.003	1.255	1.783
1/14	54.987	139.423	32	85			69.230	242.831	1.087	1.657
1/15	63.672	147.011	32	85			69.570	243.859	1.101	1.753
1/16	50.408	130.903	32	85						
2/1	48.274	230.109	35	170			27.299	249.229	0.506	1.061
2/2	48.381	250.185	35	170			26.548	242.430	0.549	0.939
2/3	54.317	245.625	35	170			26.740	242.451	0.493	0.987
2/4	57.023	261.509	35	170			26.484	241.937	0.464	0.925
2/5	55.632	240.866	35	170			26.463	242.218	0.476	0.906
2/6	71.010	267.260	35	170			26.649	241.700	0.375	0.904
2/7	56.426	241.585	35	170			26.441	241.819	0.409	1.001
2/8	68.784	226.299	35	170			26.843	244.611	0.390	1.081
2/9	58.919	243.915	35	170			26.513	241.415	0.450	0.990
2/10	74.551	249.639	35	170			26.655	243.011	0.358	0.973
2/11	62.196	229.926	35	170			26.864	243.836	0.432	1.009
2/12	76.375	218.234	35	170			26.759	244.666	0.350	1.110
2/13	54.699	212.340	35	170			26.604	243.062	0.486	1.143
2/14	62.422	239.335	35	170			26.522	242.032	0.425	1.011
2/15	38.375	209.709	35	170			26.753	244.320	0.458	1.199
2/16	48.621	194.784	35	170			26.283	240.461	0.541	1.234
3/1	43.126	213.808	26	143			26.649	242.195	0.595	1.133
3/2	49.299	239.205	26	143			25.431	244.588	0.516	1.221
3/3	42.401	201.831	26	143			25.222	242.731	0.595	1.199
3/4	43.235	212.961	26	143			25.132	243.371	0.581	1.141
3/5	43.699	203.180	26	143			25.075	241.302	0.574	1.188
3/6	45.108	219.653	26	143			24.897	240.328	0.552	1.125
3/7	45.124	238.690	26	143			24.815	238.538	0.650	0.999
3/8	52.015	215.031	26	143			25.145	242.378	0.483	1.171
3/9	41.090	208.138	26	143			25.040	239.589	0.609	1.151
3/10	49.029	212.120	26	143			25.104	242.078	0.512	1.141
3/11	47.833	221.033	26	143			24.950	239.567	0.522	1.079
3/12	48.449	210.429	26	143			25.173	243.081	0.520	1.155
3/13	44.723	205.893	26	143			24.944	240.550	0.568	1.169
3/14	51.027	221.417	26	143			25.215	243.219	0.494	1.029
3/15	42.750	201.215	26	143			25.111	242.001	0.537	1.203
3/16			26	143			25.321	244.028	0.539	1.099

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Table 3 IM FI Signal to-noise ratio, signal (cts), and noise (cts) at the radiance levels. (cont.)

SIGNAL NOISE

BAND/ CHANNEL	CALCULATED VALUES		CALCULATED VALUES	
	LOW	HIGH	LOW	HIGH
4/ 1	17.8771	241.4081	0.3961	0.6401
4/ 2	17.0141	239.5311	0.3711	0.8101
4/ 3	17.2891	238.3241	0.4081	0.8491
4/ 4	16.8481	236.6241	0.2871	0.8491
4/ 5	17.0391	239.0391	0.3221	0.8611
4/ 6	17.5211	243.9131	0.3711	0.7941
4/ 7	17.5451	239.3051	0.4201	0.8691
4/ 8	17.2401	240.7741	0.4181	0.7481
4/ 9	17.0801	236.7291	0.3301	0.7371
4/10	17.1451	241.3661	0.4451	0.6981
4/11	17.2951	239.2891	0.4141	0.8331
4/12	16.9681	238.6151	0.3311	0.8401
4/13	17.0081	238.3281	0.3351	0.8591
4/14	17.1401	239.1211	0.3891	0.8201
4/15	17.0801	238.4221	0.3591	0.8581
4/16	17.1401	240.0901	0.4391	0.7871
5/ 1	34.7141	240.6951	0.8961	1.2701
5/ 2	34.0361	237.7871	0.8531	1.2651
5/ 3	34.2741	239.0801	0.9701	1.3951
5/ 4	34.1591	238.0671	0.9751	1.3911
5/ 5	34.2791	239.2541	0.9251	1.3411
5/ 6	34.3381	239.3701	0.8861	1.3211
5/ 7	33.9271	237.2241	1.3391	1.6511
5/ 8	34.8511	242.0901	0.9211	1.2841
5/ 9	34.2901	239.3181	0.9471	1.3811
5/10	34.7011	241.4281	1.2031	1.5771
5/11	34.4991	241.0981	0.8951	1.2821
5/12	34.5001	240.8761	1.0461	1.4191
5/13	34.2231	239.3691	0.9541	1.3091
5/14	34.2731	238.1511	0.9761	1.3091
5/15	34.2121	239.2011	0.9171	1.3301
5/16	34.0861	240.3821	0.9001	1.3161
7/ 1	28.1591	235.3941	0.9081	1.2871
7/ 2	27.5411	232.9321	0.9711	1.2841
7/ 3	27.8101	234.8791	0.9331	1.2811
7/ 4	27.6751	233.9711	0.9701	1.2921
7/ 5	27.9001	236.6641	0.8811	1.2481
7/ 6	27.5891	233.0731	0.9991	1.3161
7/ 7	27.7561	235.4631	0.9321	1.3171
7/ 8	27.8131	234.9141	1.0931	1.2771
7/ 9	27.6231	234.6261	0.9851	1.3931
7/10	27.6591	234.3211	1.0711	1.3671
7/11	27.0931	236.3751	1.0081	1.3131
7/12	27.6901	235.3721	1.0941	1.3471
7/13	27.3751	233.1161	0.9181	1.2331
7/14	27.8941	235.4401	1.0681	1.3711
7/15	27.6531	235.0181	0.9401	1.2701
7/16	27.7631	234.5481	1.0041	1.2301

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INDEX C
SIGNAL TO NOISE RATIO

BAND/ CHANNEL	CALCULATED VALUES		SPEC VALUES		CHANNELS OUT OF SPEC	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
4/ 1	45.0891	390.7711	32	240		
4/ 2	45.8581	292.8001	32	240		
4/ 3	42.3641	280.5621	32	240		
4/ 4	59.7491	278.6661	32	240		
4/ 5	52.8651	277.6811	32	240		
4/ 6	47.2311	307.1871	32	240		
4/ 7	41.7411	279.4221	32	240		
4/ 8	41.2711	321.8231	32	240		
4/ 9	51.7351	321.0581	32	240		
4/10	18.5151	345.6901	32	240		
4/11	41.7541	287.1931	32	240		
4/12	50.7021	284.0031	32	240		
4/13	50.7611	277.6691	32	240		
4/14	49.1071	291.1521	32	240		
4/15	47.4851	270.7491	32	240		
4/16	39.0761	304.9081	32	240		
5/ 1	39.1831	189.4831	13	75		
5/ 2	39.9621	187.9281	13	75		
5/ 3	35.3441	171.3951	13	75		
5/ 4	35.0211	171.1191	13	75		
5/ 5	37.0051	170.4531	13	75		
5/ 6	39.7721	181.0171	13	75		
5/ 7	25.3611	143.5601	13	75		
5/ 8	37.8211	189.5691	13	75		
5/ 9	36.2241	173.2791	13	75		
5/10	28.8541	163.4971	13	75		
5/11	38.5411	188.0941	13	75		
5/12	33.0011	169.7191	13	75		
5/13	35.9001	172.6461	13	75		
5/14	37.0771	182.0981	13	75		
5/15	37.3131	178.0861	13	75		
5/16	36.3081	182.6761	13	75		
7/ 1	31.2401	182.8651	5	45		
7/ 2	28.3561	181.3671	5	45		
7/ 3	28.8131	182.9271	5	45		
7/ 4	28.5331	181.1211	5	45		
7/ 5	31.6701	189.4151	5	45		
7/ 6	27.6241	177.1101	5	45		
7/ 7	28.7891	178.7361	5	45		
7/ 8	25.1361	170.4581	5	45		
7/ 9	28.0401	181.5001	6	45		
7/10	25.8341	171.3971	5	45		
7/11	27.7531	179.2901	5	45		
7/12	27.3191	174.7961	5	45		
7/13	28.8121	189.1241	5	45		
7/14	26.1291	174.3301	5	45		
7/15	29.4181	185.0681	5	45		
7/16	27.6461	189.3171	5	45		

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	0.846	0.080	0.108
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	1.059	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	1.943	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	0.783	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	0.870	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	1.279	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	0.738	1.489	0.116	0.118
10	0.550	1.069	0.729	1.463	0.116	0.128
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	1.280	0.741	1.483	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	1.065	0.734	1.472	0.119	0.130

RADIANCE	LEVEL	5				
1	0.933	2.176	1.252	2.436	0.190	0.233
2	0.953	1.931	1.196	2.275	0.196	0.242
3	0.955	2.177	1.259	2.493	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	0.154
2	0.663	1.331	0.806	1.417	0.121	0.165
3	0.689	1.454	0.863	1.603	0.110	0.155
4	0.673	1.344	0.807	1.425	0.119	0.161
5	0.688	1.451	0.866	1.608	0.109	0.154
6	0.673	1.351	0.804	1.389	0.119	0.167
7	0.683	1.457	0.865	1.610	0.109	0.154
8	0.670	1.339	0.801	1.425	0.119	0.161
9	0.683	1.454	0.862	1.612	0.108	0.153
10	0.672	1.341	0.803	1.415	0.119	0.160
11	0.693	1.454	0.862	1.605	0.108	0.152
12	0.666	1.350	0.805	1.424	0.118	0.164
13	0.687	1.464	0.864	1.613	0.109	0.154
14	0.668	1.337	0.805	1.426	0.119	0.164
15	0.702	1.457	0.861	1.607	0.111	0.153
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	0.044
2	0.224	0.458	0.339	0.599	0.018	0.057
3	0.257	0.548	0.340	0.569	0.010	0.044
4	0.227	0.463	0.340	0.501	0.009	0.037
5	0.257	0.547	0.342	0.574	0.010	0.044
6	0.227	0.467	0.335	0.564	0.009	0.037
7	0.254	0.549	0.342	0.571	0.010	0.044
8	0.226	0.463	0.337	0.600	0.009	0.037
9	0.255	0.548	0.342	0.574	0.010	0.044
10	0.226	0.464	0.339	0.595	0.009	0.034
11	0.257	0.547	0.341	0.571	0.010	0.044
12	0.229	0.466	0.340	0.600	0.009	0.034
13	0.257	0.551	0.343	0.575	0.010	0.044
14	0.225	0.464	0.340	0.601	0.009	0.034
15	0.261	0.548	0.342	0.572	0.010	0.044
16	0.223	0.467	0.342	0.600	0.010	0.037

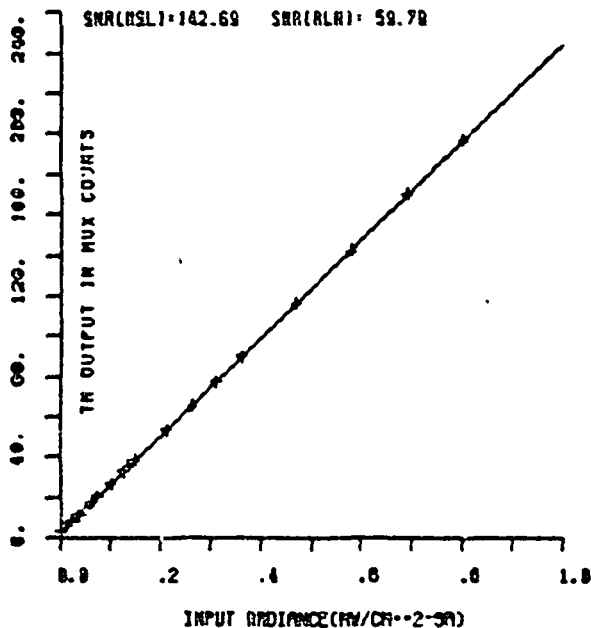
RADIANCE LEVEL 8						
1	0.002	0.001	0.001	0.001	-0.002	-0.001
2	0.002	0.003	0.001	0.002	-0.002	-0.001
3	0.002	0.002	0.001	-0.003	-0.002	-0.001
4	0.002	0.003	0.002	0.002	-0.002	-0.001
5	0.002	0.003	0.001	0.001	-0.002	-0.001
6	0.002	0.001	0.001	-0.002	-0.002	-0.001
7	0.002	0.003	0.001	-0.007	-0.002	-0.001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

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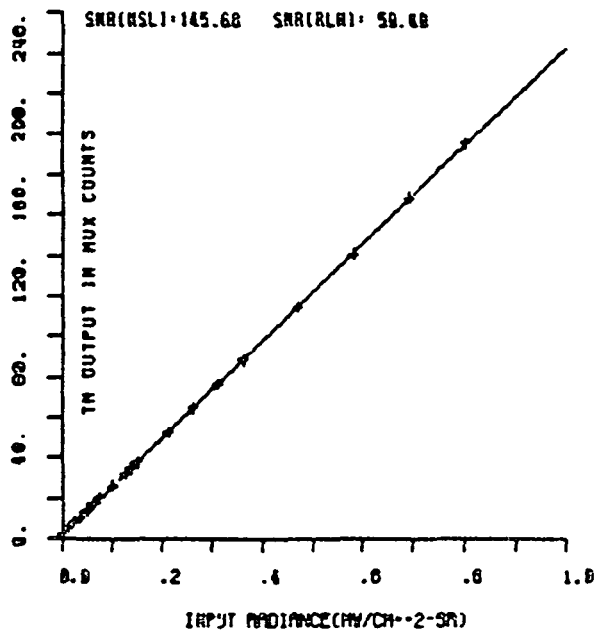
BRND: 1 CHANNEL: 1

GAIN=241.47 OFFSET: 2.95 SIGMA= 0.16
SRR(HSL)=142.69 SRR(LLN)= 59.78



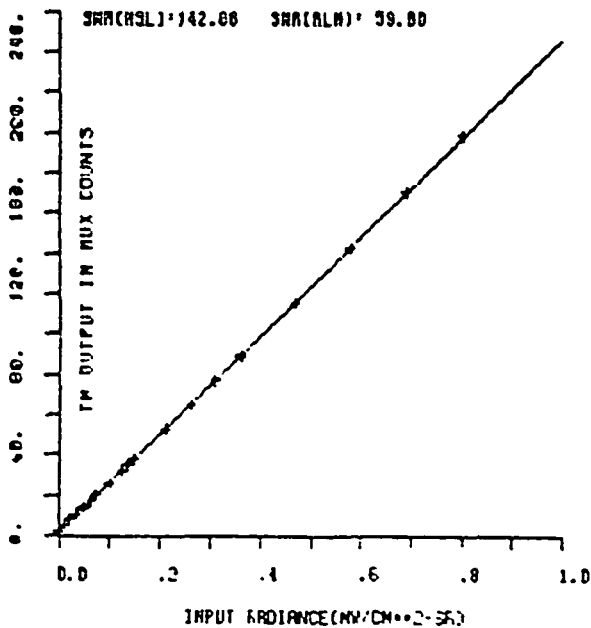
BRND: 1 CHANNEL: 2

GAIN=240.59 OFFSET: 1.97 SIGMA= 0.18
SRR(HSL)=145.68 SRR(LLN)= 59.68



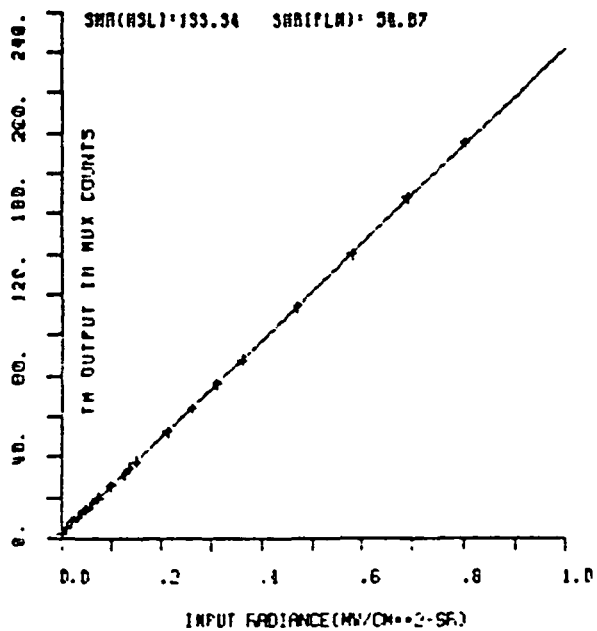
BRND: 1 CHANNEL: 3

GAIN=243.58 OFFSET: 1.89 SIGMA= 0.20
SRR(HSL)=142.88 SRR(LLN)= 59.80



BRND: 1 CHANNEL: 4

GAIN=240.00 OFFSET: 1.67 SIGMA= 0.20
SRR(HSL)=139.34 SRR(LLN)= 58.87

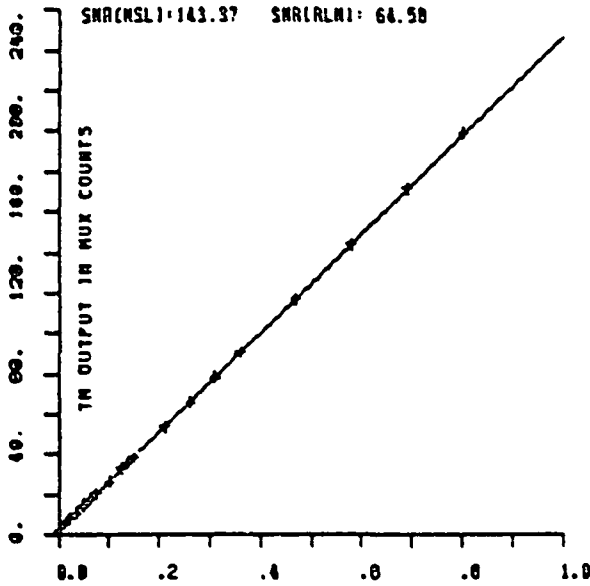


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BAND 1 CHANNEL 5

GAIN=244.47 OFFSET= 1.79 SIGMA= 0.16

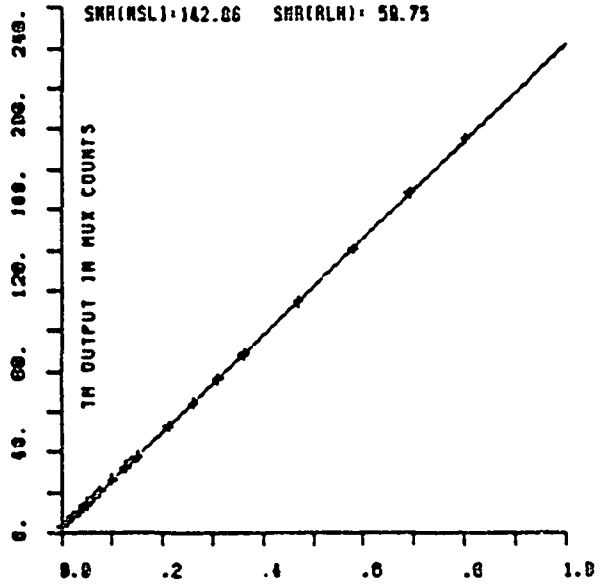
SNR(NSL)=143.37 SNR(RLN)= 64.58



BAND 1 CHANNEL 6

GAIN=239.64 OFFSET= 1.99 SIGMA= 0.20

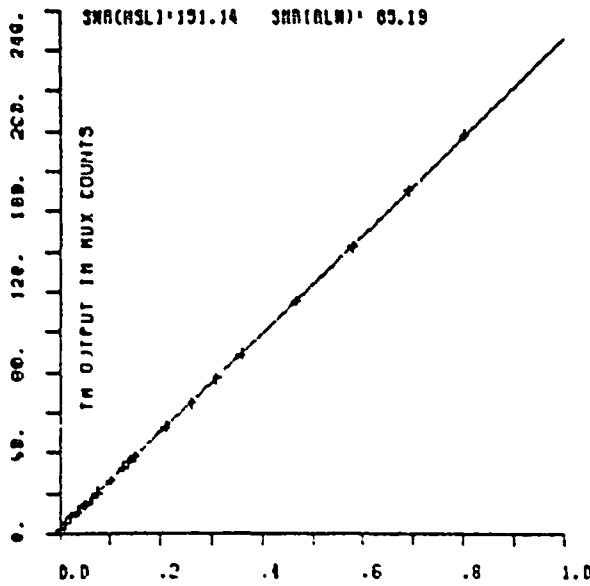
SNR(NSL)=142.66 SNR(RLN)= 58.75



BAND 1 CHANNEL 7

GAIN=243.16 OFFSET= 1.76 SIGMA= 0.15

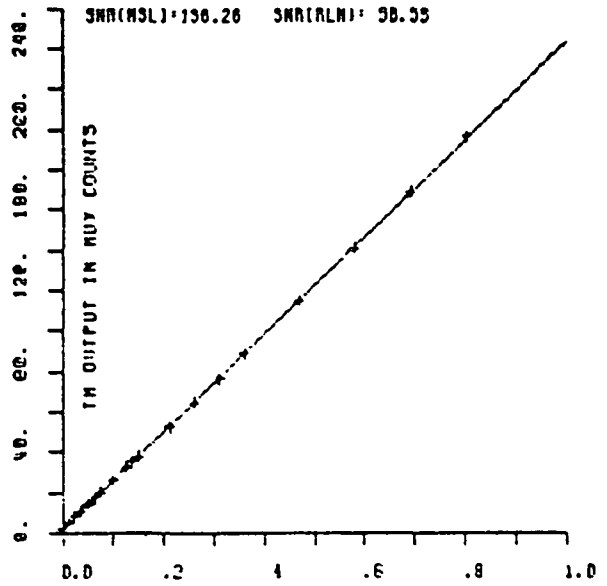
SNR(NSL)=151.14 SNR(RLN)= 65.19



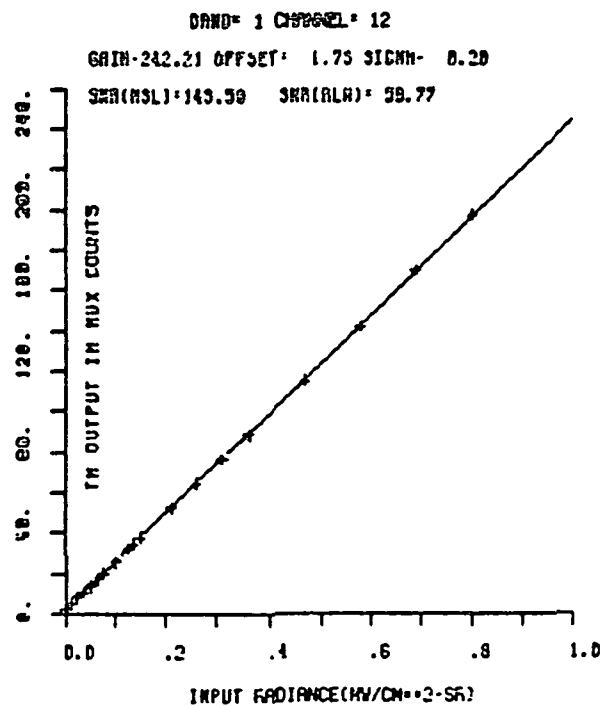
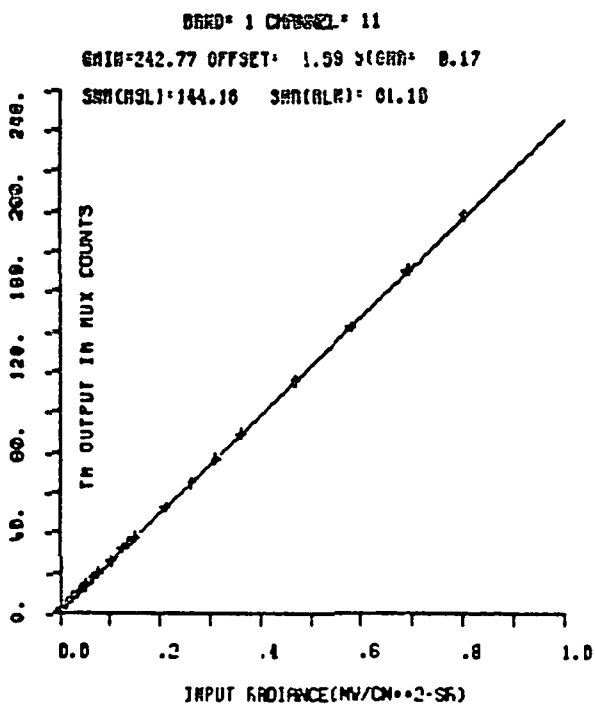
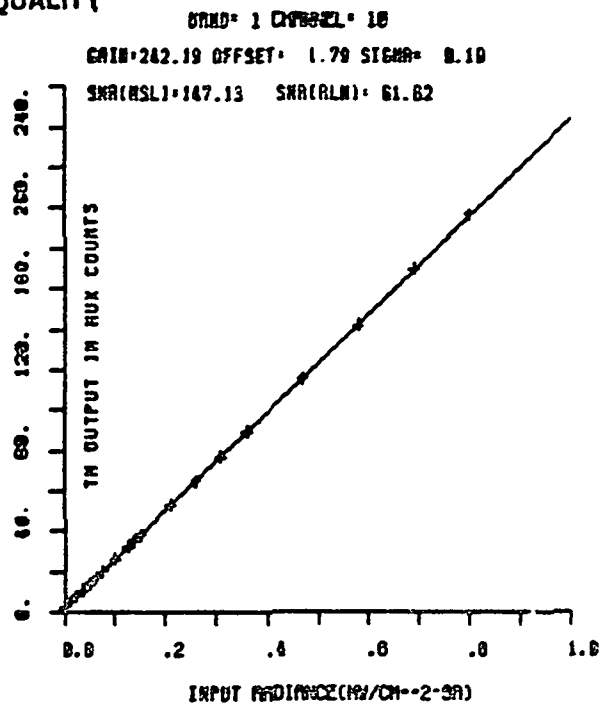
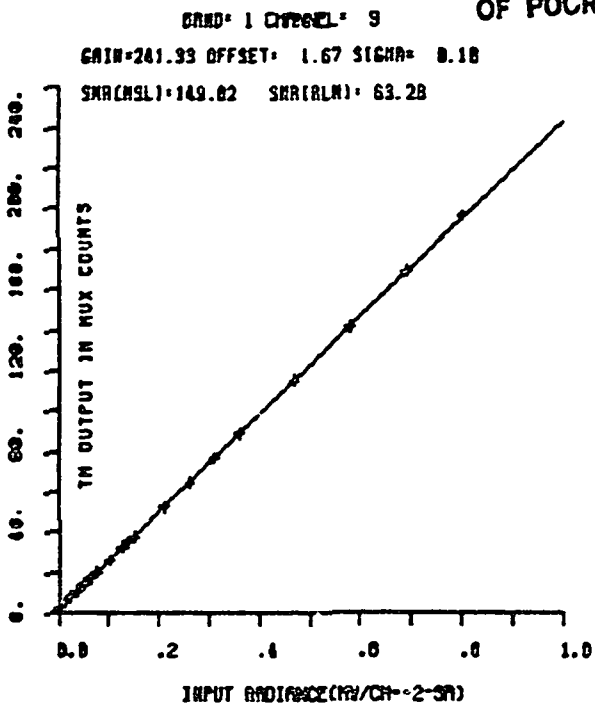
BAND 1 CHANNEL 8

GAIN=246.62 OFFSET= 2.02 SIGMA= 0.19

SNR(NSL)=156.26 SNR(RLN)= 58.55



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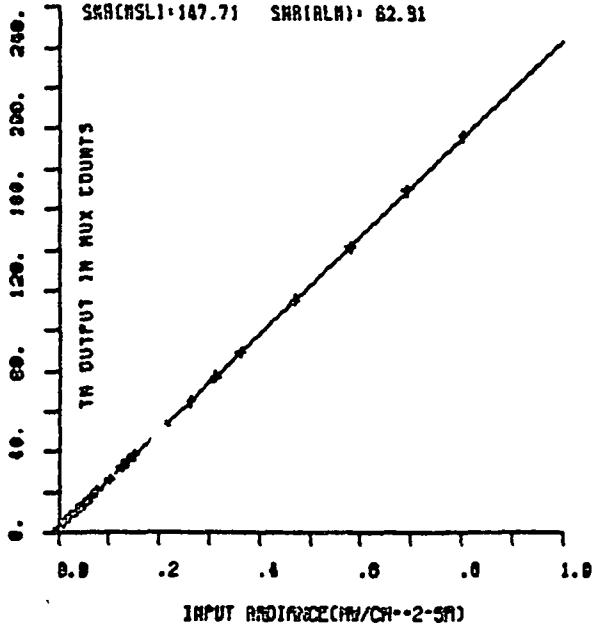


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BAND* 1 CHANNEL* 13

GAIN*241.51 OFFSET* 1.75 SIGMA* 0.17

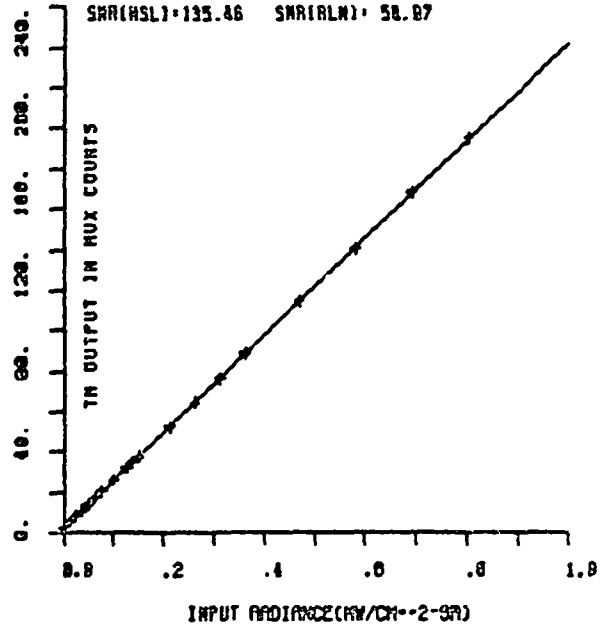
SNR(NSL)*147.71 SNR(RLN)* 62.91



BAND* 1 CHANNEL* 14

GAIN*239.55 OFFSET* 1.91 SIGMA* 0.19

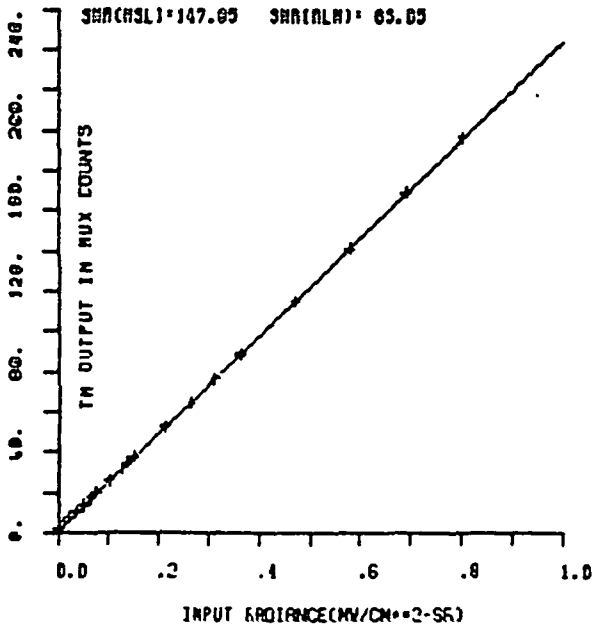
SNR(NSL)*135.46 SNR(RLN)* 58.87



BAND* 1 CHANNEL* 15

GAIN*241.23 OFFSET* 1.86 SIGMA* 0.17

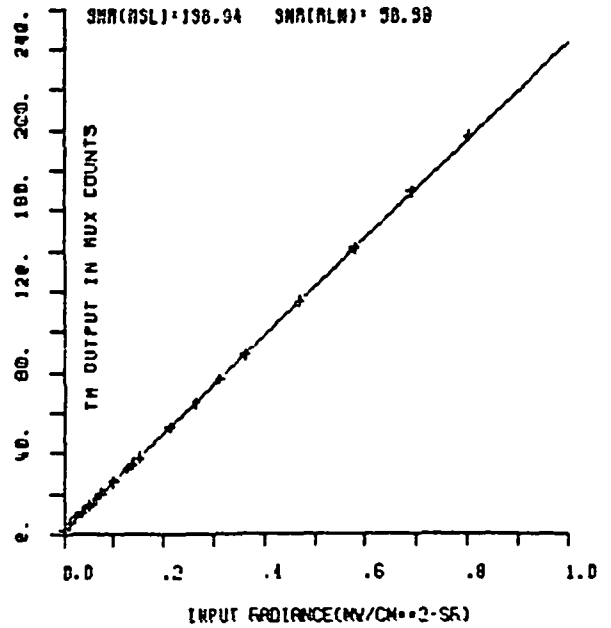
SNR(NSL)*147.85 SNR(RLN)* 63.85



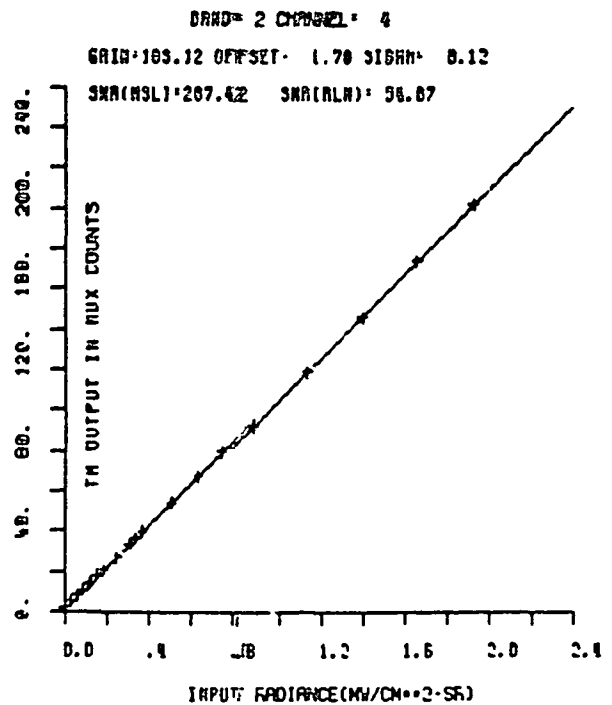
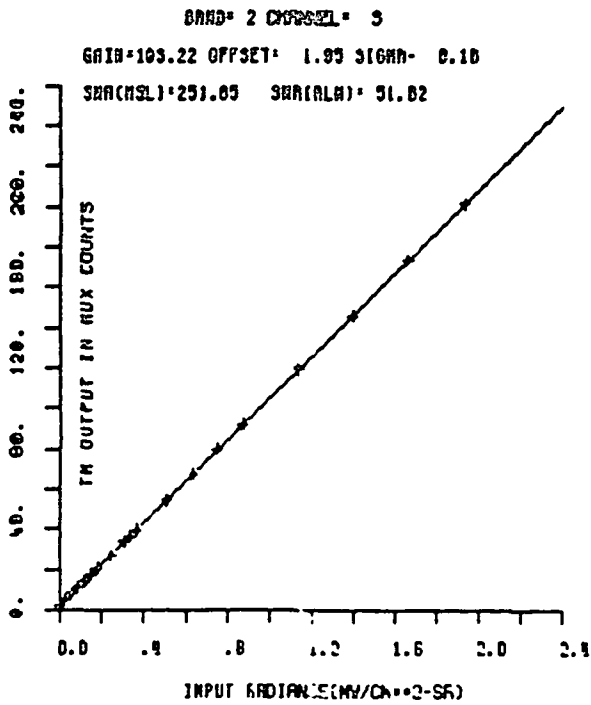
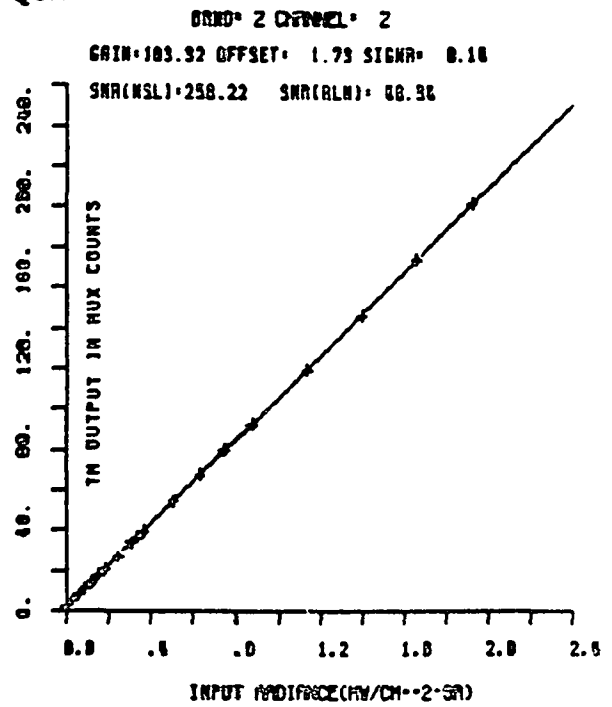
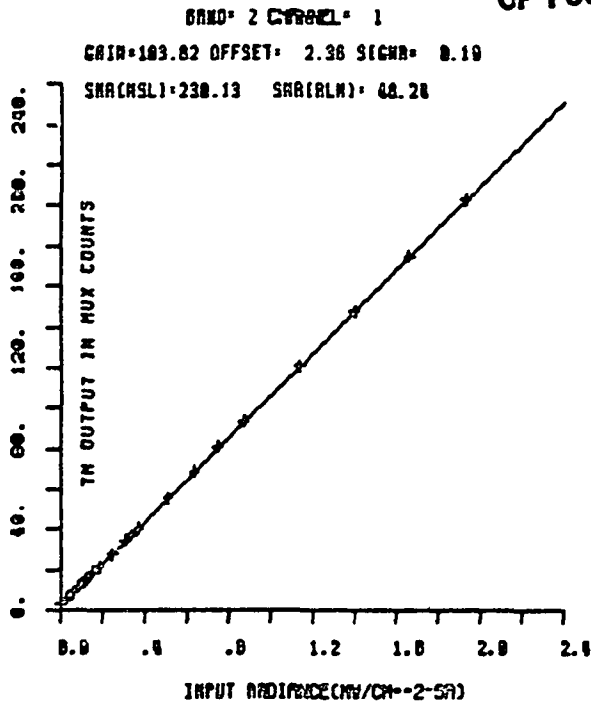
BAND* 1 CHANNEL* 16

GAIN*241.76 OFFSET* 1.86 SIGMA* 0.16

SNR(NSL)*158.94 SNR(RLN)* 58.99



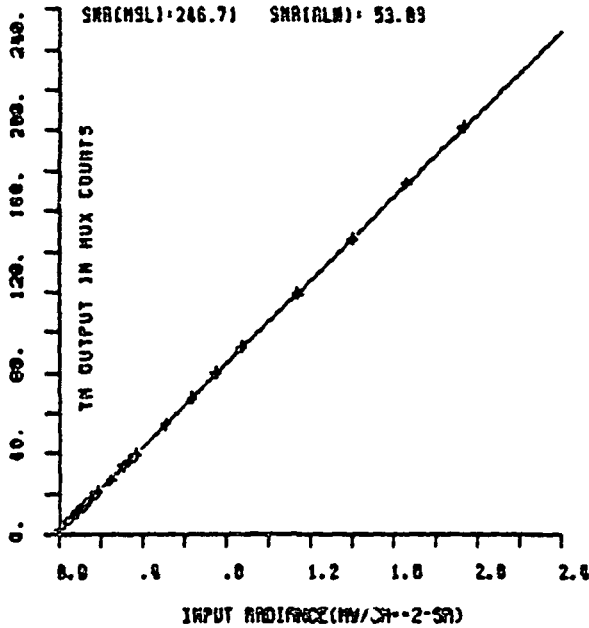
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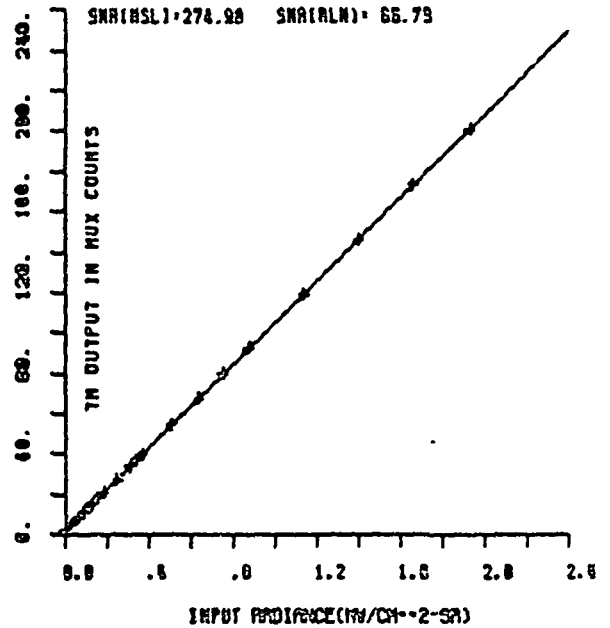
BAND 2 CHANNEL 5

GAIN=103.32 OFFSET= 1.63 SIGMA= 0.18
SRR(NSL)=246.71 SRR(ALN)= 53.89



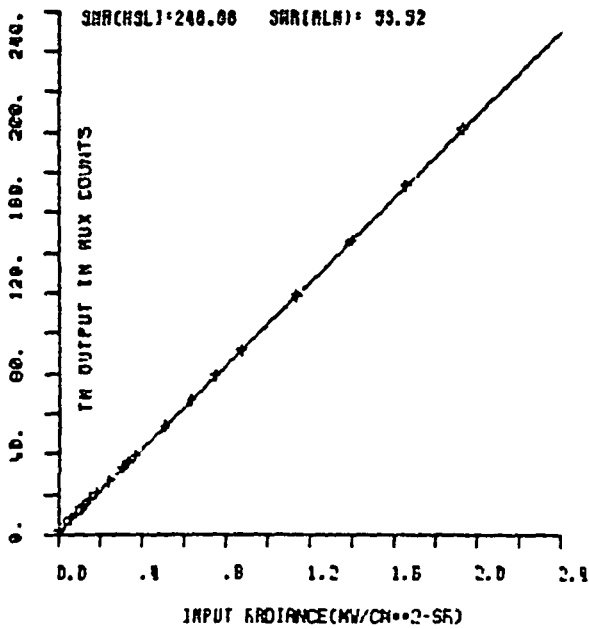
BAND 2 CHANNEL 6

GAIN=102.98 OFFSET= 1.86 SIGMA= 0.17
SRR(NSL)=274.98 SRR(ALN)= 65.79



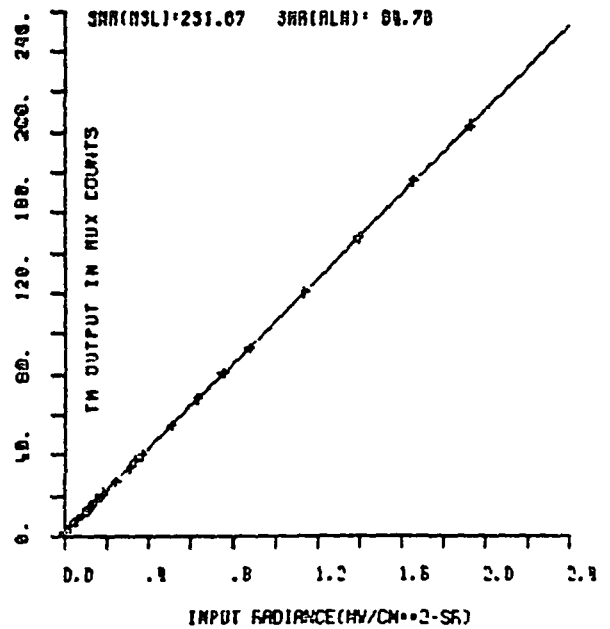
BAND 2 CHANNEL 7

GAIN=103.19 OFFSET= 1.68 SIGMA= 0.18
SRR(NSL)=246.86 SRR(ALN)= 53.92



BAND 2 CHANNEL 8

GAIN=104.24 OFFSET= 1.81 SIGMA= 0.17
SRR(NSL)=251.07 SRR(ALN)= 64.78

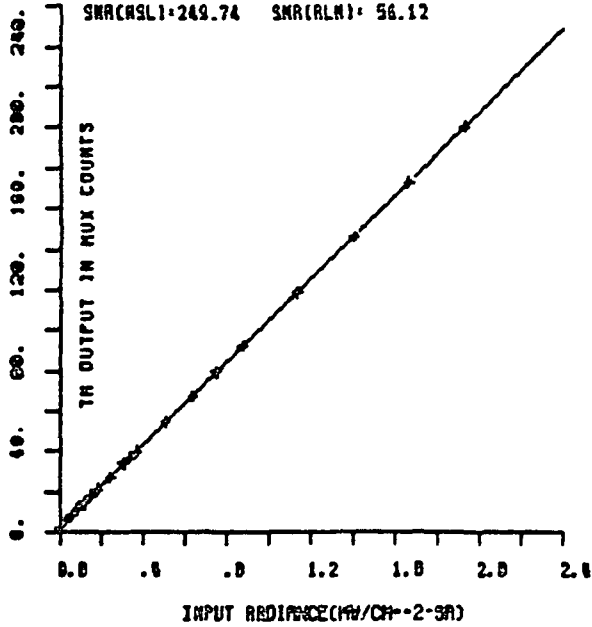


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BAND= 2 CHANNEL= 9

GAIN=102.05 OFFSET= 1.81 SIGMA= 0.12

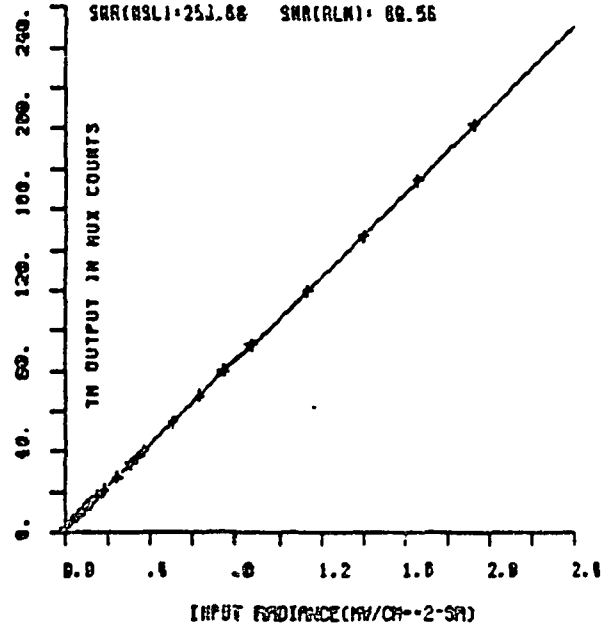
SNR(NSL)=249.74 SNR(ALM)= 56.12



BAND= 2 CHANNEL= 10

GAIN=103.59 OFFSET= 1.79 SIGMA= 0.18

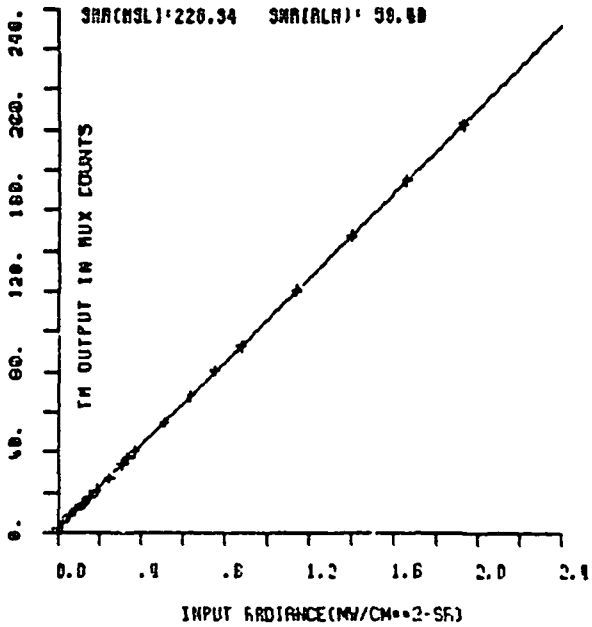
SNR(NSL)=253.68 SNR(ALM)= 60.56



BAND= 2 CHANNEL= 11

GAIN=103.63 OFFSET= 1.93 SIGMA= 0.18

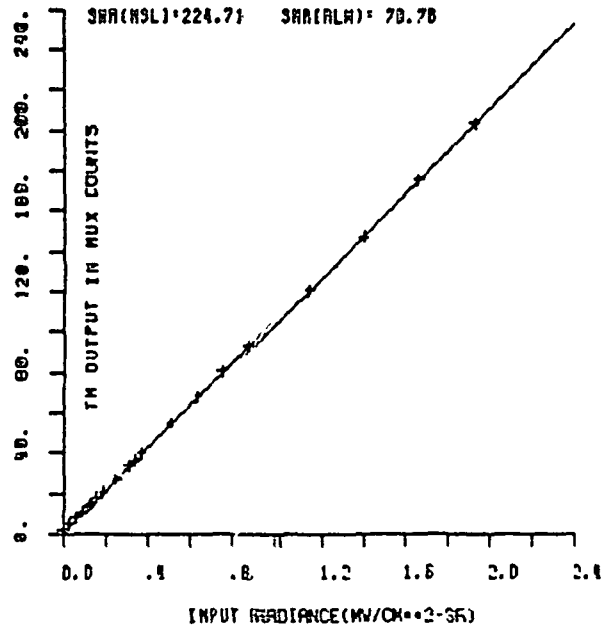
SNR(NSL)=228.34 SNR(ALM)= 59.69



BAND= 2 CHANNEL= 12

GAIN=104.28 OFFSET= 1.79 SIGMA= 0.15

SNR(NSL)=224.71 SNR(ALM)= 70.76

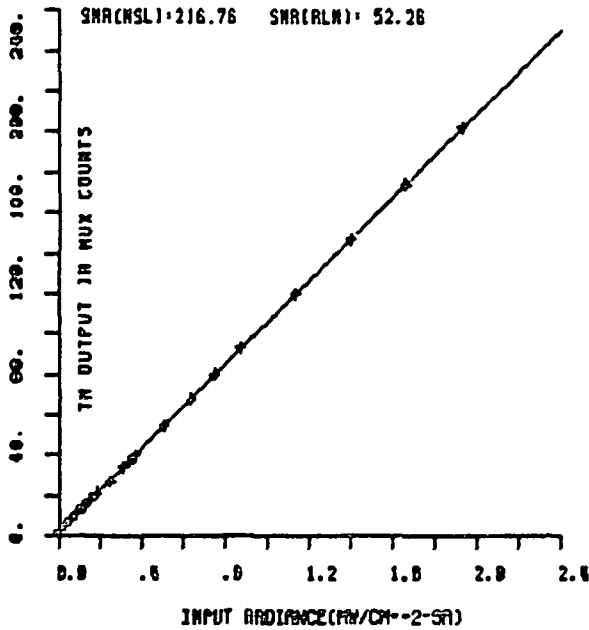


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BAND 2 CHANNEL 13

GAIN=103.60 OFFSET= 1.71 SIGMA= 0.18

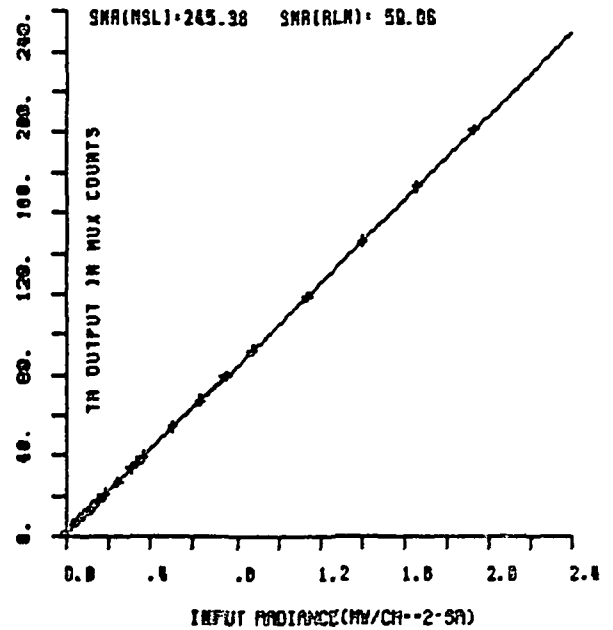
SNR(NSL)=216.76 SNR(ALN)= 52.26



BAND 2 CHANNEL 14

GAIN=103.14 OFFSET= 1.74 SIGMA= 0.19

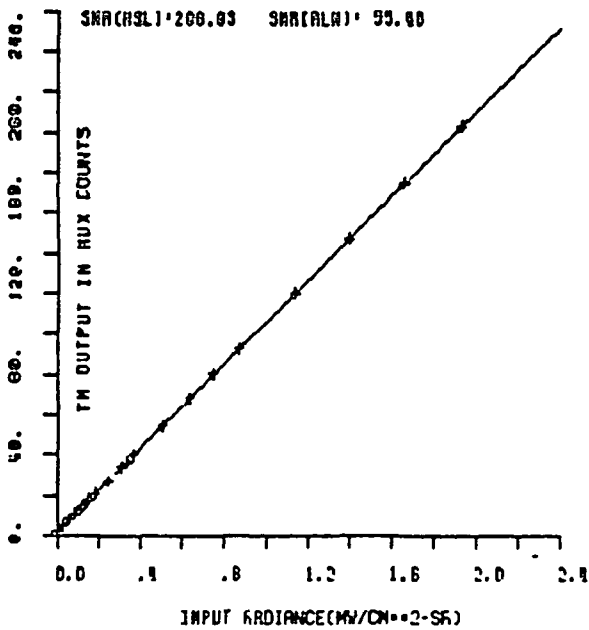
SNR(NSL)=245.38 SNR(ALN)= 50.86



BAND 2 CHANNEL 15

GAIN=104.12 OFFSET= 1.74 SIGMA= 0.15

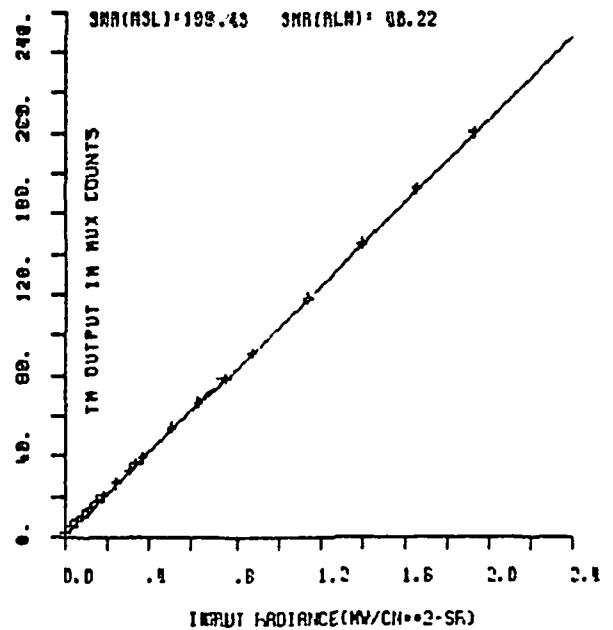
SNR(NSL)=206.83 SNR(ALN)= 55.80



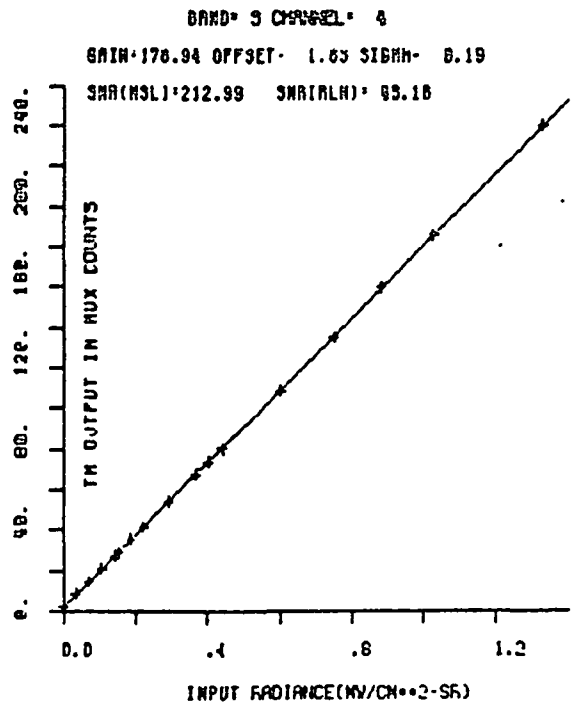
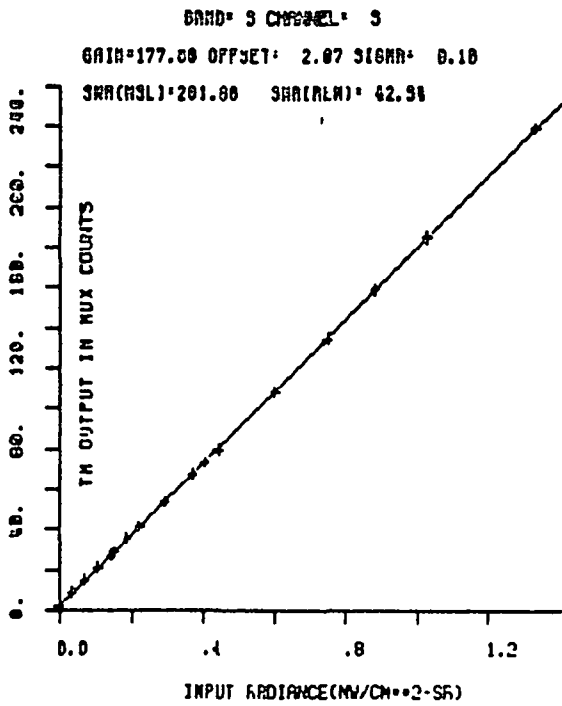
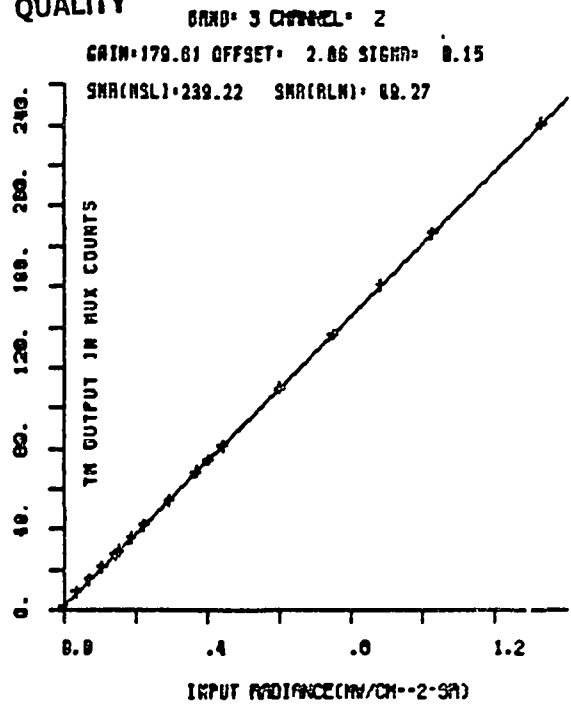
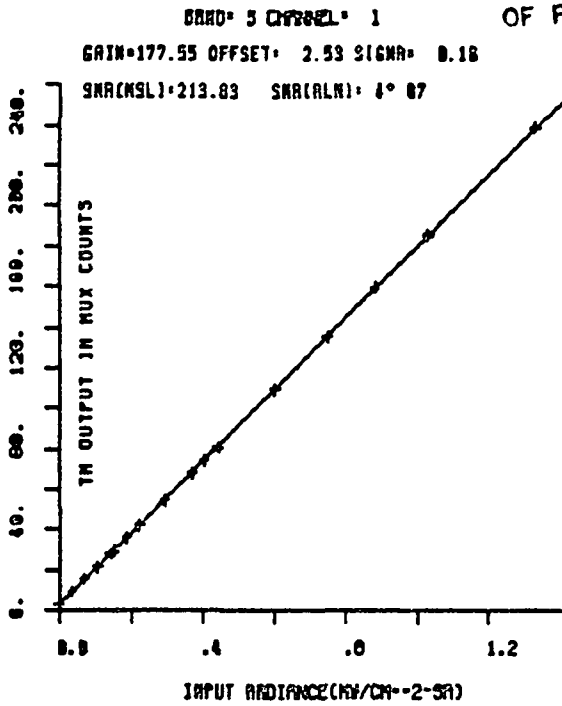
BAND 2 CHANNEL 16

GAIN=102.92 OFFSET= 1.64 SIGMA= 0.15

SNR(NSL)=198.43 SNR(ALN)= 56.22



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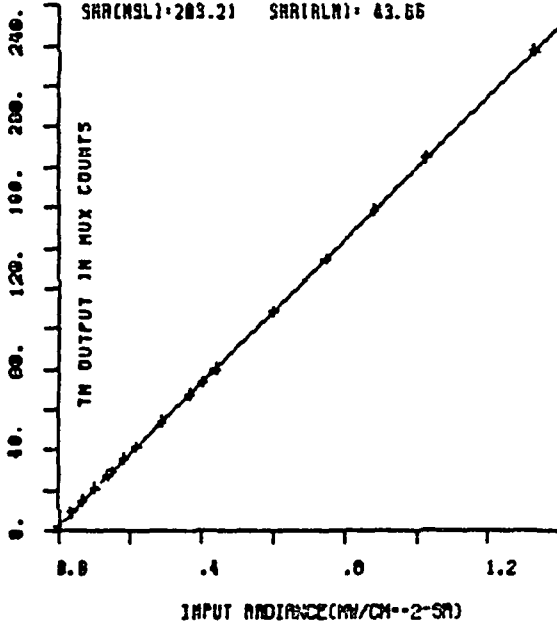


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BAND 3 CHANNEL 5

GAIN=177.28 OFFSET= 2.88 SIGMA= 0.17

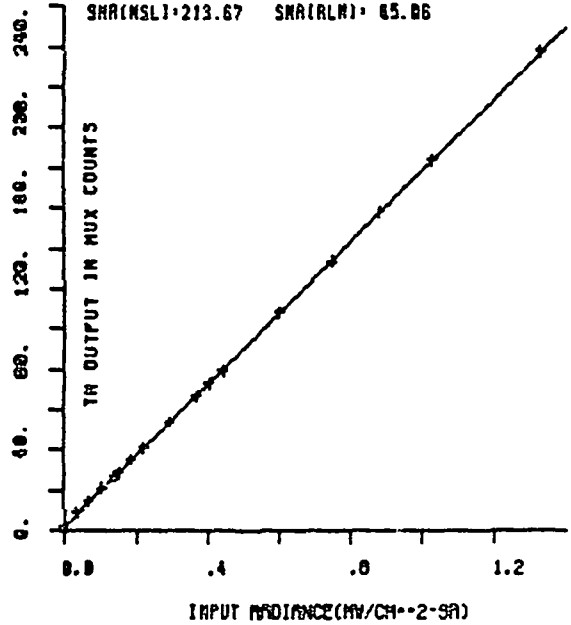
SRR(NSL)=283.21 SRR(ALN)= 43.66



BAND 3 CHANNEL 6

GAIN=176.64 OFFSET= 1.89 SIGMA= 0.21

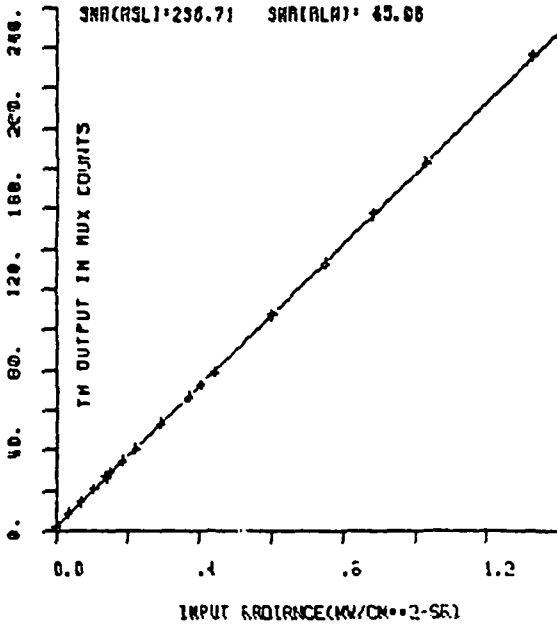
SRR(NSL)=213.67 SRR(ALN)= 65.86



BAND 3 CHANNEL 7

GAIN=175.22 OFFSET= 2.81 SIGMA= 0.21

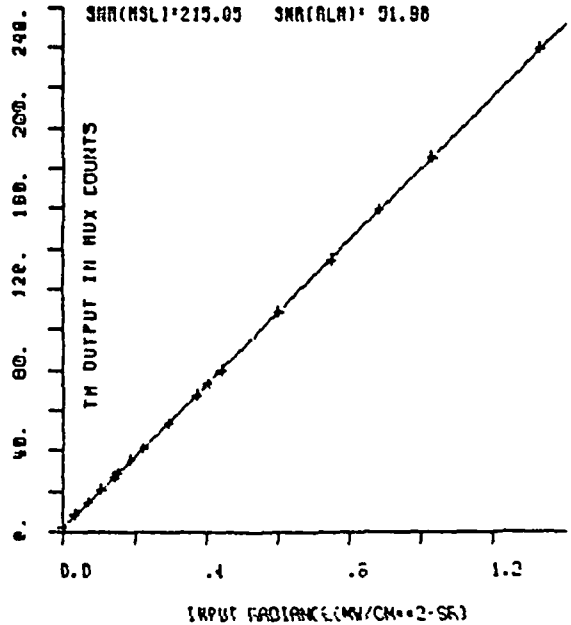
SRR(NSL)=296.71 SRR(ALN)= 45.86



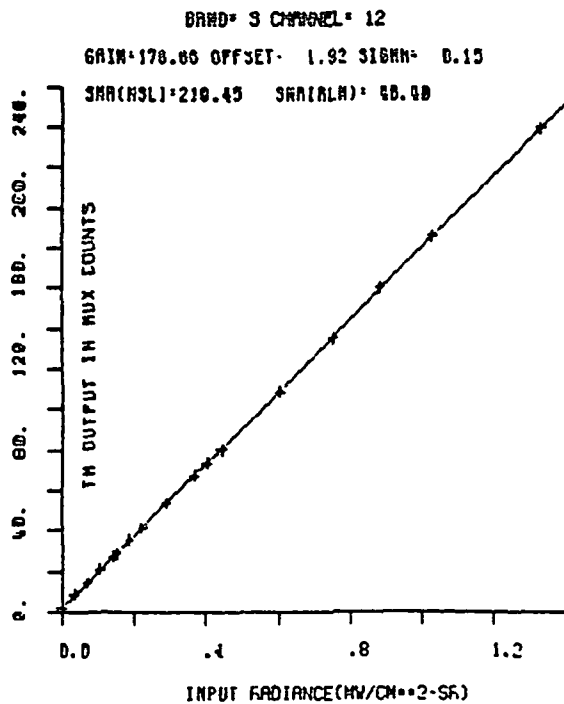
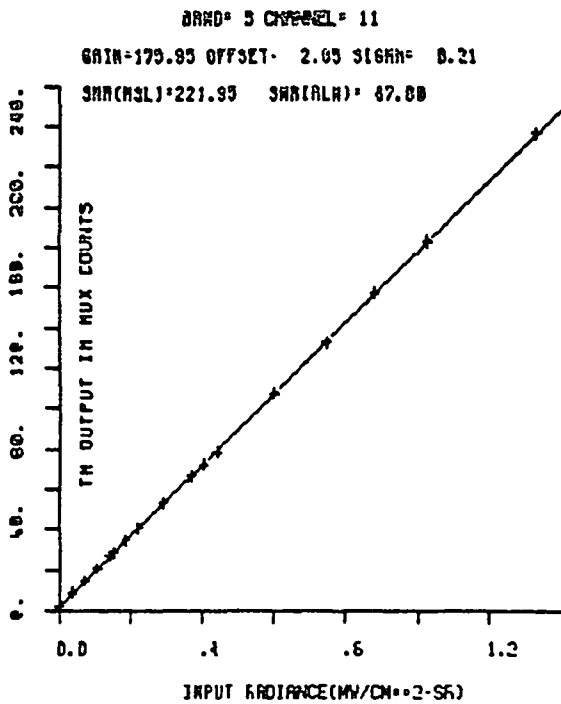
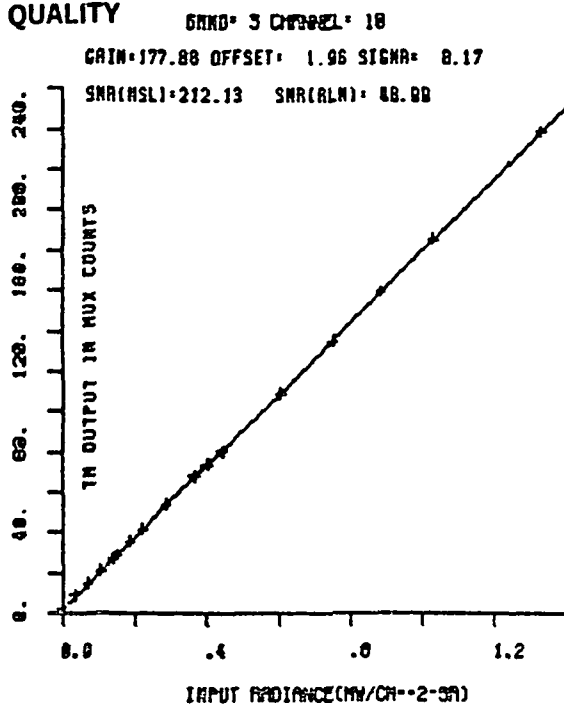
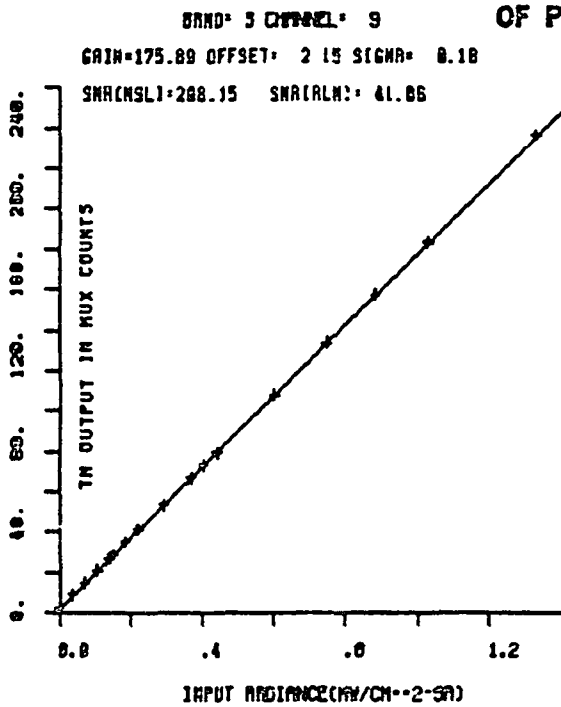
BAND 3 CHANNEL 8

GAIN=176.18 OFFSET= 1.95 SIGMA= 0.19

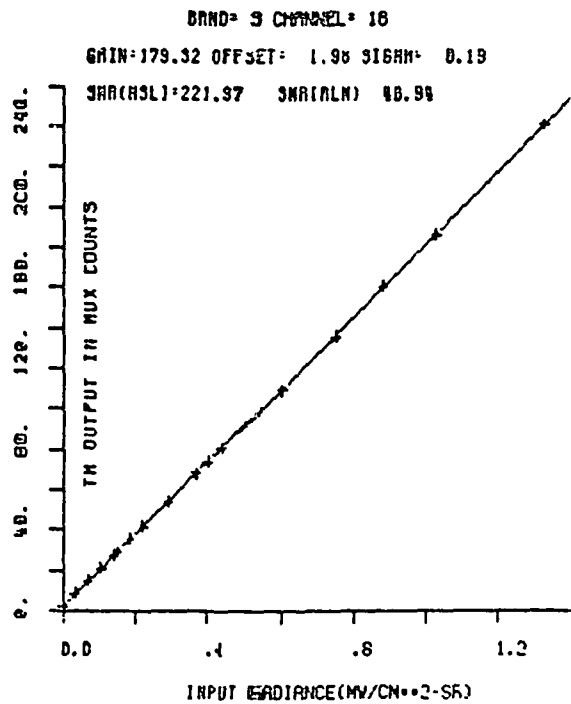
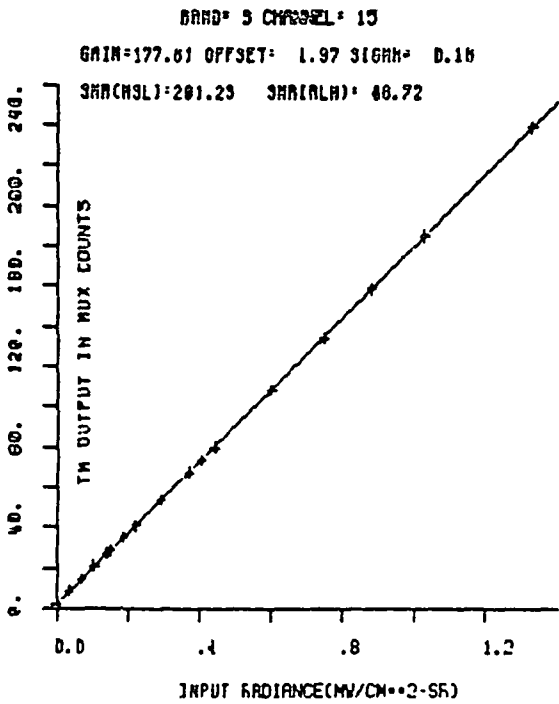
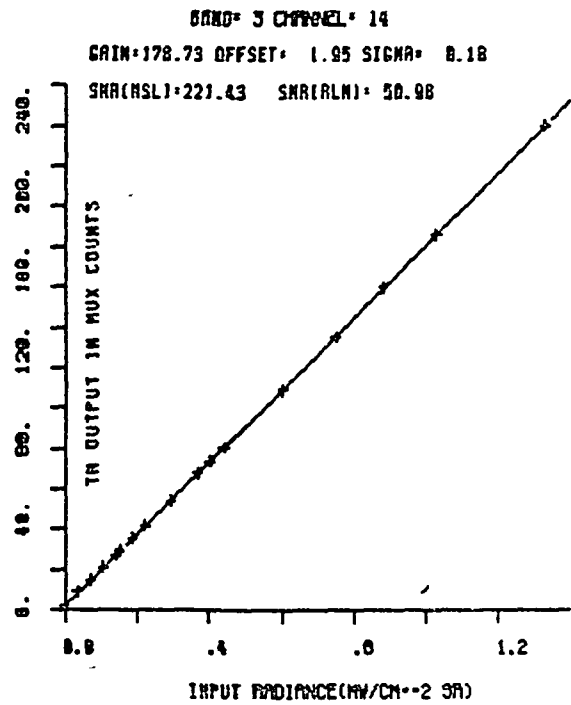
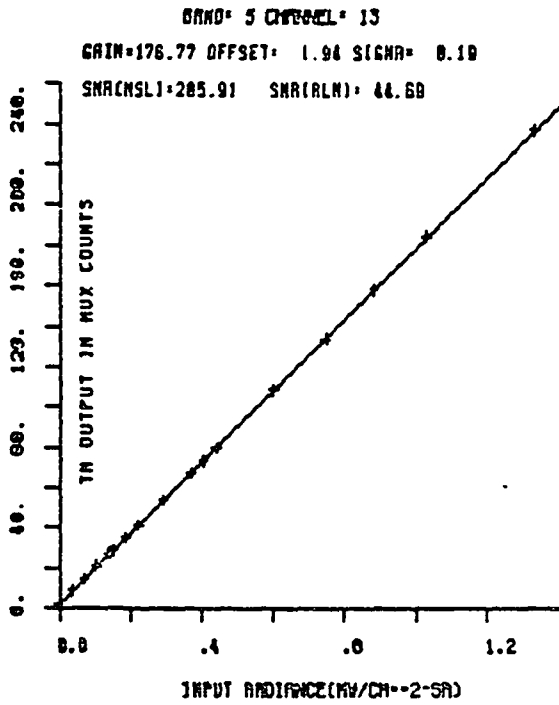
SRR(NSL)=215.05 SRR(ALN)= 51.86



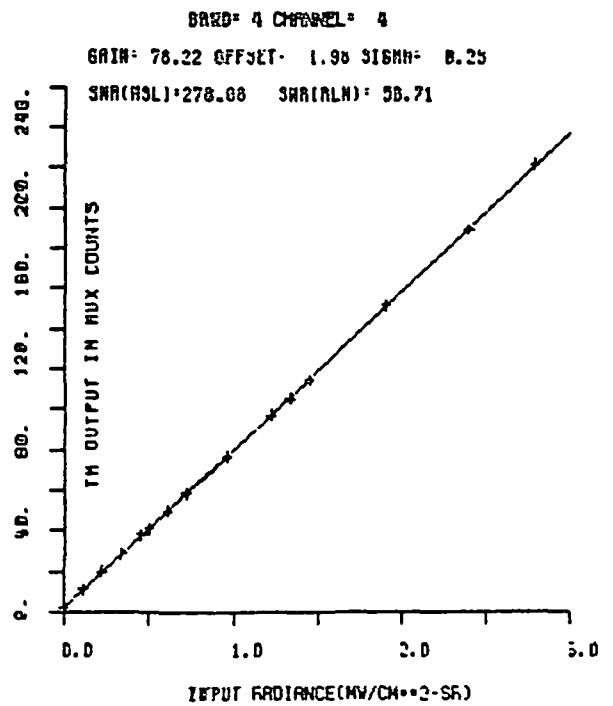
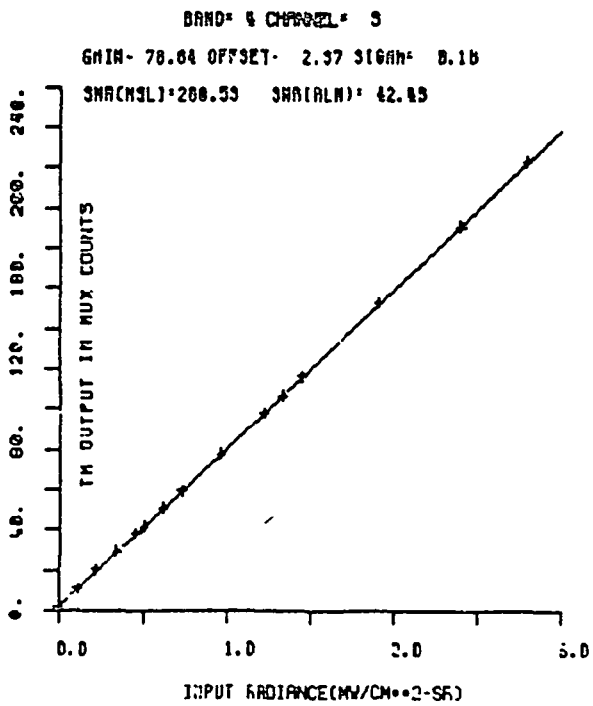
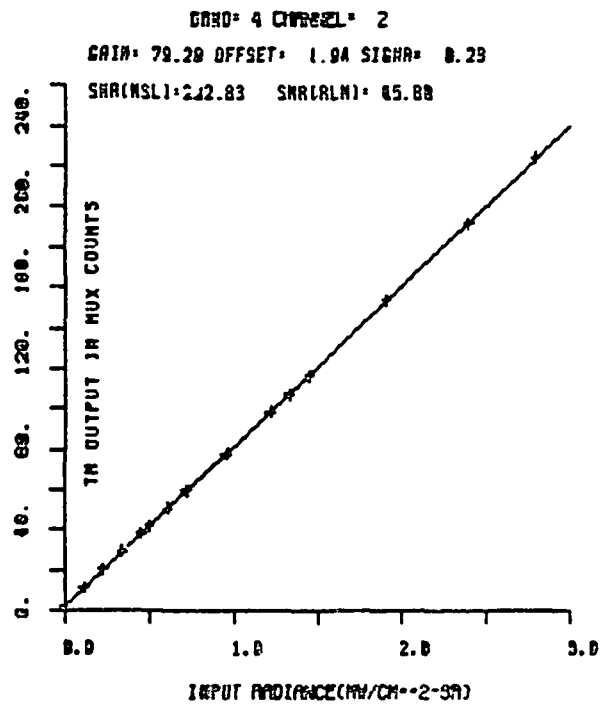
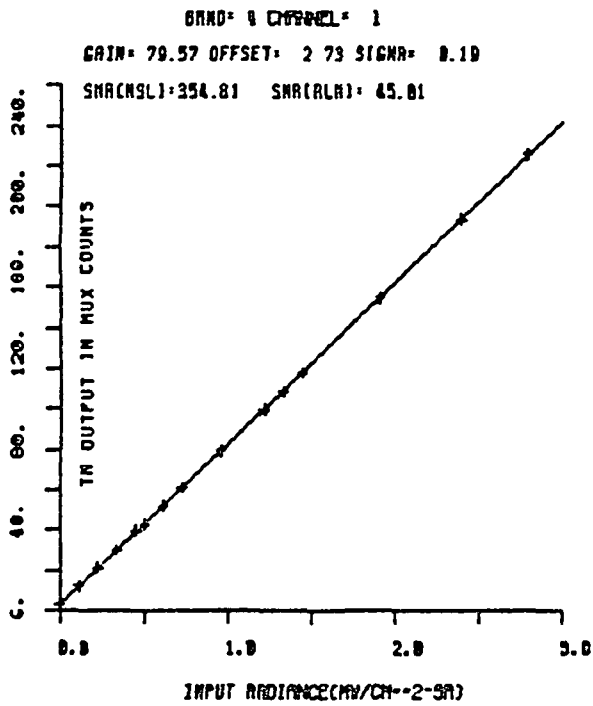
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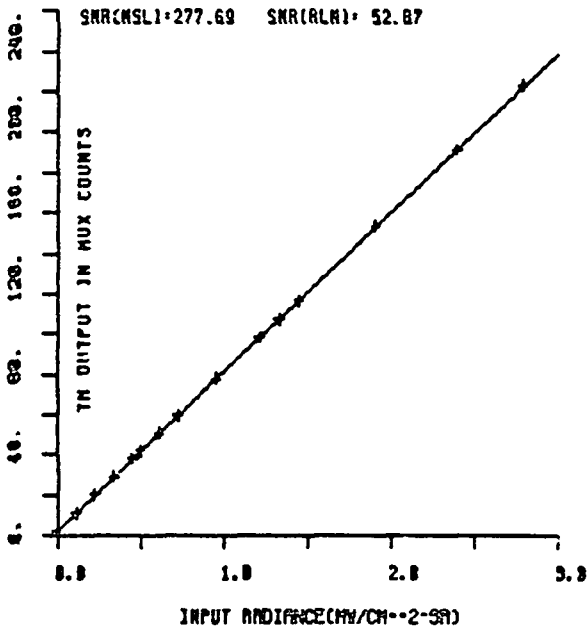


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BAND 4 CHANNEL 5

GAIN= 79.88 OFFSET= 2.89 SIGMA= 8.21

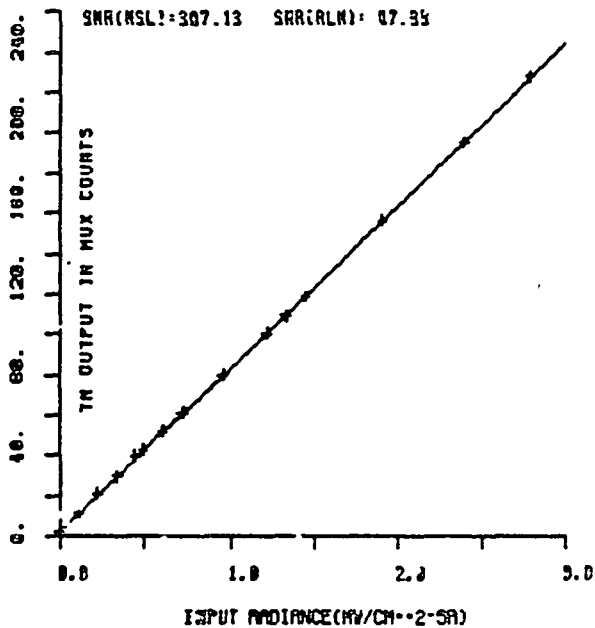
SNR(NSL)=277.69 SNR(ALM)= 52.87



BAND 4 CHANNEL 6

GAIN= 88.54 OFFSET= 2.28 SIGMA= 8.21

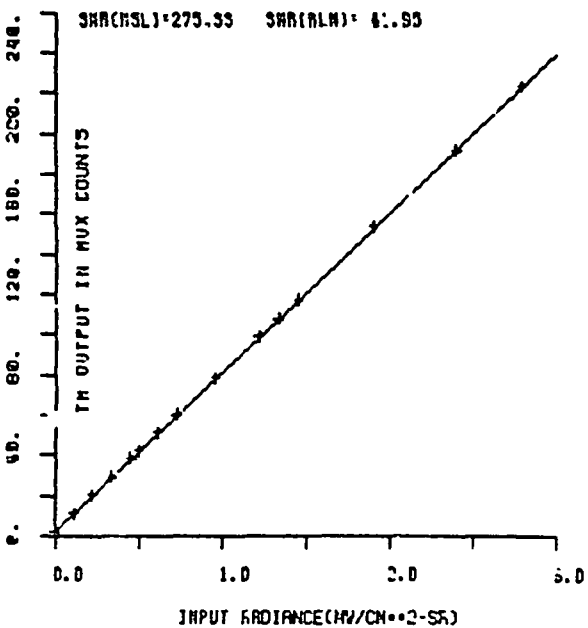
SNR(NSL)=307.13 SNR(ALM)= 67.95



BAND 4 CHANNEL 7

GAIN= 78.86 OFFSET= 2.85 SIGMA= 8.18

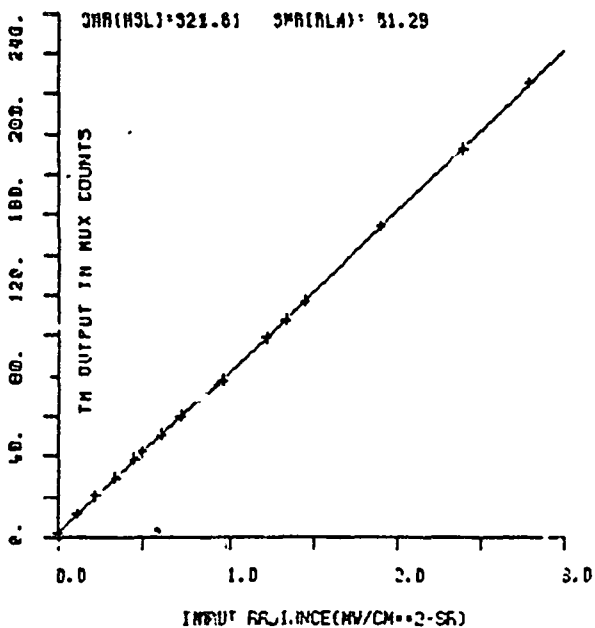
SNR(NSL)=275.33 SNR(ALM)= 51.95



BAND 4 CHANNEL 8

GAIN= 79.54 OFFSET= 2.14 SIGMA= 8.22

SNR(NSL)=321.81 SNR(ALM)= 51.29

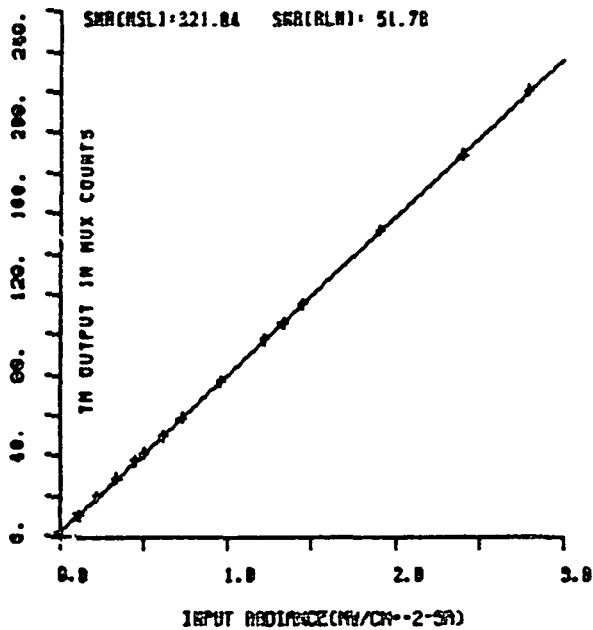


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BAND* 4 CHANNEL* 9

GAIN* 78.16 OFFSET* 2.23 SIGMA* 0.16

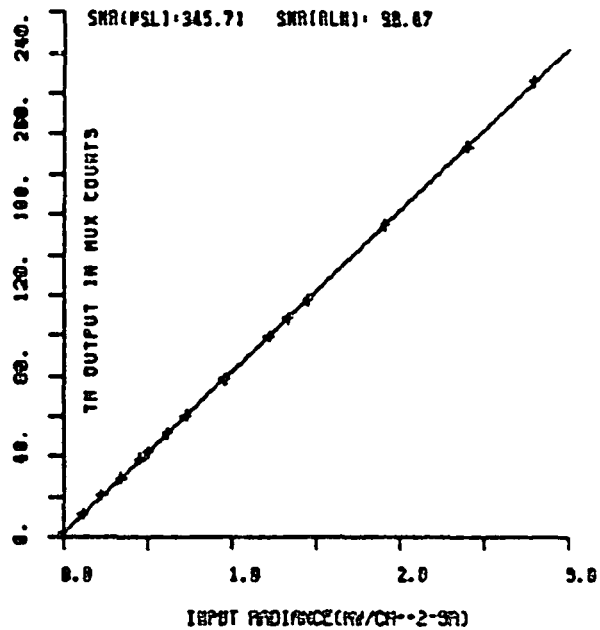
SNR(NSL)*321.84 SNR(ALN)* 51.78



BAND* 4 CHANNEL* 10

GAIN* 79.81 OFFSET* 1.97 SIGMA* 0.22

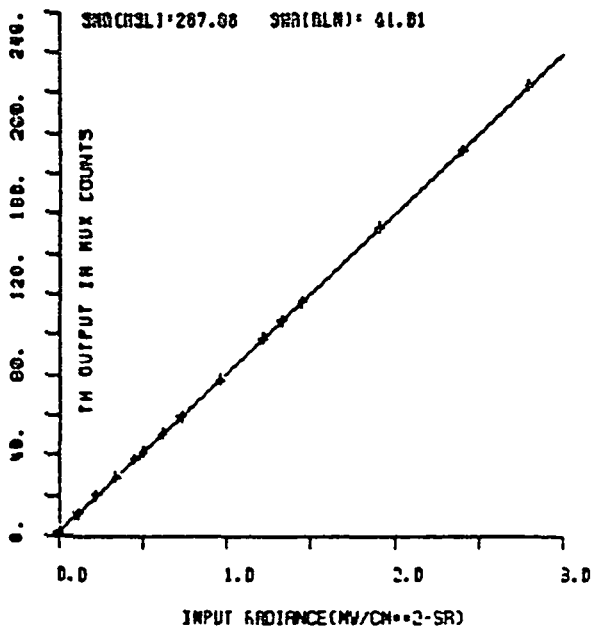
SNR(NSL)*345.71 SNR(ALN)* 98.87



BAND* 4 CHANNEL* 11

GAIN* 78.98 OFFSET* 2.32 SIGMA* 0.18

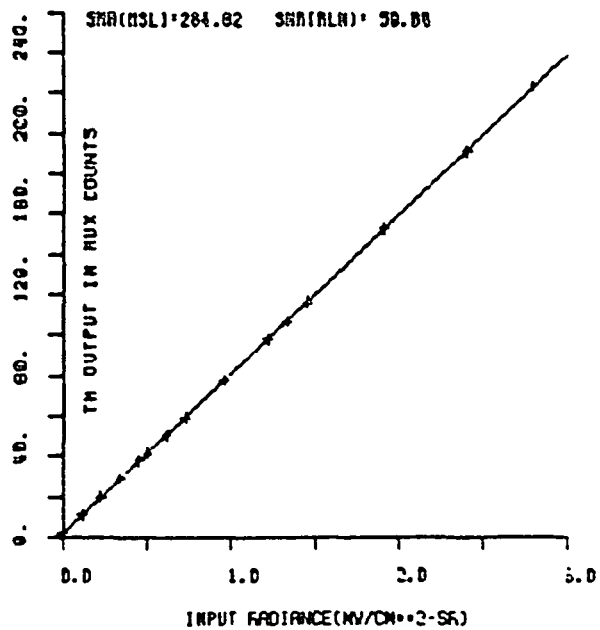
SNR(NSL)*287.88 SNR(ALN)* 41.81



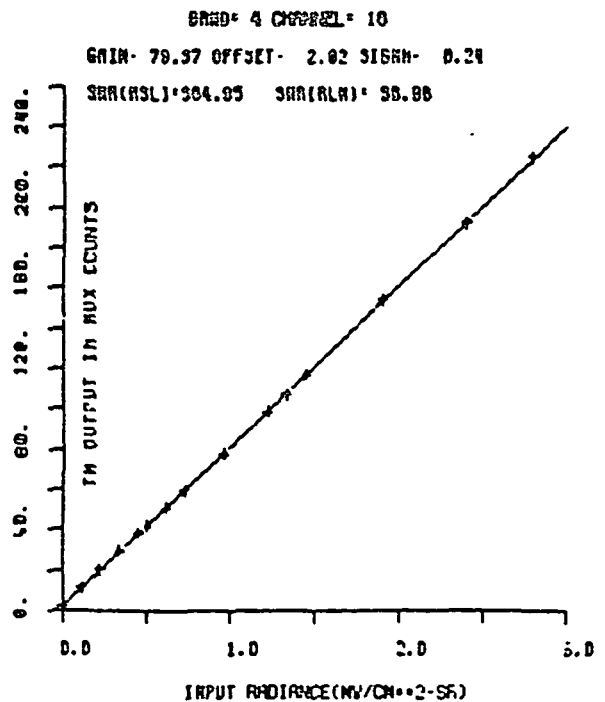
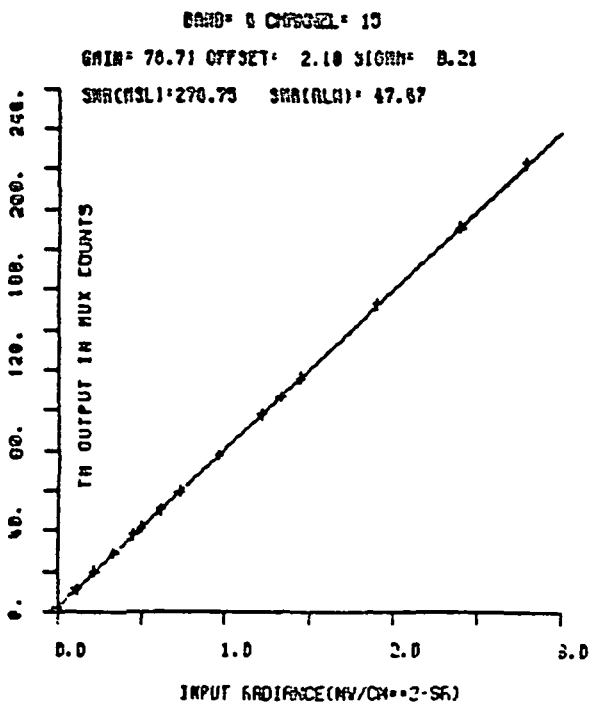
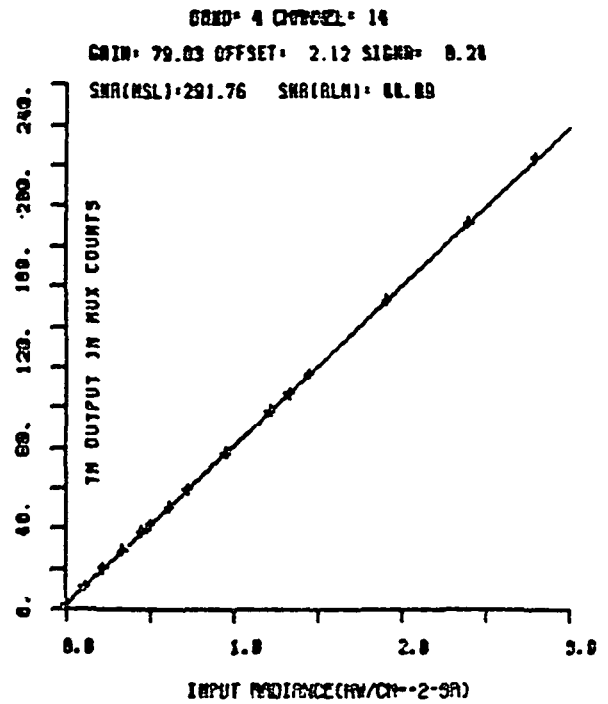
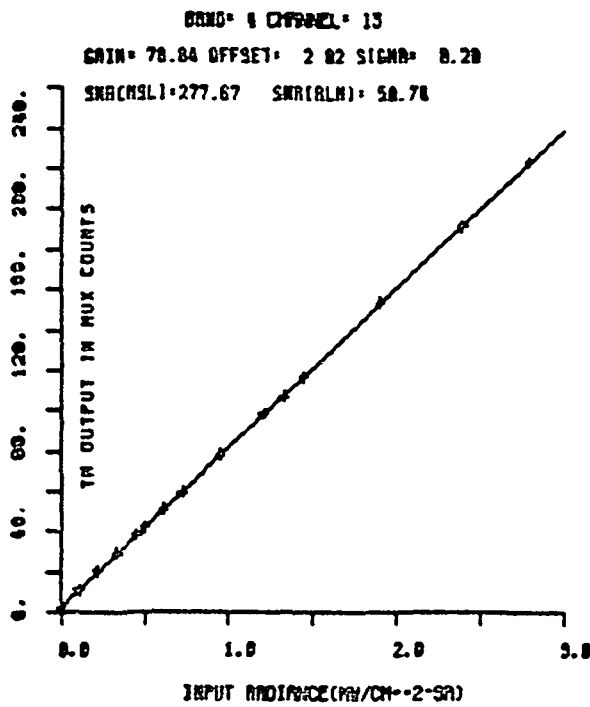
BAND* 4 CHANNEL* 12

GAIN* 78.89 OFFSET* 1.86 SIGMA* 0.21

SNR(NSL)*284.82 SNR(ALN)* 98.88



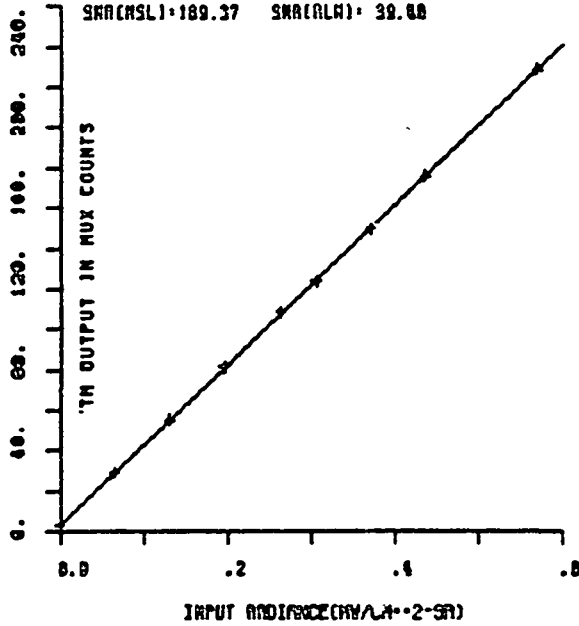
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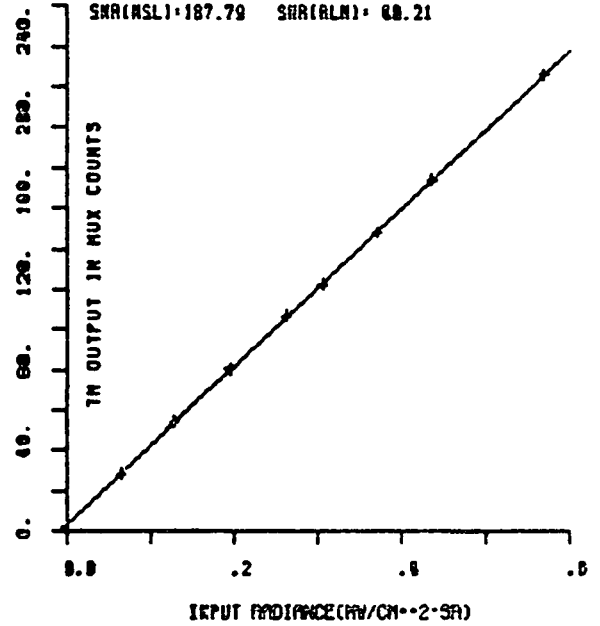
BAND 3 CHANNEL 1

GAIN=995.39 OFFSET= 3.27 SIGMA= 0.29
SRR(MSL)=189.37 SRR(ALM)= 39.68



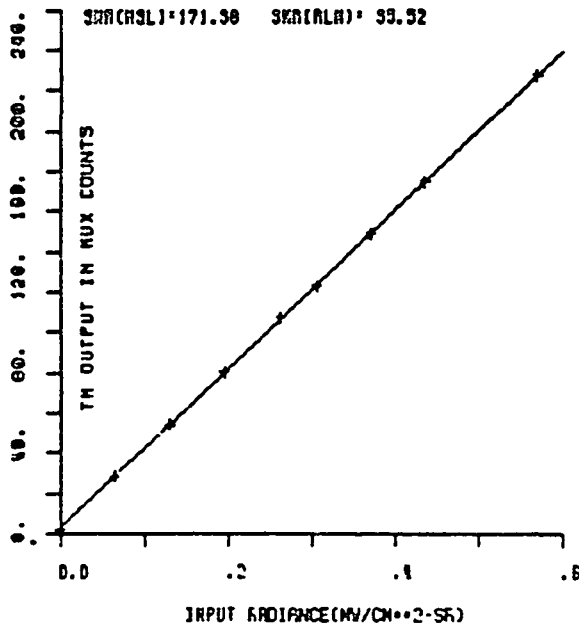
BAND 3 CHANNEL 2

GAIN=998.98 OFFSET= 3.83 SIGMA= 0.29
SRR(MSL)=187.78 SRR(ALM)= 40.21



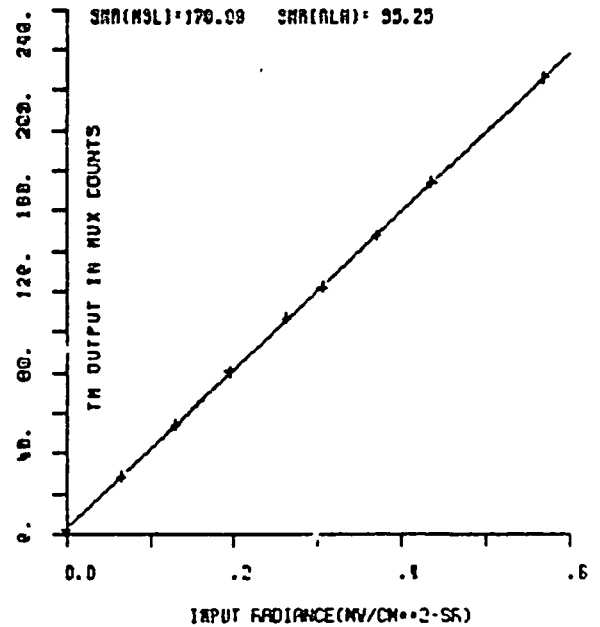
BAND 3 CHANNEL 3

GAIN=993.28 OFFSET= 2.88 SIGMA= 0.29
SRR(MSL)=171.38 SRR(ALM)= 39.52



BAND 3 CHANNEL 4

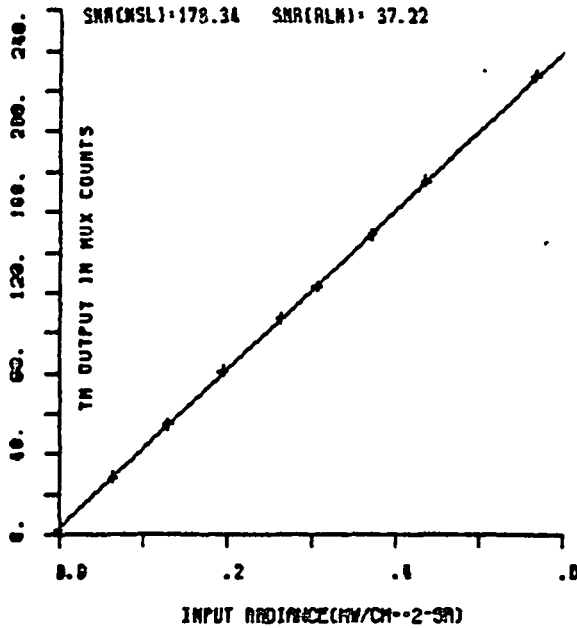
GAIN=991.37 OFFSET= 3.07 SIGMA= 0.29
SRR(MSL)=170.09 SRR(ALM)= 39.25



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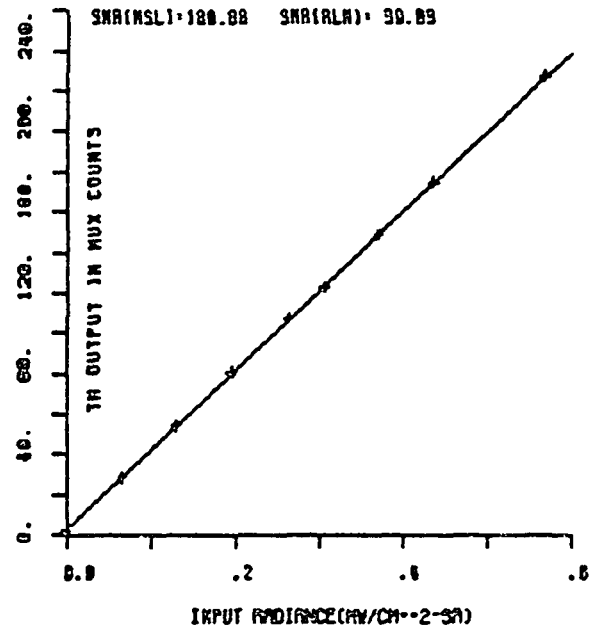
BRAND 5 CHANNEL 5

GAIN=993.62 OFFSET= 2.64 SIGMA= 0.23
SNR(NSL)=178.34 SNR(ALN)= 37.22



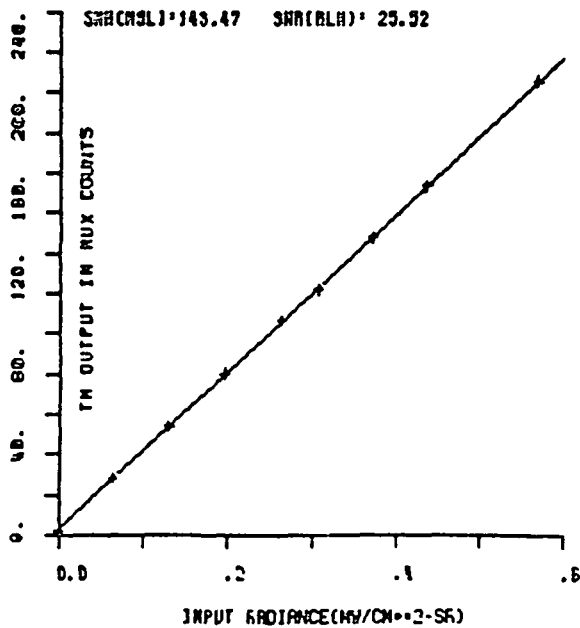
BRAND 5 CHANNEL 6

GAIN=993.56 OFFSET= 3.69 SIGMA= 0.25
SNR(NSL)=180.88 SNR(ALN)= 90.89



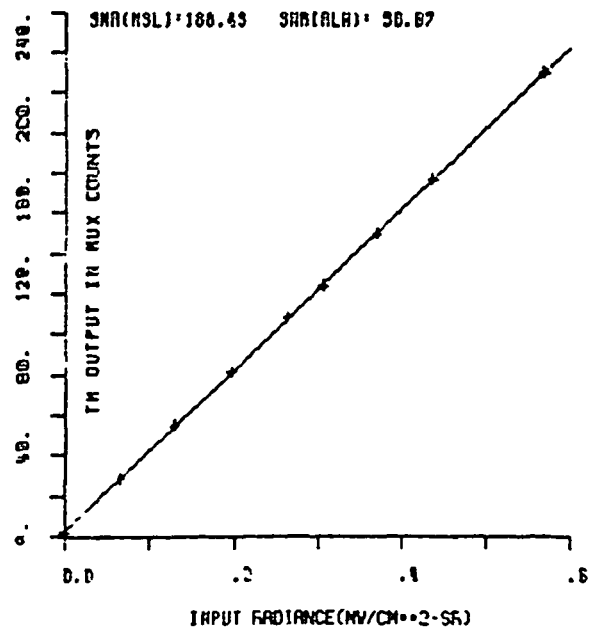
BRAND 5 CHANNEL 7

GAIN=988.98 OFFSET= 2.93 SIGMA= 0.22
SNR(NSL)=143.47 SNR(ALN)= 25.92



BRAND 5 CHANNEL 8

GAIN=997.74 OFFSET= 5.26 SIGMA= 0.25
SNR(NSL)=180.43 SNR(ALN)= 56.67

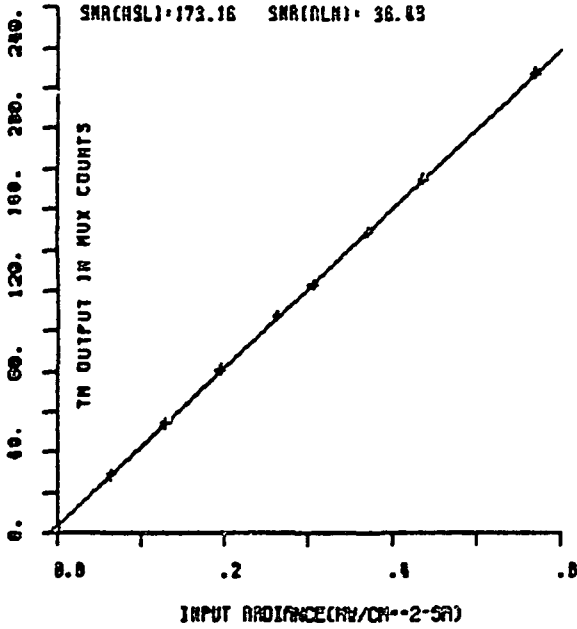


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BAND 5 CHANNEL 9

GAIN=993.81 OFFSET= 3.88 SIGMA= 0.29

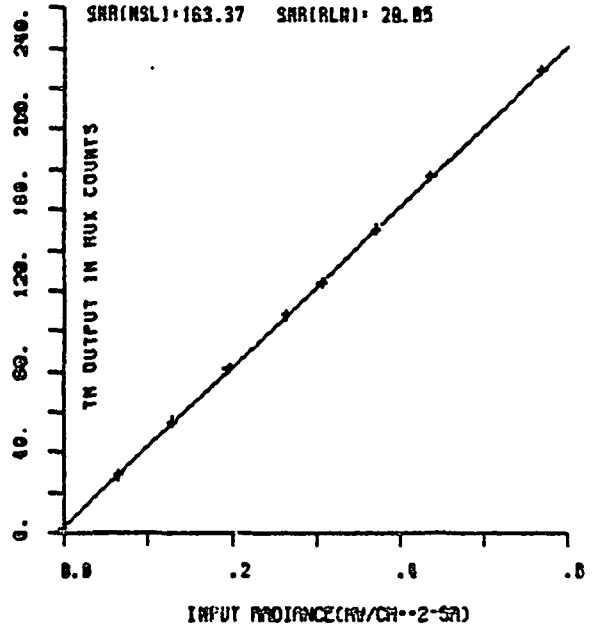
SNR(NSL)=173.16 SNR(ALH)= 36.83



BAND 5 CHANNEL 10

GAIN=996.74 OFFSET= 3.28 SIGMA= 0.29

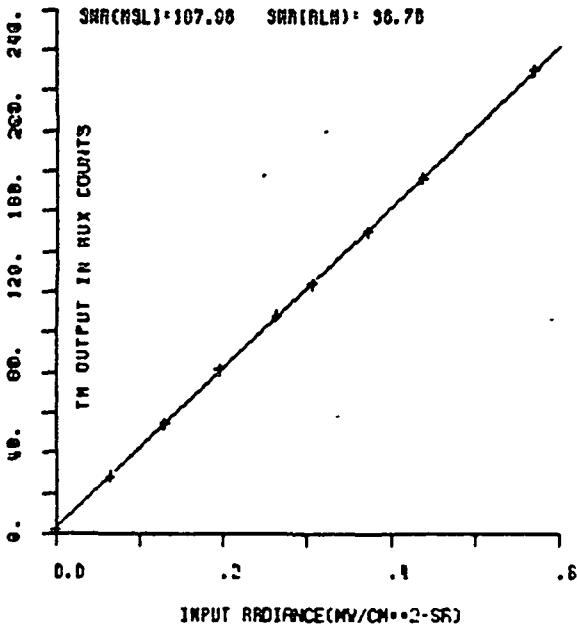
SNR(NSL)=163.37 SNR(ALH)= 28.85



BAND 5 CHANNEL 11

GAIN=988.83 OFFSET= 2.98 SIGMA= 0.22

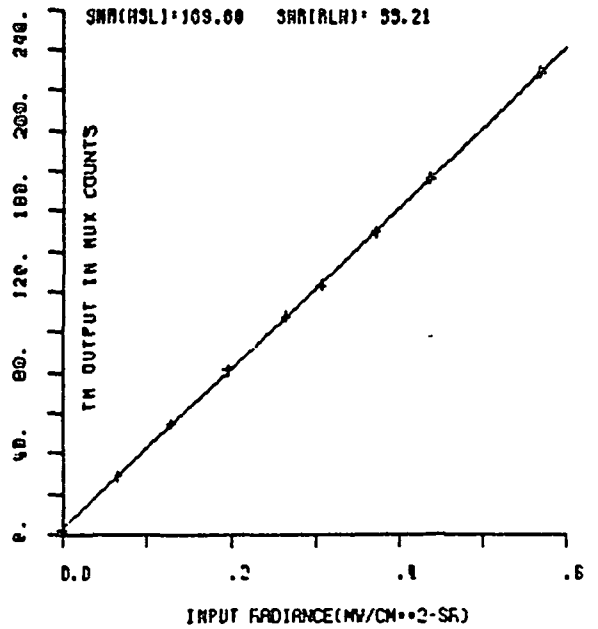
SNR(NSL)=107.98 SNR(ALH)= 36.78



BAND 5 CHANNEL 12

GAIN=996.11 OFFSET= 3.88 SIGMA= 0.22

SNR(NSL)=109.68 SNR(ALH)= 53.21

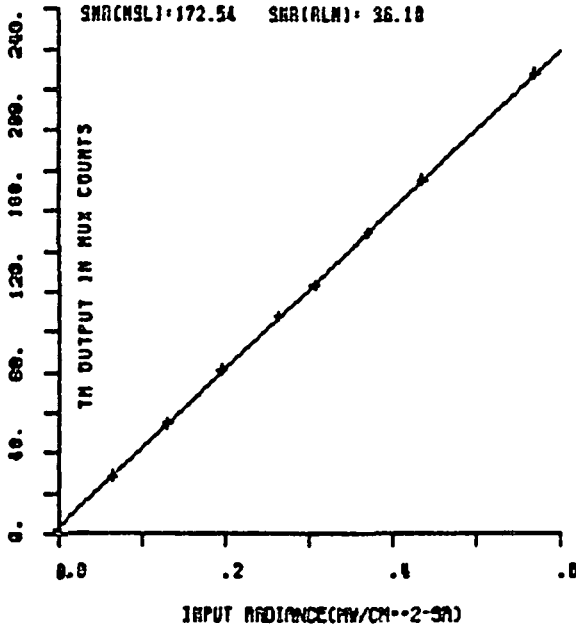


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BAND 5 CHANNEL 13

GAIN=393.89 OFFSET= 2.96 SIGMA= 0.23

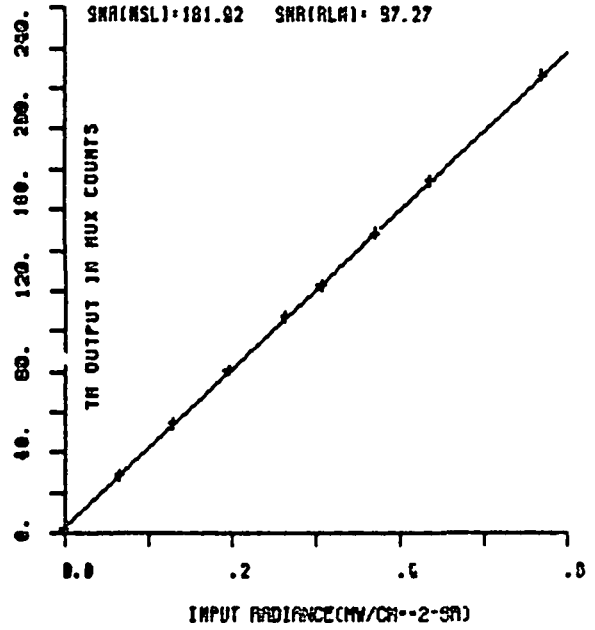
SNR(NSL)=172.54 SNR(ALM)= 36.18



BAND 5 CHANNEL 14

GAIN=391.89 OFFSET= 3.17 SIGMA= 0.26

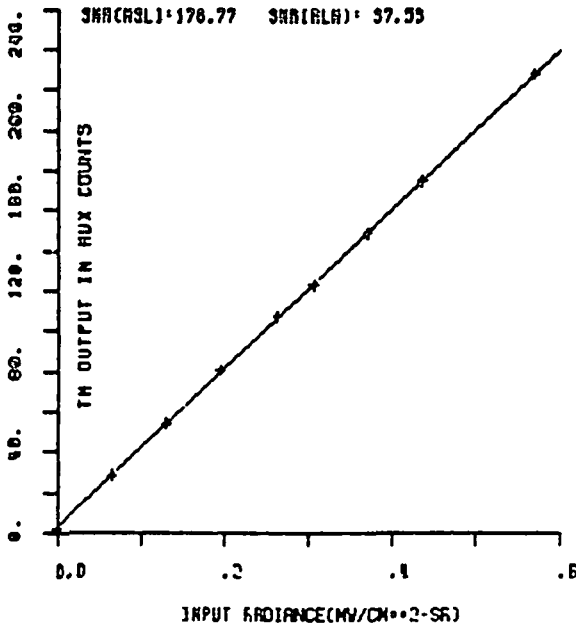
SNR(NSL)=181.92 SNR(ALM)= 97.27



BAND 5 CHANNEL 15

GAIN=393.00 OFFSET= 2.92 SIGMA= 0.21

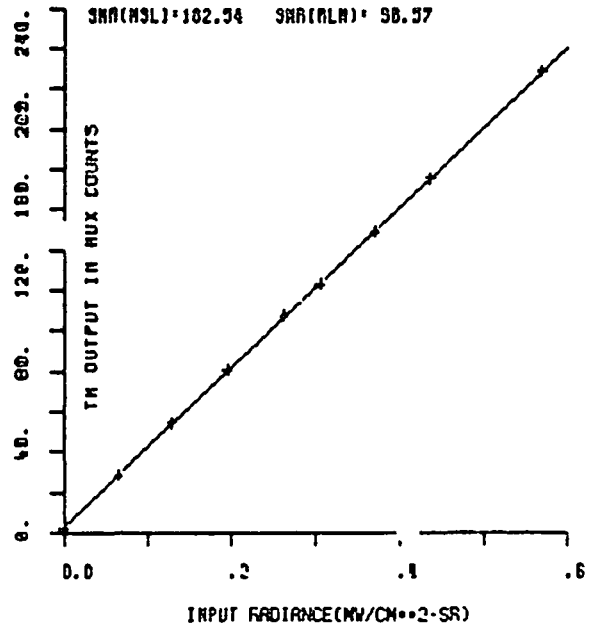
SNR(NSL)=176.77 SNR(ALM)= 97.99



BAND 5 CHANNEL 16

GAIN=395.19 OFFSET= 3.11 SIGMA= 0.25

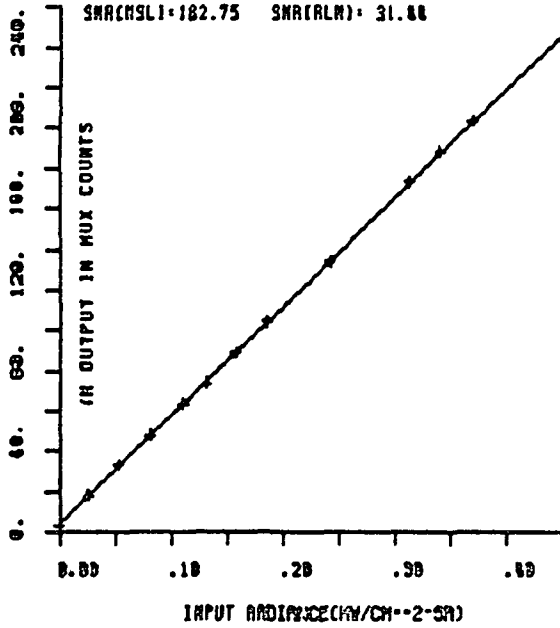
SNR(NSL)=182.94 SNR(ALM)= 96.97



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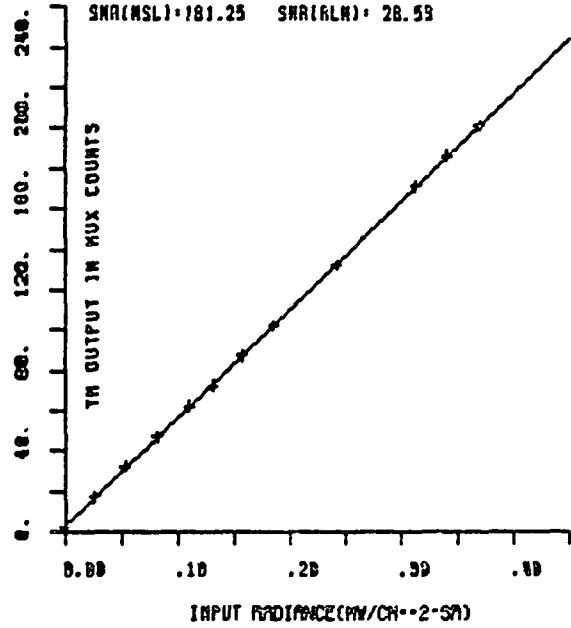
BAND 7 CHANNEL 1

GAIN=939.29 OFFSET= 3.72 SIGMA= 0.95
SNA(NSL)=182.75 SNA(RLN)= 31.88



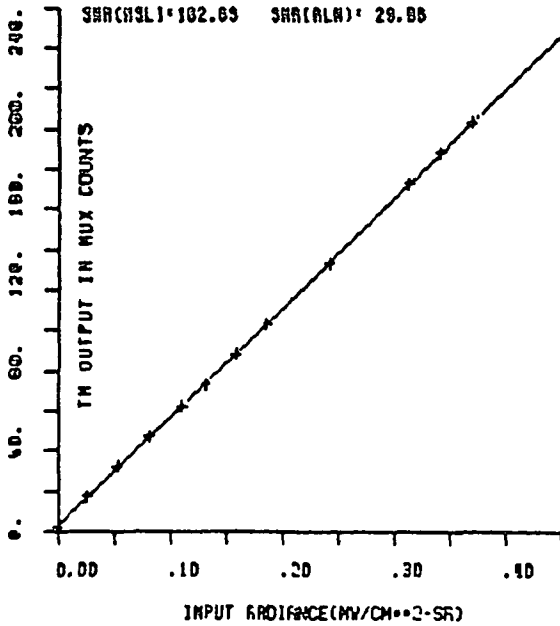
BAND 7 CHANNEL 2

GAIN=935.02 OFFSET= 3.18 SIGMA= 0.99
SNA(NSL)=181.25 SNA(RLN)= 28.59



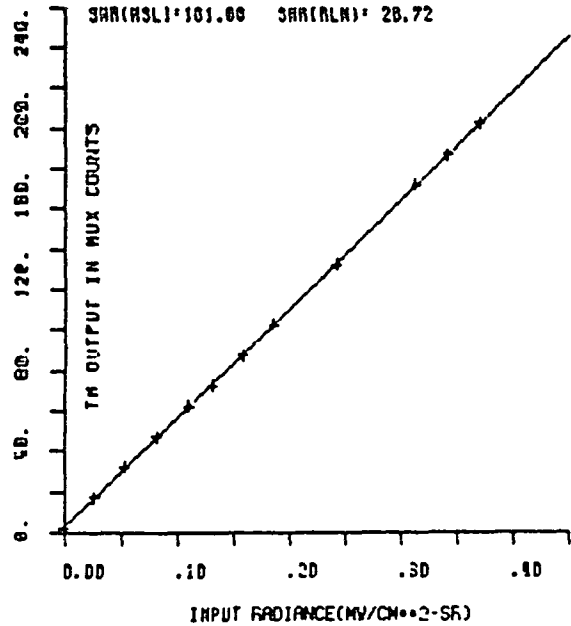
BAND 7 CHANNEL 3

GAIN=939.47 OFFSET= 3.15 SIGMA= 0.95
SNA(NSL)=182.63 SNA(RLN)= 29.86



BAND 7 CHANNEL 4

GAIN=937.98 OFFSET= 3.15 SIGMA= 0.99
SNA(NSL)=181.68 SNA(RLN)= 28.72

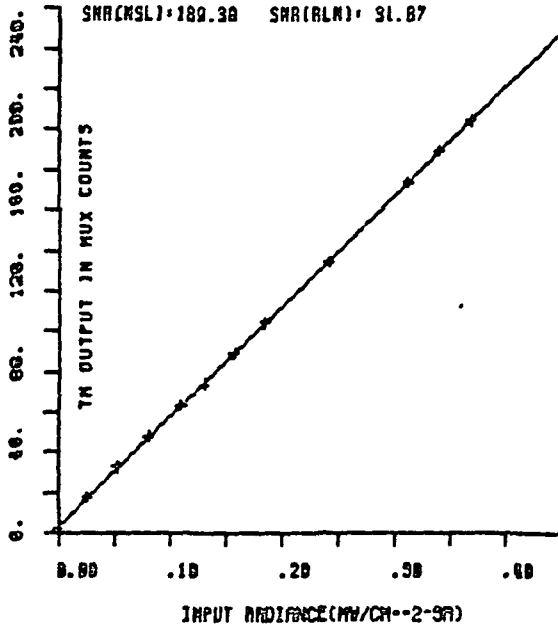


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BRND: 7 CHANNEL: 5

GAIN=543.90 OFFSET: 3.88 SIGMA= 0.95

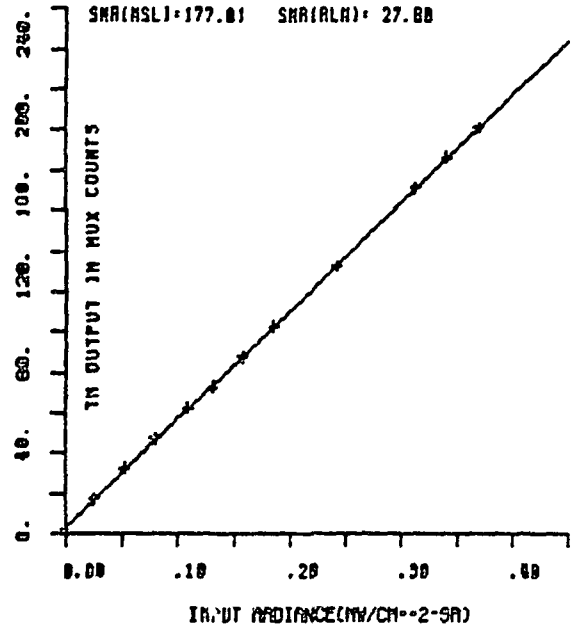
SRA(NSL)=189.38 SRA(RLN)= 91.87



BRND: 7 CHANNEL: 6

GAIN=535.27 OFFSET: 3.13 SIGMA= 0.99

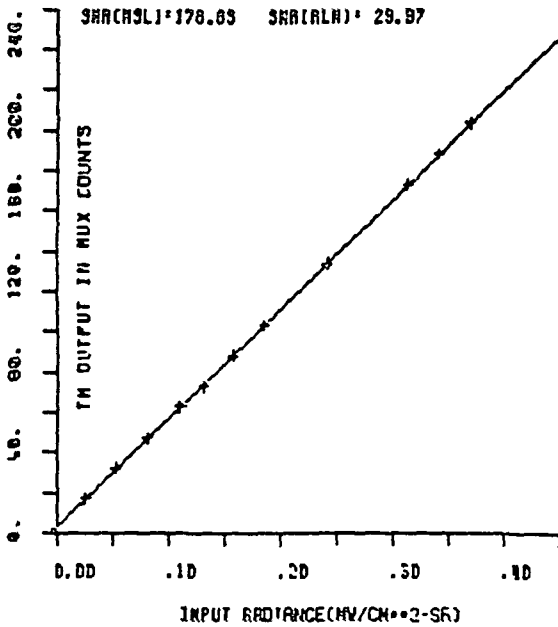
SRA(NSL)=177.81 SRA(RLN)= 27.88



BRND: 7 CHANNEL: 7

GAIN=541.68 OFFSET: 3.83 SIGMA= 0.98

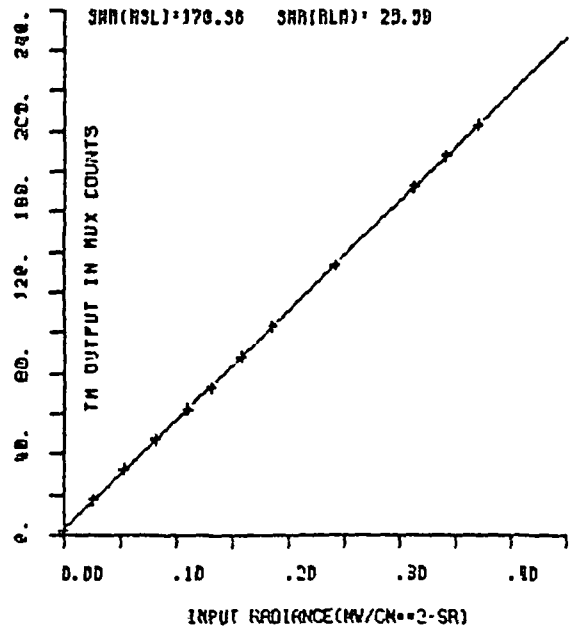
SRA(NSL)=178.65 SRA(RLN)= 29.97



BRND: 7 CHANNEL: 8

GAIN=539.25 OFFSET: 3.13 SIGMA= 0.94

SRA(NSL)=178.56 SRA(RLN)= 29.99

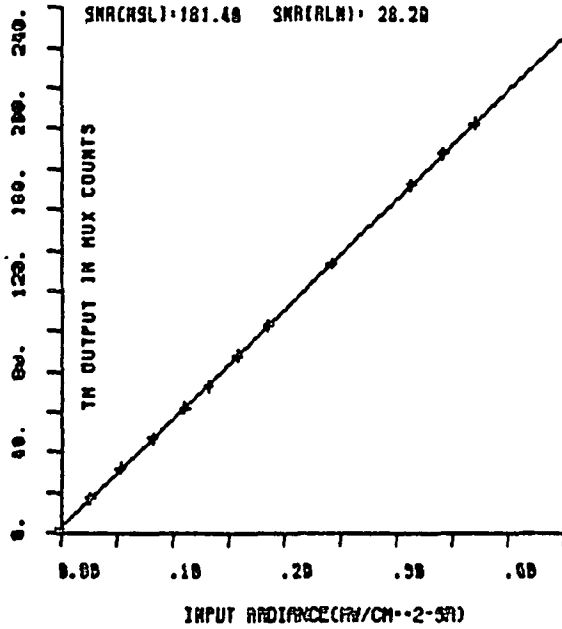


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BAND 7 CHANNEL 9

GAIN=538.38 OFFSET= 2.97 SIGMA= 0.92

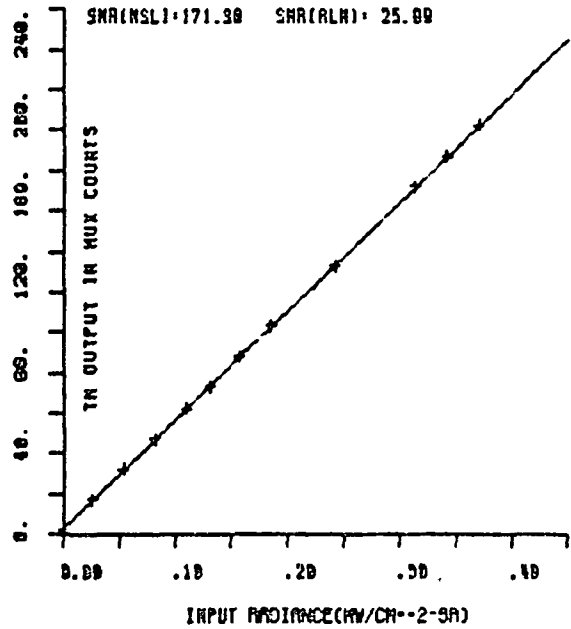
SNR(NSL)=181.48 SNR(ALN)= 28.28



BAND 7 CHANNEL 10

GAIN=538.97 OFFSET= 3.06 SIGMA= 0.91

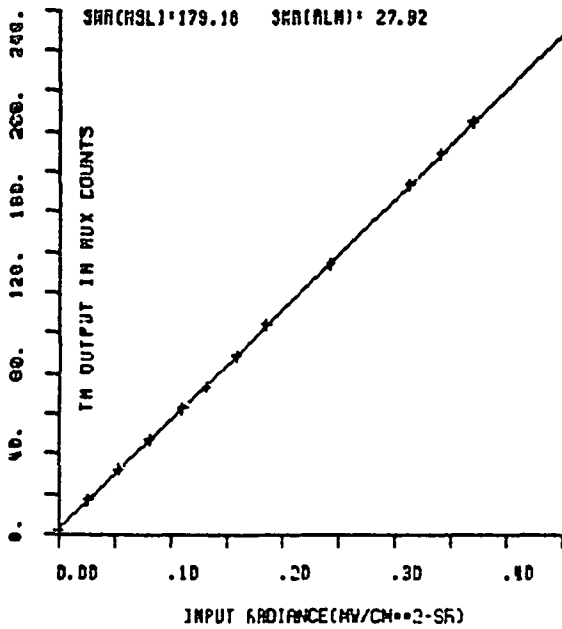
SNR(NSL)=171.98 SNR(ALN)= 25.89



BAND 7 CHANNEL 11

GAIN=545.39 OFFSET= 3.06 SIGMA= 0.98

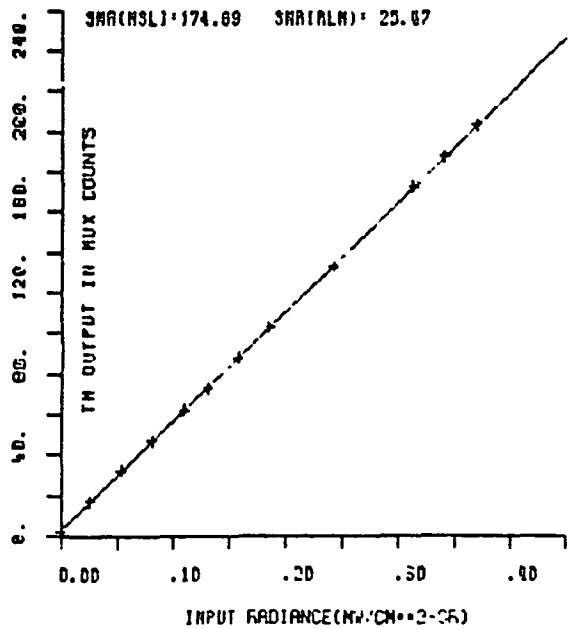
SNR(NSL)=179.18 SNR(ALN)= 27.82



BAND 7 CHANNEL 12

GAIN=541.05 OFFSET= 2.98 SIGMA= 0.92

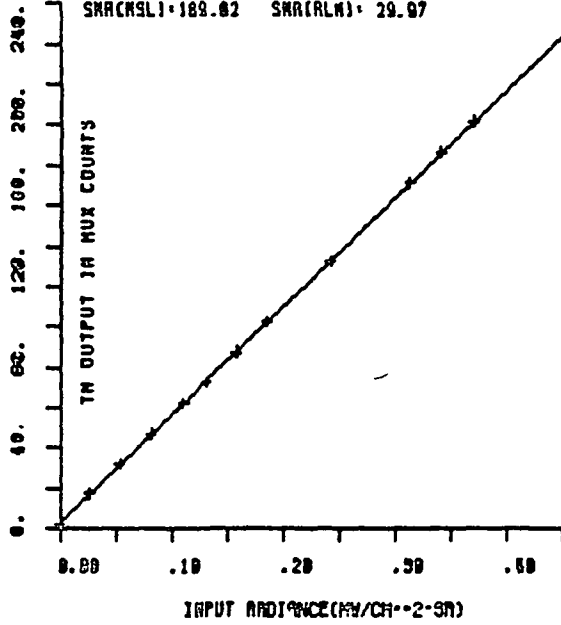
SNR(NSL)=174.89 SNR(ALN)= 25.87



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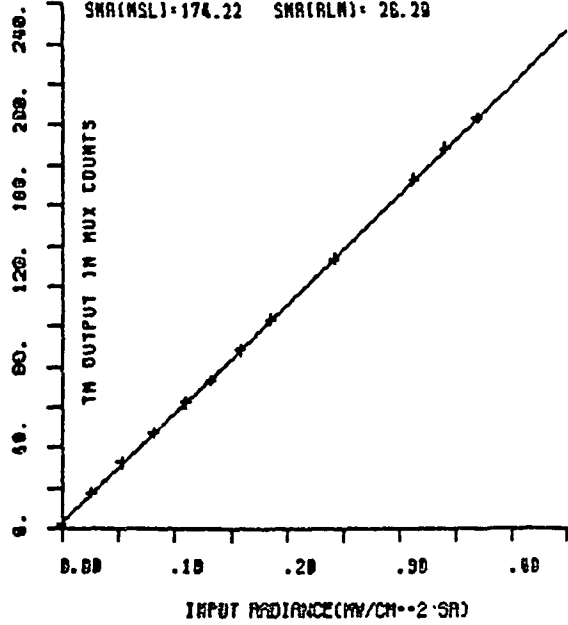
BAND 7 CHANNEL 13

GAIN=536.67 OFFSET= 2.86 SIGMA= 0.98
SNR(NSL)=189.82 SNR(RLN)= 29.97



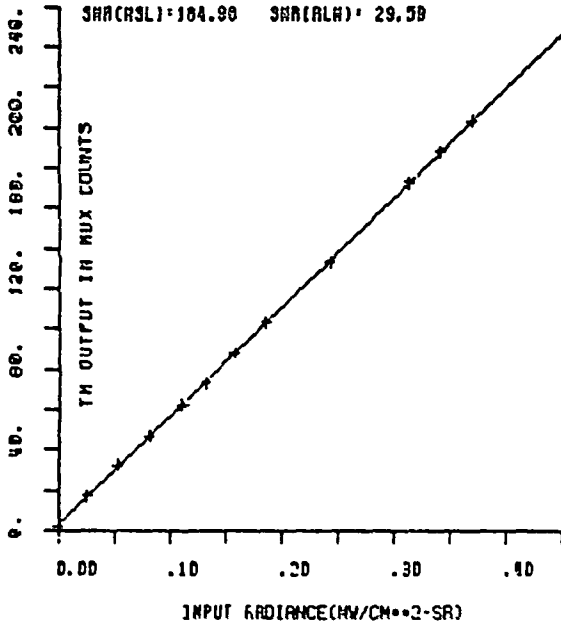
BAND 7 CHANNEL 14

GAIN=548.64 OFFSET= 3.19 SIGMA= 0.93
SNR(NSL)=174.22 SNR(RLN)= 26.29



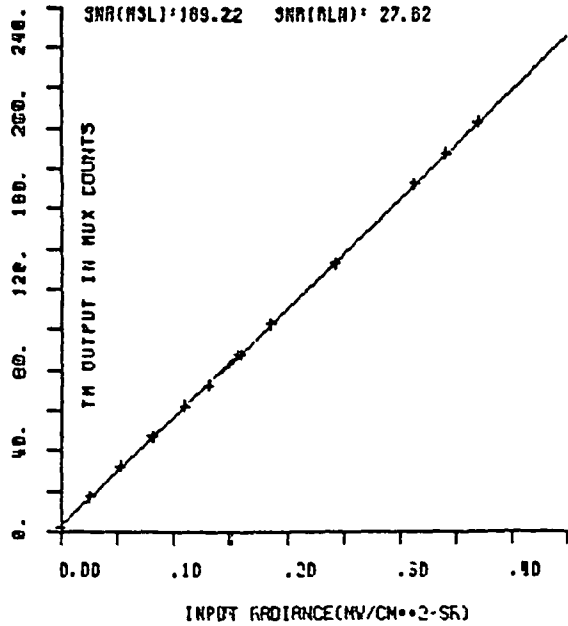
BAND 7 CHANNEL 15

GAIN=540.22 OFFSET= 2.98 SIGMA= 0.92
SNR(NSL)=184.98 SNR(RLN)= 29.59

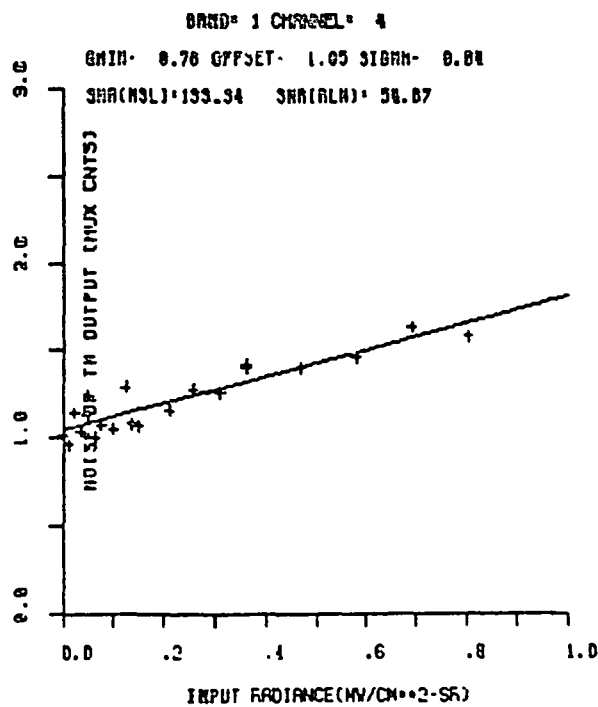
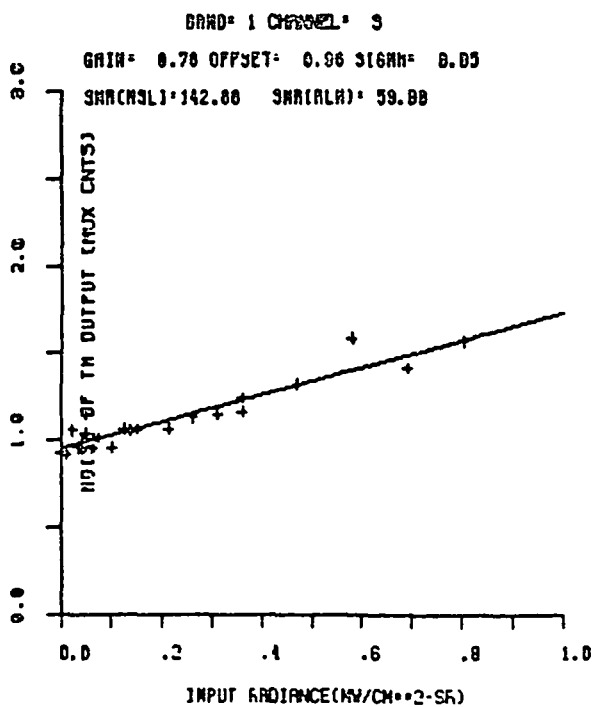
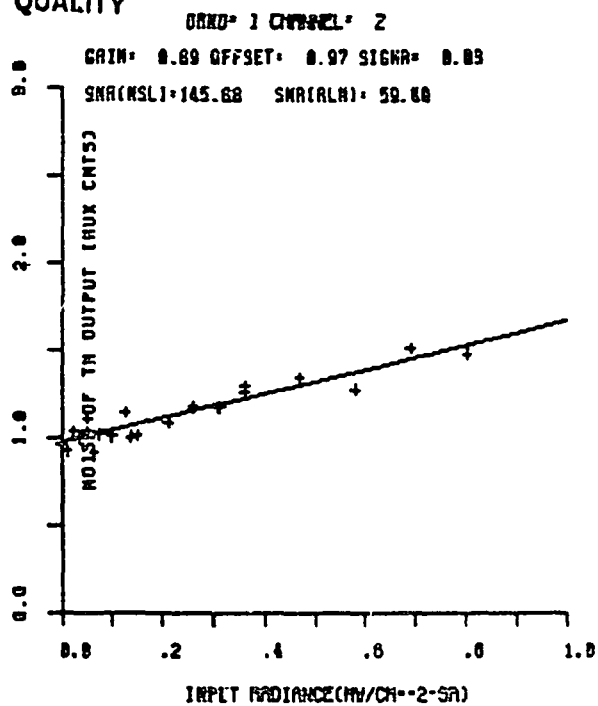
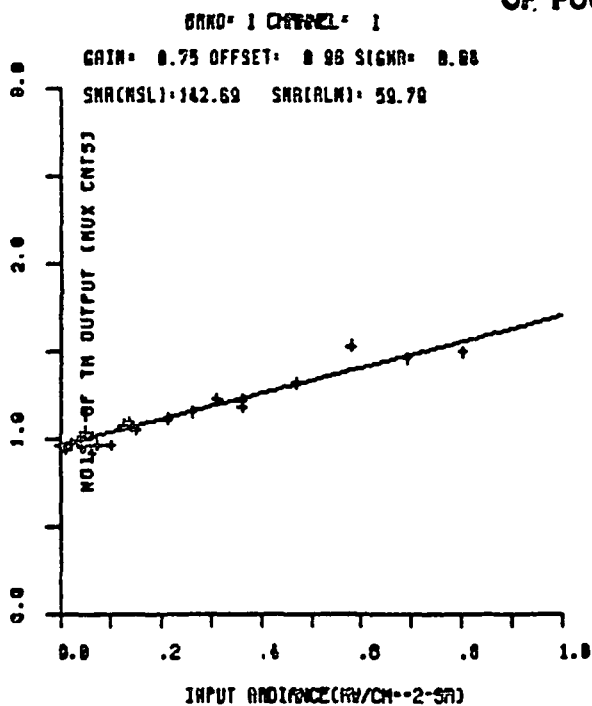


BAND 7 CHANNEL 16

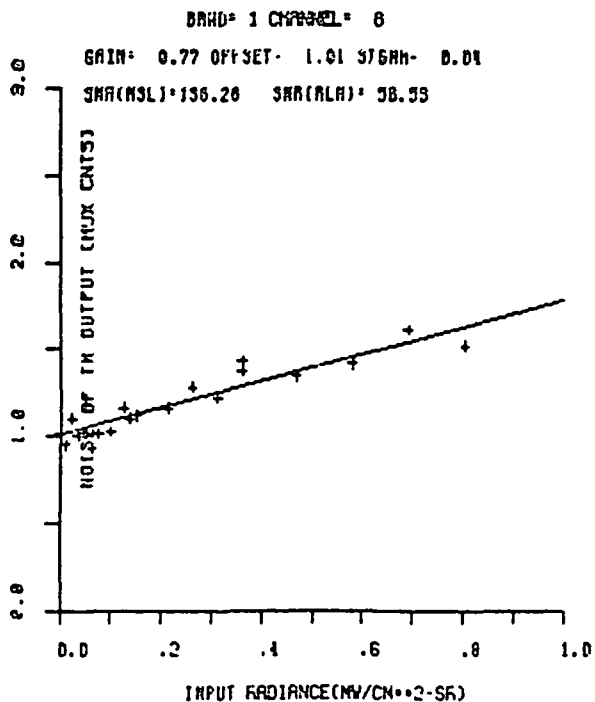
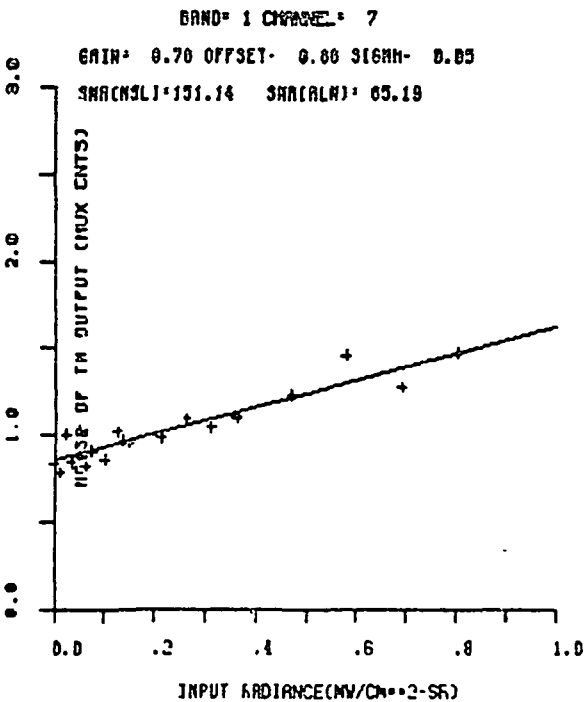
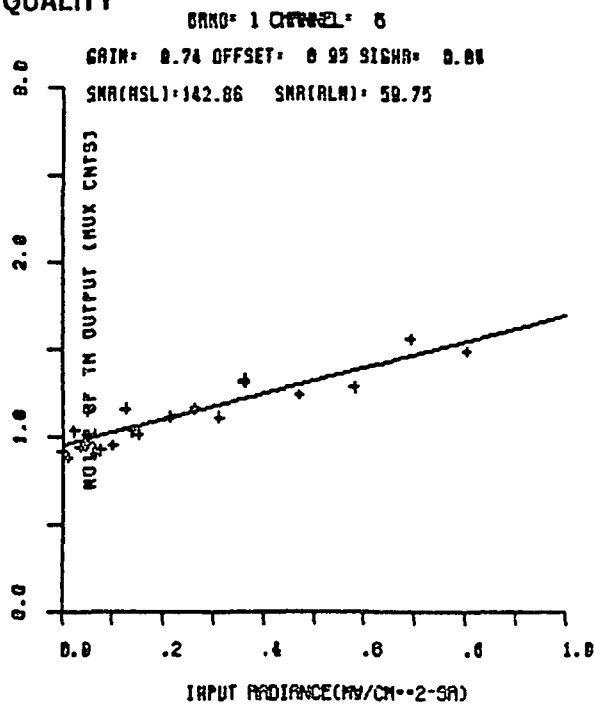
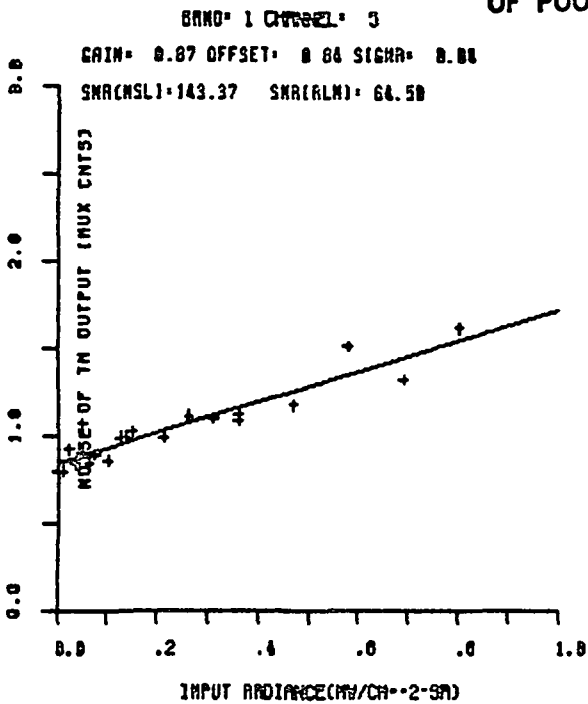
GAIN=536.88 OFFSET= 3.16 SIGMA= 0.93
SNR(NSL)=189.22 SNR(RLN)= 27.62



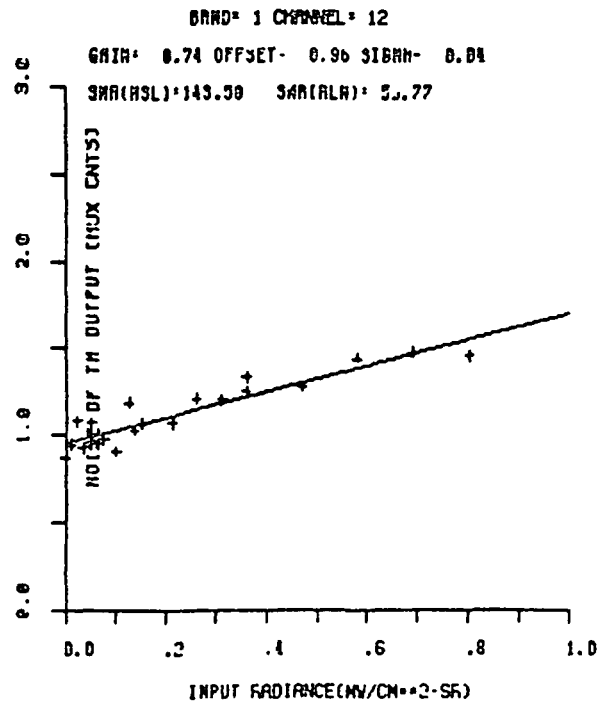
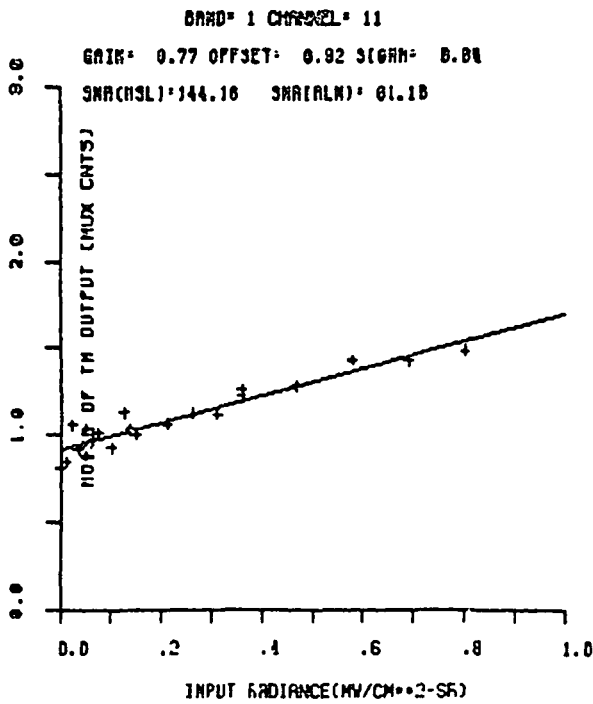
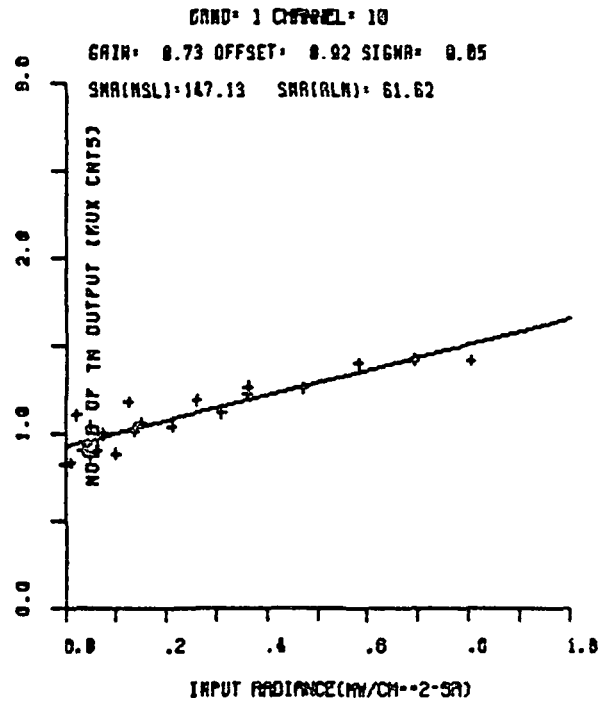
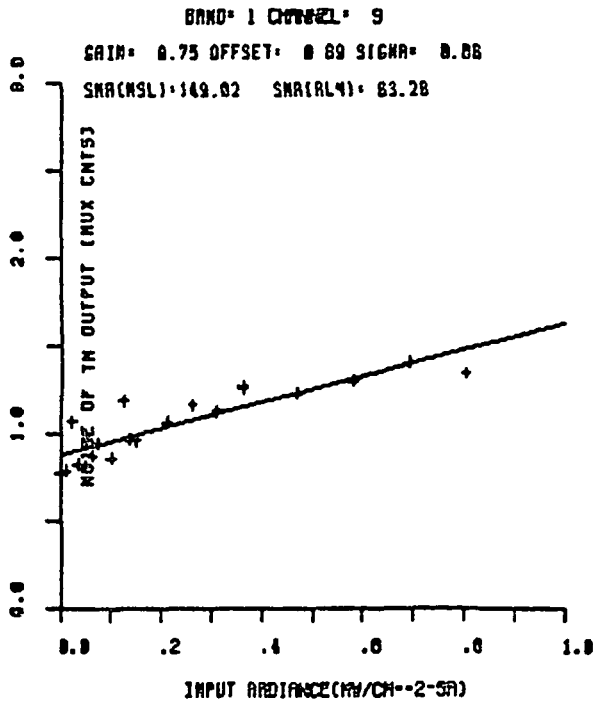
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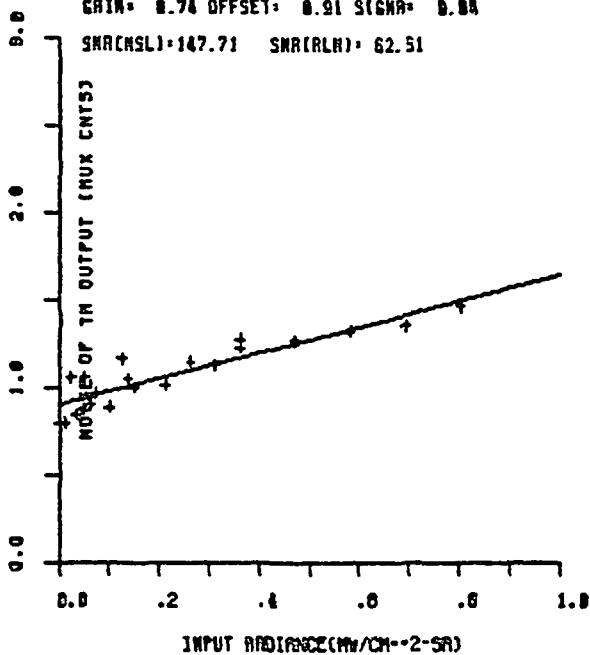
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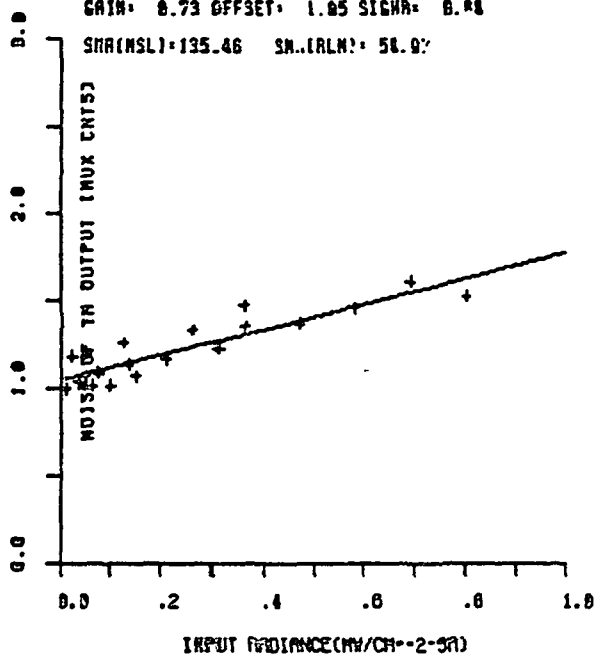
BAND= 1 CHANNEL= 13

GAIN= 0.74 OFFSET= 0.91 SIGMA= 0.04
SNR(NSL)=147.71 SNR(RLN)= 62.51



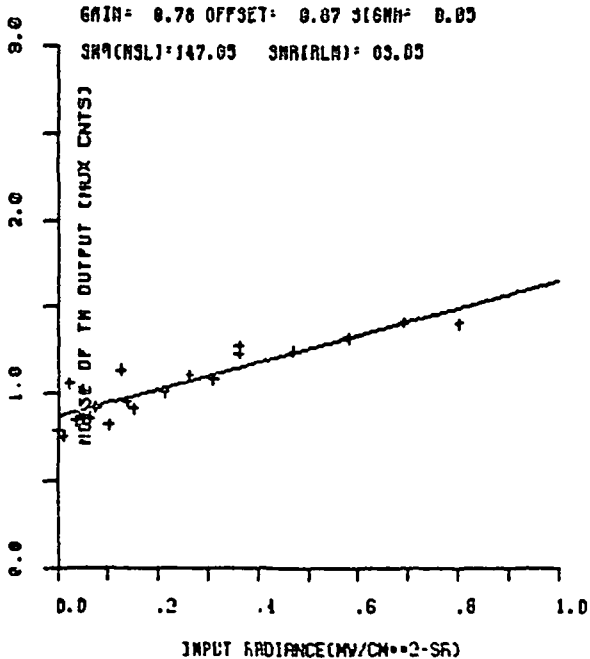
BAND= 1 CHANNEL= 14

GAIN= 0.73 OFFSET= 1.05 SIGMA= 0.04
SNR(NSL)=135.46 SNR(RLN)= 58.97



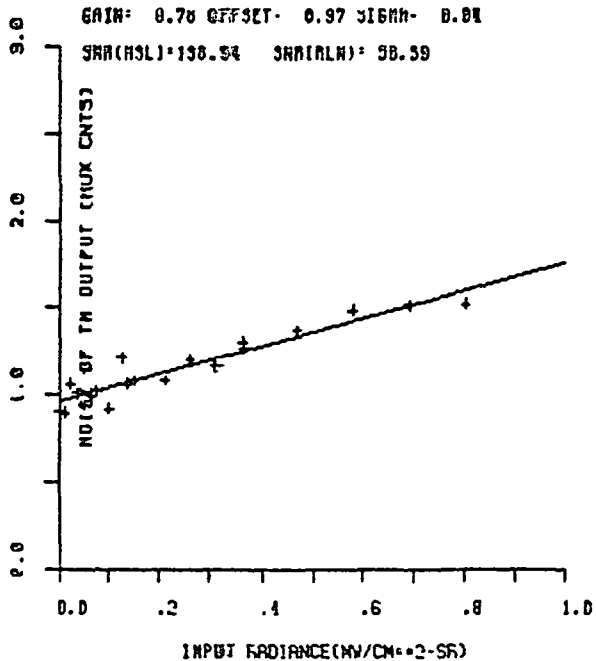
BAND= 1 CHANNEL= 15

GAIN= 0.76 OFFSET= 0.87 SIGMA= 0.03
SNR(NSL)=147.03 SNR(RLN)= 63.03

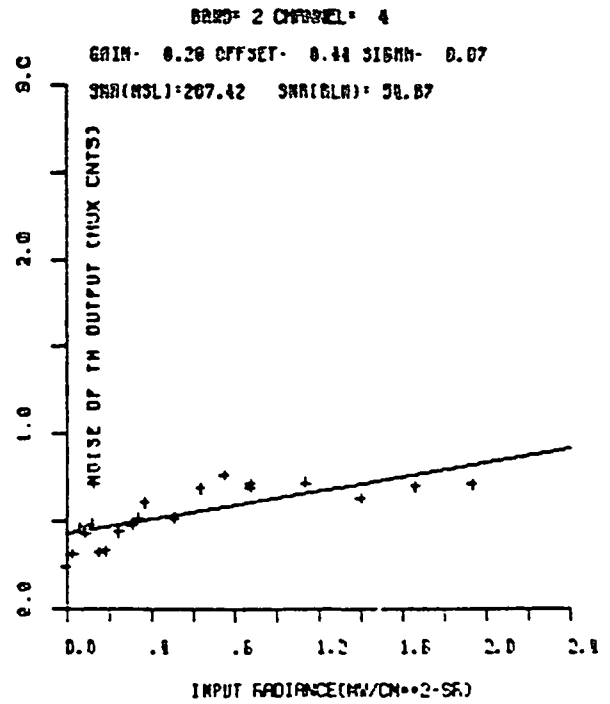
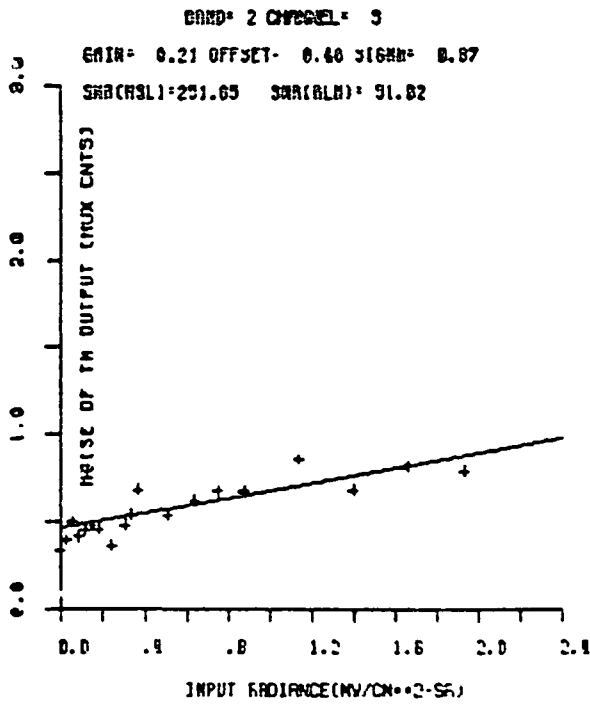
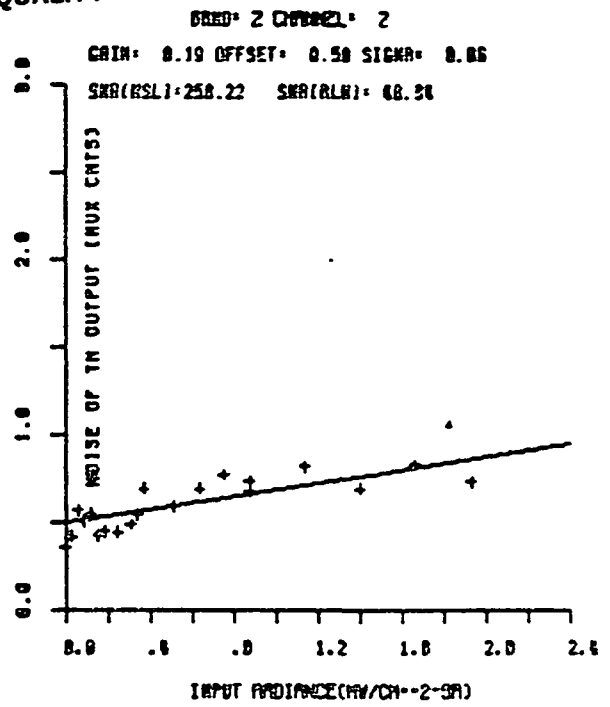
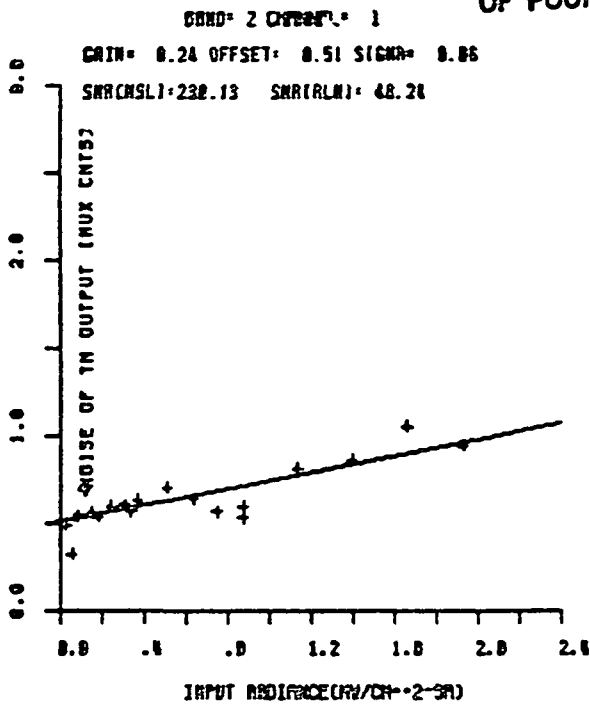


BAND= 1 CHANNEL= 16

GAIN= 0.78 OFFSET= 0.97 SIGMA= 0.04
SNR(NSL)=136.54 SNR(RLN)= 58.59



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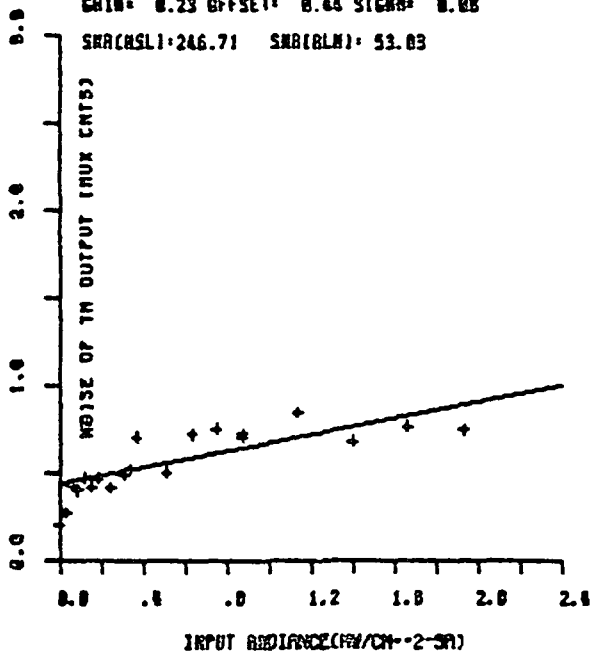


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BAND= 2 CHANNEL= 5

GAIN= 0.23 OFFSET= 0.44 SIGMA= 0.05

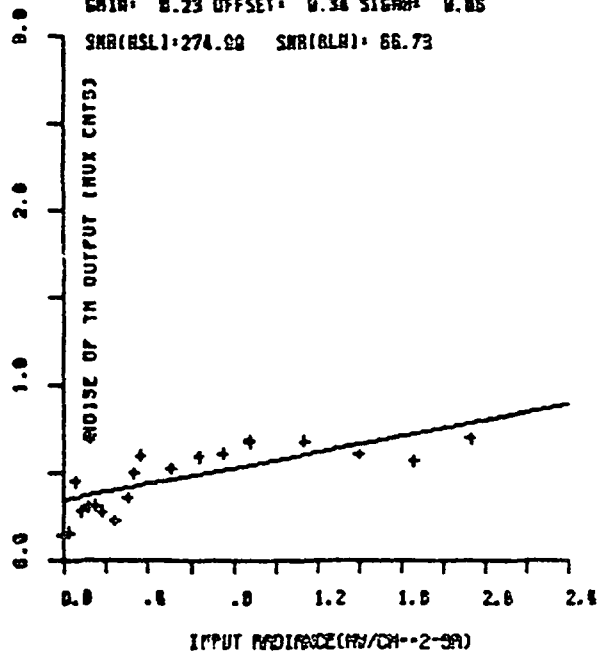
SNR(HSL)=246.71 SNR(BLN)= 53.03



BAND= 2 CHANNEL= 6

GAIN= 0.23 OFFSET= 0.34 SIGMA= 0.05

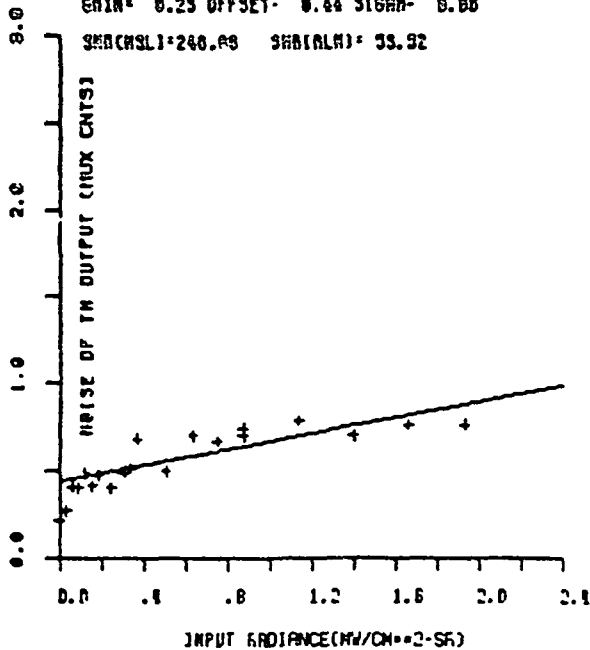
SNR(HSL)=274.00 SNR(BLN)= 66.73



BAND= 2 CHANNEL= 7

GAIN= 0.23 OFFSET= 0.44 SIGMA= 0.05

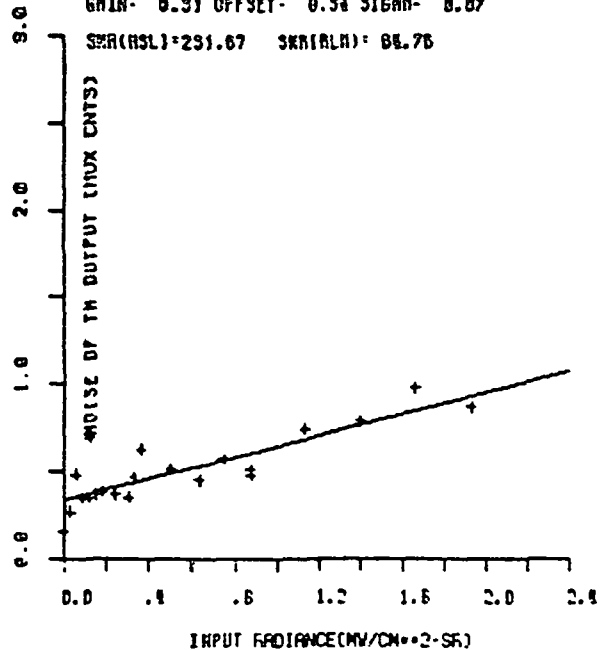
SNR(HSL)=246.95 SNR(BLN)= 53.92



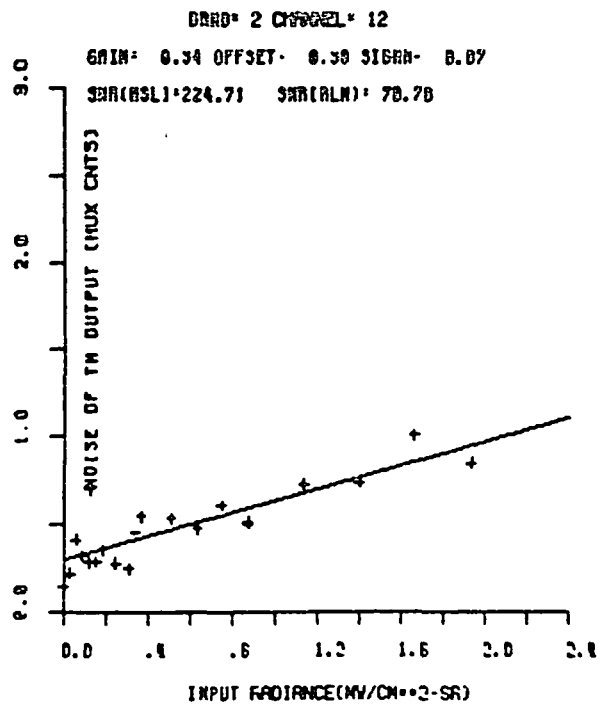
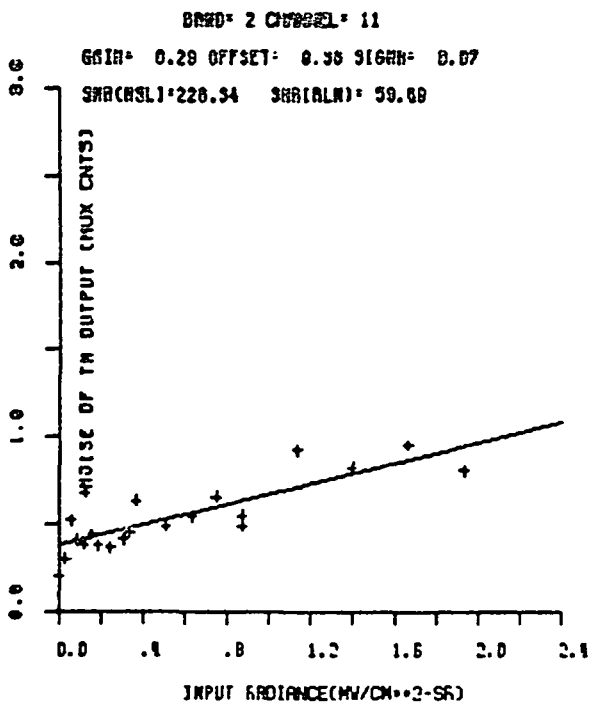
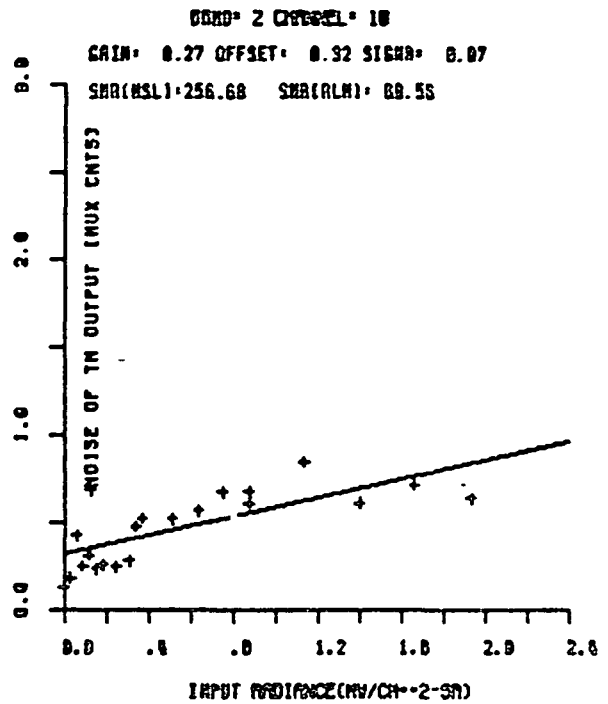
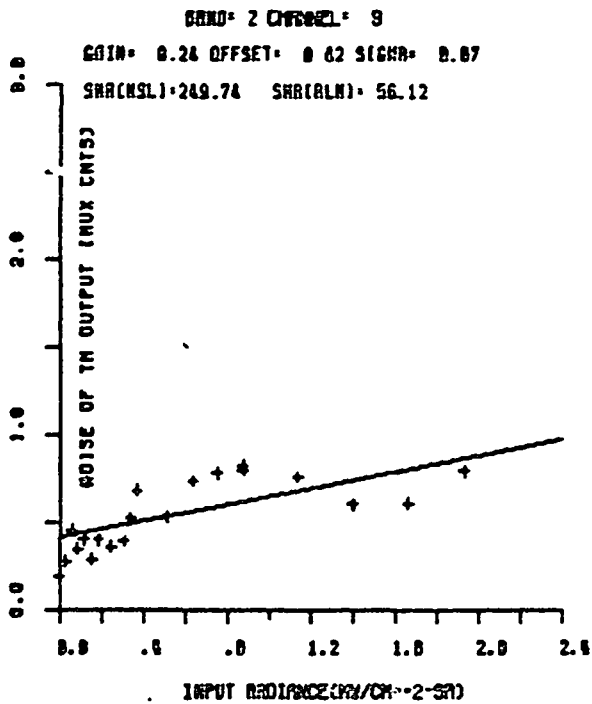
BAND= 2 CHANNEL= 8

GAIN= 0.23 OFFSET= 0.34 SIGMA= 0.07

SNR(HSL)=251.67 SNR(BLN)= 66.76



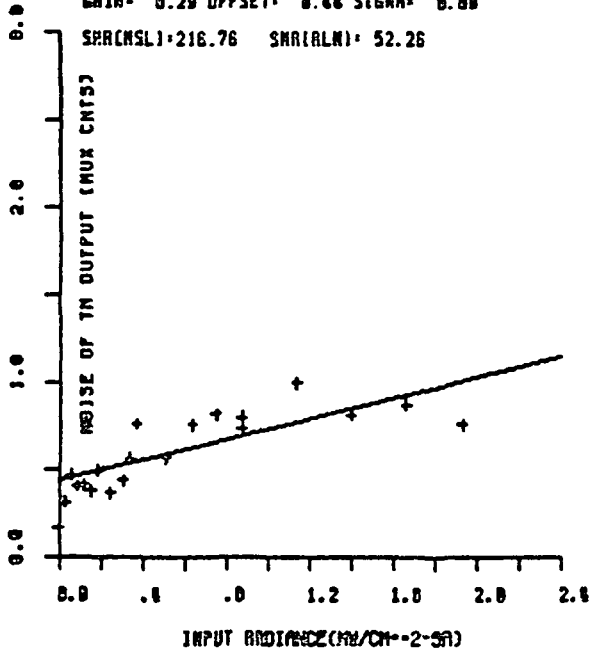
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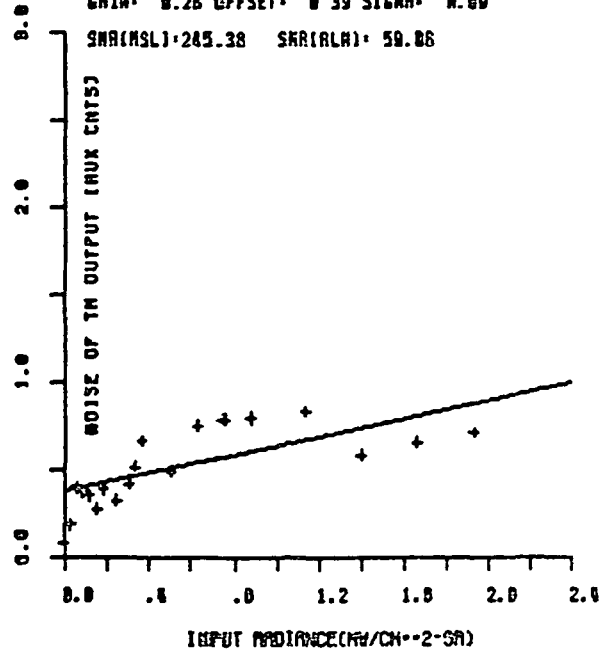
BRND= 2 CHANNEL= 13

GAIN= 0.29 OFFSET= 0.66 SIGMA= 0.09
SNR(NSL)=216.76 SNR(ALN)= 52.26



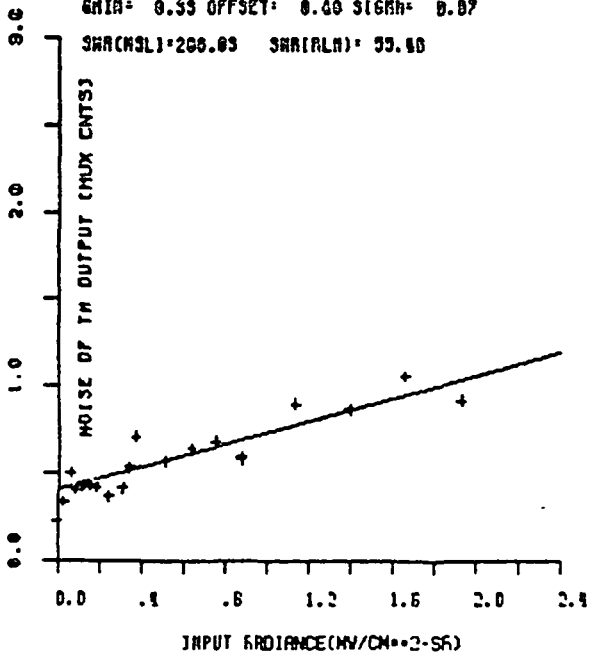
BRND= 2 CHANNEL= 14

GAIN= 0.26 OFFSET= 0.39 SIGMA= 0.09
SNR(NSL)=285.38 SNR(ALN)= 59.86



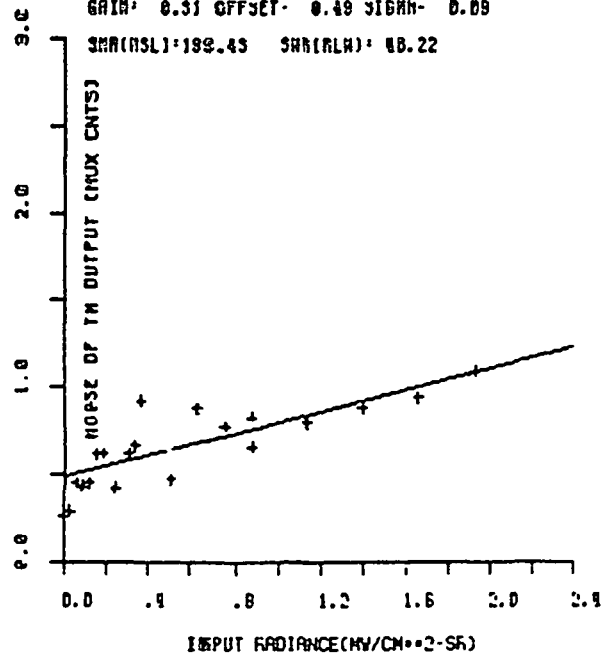
BRND= 2 CHANNEL= 15

GAIN= 0.33 OFFSET= 0.60 SIGMA= 0.07
SNR(NSL)=266.03 SNR(ALN)= 55.80



BRND= 2 CHANNEL= 16

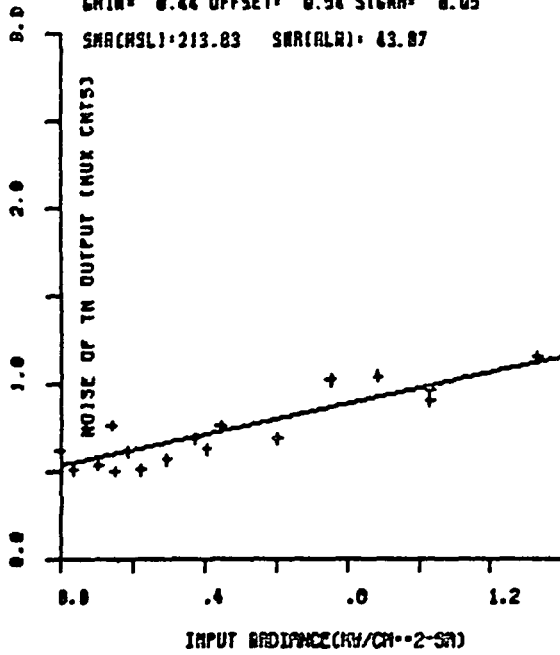
GAIN= 0.31 OFFSET= 0.49 SIGMA= 0.09
SNR(NSL)=199.45 SNR(ALN)= 48.22



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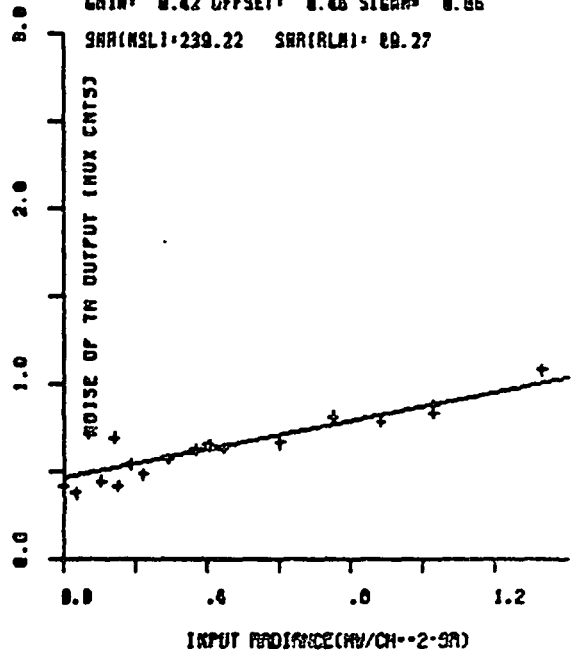
BRND* 3 CHANNEL* 1

GAIN* 0.44 OFFSET* 0.54 SIGMA* 0.05
SNA(CHSL)*213.83 SNA(ALL)* 43.87



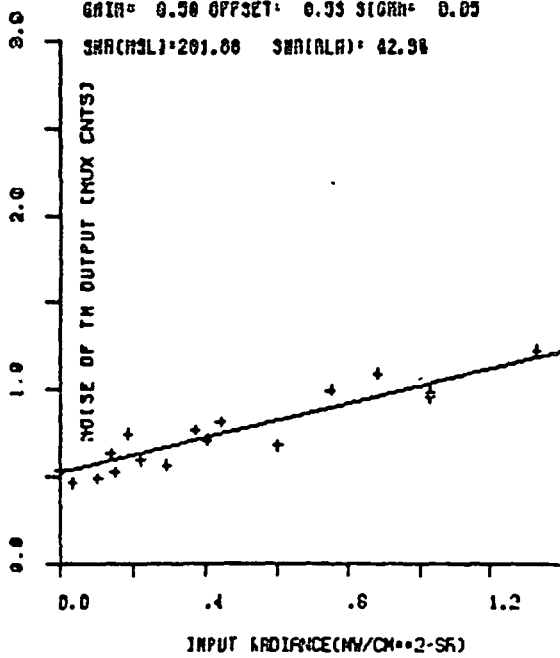
BRND* 3 CHANNEL* 2

GAIN* 0.42 OFFSET* 0.66 SIGMA* 0.06
SNA(NSL)*239.22 SNA(ALL)* 89.27



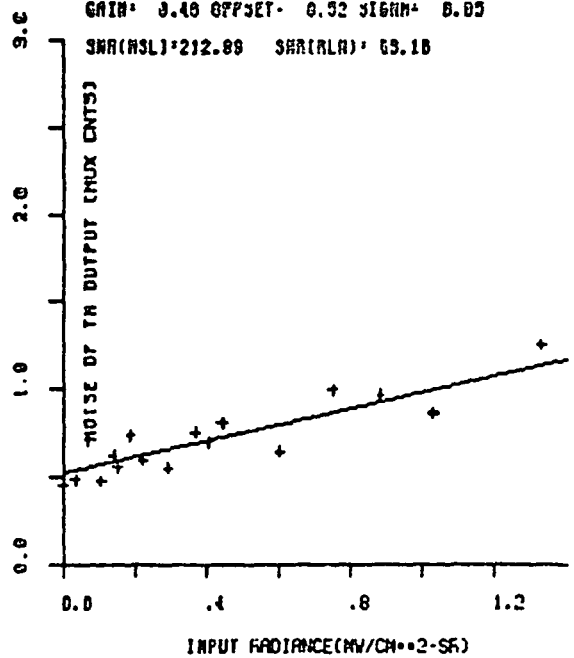
BRND* 3 CHANNEL* 3

GAIN* 0.50 OFFSET* 0.55 SIGMA* 0.05
SNA(CHSL)*201.06 SNA(ALL)* 42.96

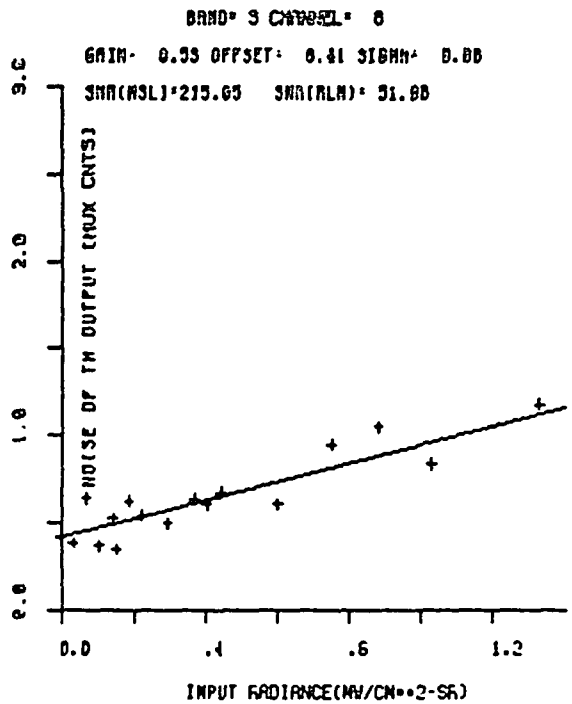
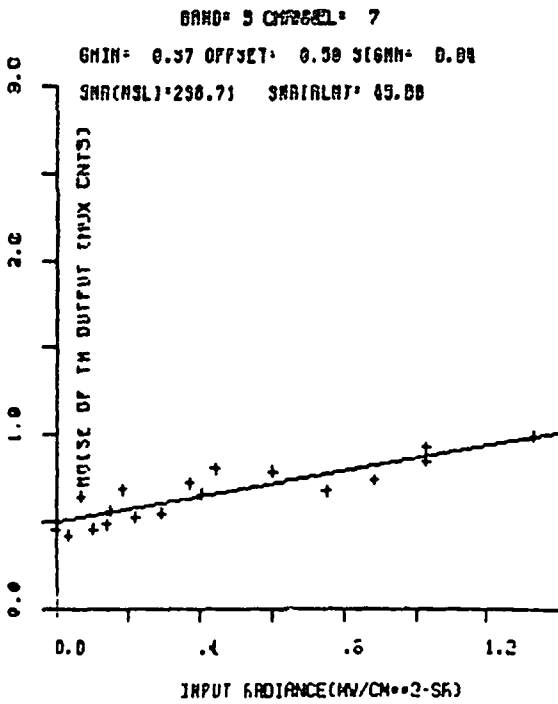
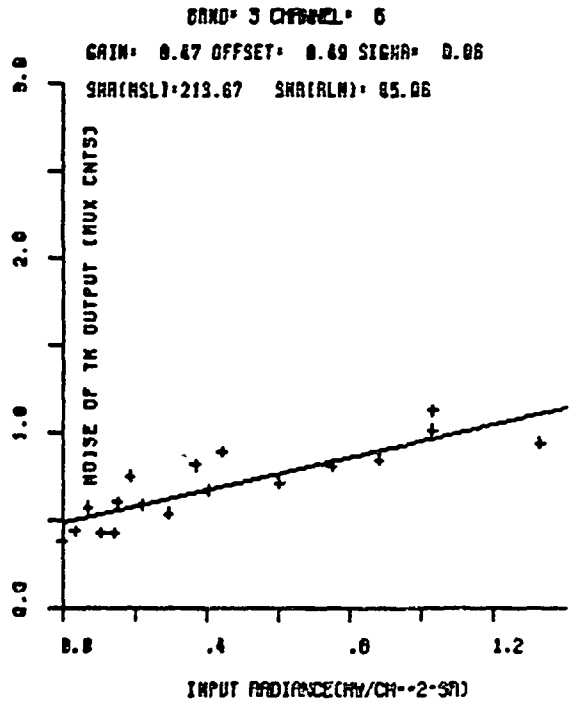
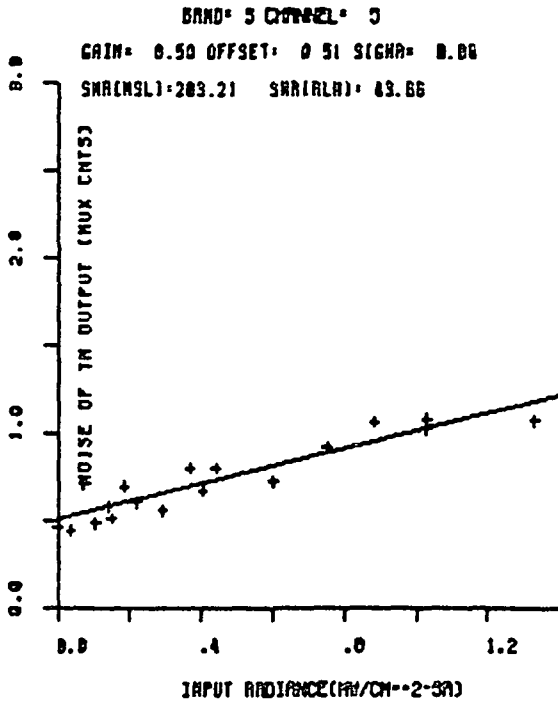


BRND* 3 CHANNEL* 4

GAIN* 0.40 OFFSET* 0.52 SIGMA* 0.05
SNA(NSL)*212.89 SNA(ALL)* 63.18

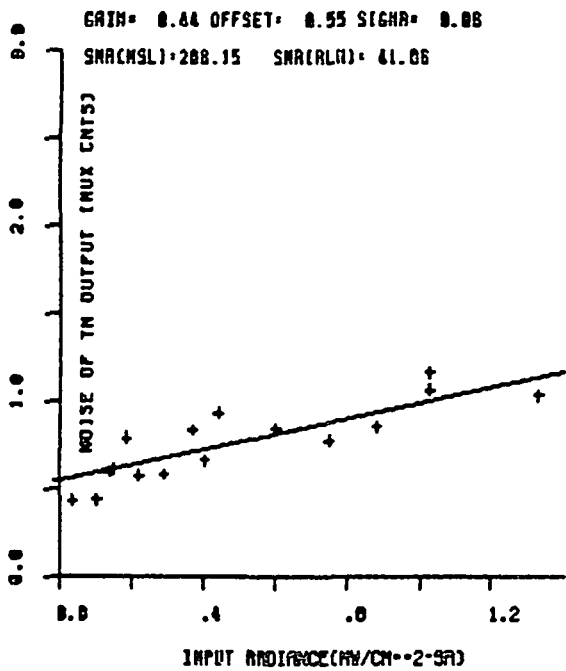


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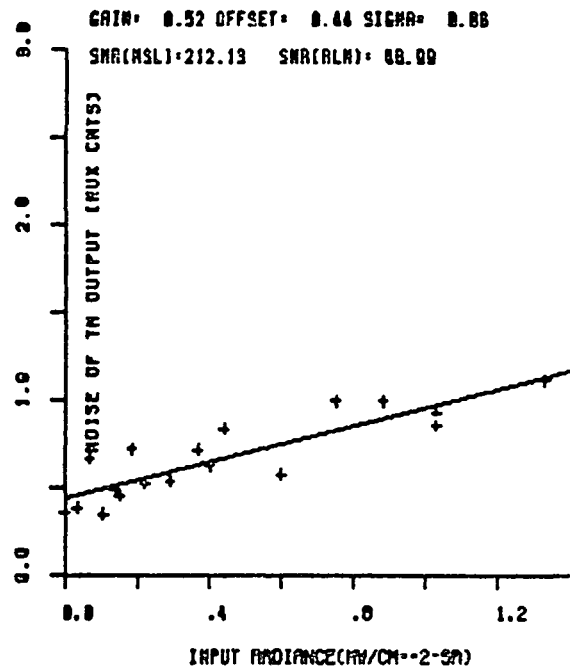


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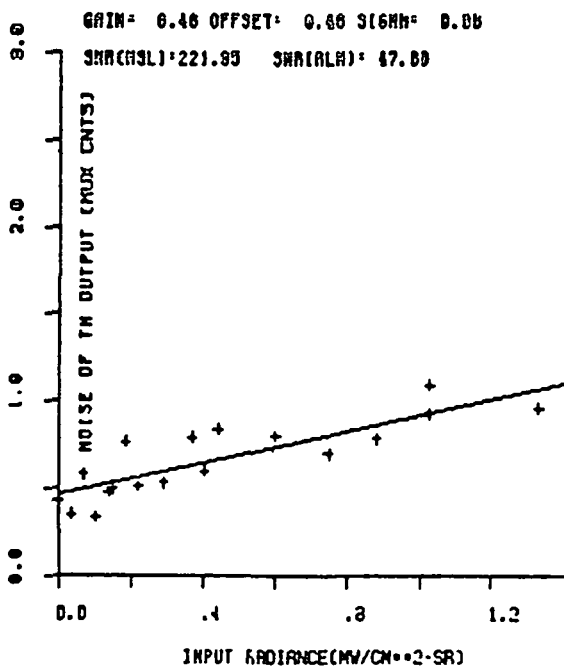
BAND 3 CHANNEL 9



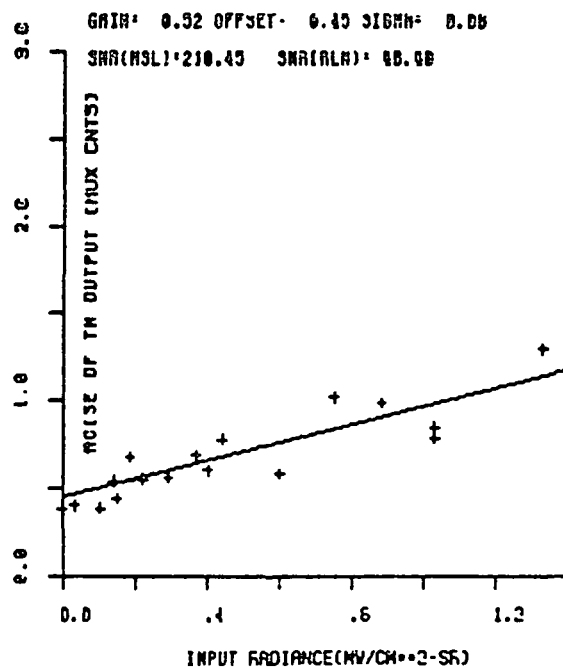
BAND 3 CHANNEL 10



BAND 3 CHANNEL 11



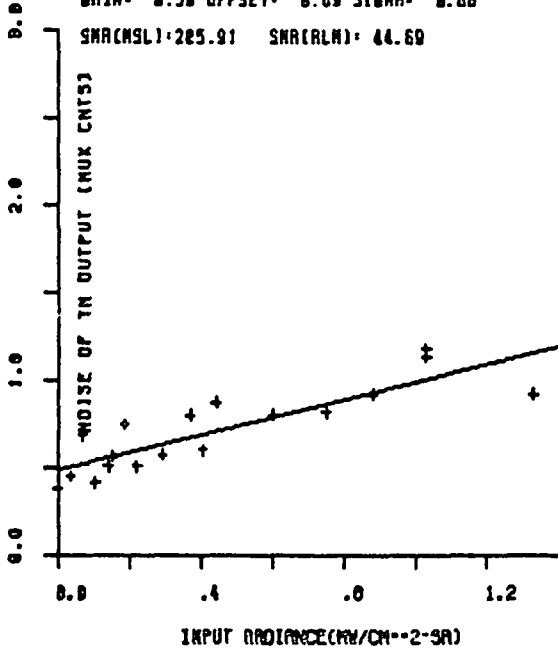
BAND 3 CHANNEL 12



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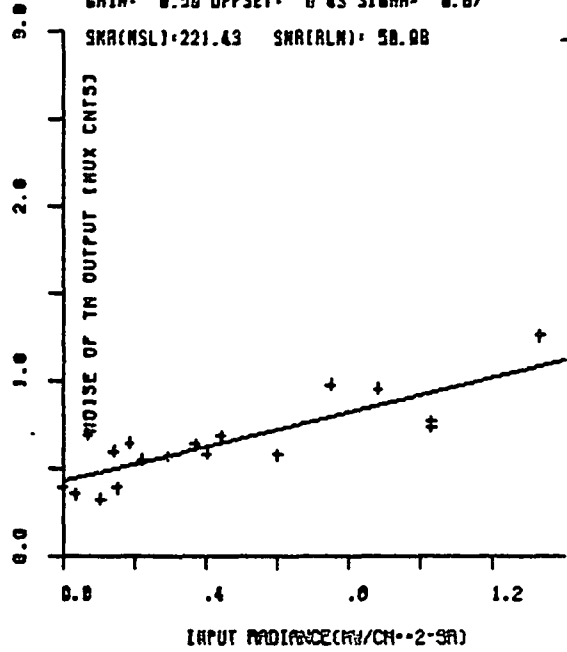
BAND 3 CHANNEL 13

GAIN= 0.50 OFFSET= 0.69 SIGMA= 0.06
SNR(NSL)=205.91 SNR(RLN)= 44.60



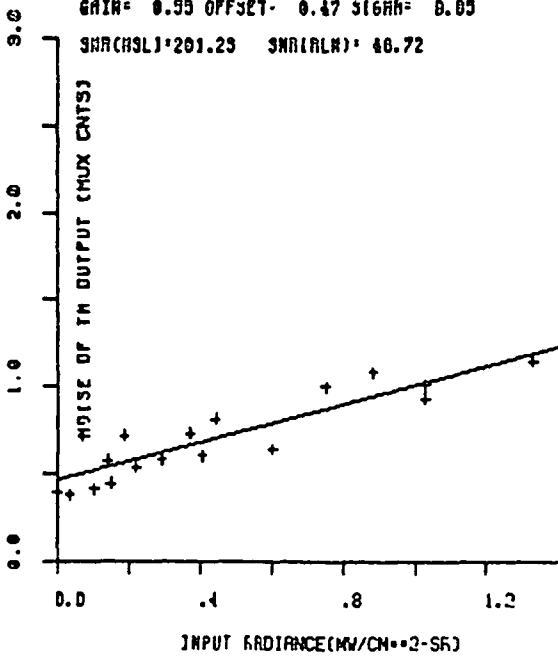
BAND 3 CHANNEL 14

GAIN= 0.50 OFFSET= 0.43 SIGMA= 0.07
SNR(NSL)=221.43 SNR(RLN)= 50.00



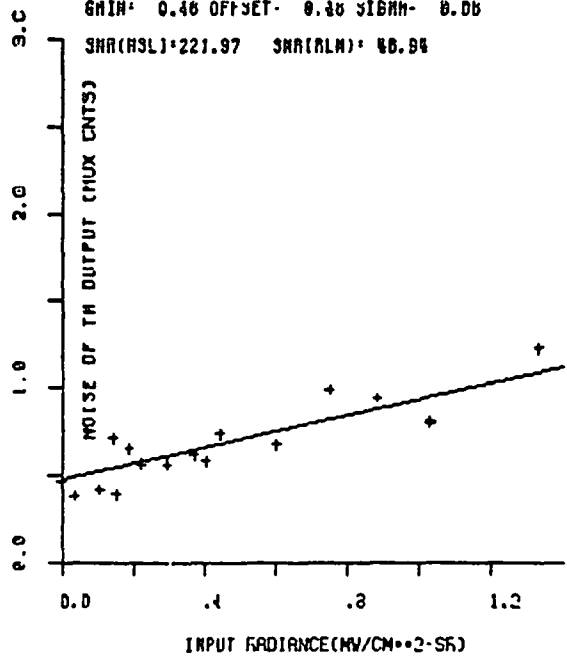
BAND 3 CHANNEL 15

GAIN= 0.50 OFFSET= 0.47 SIGMA= 0.05
SNR(NSL)=201.23 SNR(RLN)= 40.72



BAND 3 CHANNEL 16

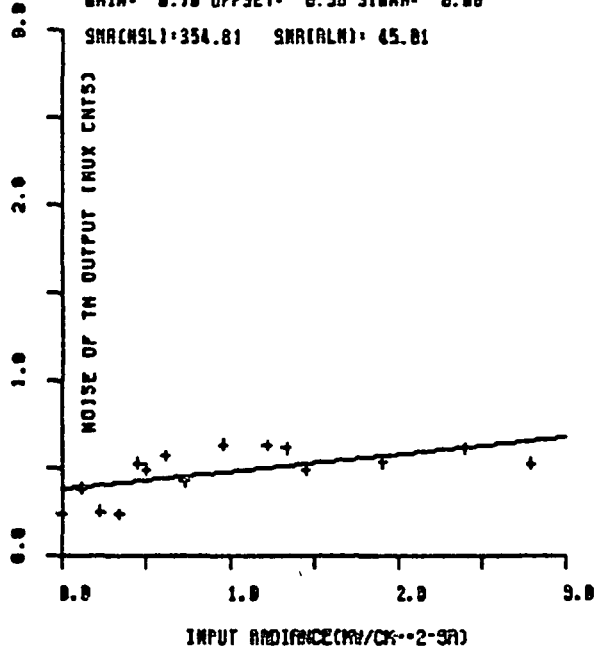
GAIN= 0.46 OFFSET= 0.40 SIGMA= 0.06
SNR(NSL)=221.97 SNR(RLN)= 46.04



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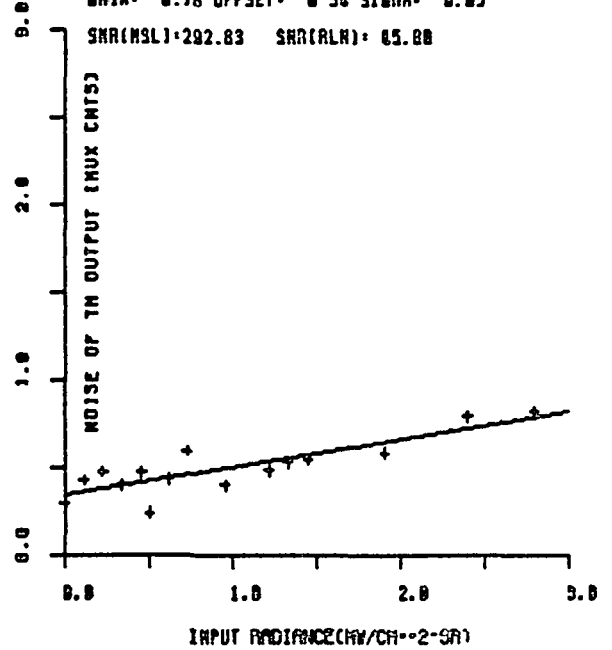
BAND 4 CHANNEL 1

GAIN= 0.10 OFFSET= 0.38 SIGMA= 0.06
SNR(MSL)=354.81 SNR(ALM)= 45.81



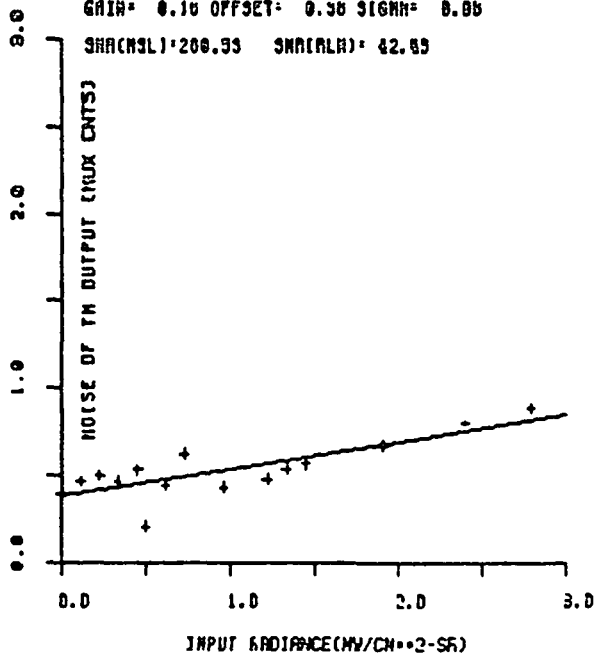
BAND 4 CHANNEL 2

GAIN= 0.18 OFFSET= 0.34 SIGMA= 0.05
SNR(MSL)=292.83 SNR(ALM)= 65.88



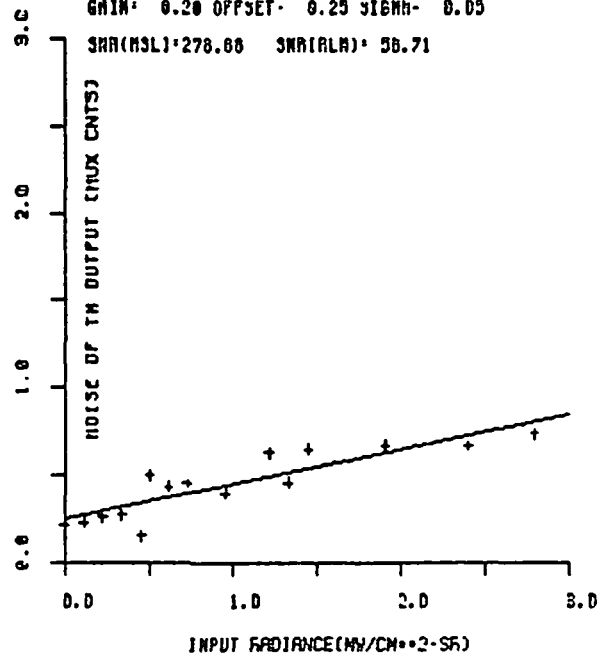
BAND 4 CHANNEL 3

GAIN= 0.10 OFFSET= 0.38 SIGMA= 0.06
SNR(MSL)=208.33 SNR(ALM)= 42.83

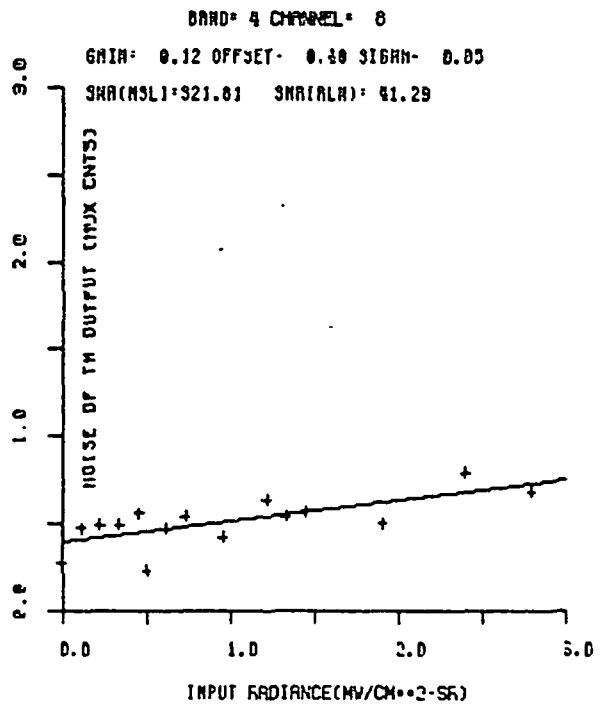
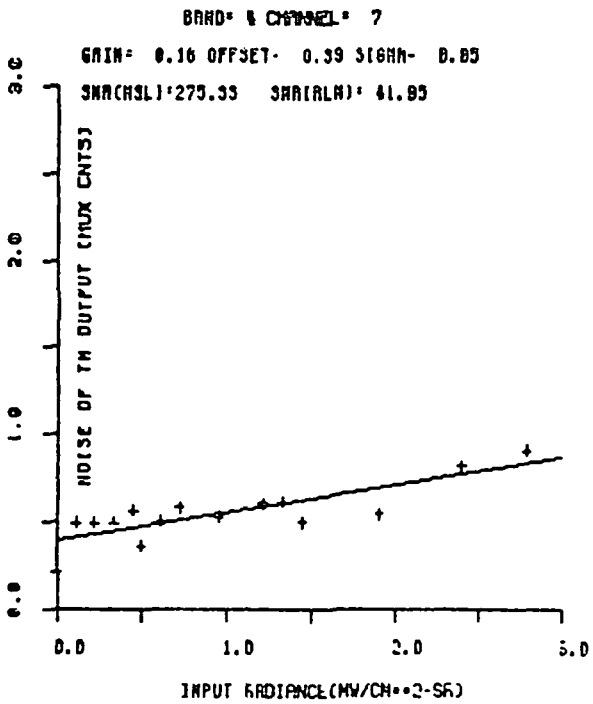
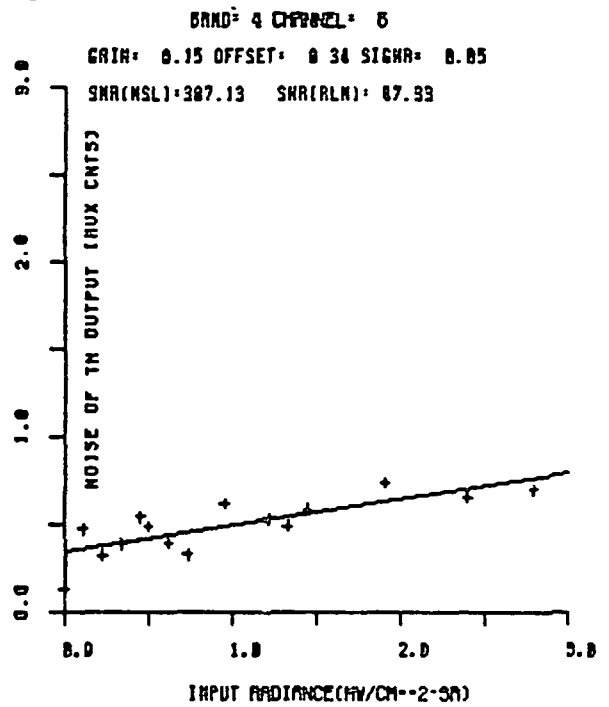
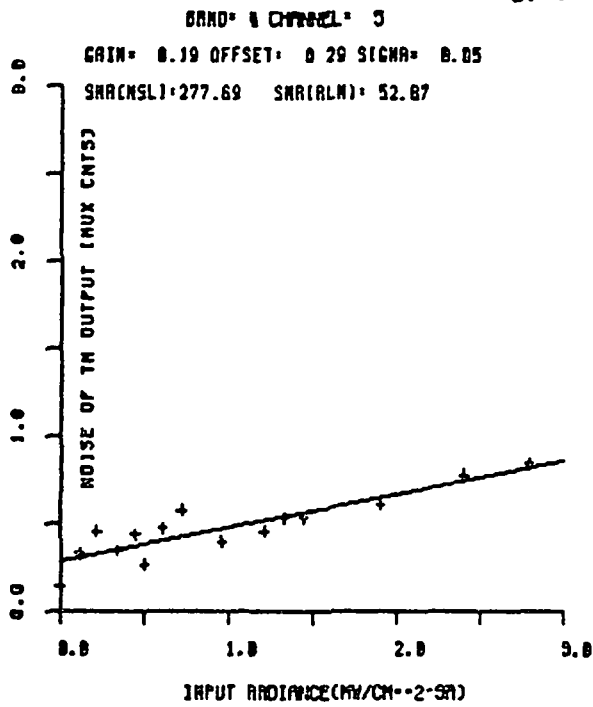


BAND 4 CHANNEL 4

GAIN= 0.20 OFFSET= 0.23 SIGMA= 0.05
SNR(MSL)=278.68 SNR(ALM)= 58.71



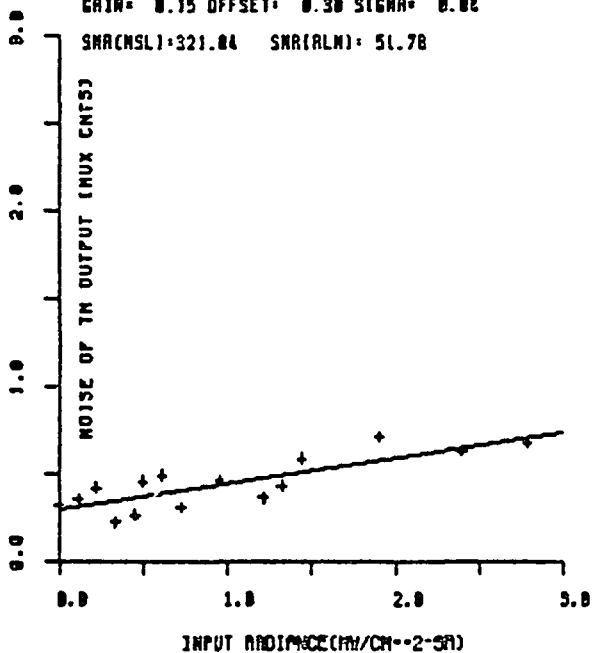
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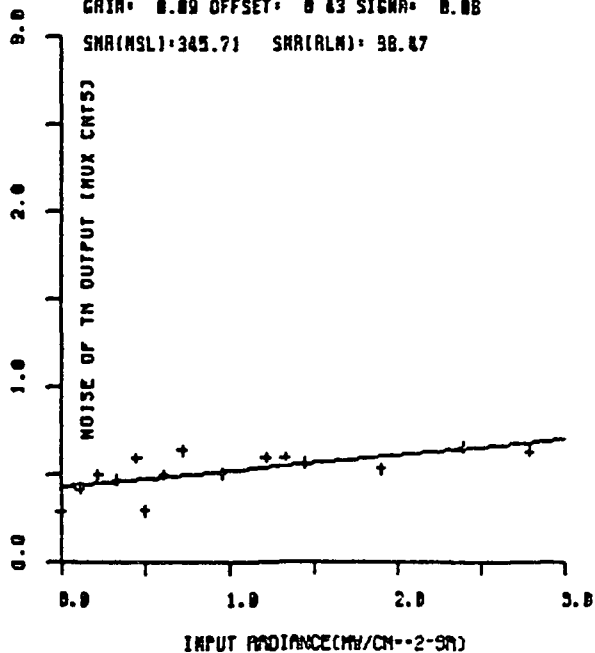
BRAND 4 CHANNEL 9

GAIN= 0.15 OFFSET= 0.30 SIGMA= 0.02
SNR(NSL)=321.04 SNR(ALM)= 51.78



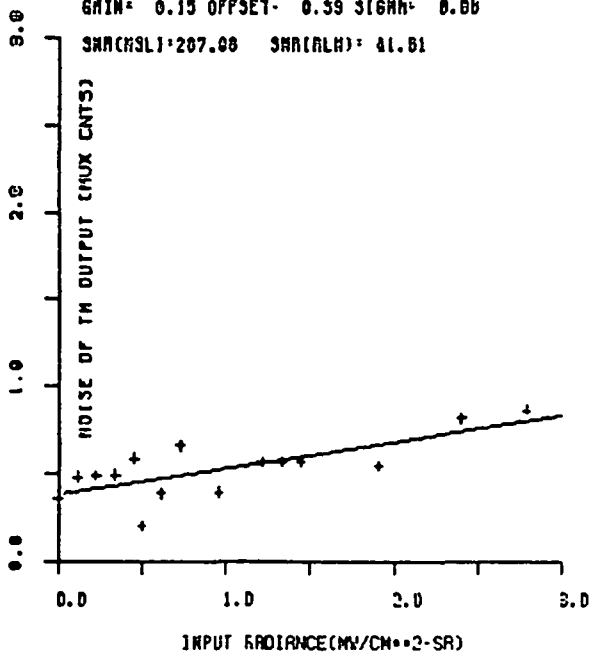
BRAND 4 CHANNEL 10

GAIN= 0.09 OFFSET= 0.43 SIGMA= 0.03
SNR(NSL)=345.71 SNR(ALM)= 58.87



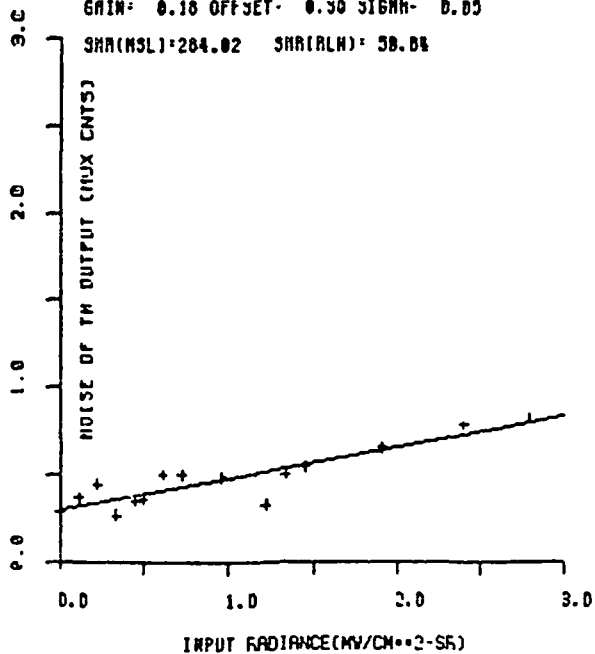
BRAND 4 CHANNEL 11

GAIN= 0.13 OFFSET= 0.39 SIGMA= 0.02
SNR(NSL)=287.06 SNR(ALM)= 41.81



BRAND 4 CHANNEL 12

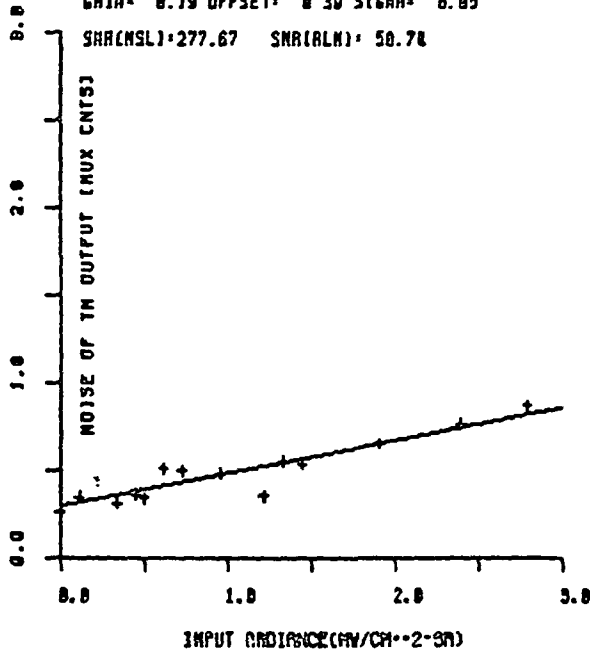
GAIN= 0.10 OFFSET= 0.30 SIGMA= 0.03
SNR(NSL)=284.02 SNR(ALM)= 58.84



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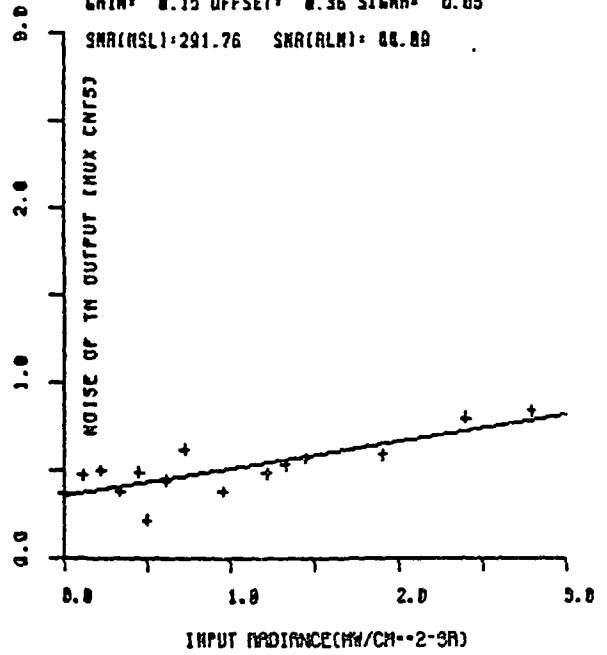
BAND 4 CHANNEL 13

GAIN= 0.19 OFFSET= 0.30 SIGMA= 0.05
SRR(NSL)=277.67 SRR(ALN)= 50.78



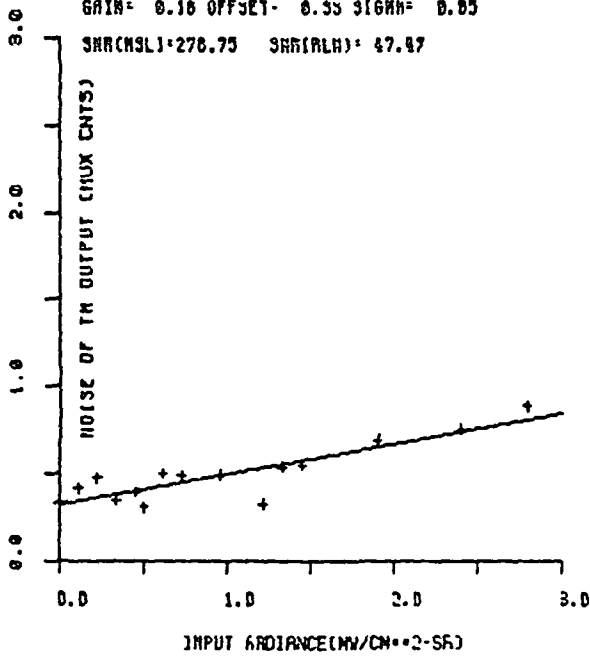
BAND 4 CHANNEL 14

GAIN= 0.15 OFFSET= 0.36 SIGMA= 0.05
SRR(NSL)=291.76 SRR(ALN)= 66.89



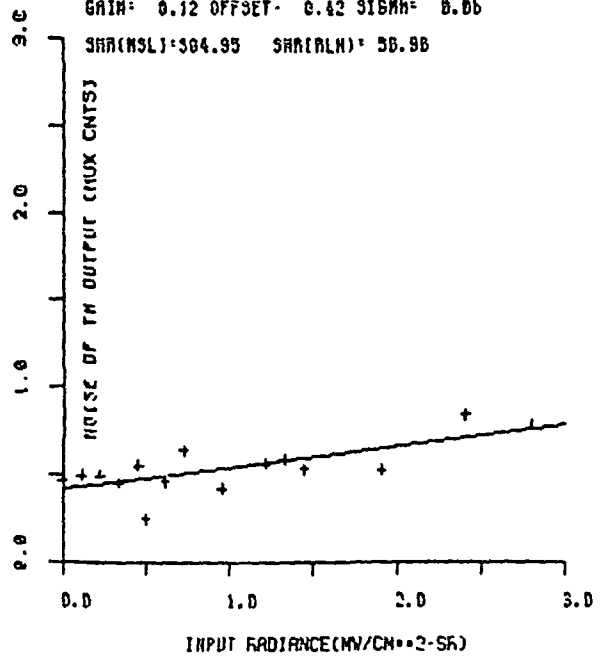
BAND 4 CHANNEL 15

GAIN= 0.16 OFFSET= 0.35 SIGMA= 0.05
SRR(NSL)=276.75 SRR(ALN)= 47.87

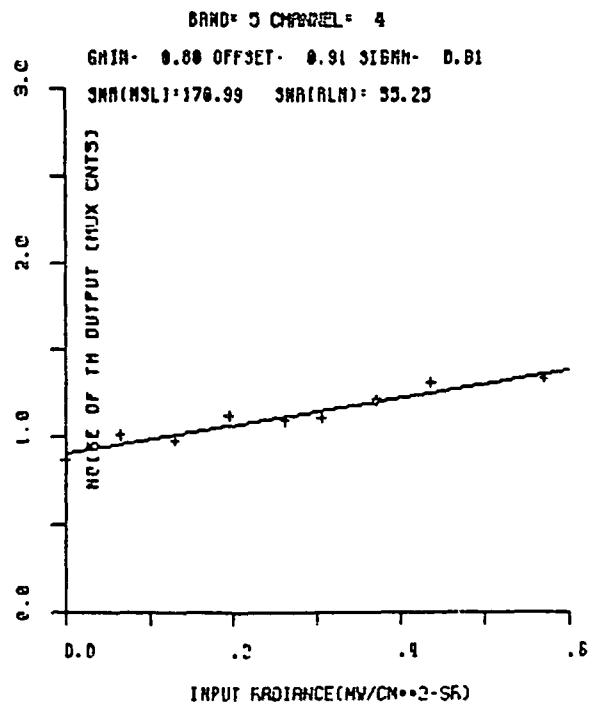
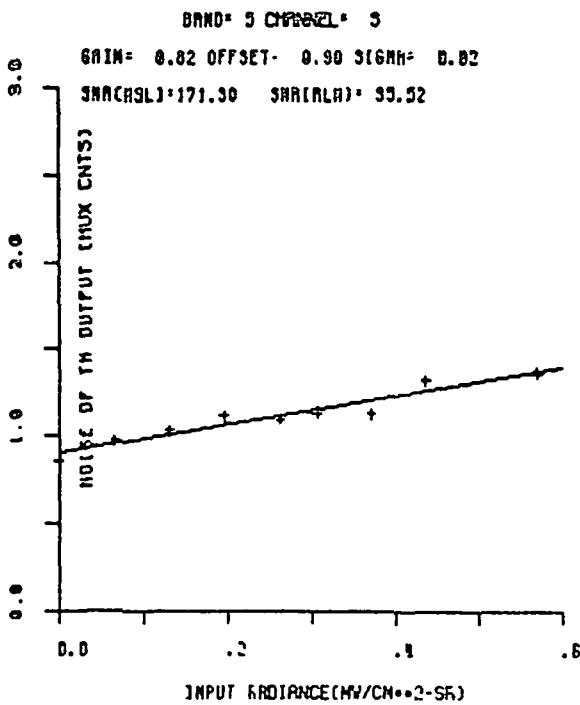
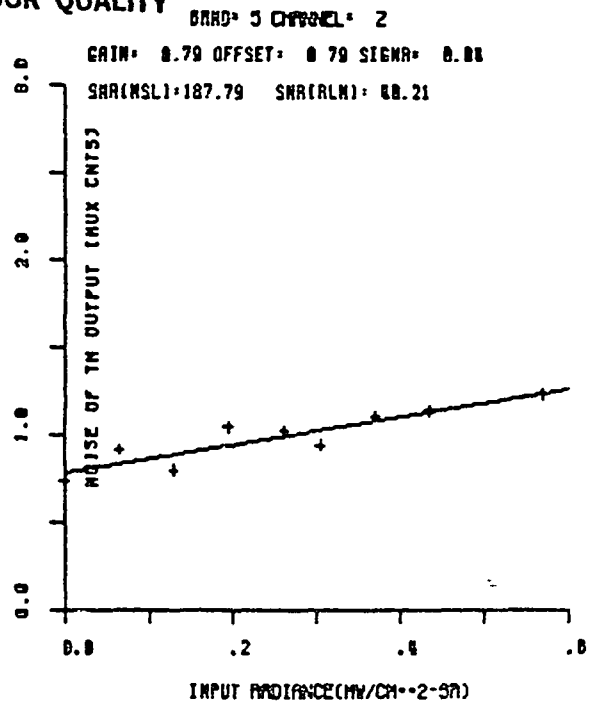
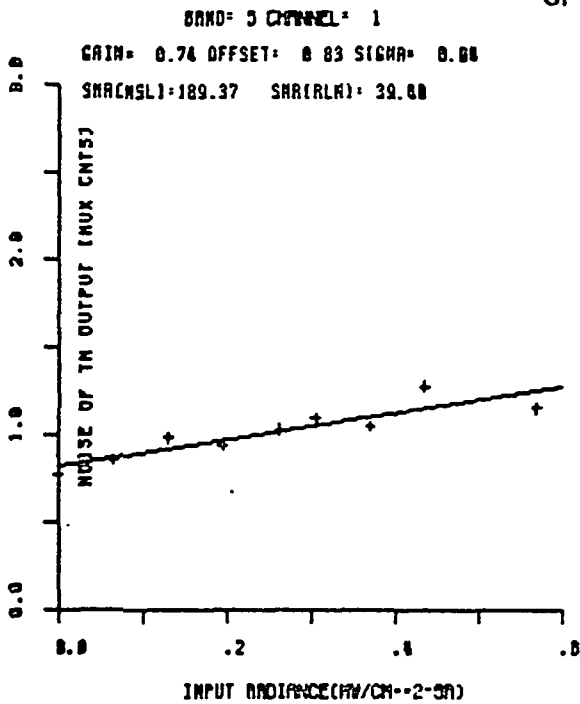


BAND 4 CHANNEL 16

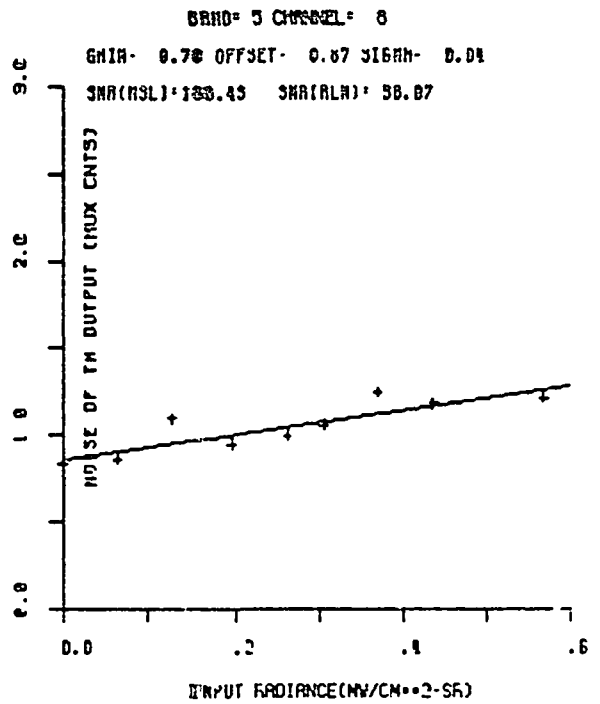
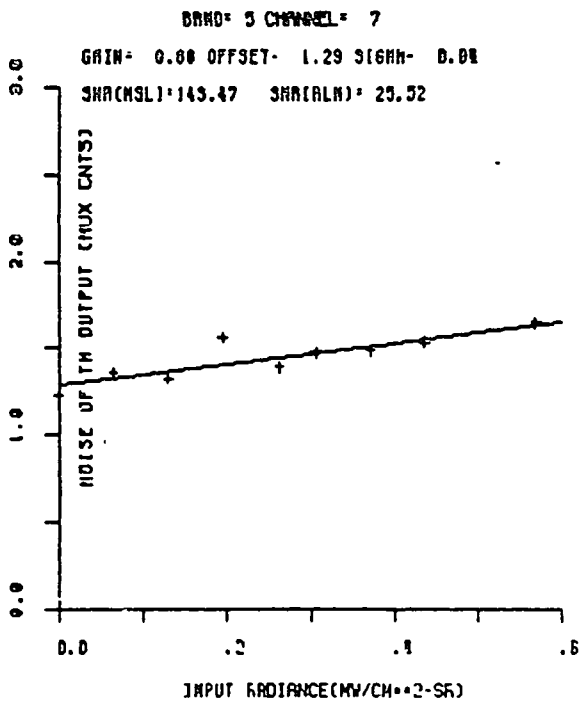
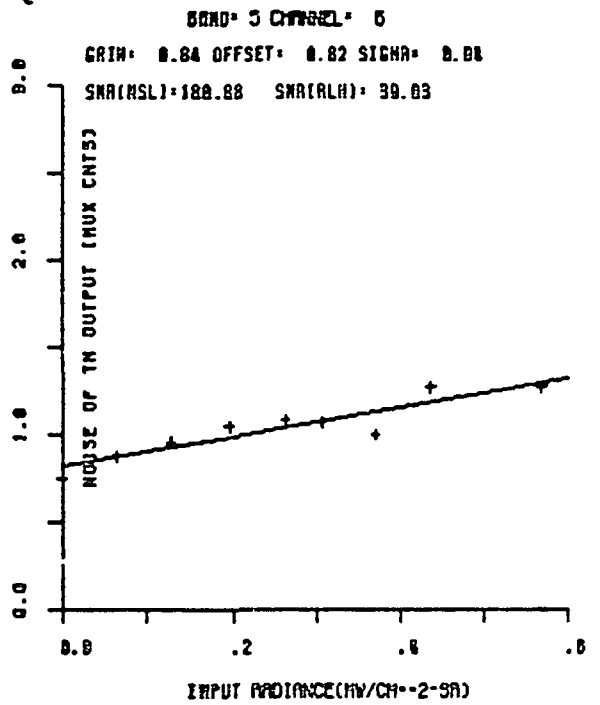
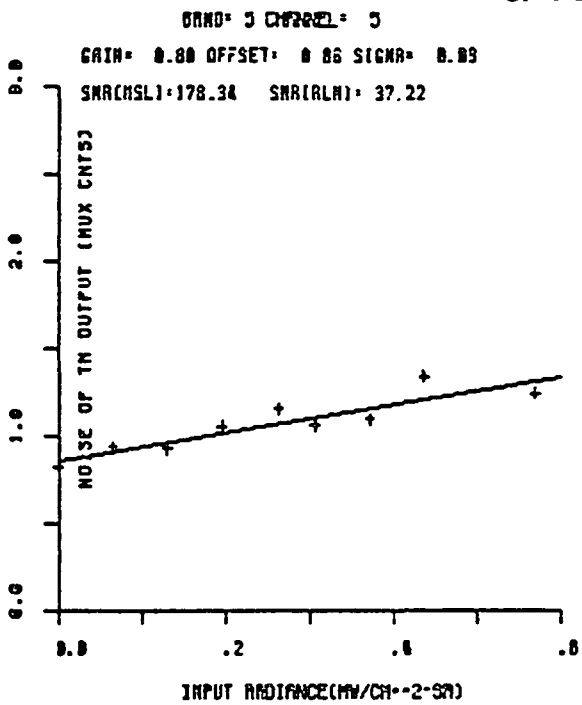
GAIN= 0.12 OFFSET= 0.42 SIGMA= 0.06
SRR(NSL)=304.95 SRR(ALN)= 50.88



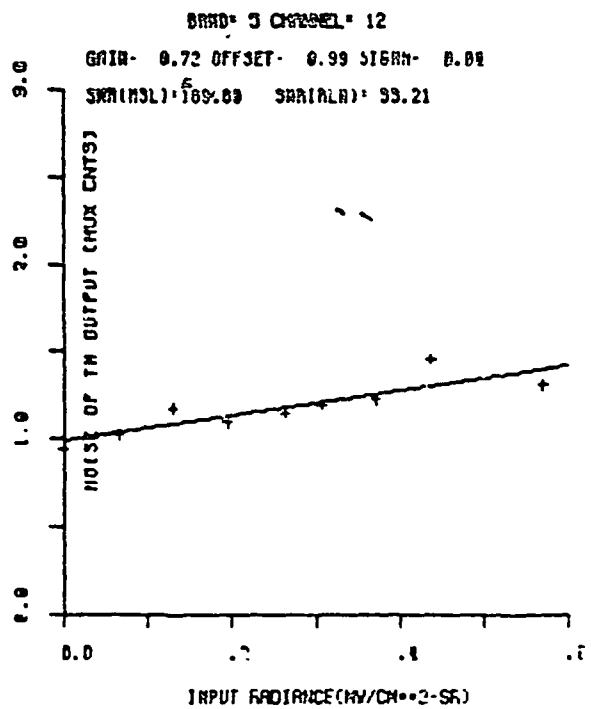
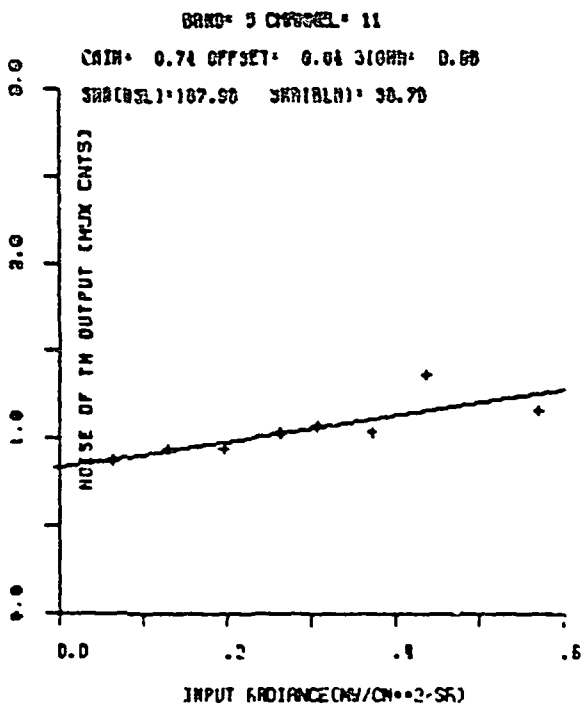
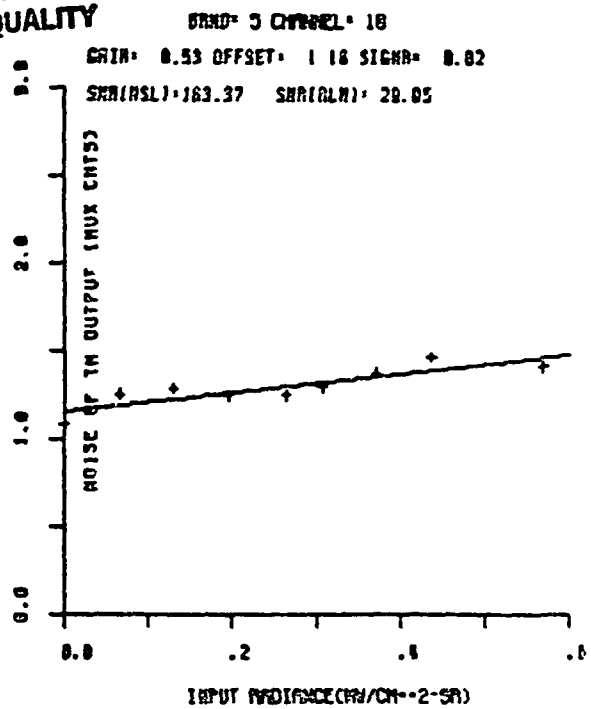
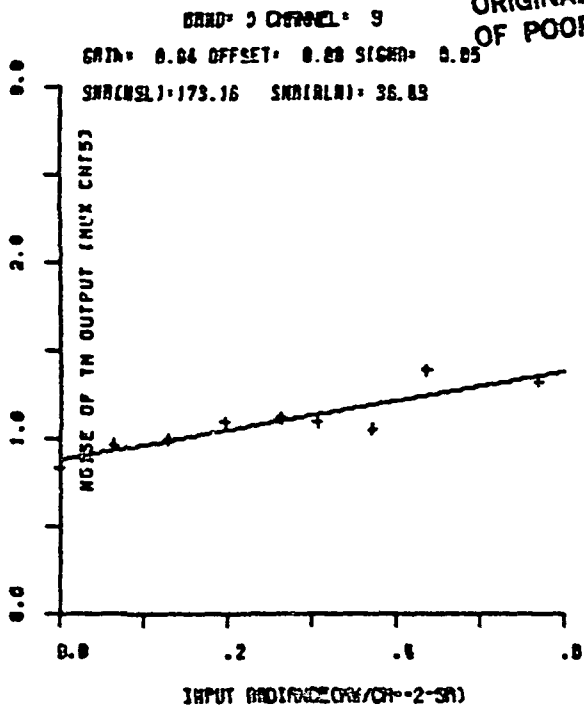
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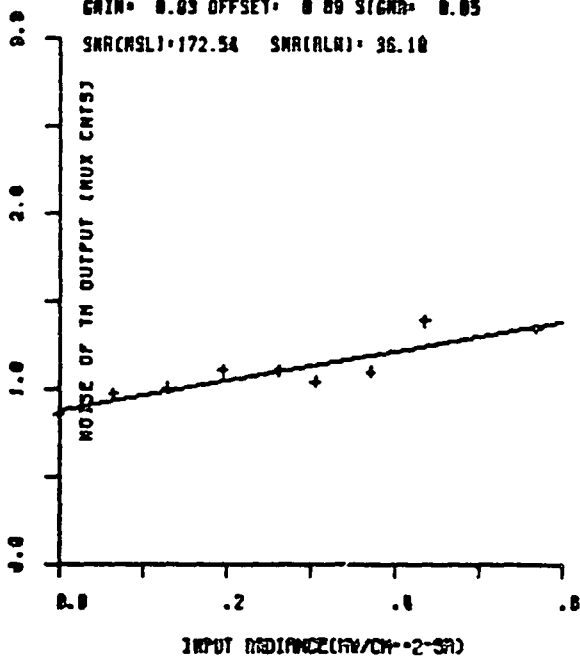


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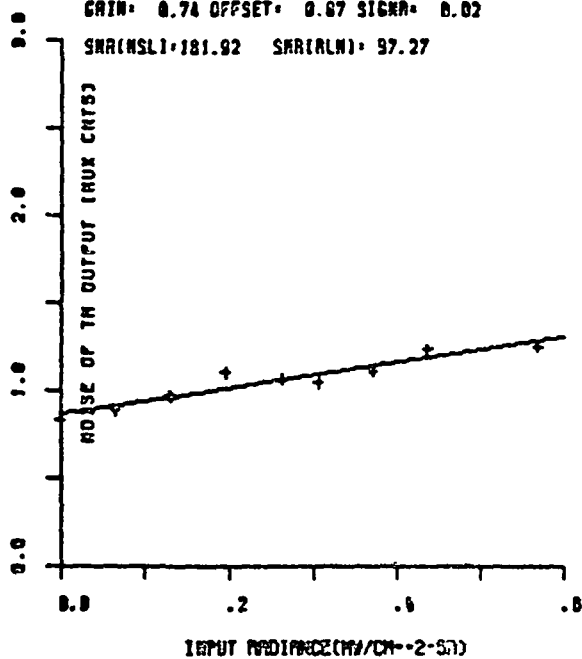
BAND= 5 CHANNEL= 13

GAIN= 0.83 OFFSET= 0.89 SIGMA= 0.05
SRR(NSLI)=172.54 SRR(ALN)= 36.18



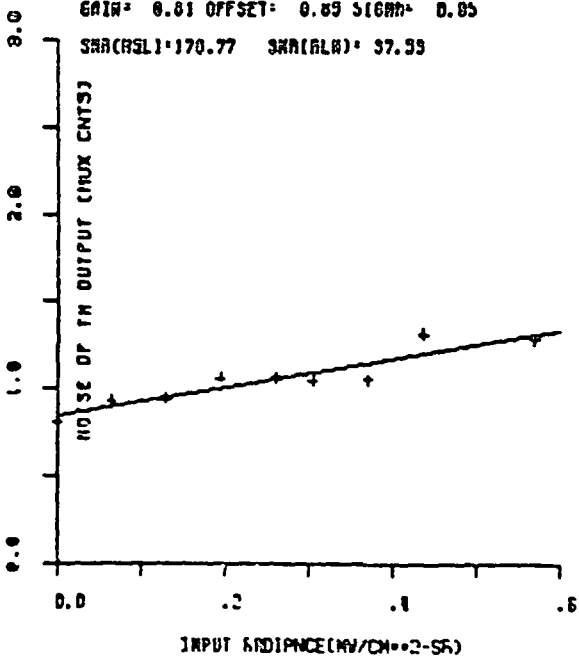
BAND= 5 CHANNEL= 14

GAIN= 0.74 OFFSET= 0.87 SIGMA= 0.02
SRR(NSLI)=181.92 SRR(ALN)= 97.27



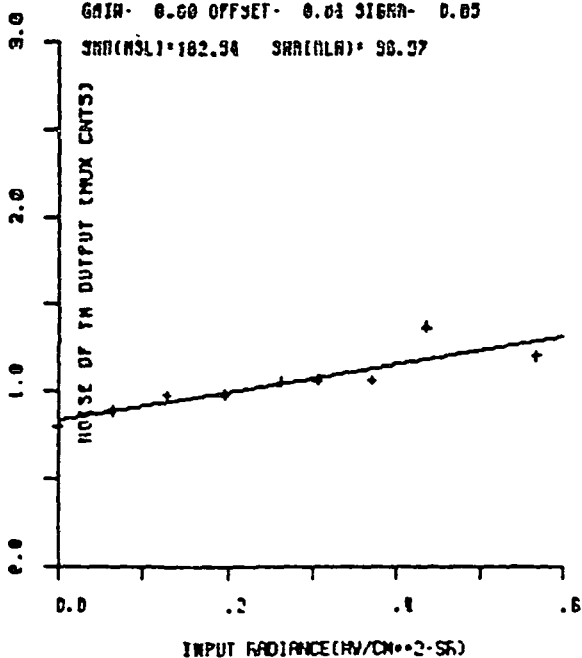
BAND= 5 CHANNEL= 15

GAIN= 0.81 OFFSET= 0.85 SIGMA= 0.05
SRR(NSLI)=170.77 SRR(ALN)= 37.33



BAND= 5 CHANNEL= 16

GAIN= 0.80 OFFSET= 0.81 SIGMA= 0.05
SRR(NSLI)=182.36 SRR(ALN)= 96.37

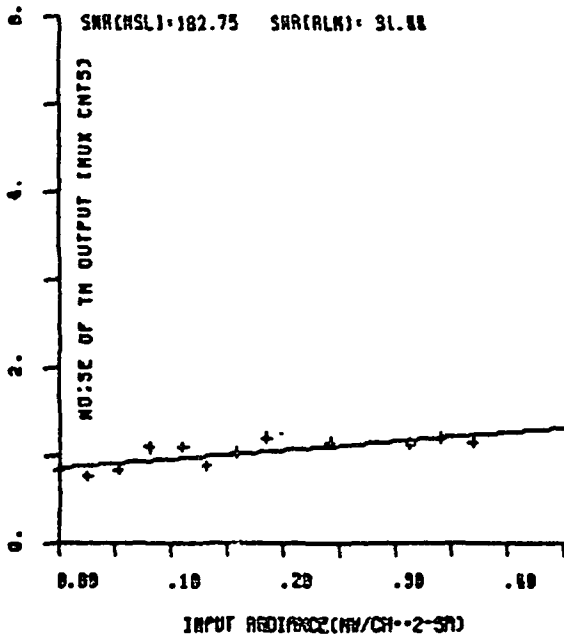


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BAND 7 CHANNEL 1

GAIN= 0.99 OFFSET= 0.08 SIGMA= 0.05

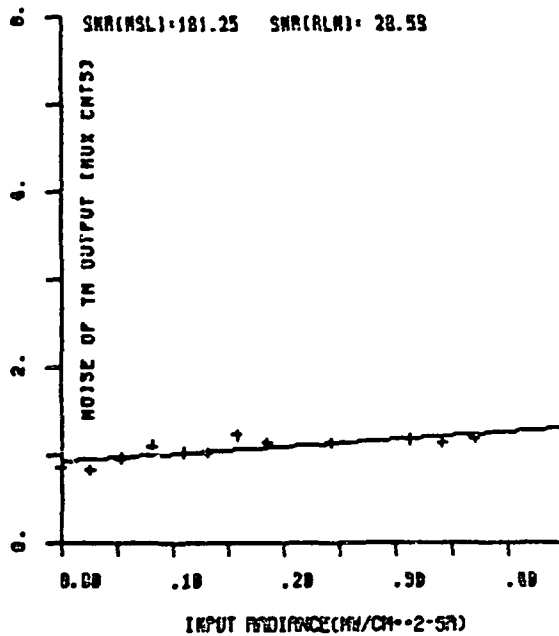
SRR(NSL)=182.75 SRR(ALN)= 31.88



BAND 7 CHANNEL 2

GAIN= 0.02 OFFSET= 0.09 SIGMA= 0.05

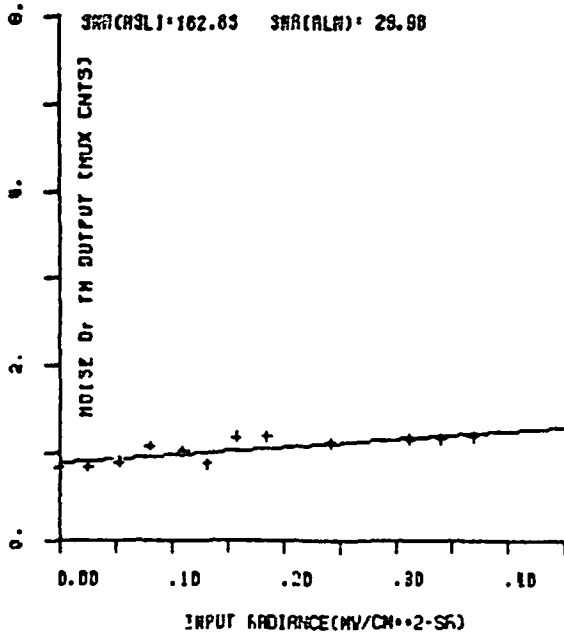
SRR(NSL)=181.25 SRR(ALN)= 28.59



BAND 7 CHANNEL 3

GAIN= 0.92 OFFSET= 0.09 SIGMA= 0.08

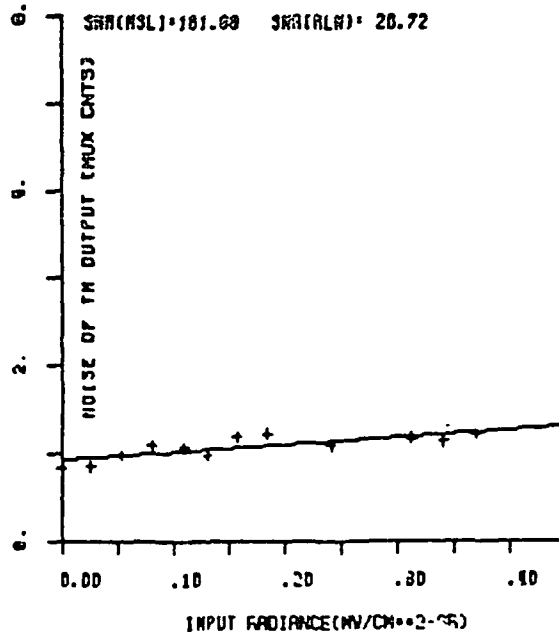
SRR(NSL)=182.85 SRR(ALN)= 29.98



BAND 7 CHANNEL 4

GAIN= 0.04 OFFSET= 0.09 SIGMA= 0.08

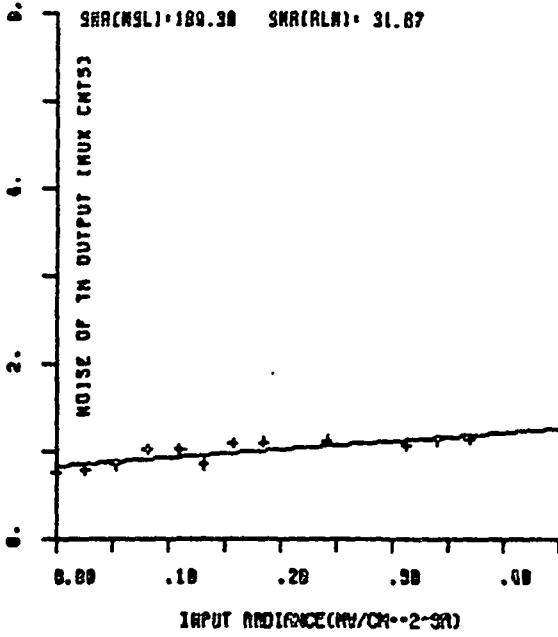
SRR(NSL)=181.00 SRR(ALN)= 28.72



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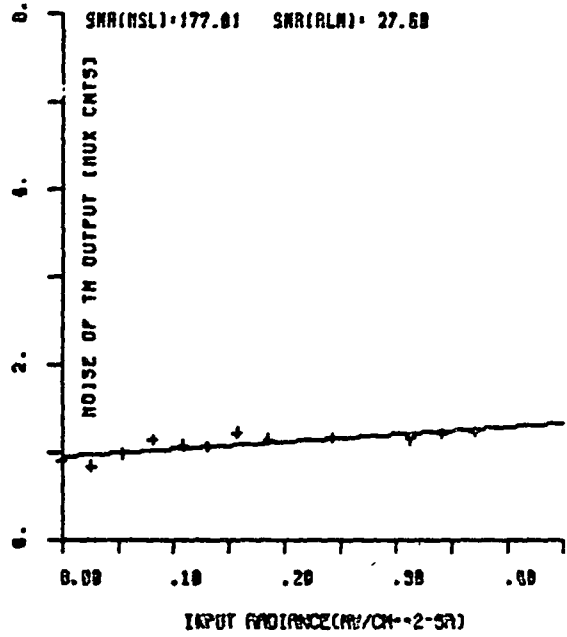
BAND= 7 CHANNEL= 5

GAIN= 0.86 OFFSET= 0.84 SIGMA= 0.89
SNR(NSL)=180.30 SNR(ALN)= 31.87



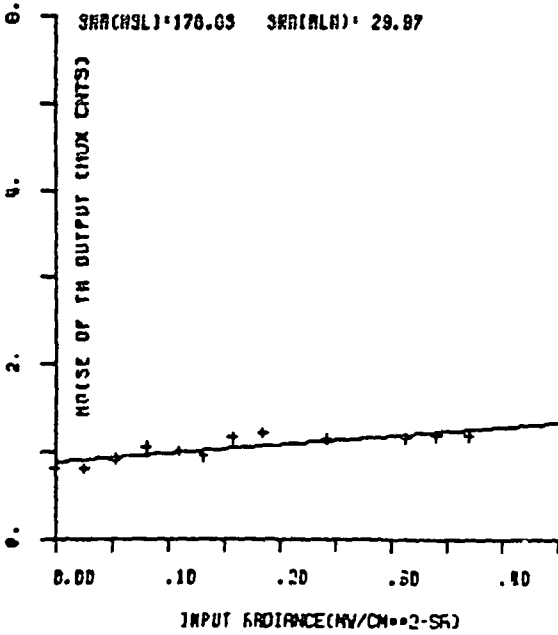
BAND= 7 CHANNEL= 6

GAIN= 0.83 OFFSET= 0.88 SIGMA= 0.85
SNR(NSL)=177.81 SNR(ALN)= 27.68



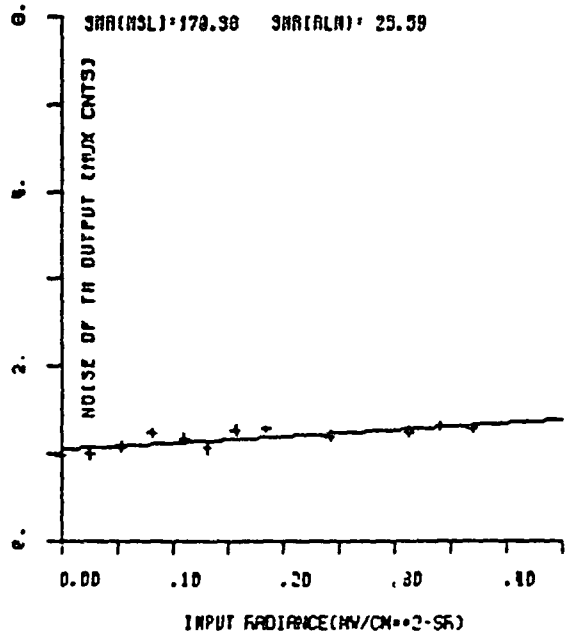
BAND= 7 CHANNEL= 7

GAIN= 1.01 OFFSET= 0.89 SIGMA= 0.81
SNR(NSL)=170.03 SNR(ALN)= 29.87



BAND= 7 CHANNEL= 8

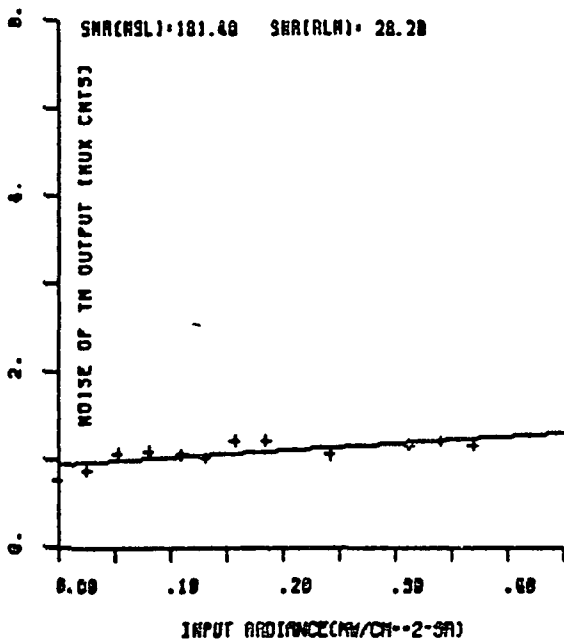
GAIN= 0.74 OFFSET= 1.06 SIGMA= 0.81
SNR(NSL)=170.38 SNR(ALN)= 25.59



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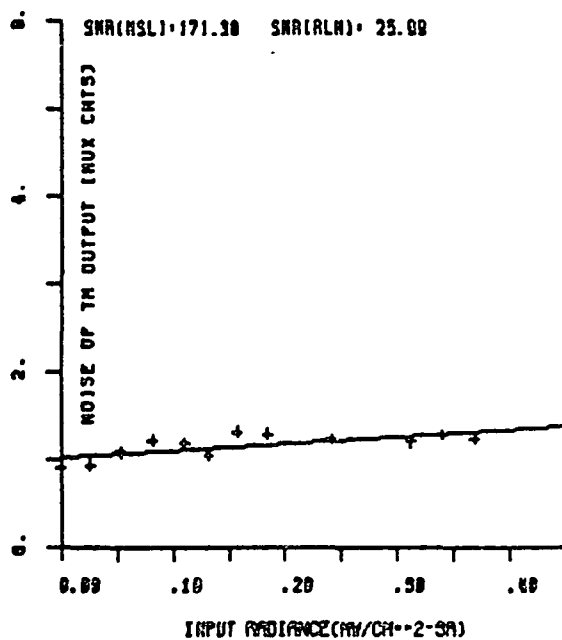
BAND 7 CHANNEL 9

GAIN= 0.89 OFFSET= 0.95 SIGMA= 0.05
SNR(HSL)=181.48 SNR(ALN)= 28.28



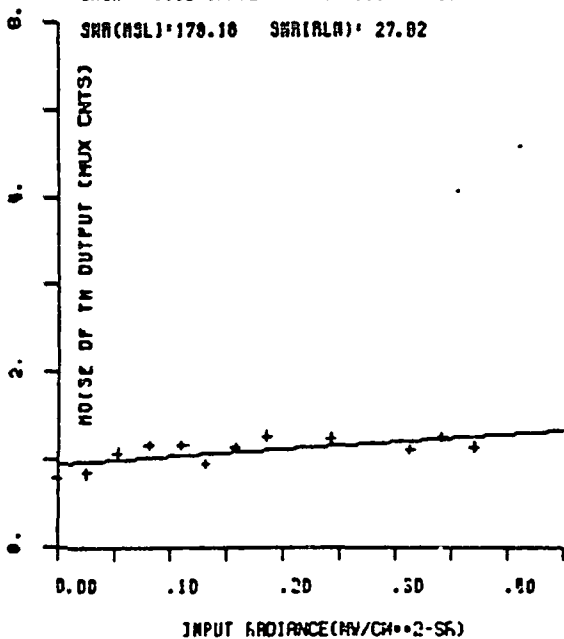
BAND 7 CHANNEL 10

GAIN= 0.77 OFFSET= 1.04 SIGMA= 0.05
SNR(HSL)=171.38 SNR(ALN)= 25.88



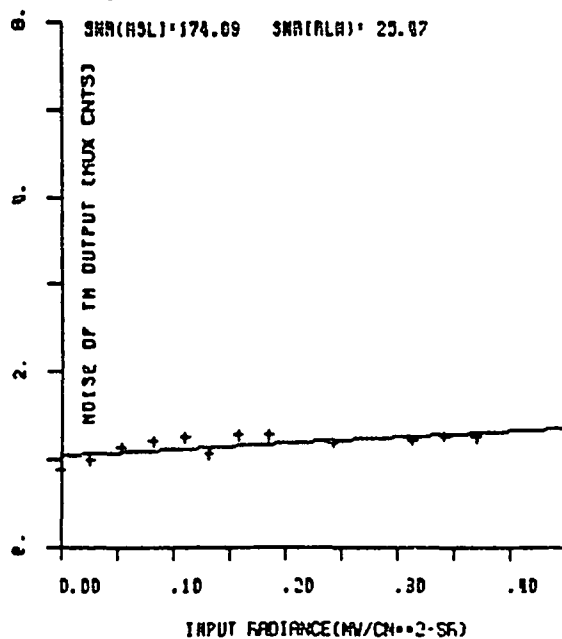
BAND 7 CHANNEL 11

GAIN= 0.82 OFFSET= 0.97 SIGMA= 0.04
SNR(HSL)=178.18 SNR(ALN)= 27.82



BAND 7 CHANNEL 12

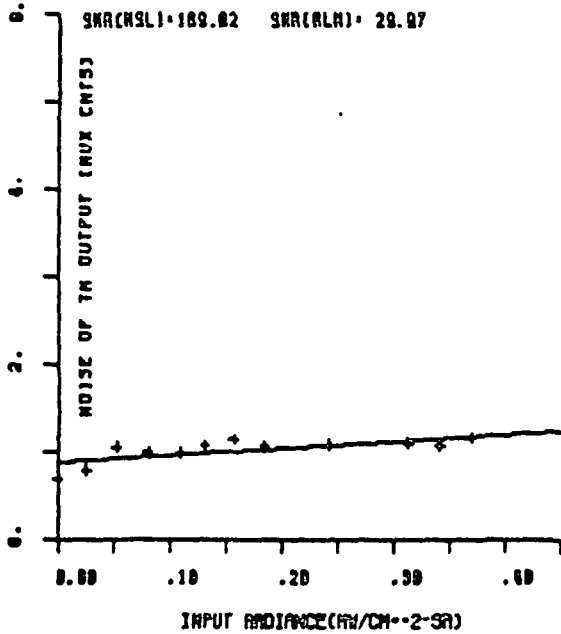
GAIN= 0.86 OFFSET= 1.06 SIGMA= 0.04
SNR(HSL)=174.09 SNR(ALN)= 25.87



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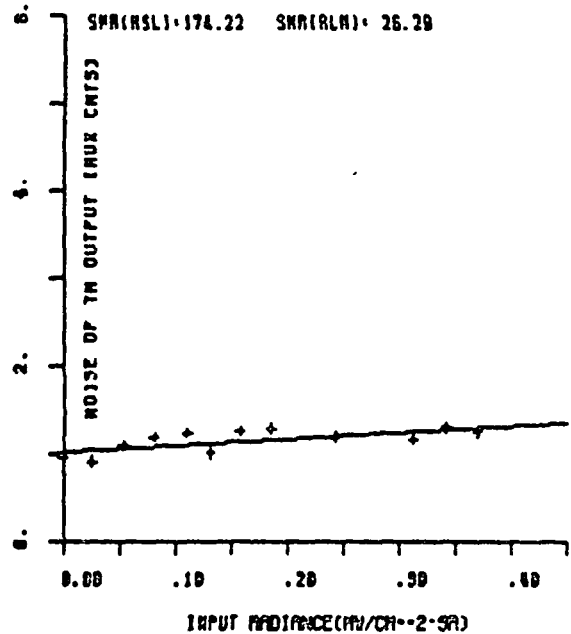
BAND* 7 CHANNEL* 13

GAIN* 0.82 OFFSET* 0.88 SIGMA* 0.88
SNR(NSL)*189.82 SNR(ALN)* 29.87



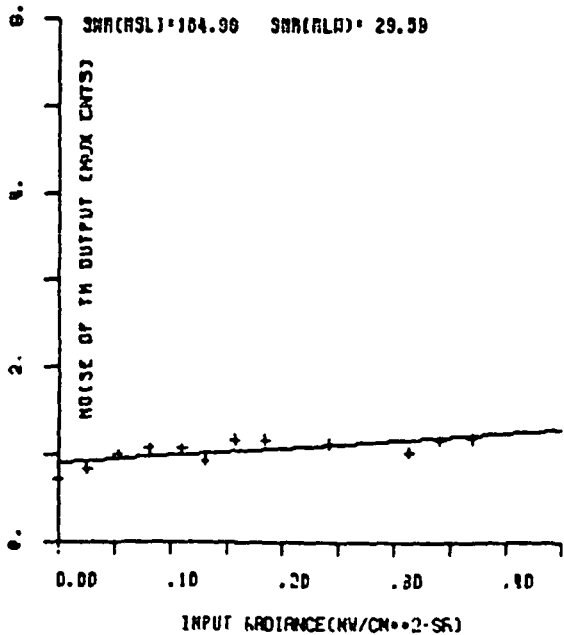
BAND* 7 CHANNEL* 14

GAIN* 0.74 OFFSET* 1.83 SIGMA* 0.88
SNR(NSL)*174.22 SNR(ALN)* 26.28



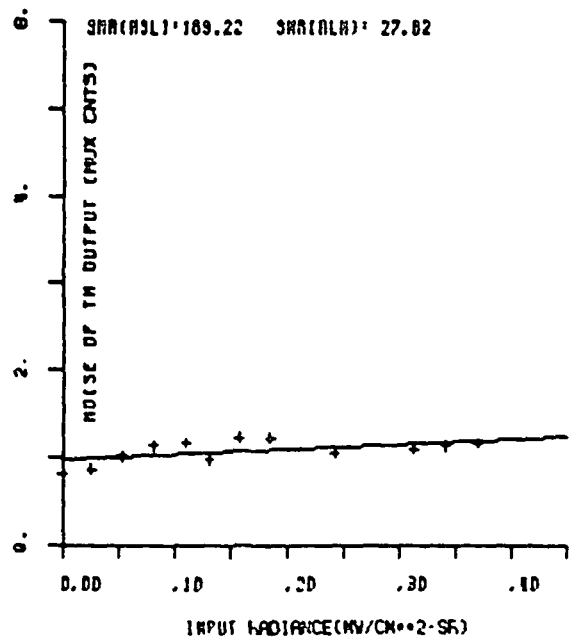
BAND* 7 CHANNEL* 15

GAIN* 0.86 OFFSET* 0.98 SIGMA* 0.85
SNR(NSL)*184.98 SNR(ALN)* 29.58



BAND* 7 CHANNEL* 16

GAIN* 0.61 OFFSET* 0.96 SIGMA* 0.85
SNR(NSL)*189.22 SNR(ALN)* 27.82



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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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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.

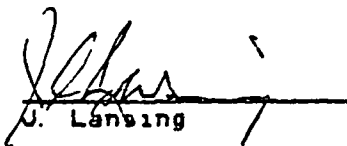
The detectors and filters were fabricated using the latest technology, so it is not known that any improvement could be made. Recommendation: use as is.

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

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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, Proto-
flight 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 FROM AC07R Test Team
 Summary, Flight Model (J. C. Campbell)
 Number 1

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.

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

F. R. Phillips

-2-

TM AC07R Test Result Summary, Flight Model Number 1

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 Description

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.

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

F. R. Phillips

-3-

TM AC07R Test Result Summary, Flight Model Number 1

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 reference 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 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

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

P. R. Phillips

-4-

TM AC07R Test Result Summary, Flight Model Number 1

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 IPOVS. 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 IPOV) 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 inadvertently 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

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

F. R. Phillips

-5-

TM AC07R Test Result Summary, Flight Model Number 1

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.

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

F. R. Phillips

-6-

TM AC07R Test Result Summary, Flight Model Number 1

After this experience, we modified our procedure to include an approximate one hour cooling off time between data collects using a "Muffin Fan" 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

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

F. R. Phillips

-7-

TM AC07R Test Result Summary, Flight Model Number 1

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 occurred. Table 2 is a listing of detector spacings within each array as obtained from the reduced data tabulations. Table 3 is a summary of

ORIGINAL PAGE IS
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29 June 1982
2221-620
HS236-8043

P. R. Phillips

-8-

TM AC07R Test Result Summary, Flight Model Number 1

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:

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Concurrence:

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Concurrence:

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Approval:

J. L. Engel

J. L. Engel, Manager, Systems Engineering

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TABLE 1.
LSP Half-Widths

<u>Collection Date</u>	<u>Band</u>	<u>Channel</u>	<u>Scan</u>	<u>LSP Width (μr)</u>	<u>In Spec.</u>	<u>Out of Spec.</u>
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.

LSP Half-Widths

<u>Collection Date</u>	<u>Band</u>	<u>Channel</u>	<u>Scan</u>	<u>LSP Width (μR)</u>	<u>In Spec.</u>	<u>Out of Spec.</u>
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

<u>Collection Date</u>	<u>Band/ Channels</u>	<u>Distance Between Channels in X-Direction</u>	
		(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

<u>Processing/ Date</u>	<u>Band</u>	<u>Channel</u>	<u>Scan</u>	<u>In-Field Response*</u> (± 2 IFOVS)	<u>Out-of-Field Response²</u> (Skirts)	<u>Total Percent</u>	<u>Average (Per IFOV) Percent</u>
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		162.5 μ r	
1		.00820		170.8 μ r
2	.00760		158.3 μ r	
2		.00824		171.7 μ r
3	.00786		163.8 μ r	
3		.00830		172.9 μ r
4	.00800		166.7 μ r	
4		.00832		173.32 μ r

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

EFL = 95.995

M_R = 0.5

Specification is: IFOV \leq 174.4 μ r

Accuracy of Measurement: \pm 16 μ r

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APPENDIX A
FIELD OF VIEW PLOTS

NEAR AND FAR FIELD DATA FOR

Y - AXIS, SAND 3 CHANNEL 2 .

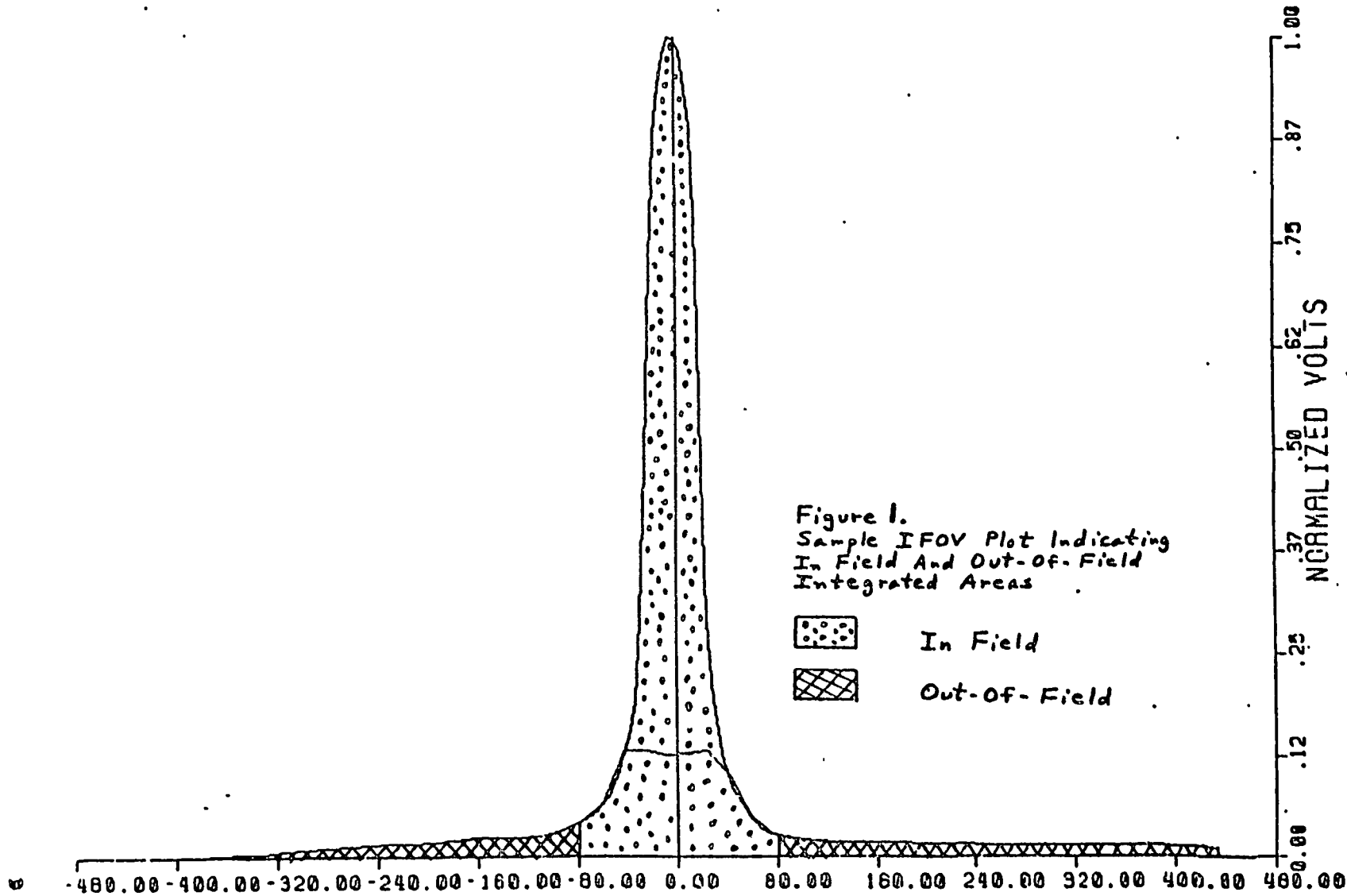




Figure 1.
Sample IFOV Plot Indicating
In Field And Out-of-Field
Integrated Areas

 In Field
 Out-of-Field

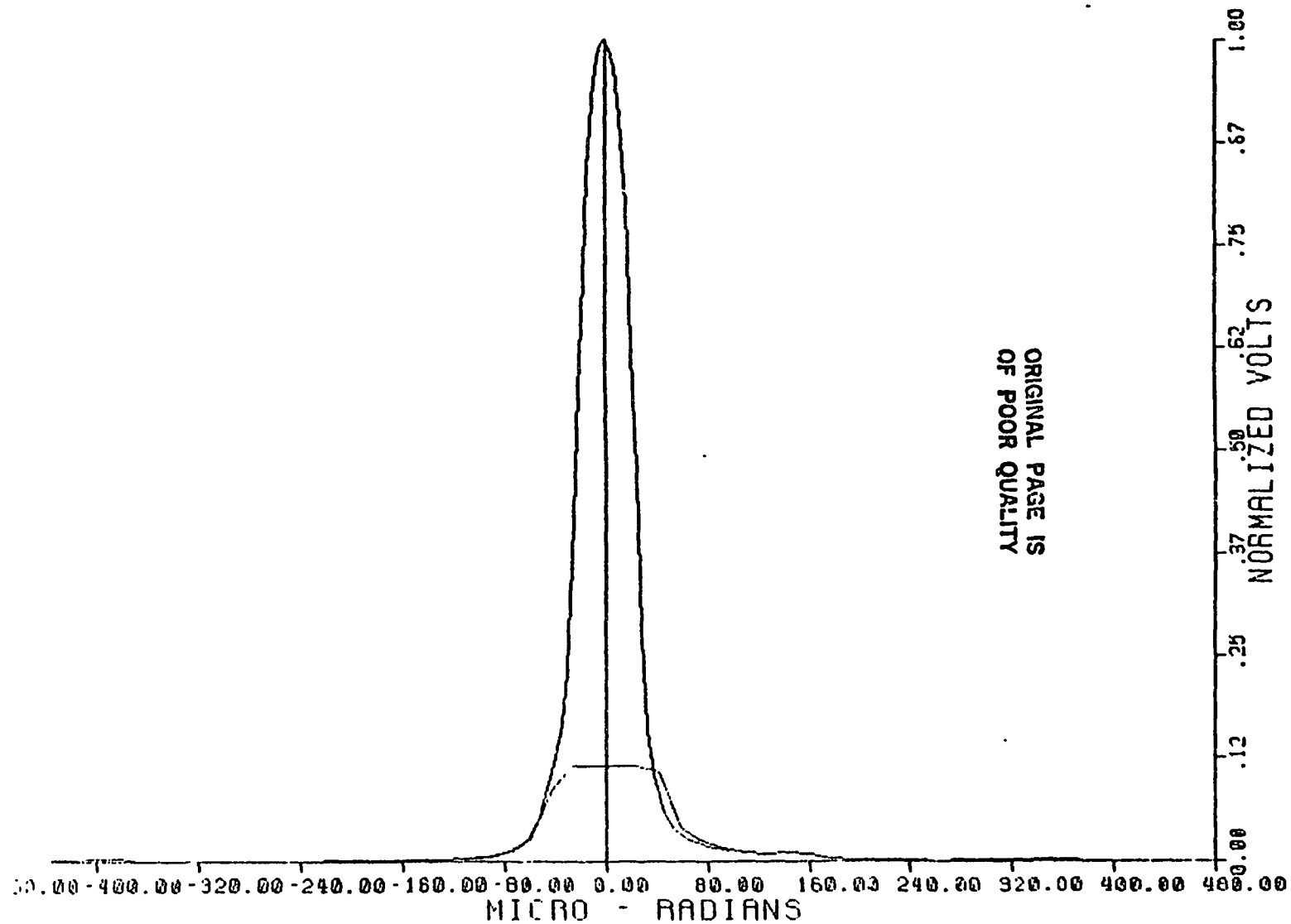
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NEAR AND FAR FIELD DATA FOR

Y - AXIS, BAND 1 CHANNEL 1

13-JUN-82

01:35:43

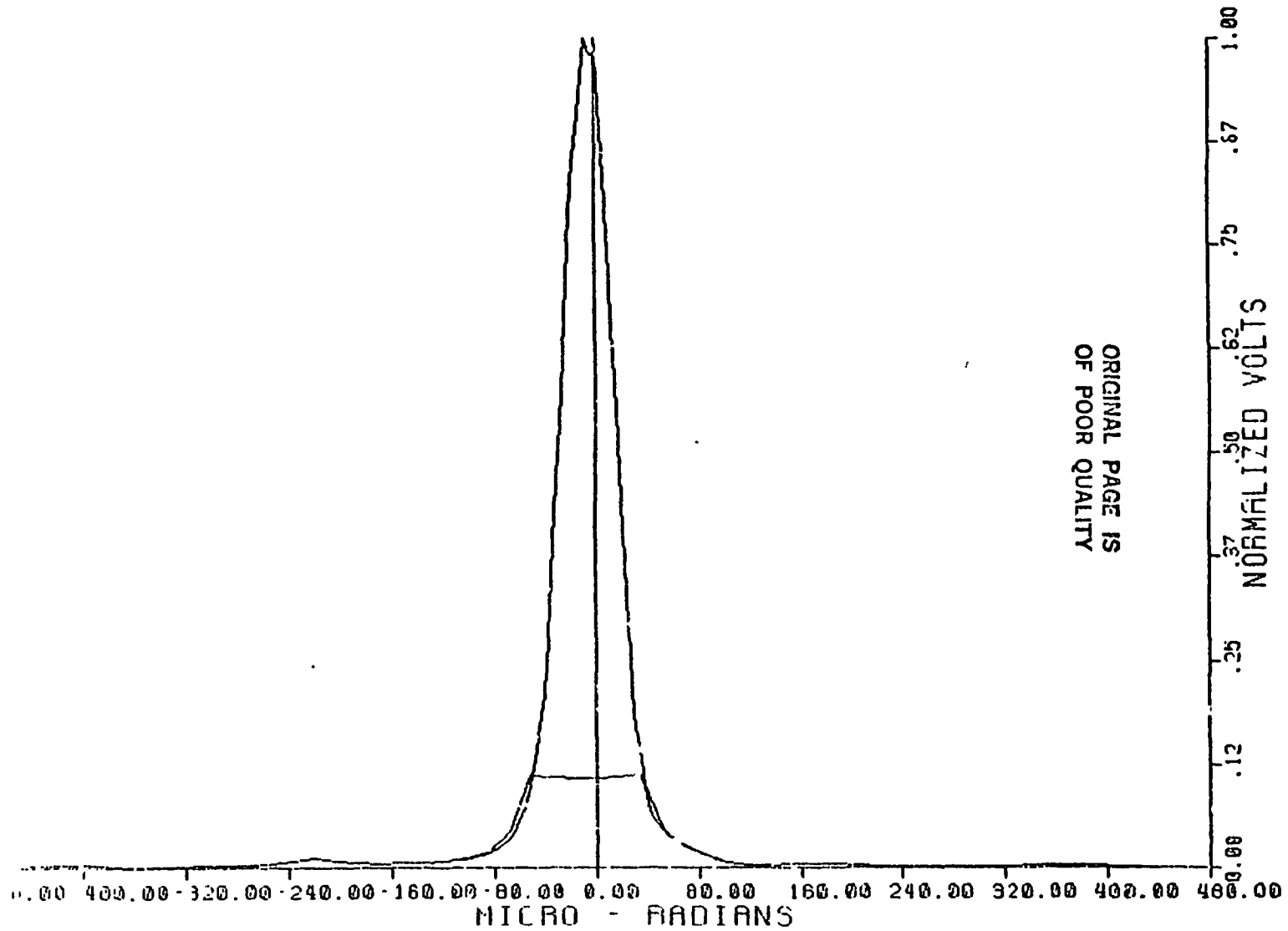


NEAR AND FAR FIELD DATA FOR

11-JUN-82

X - AXIS, BAND 1 CHANNEL 1

05:13:40

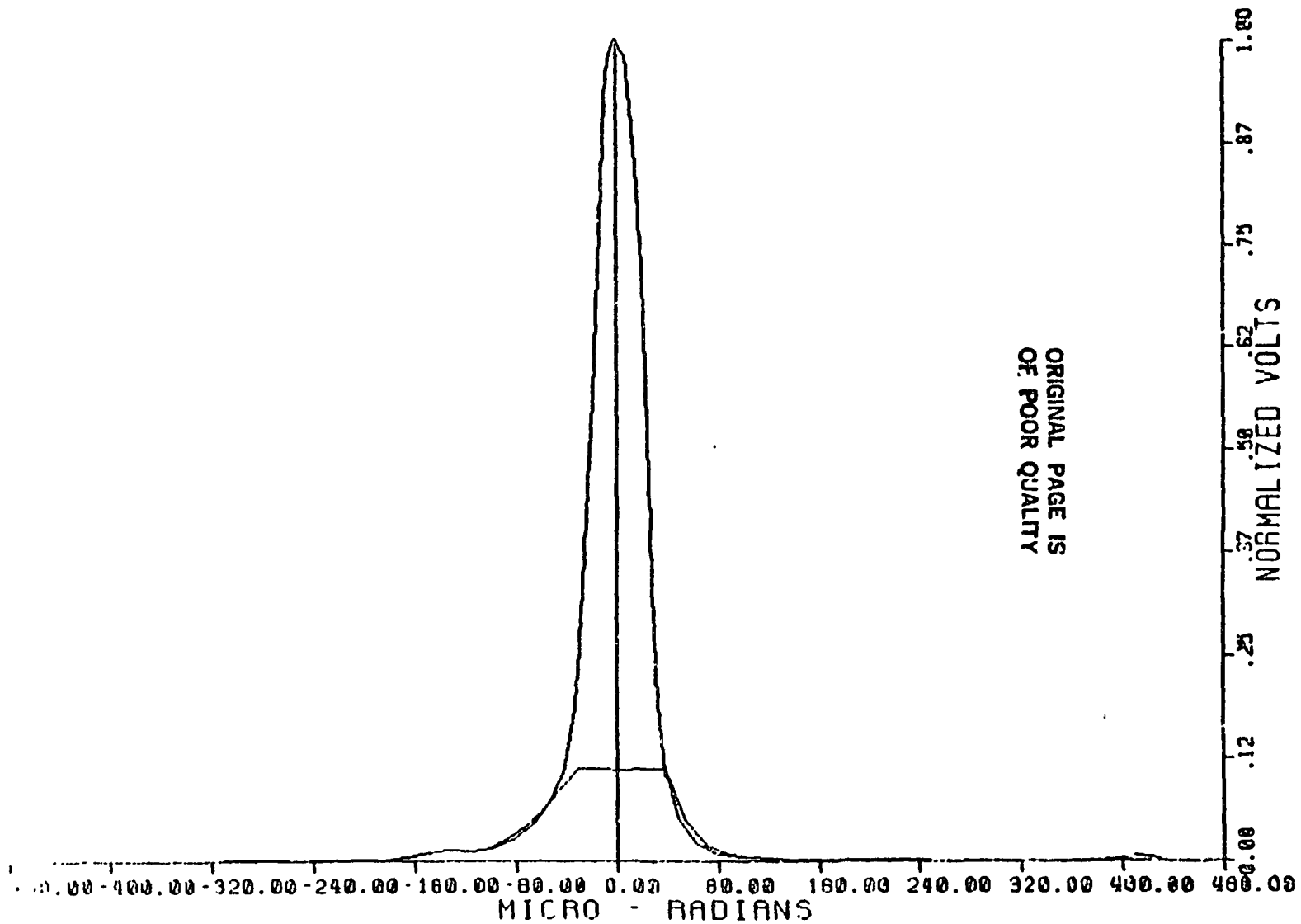


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13-JUN-82

Y - AXIS, BAND 1 CHANNEL 2

01:37:25

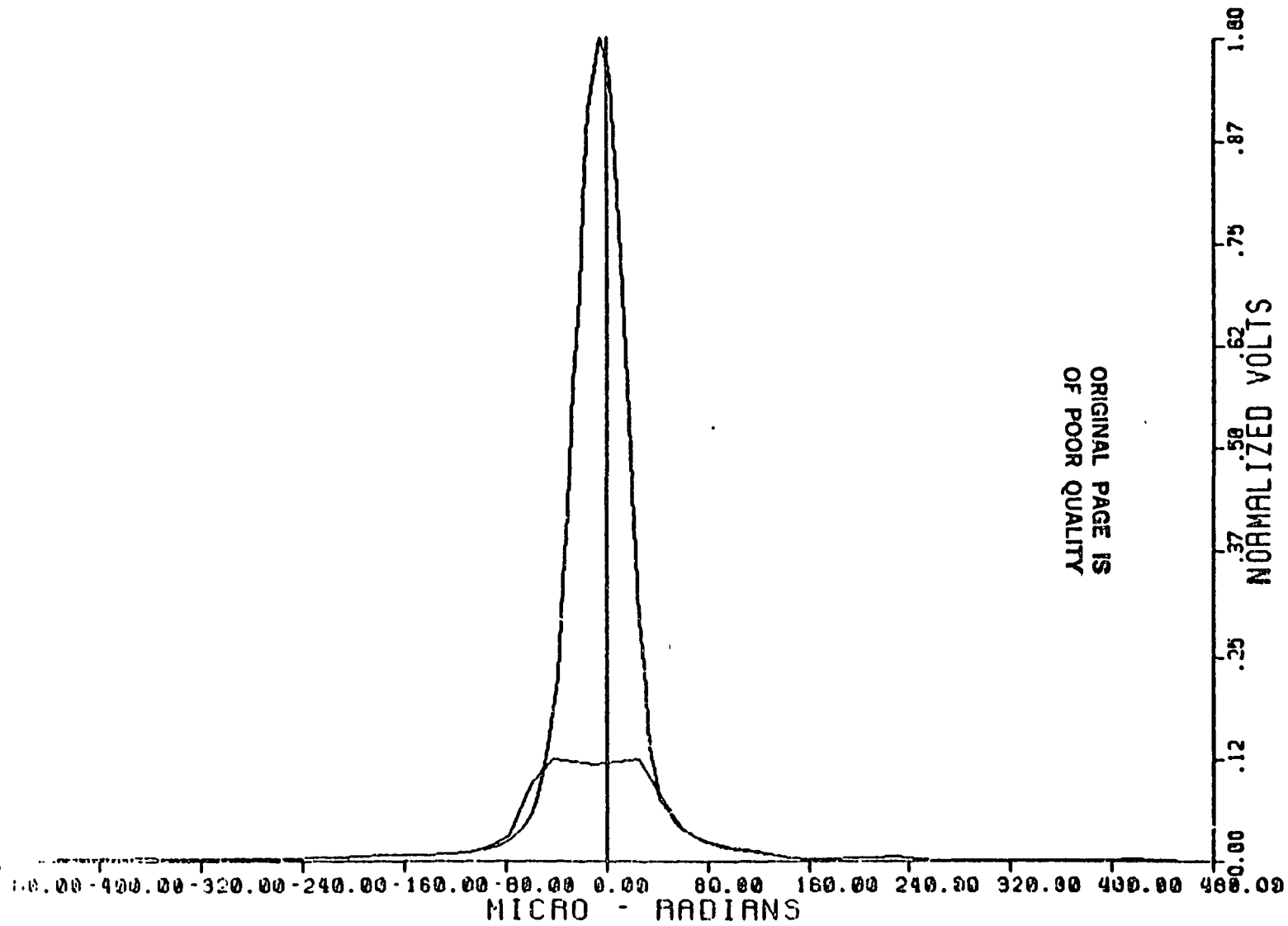


NEAR AND FAR FIELD DATA FOR

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X - AXIS, BAND 1 CHANNEL 2

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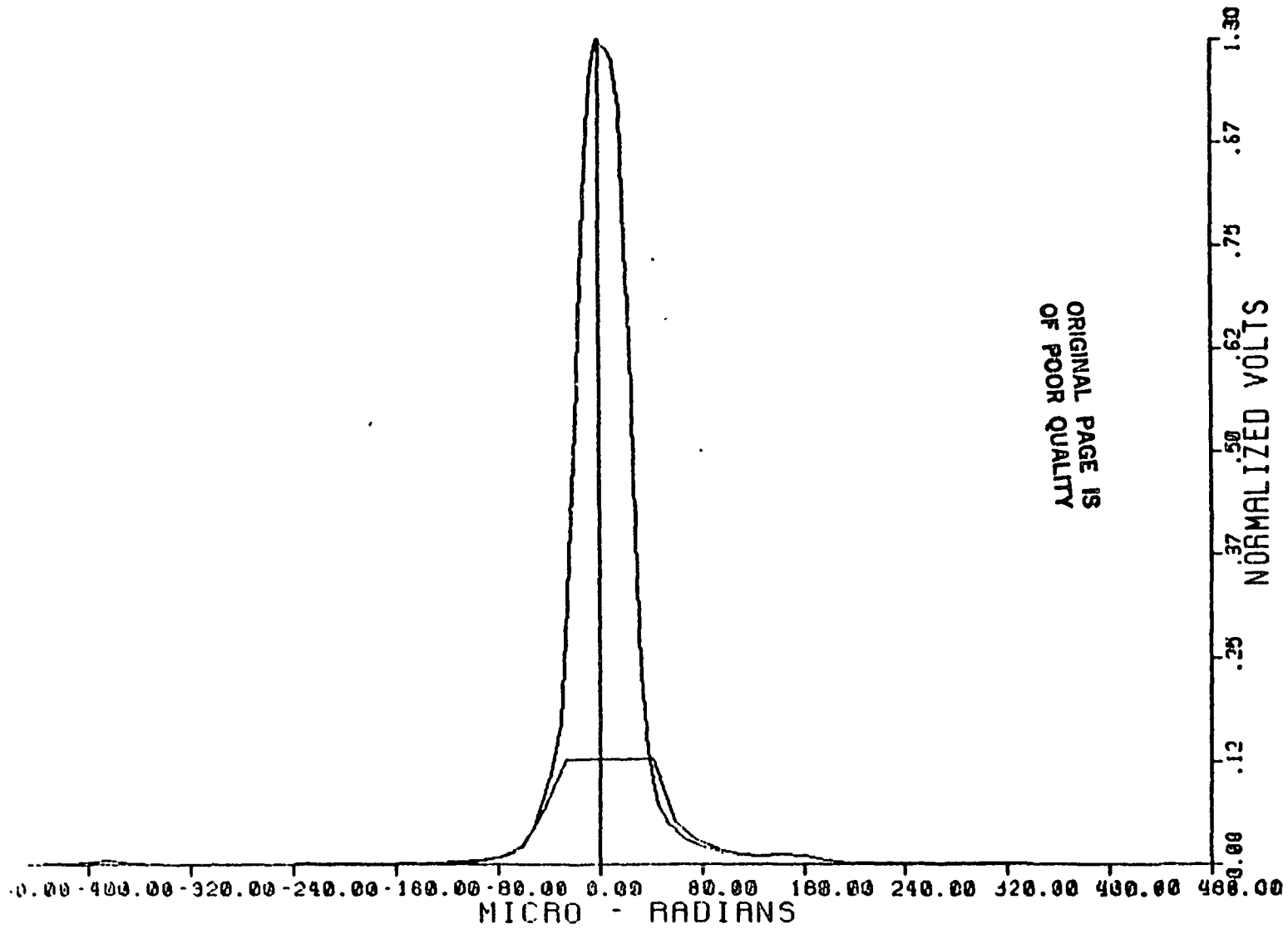


NEAR AND FAR FIELD DATA FOR

13-JUN-82

Y - AXIS, BAND 1 CHANNEL 15

01:35:49

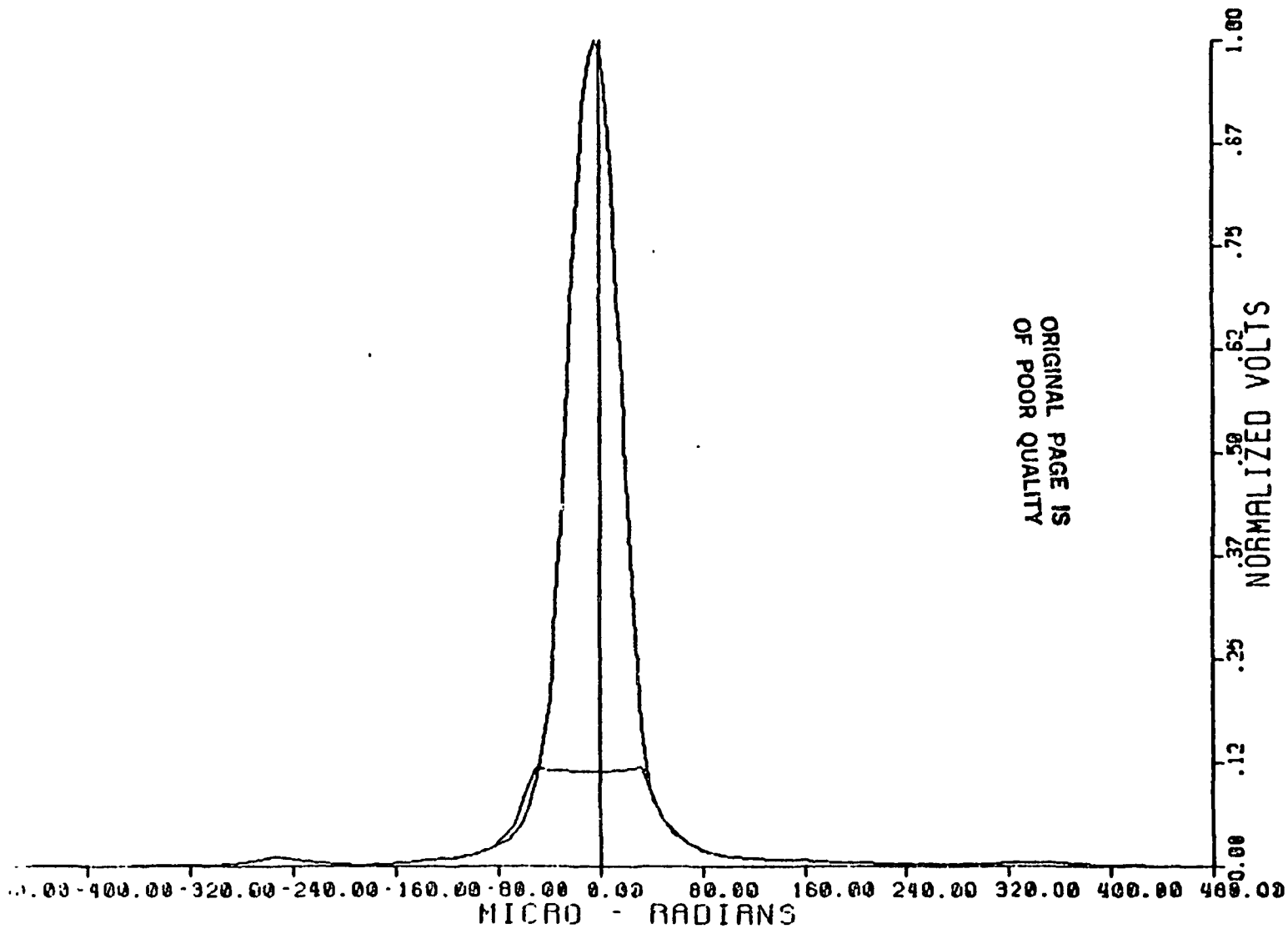


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X - AXIS. BAND 1 CHANNEL 15

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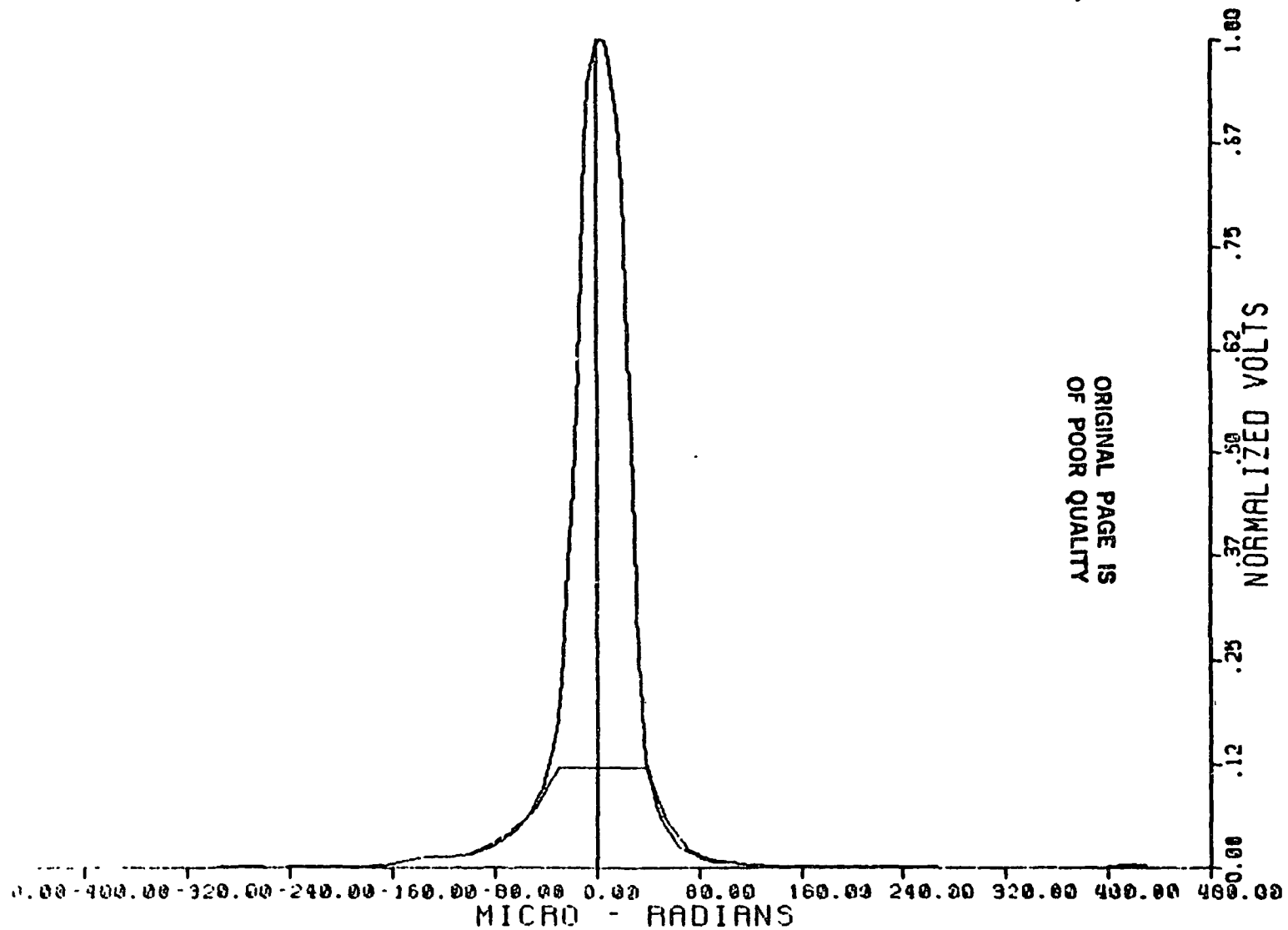


NEAR AND FAR FIELD DATA FOR

13-JUN-82

Y - AXIS, BAND 1 CHANNEL 16

01:37:32

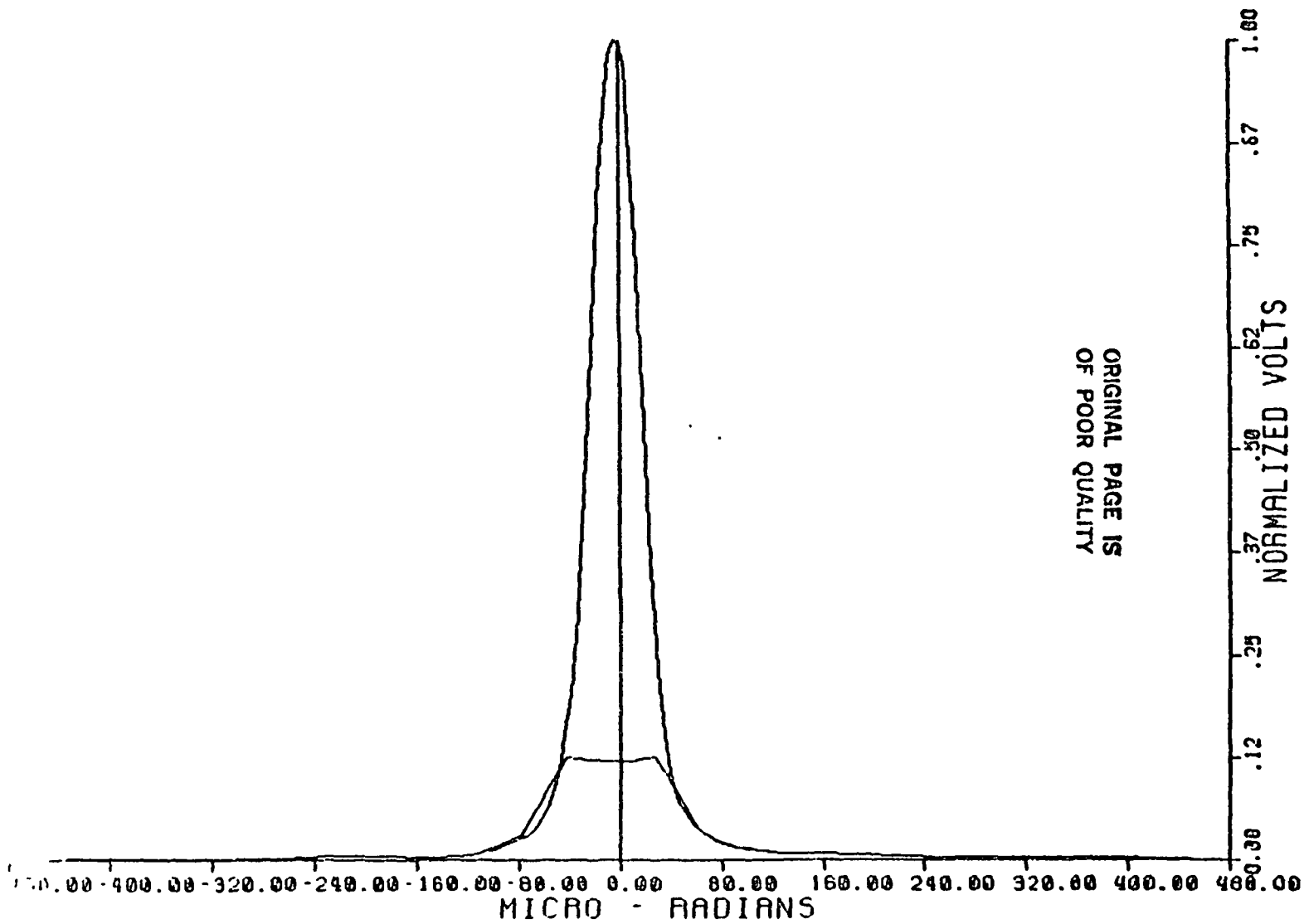


NEAR AND FAR FIELD DATA FOR

11-JUN-82

X - AXIS, BAND 1 CHANNEL 16

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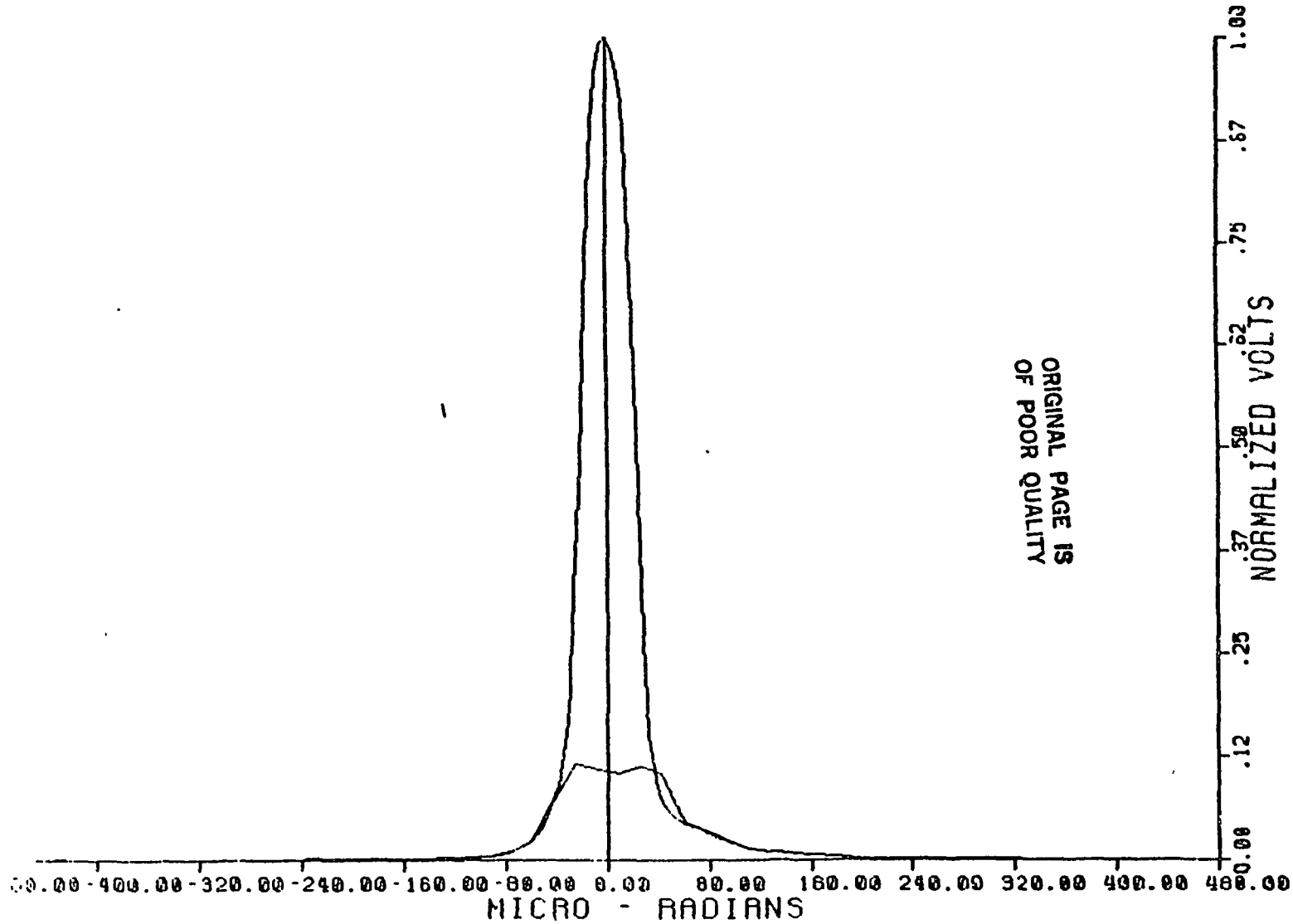


NEAR AND FAR FIELD DATA FOR

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Y - AXIS, BAND 2 CHANNEL 1

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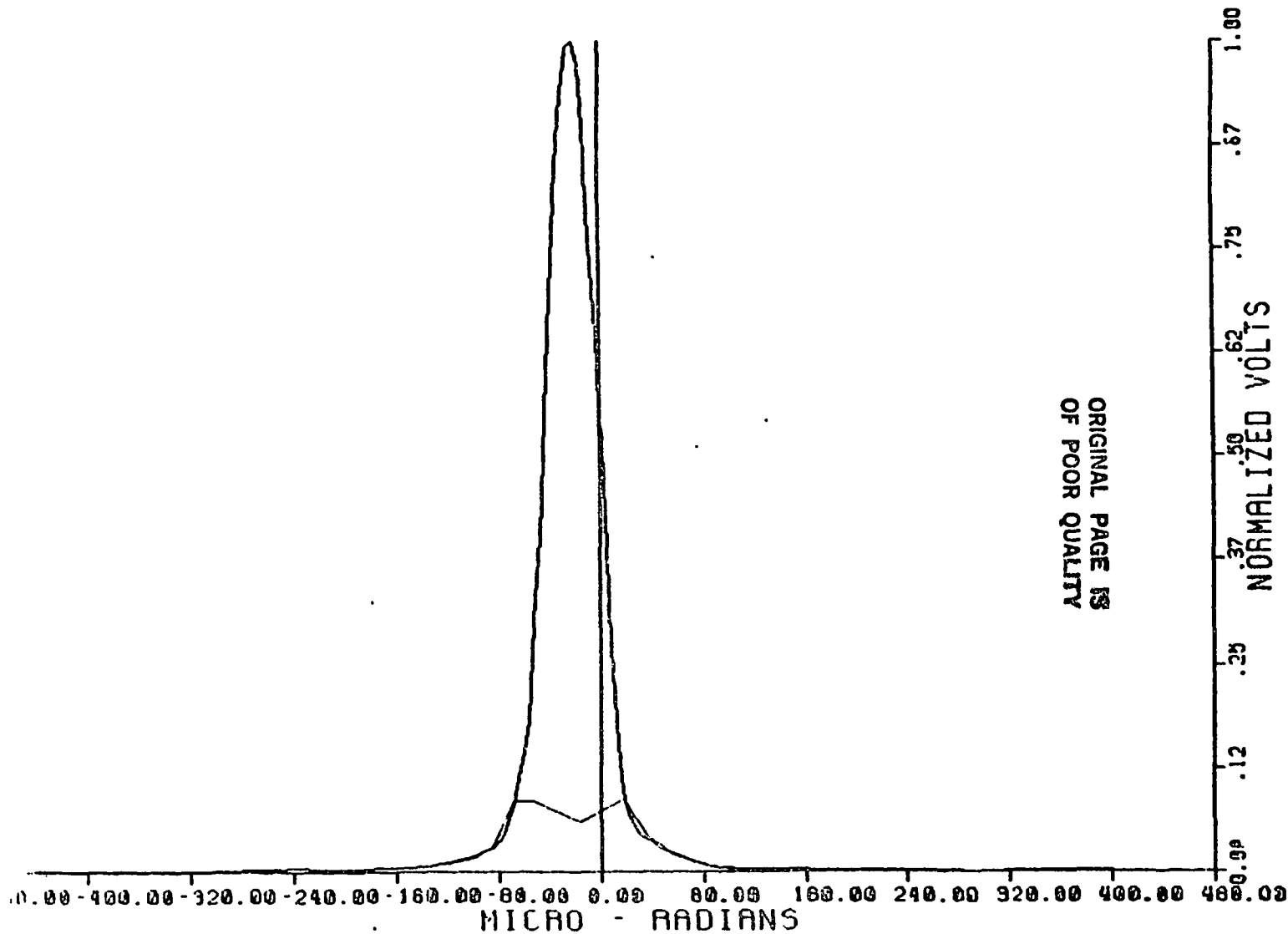


NEAR AND FAR FIELD DATA FOR

11-JUN-82

X - AXIS. BAND 2 CHANNEL 1

04:11:49

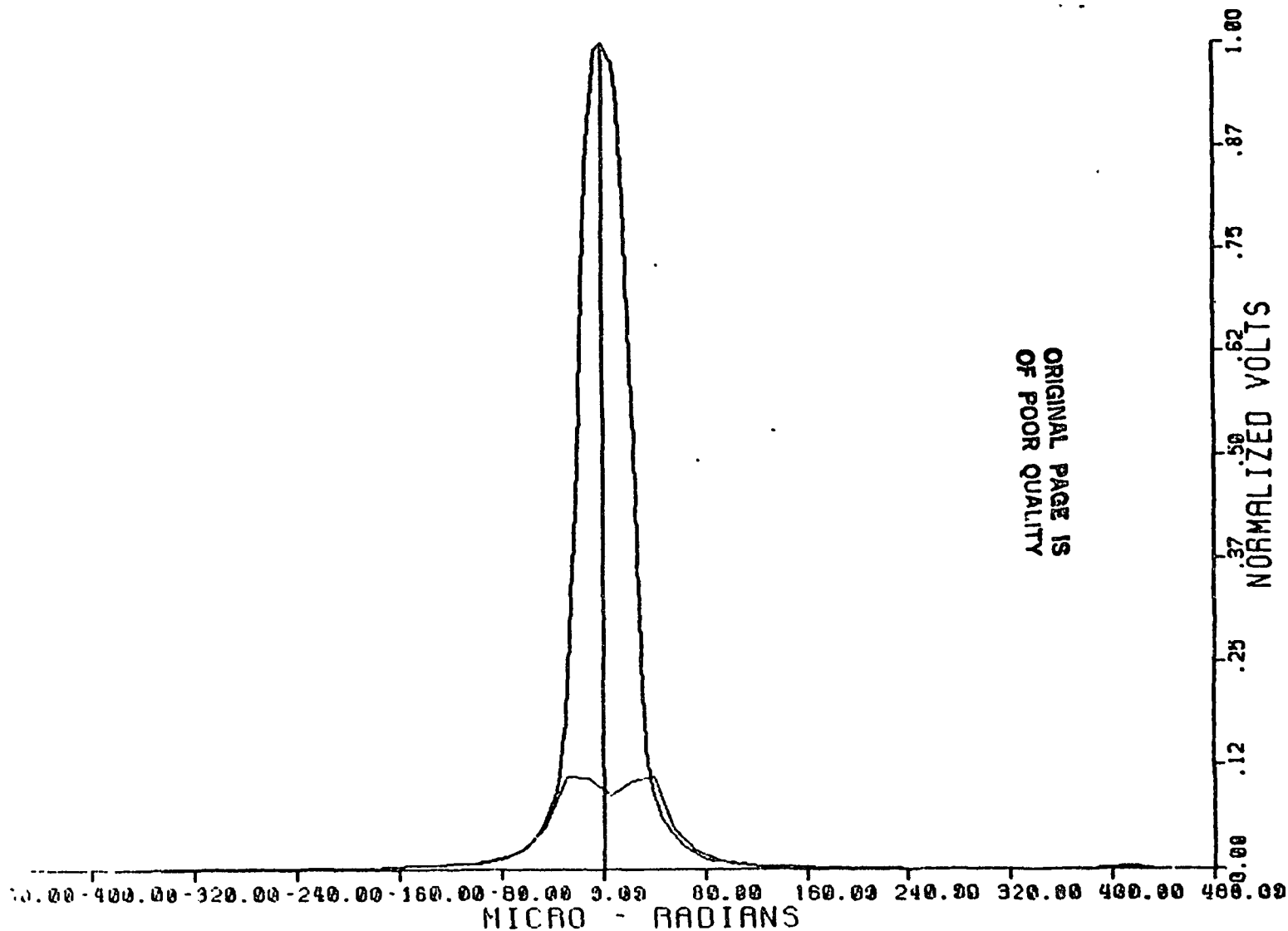


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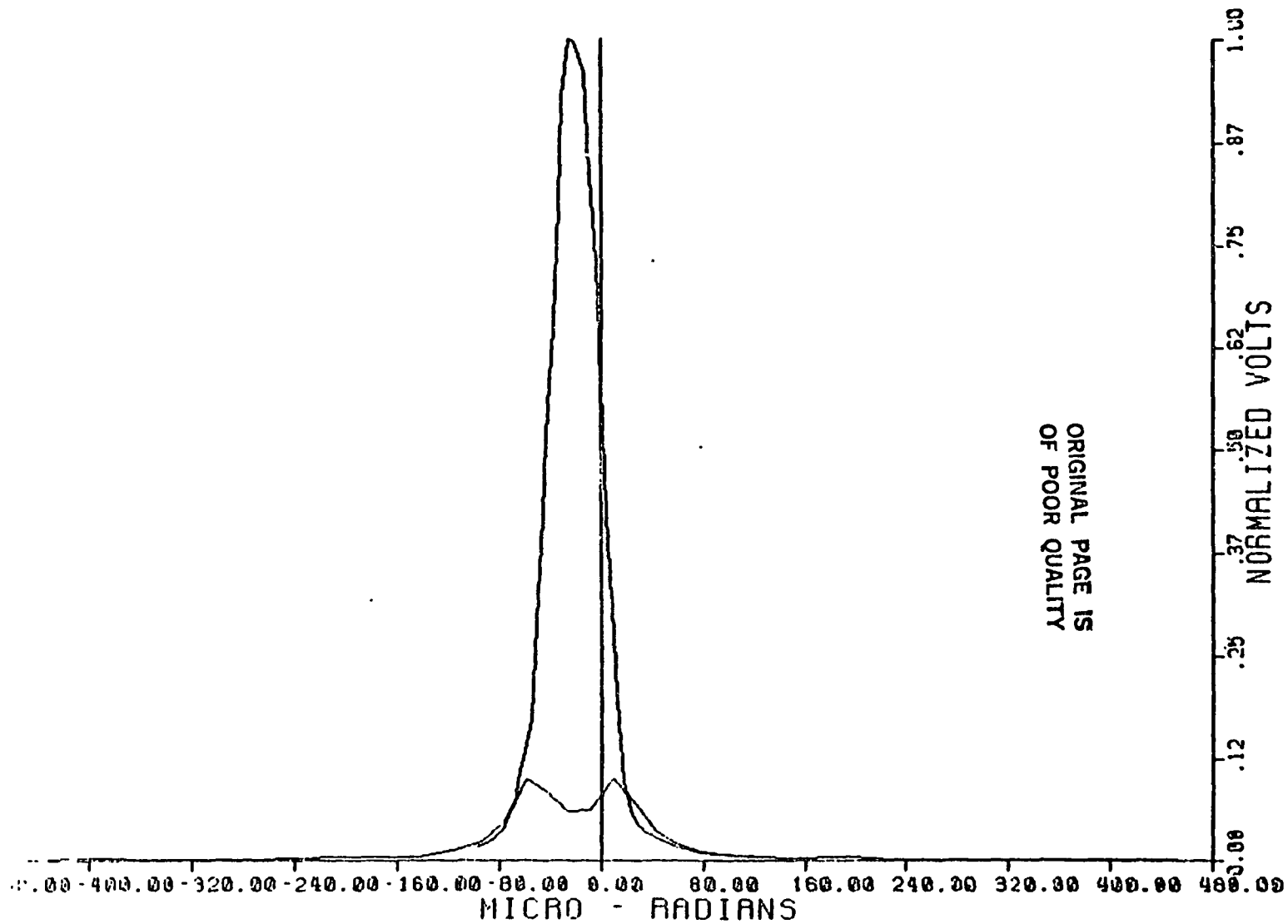
13-JUN-82

02:21:07



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X - AXIS. BAND 2 CHANNEL 2
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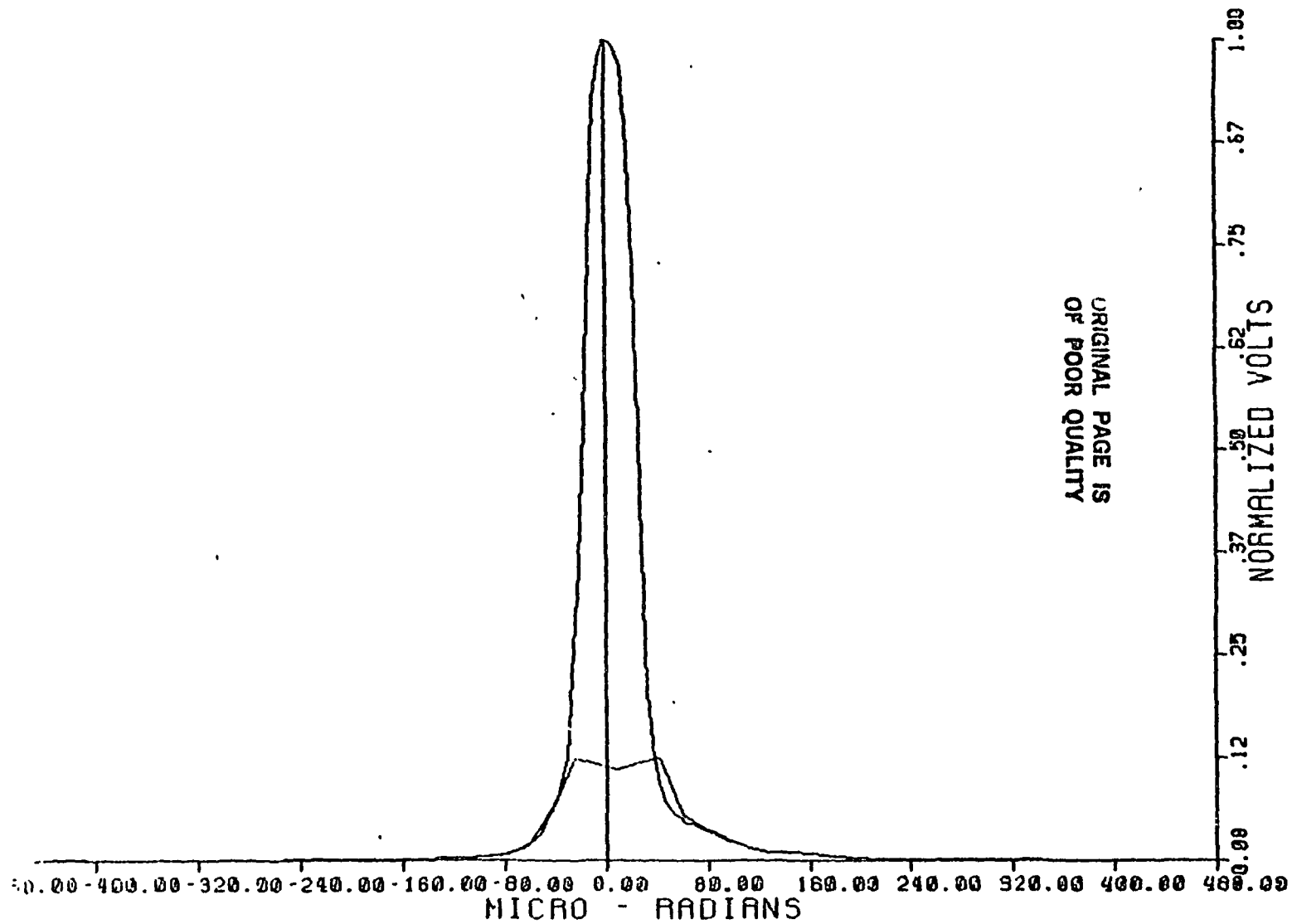


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Y - AXIS, BAND 2 CHANNEL 15

02:19:25

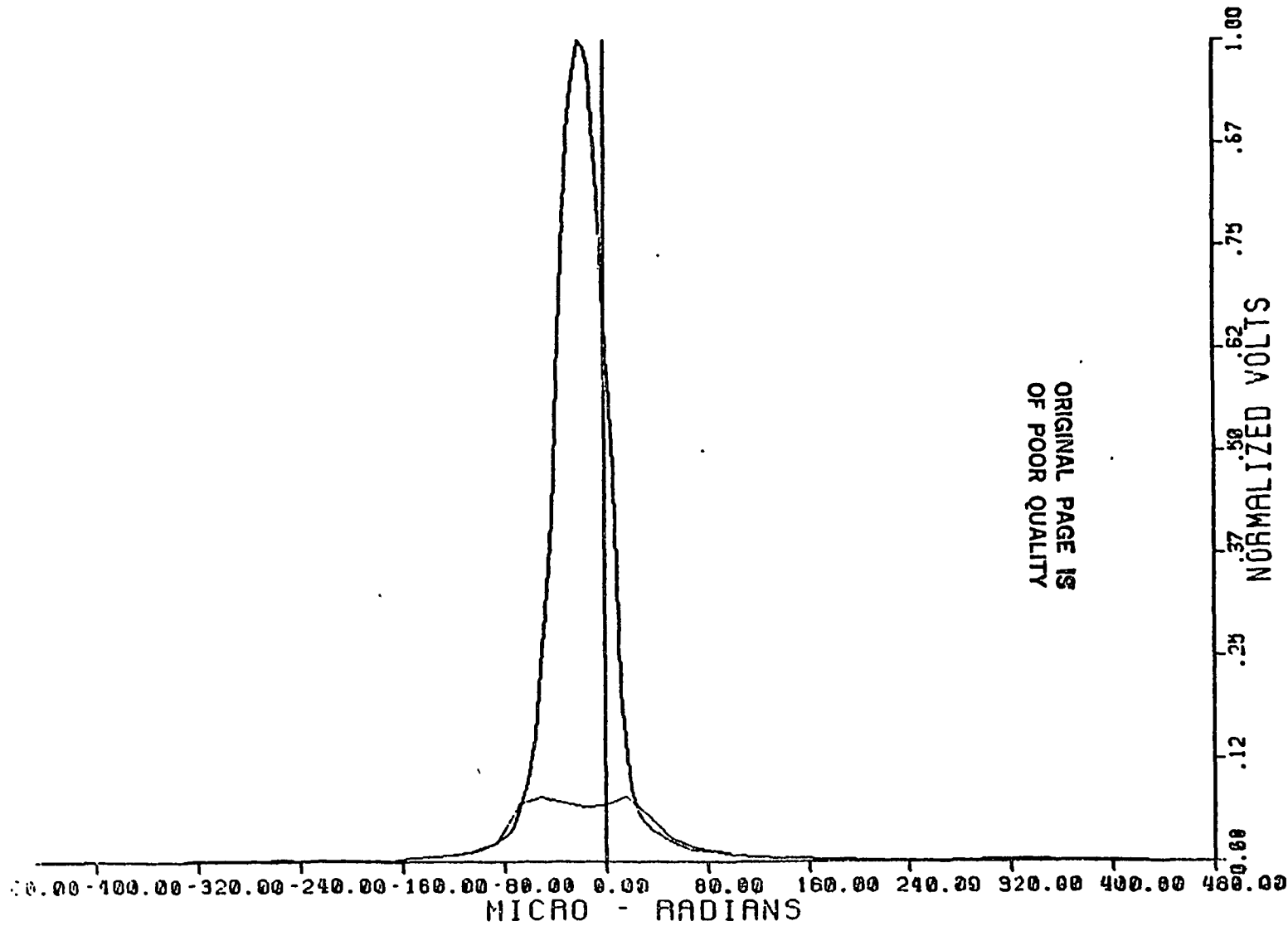


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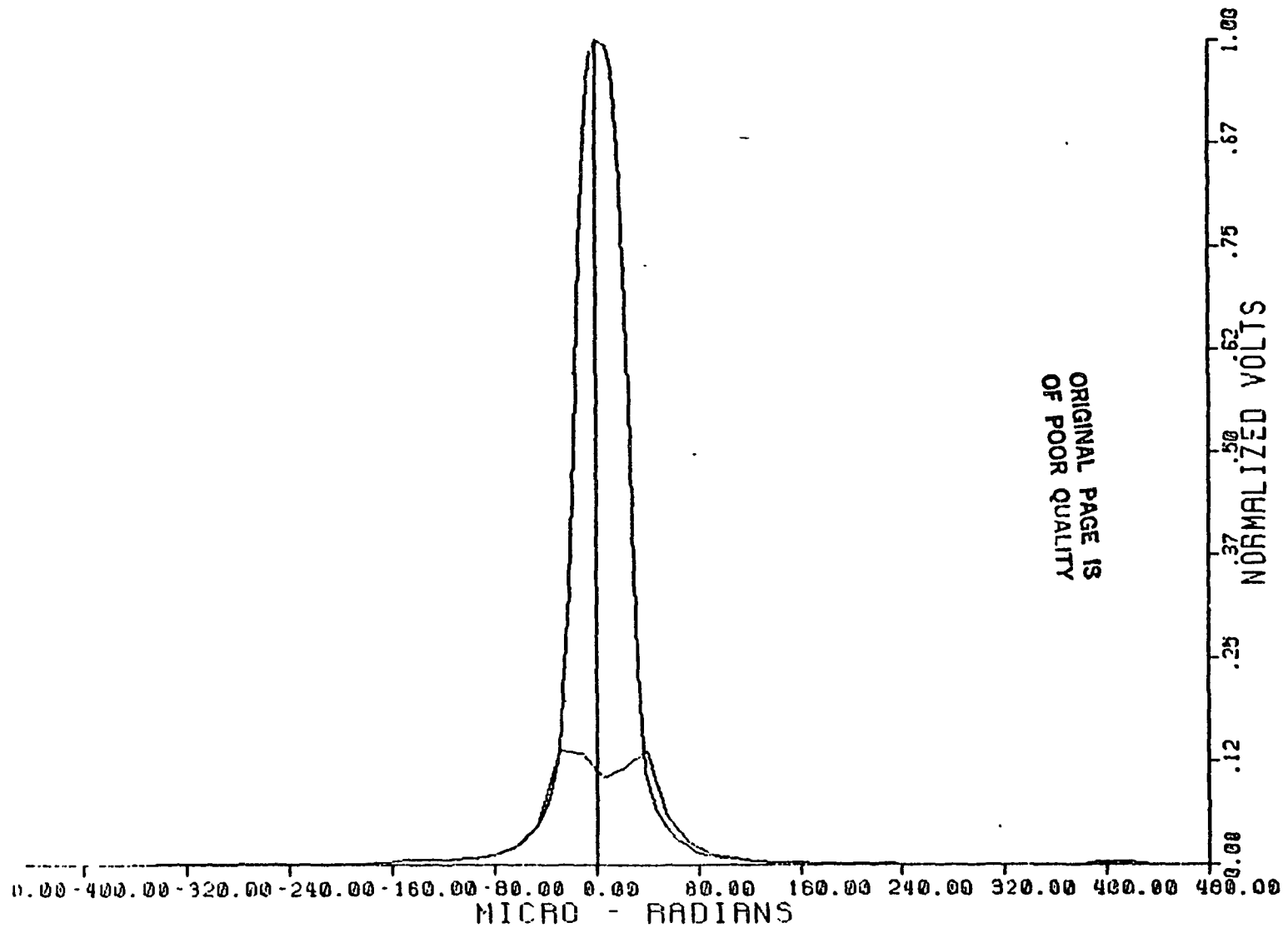
X - AXIS, BAND 2 CHANNEL 15

04:05:40



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13-JUN-82

Y - AXIS. BAND 2 CHANNEL 16
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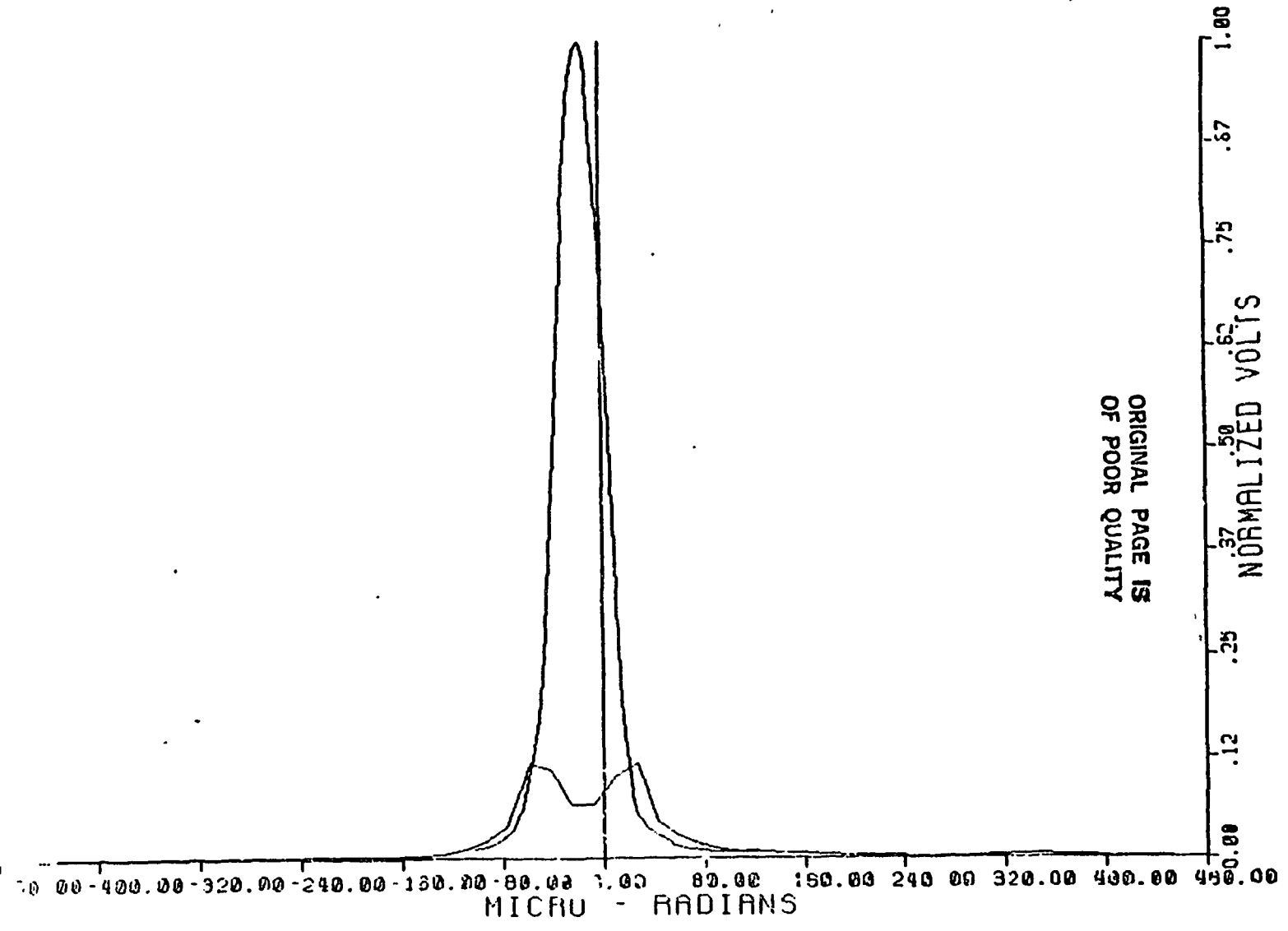
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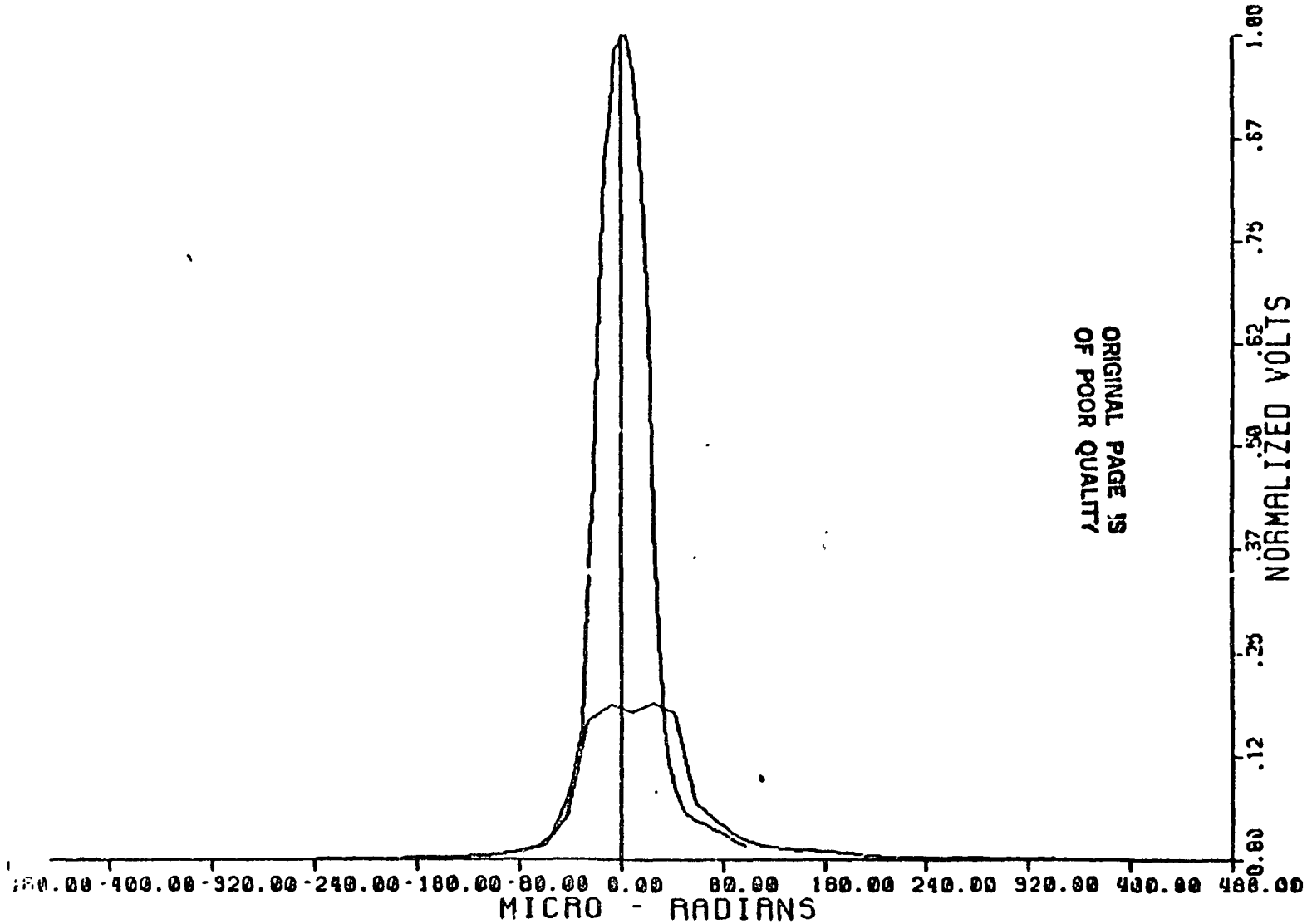


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09-JUN-82

Y - AXIS, BAND 3 CHANNEL 1

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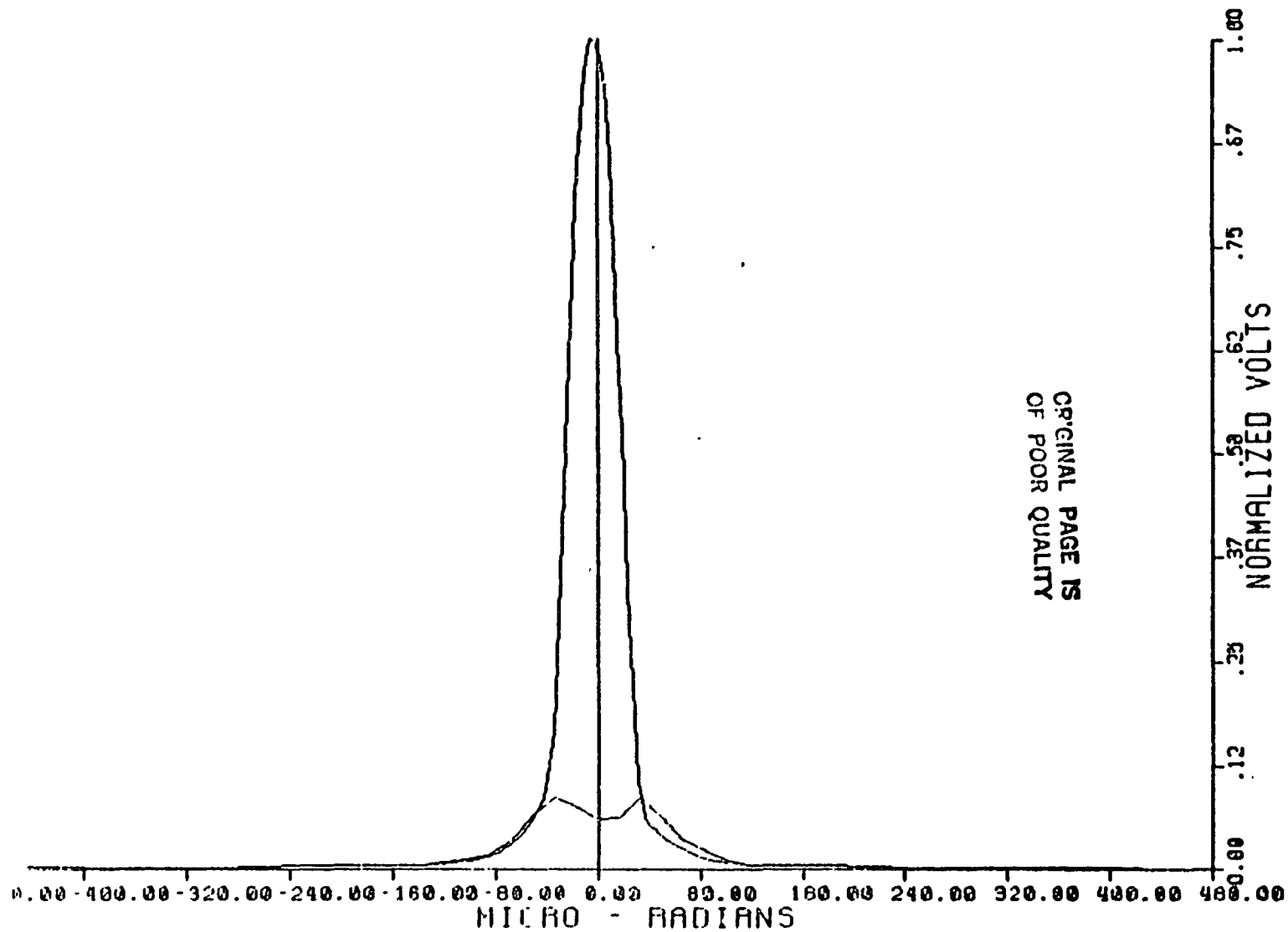


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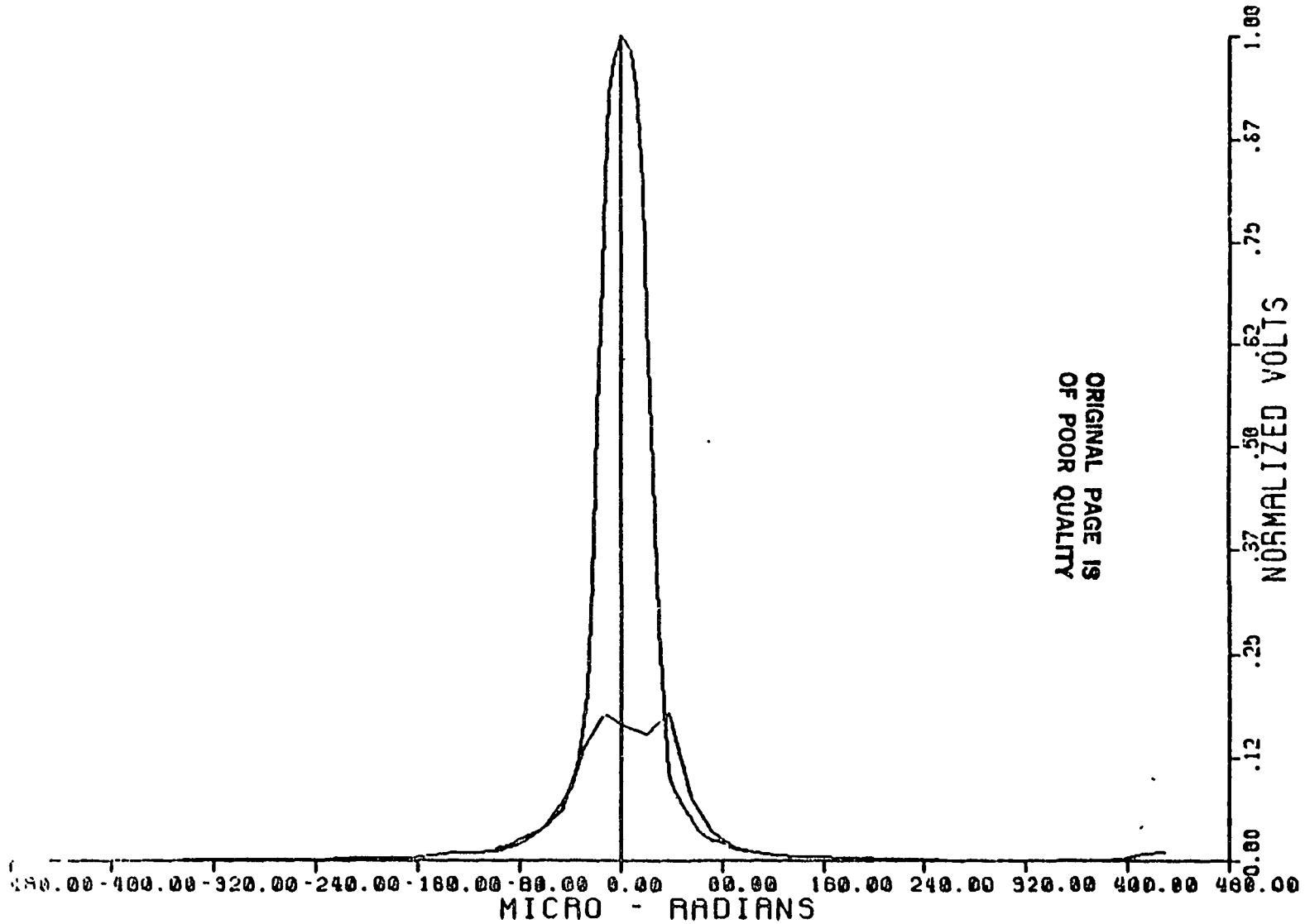


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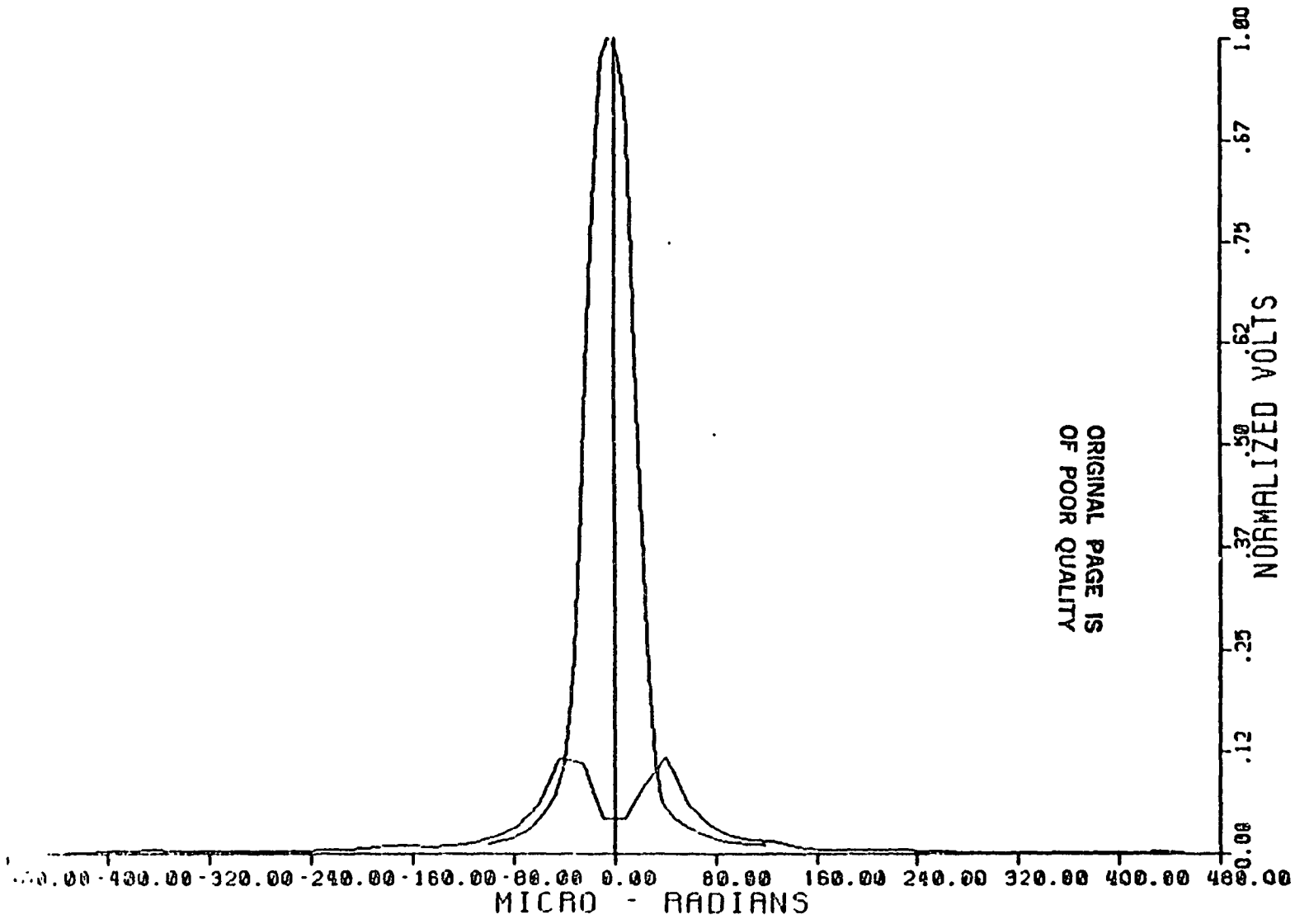
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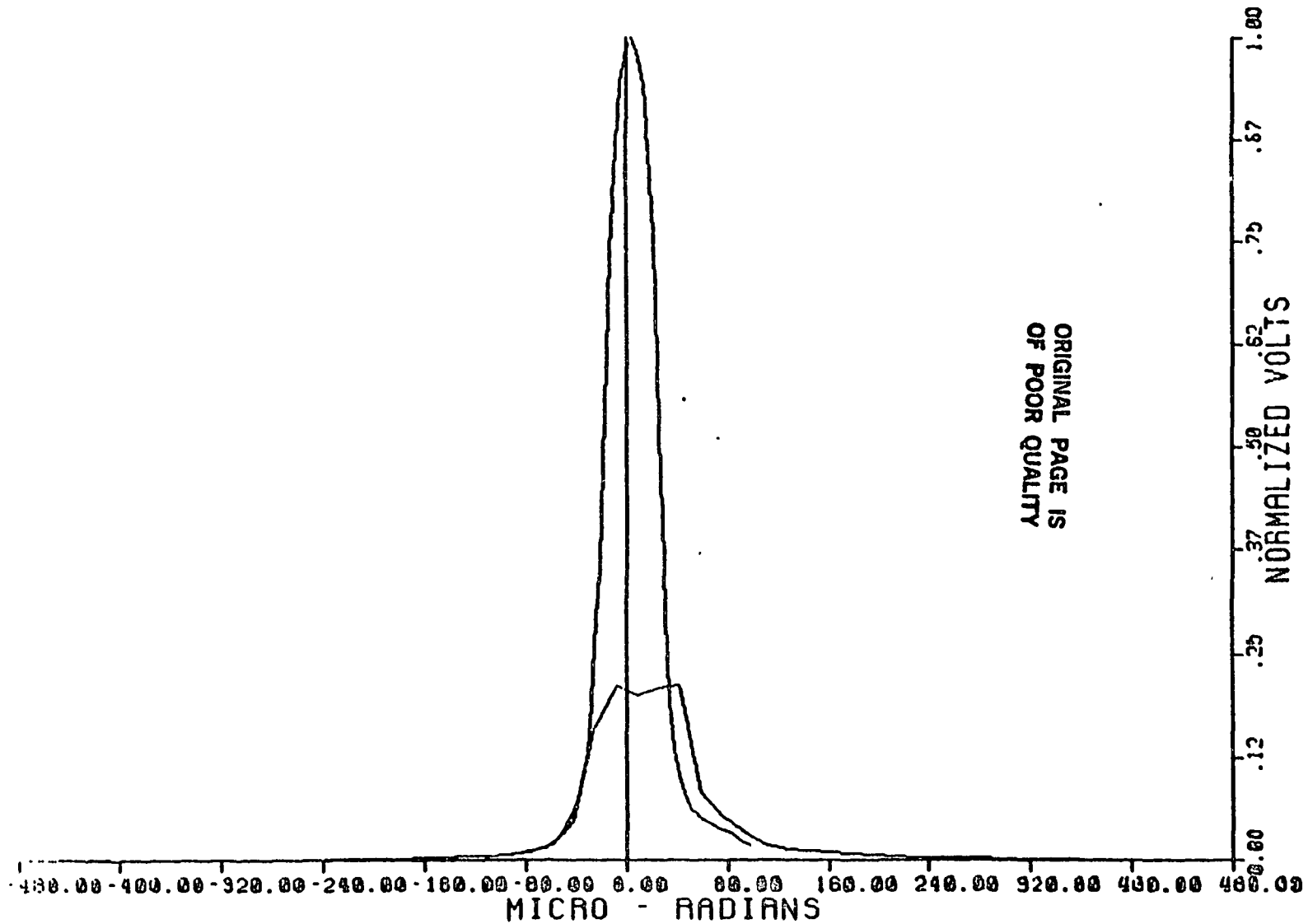


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Y - AXIS. BAND 3 CHANNEL 15

23:10:32



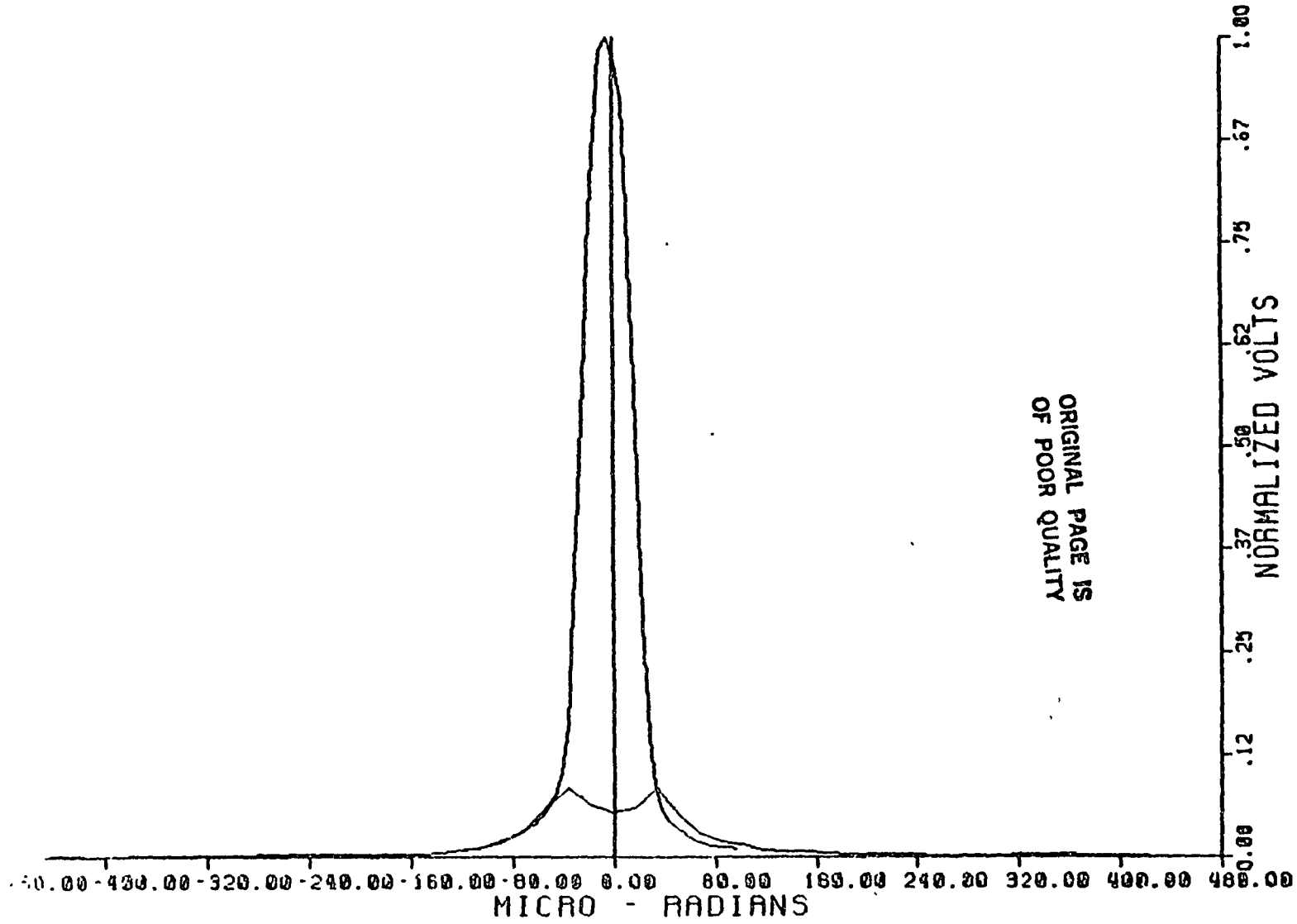
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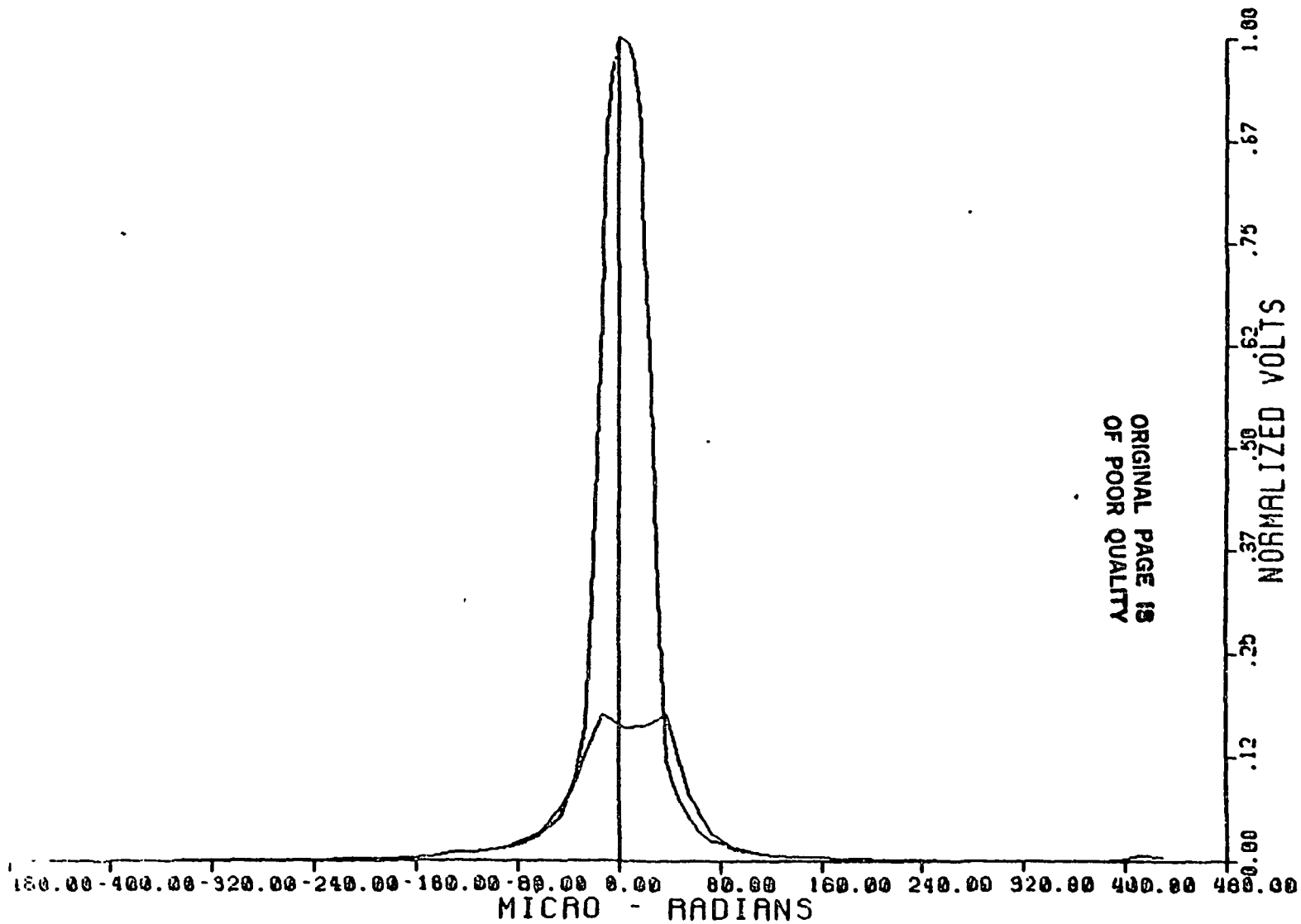


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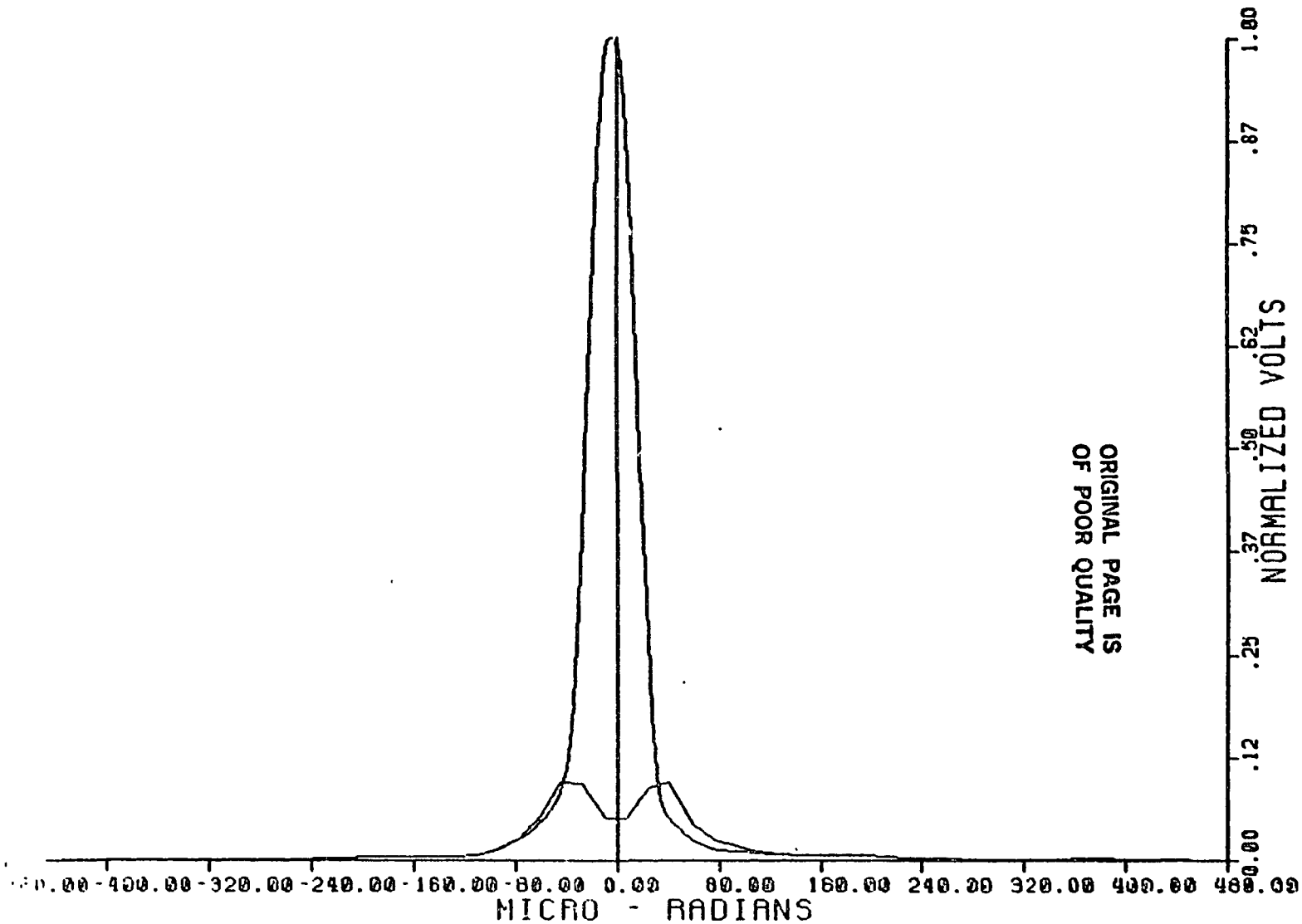


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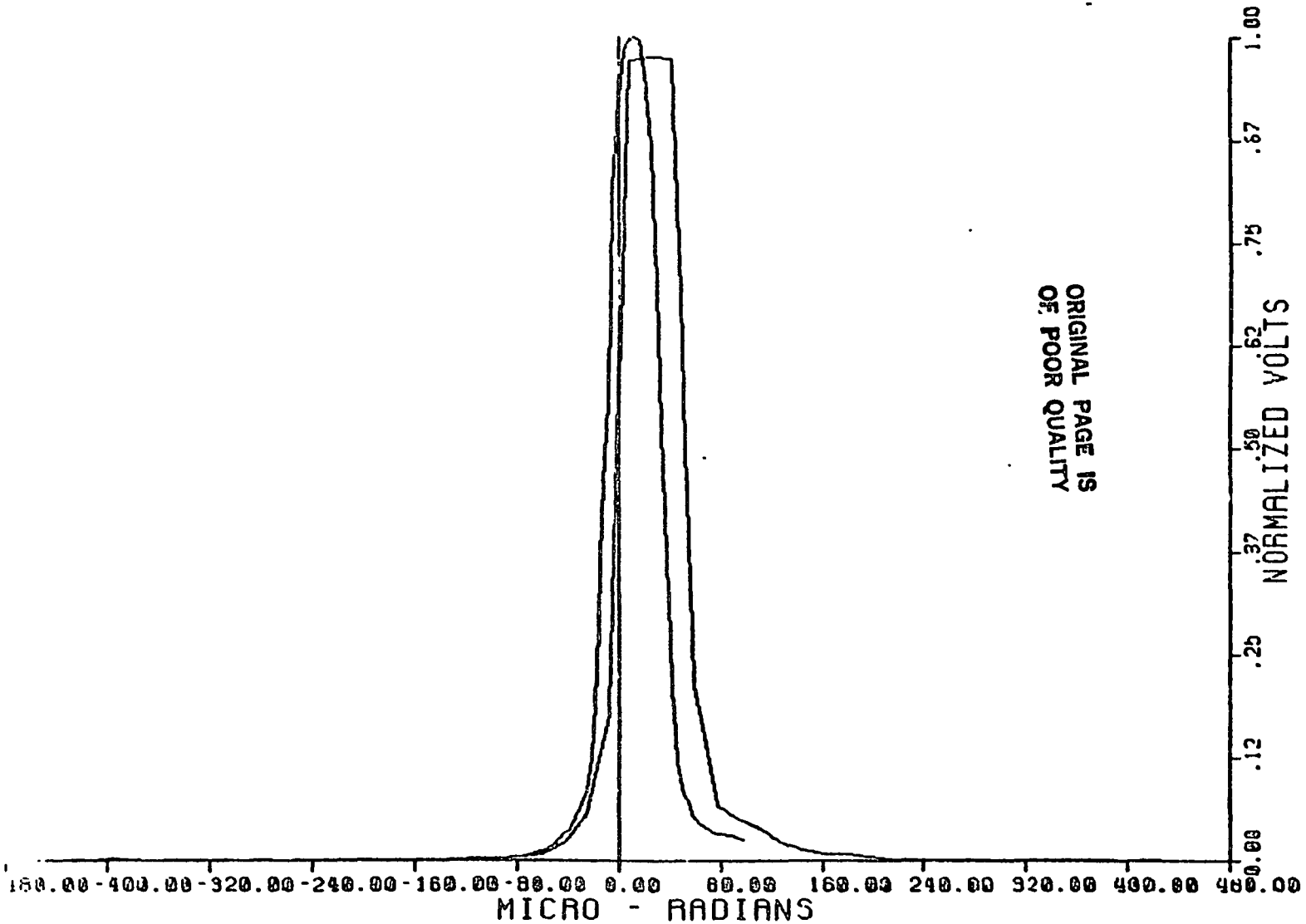


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Y - AXIS, BAND 4 CHANNEL 1

09-JUN-82

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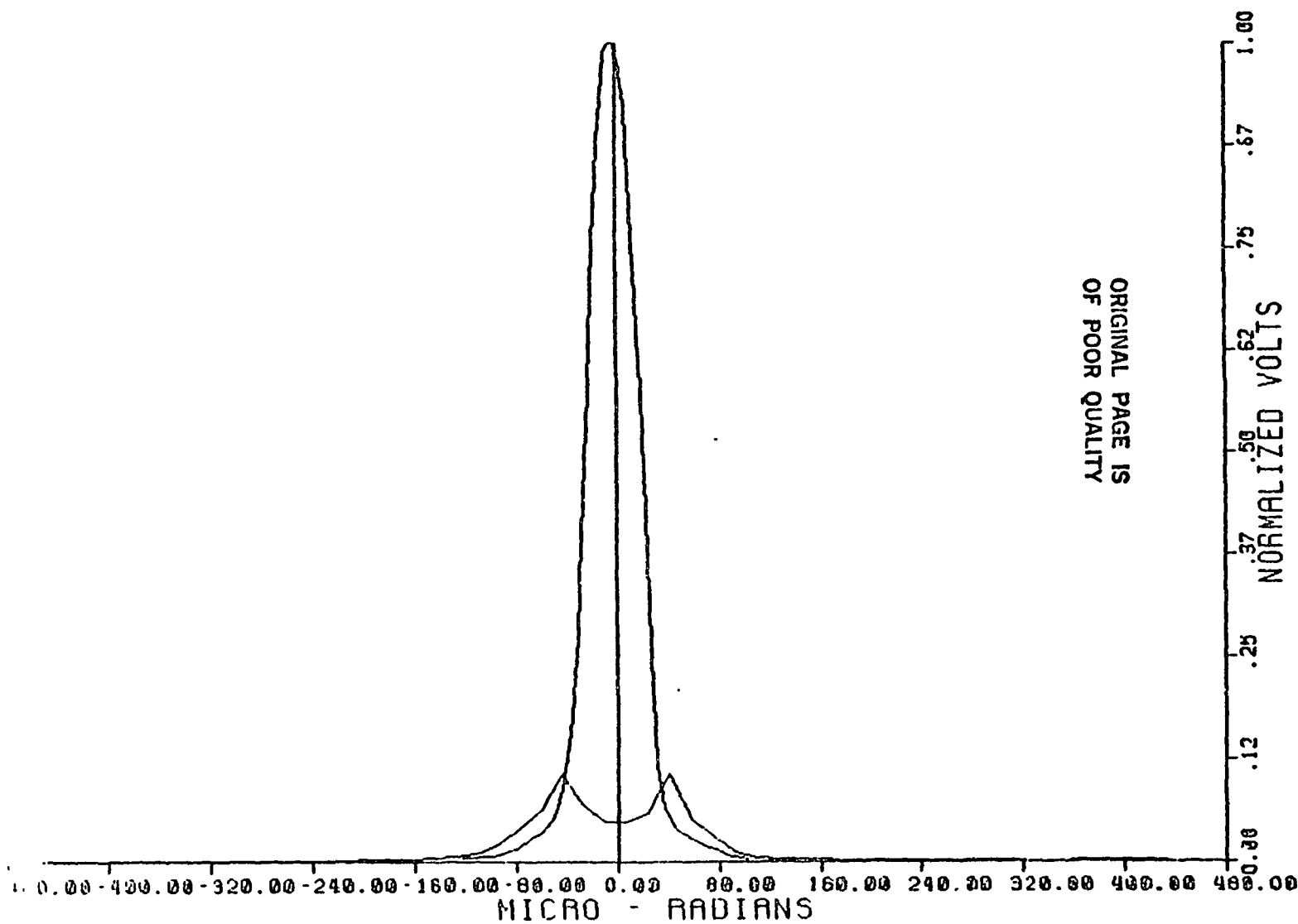
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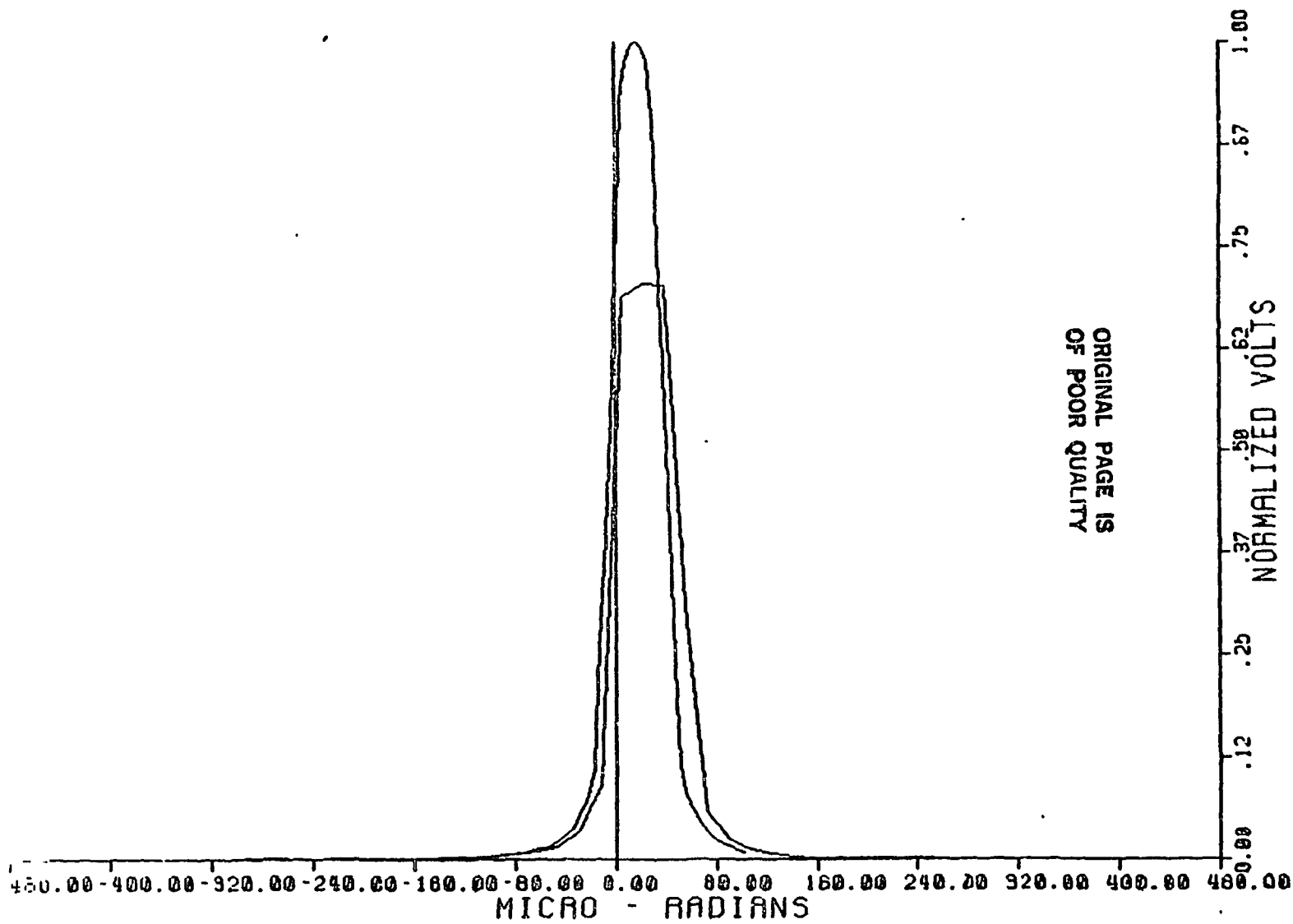


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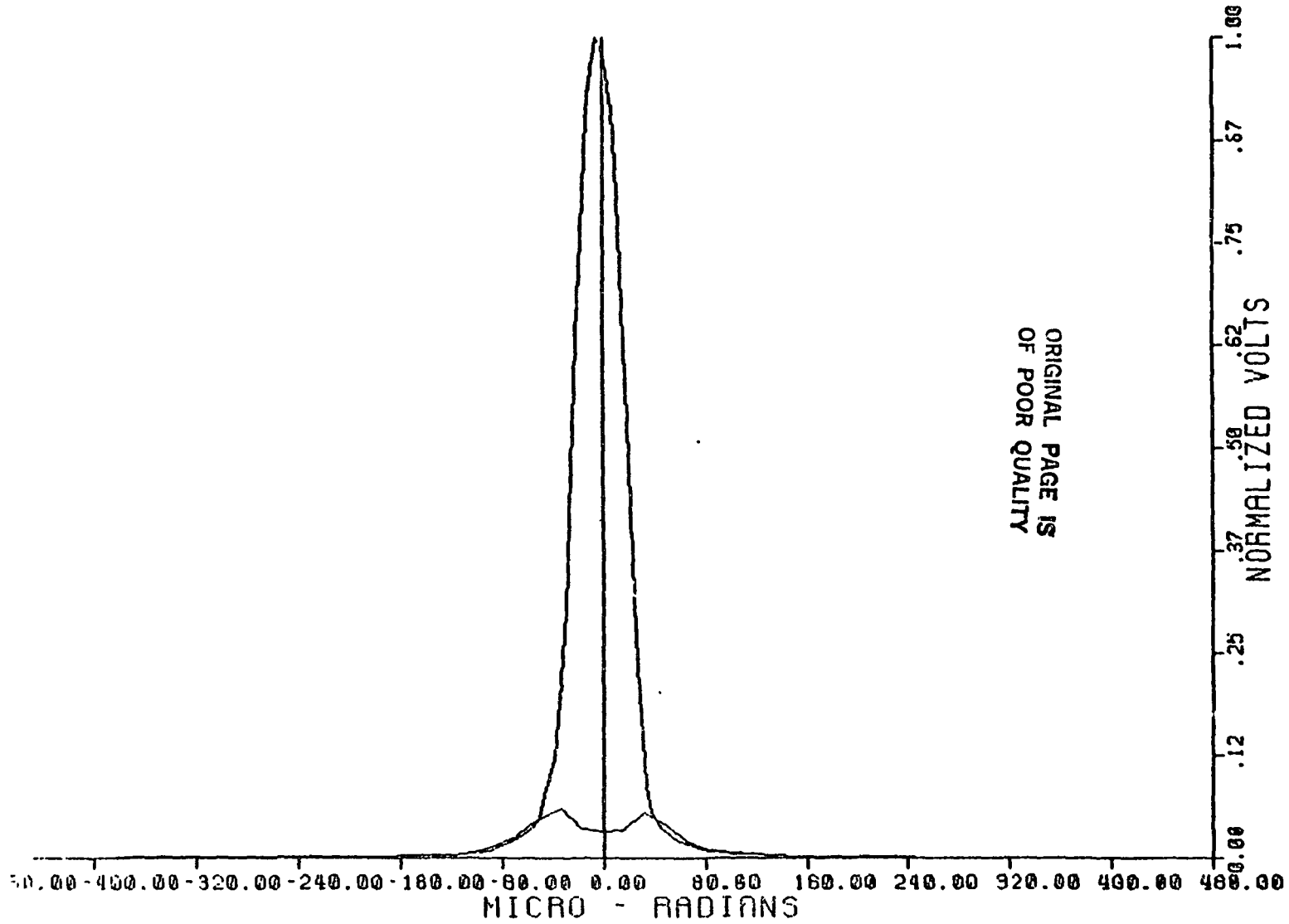


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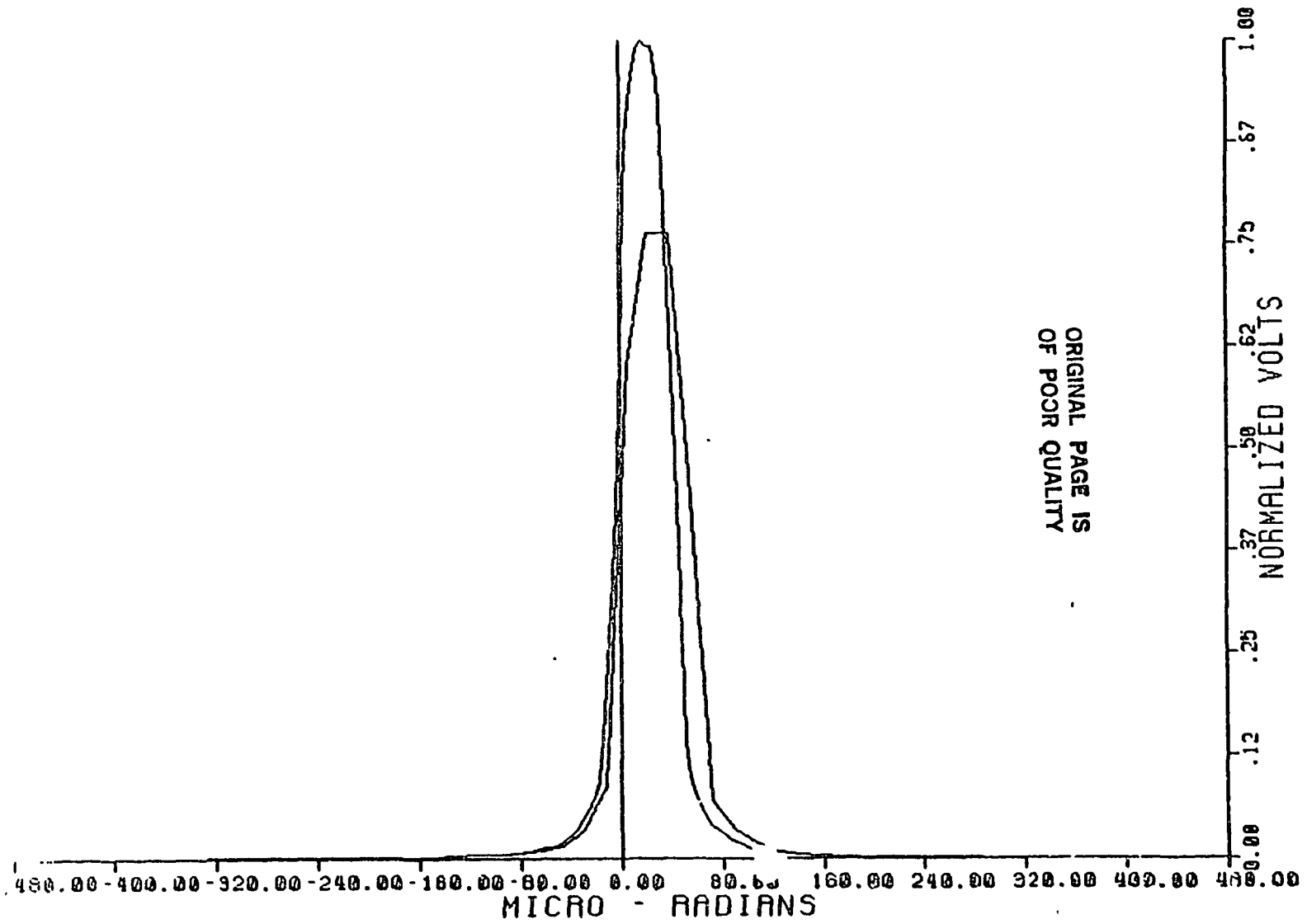


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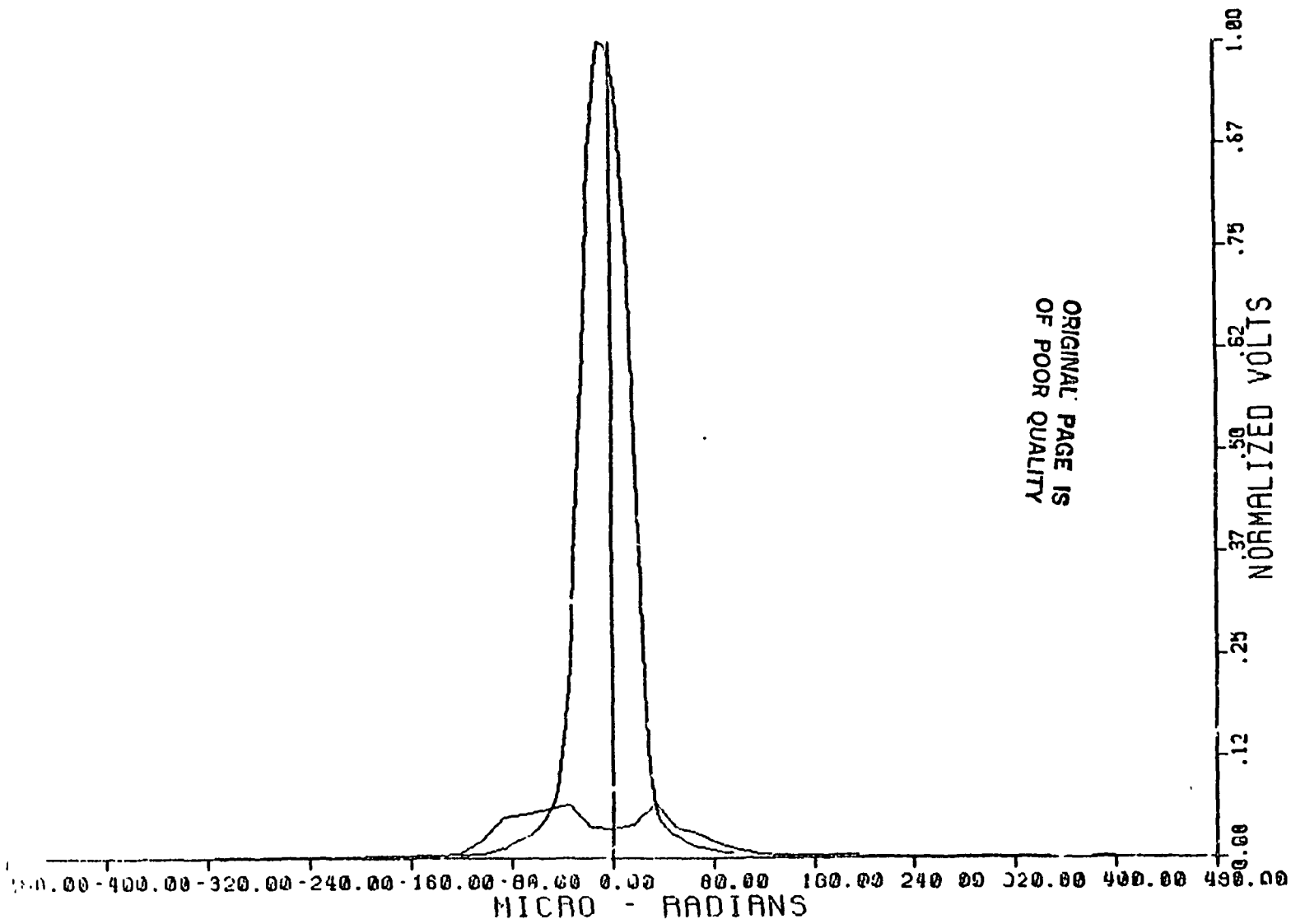
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X - AXIS, BAND 4 CHANNEL 14
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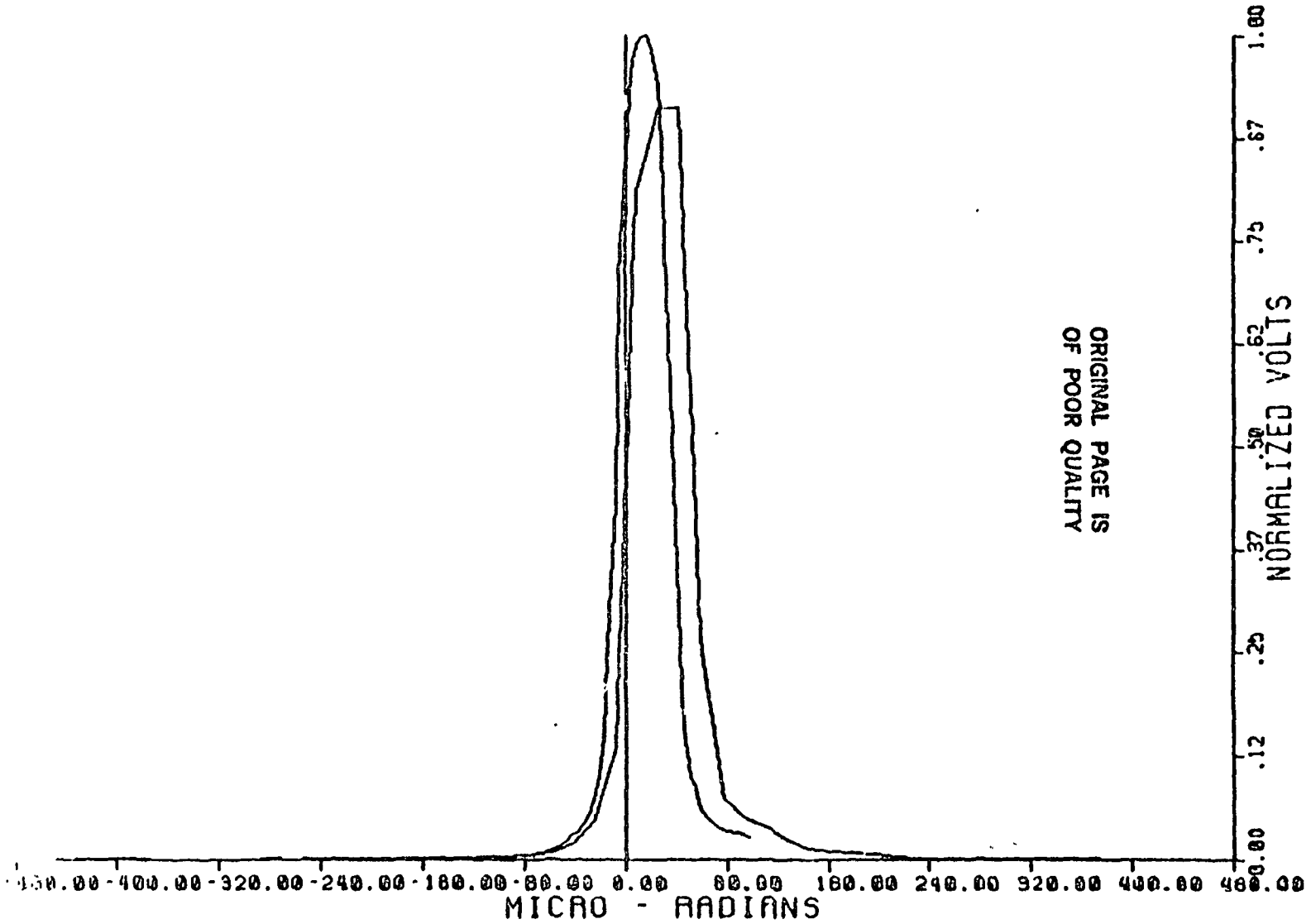


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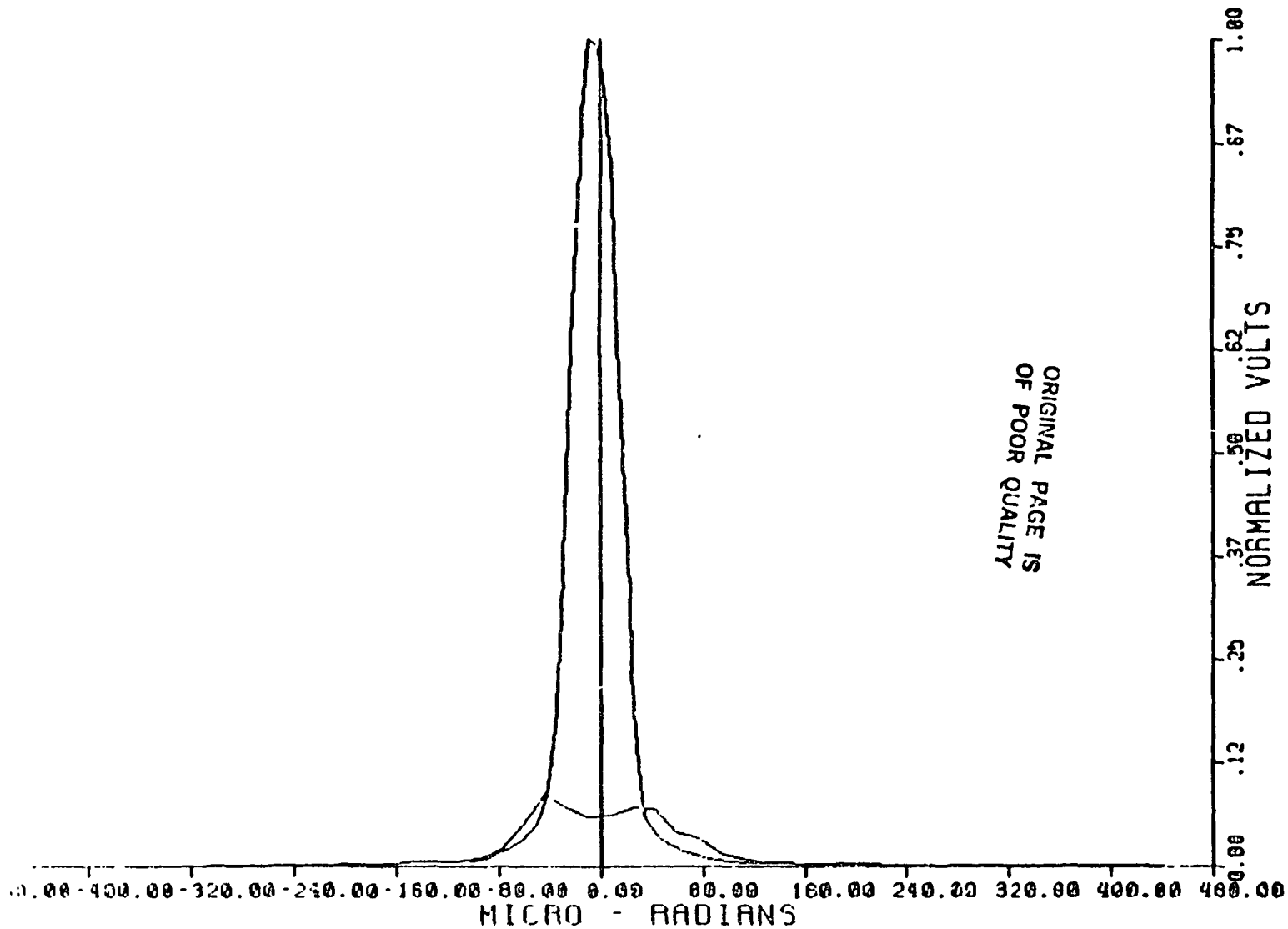


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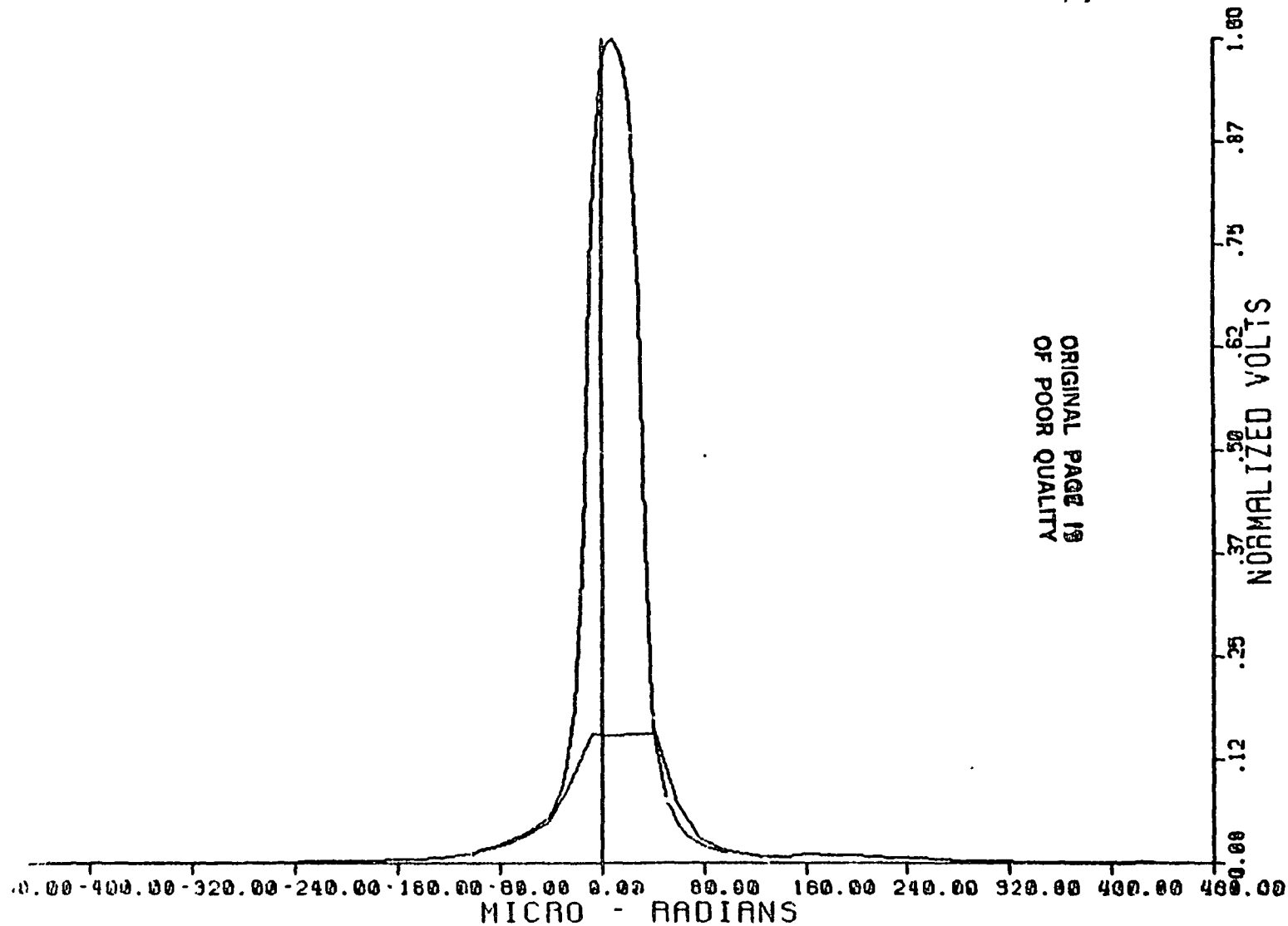


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Y-AXIS, BAND 5 CHANNEL 1

12-JUN-82

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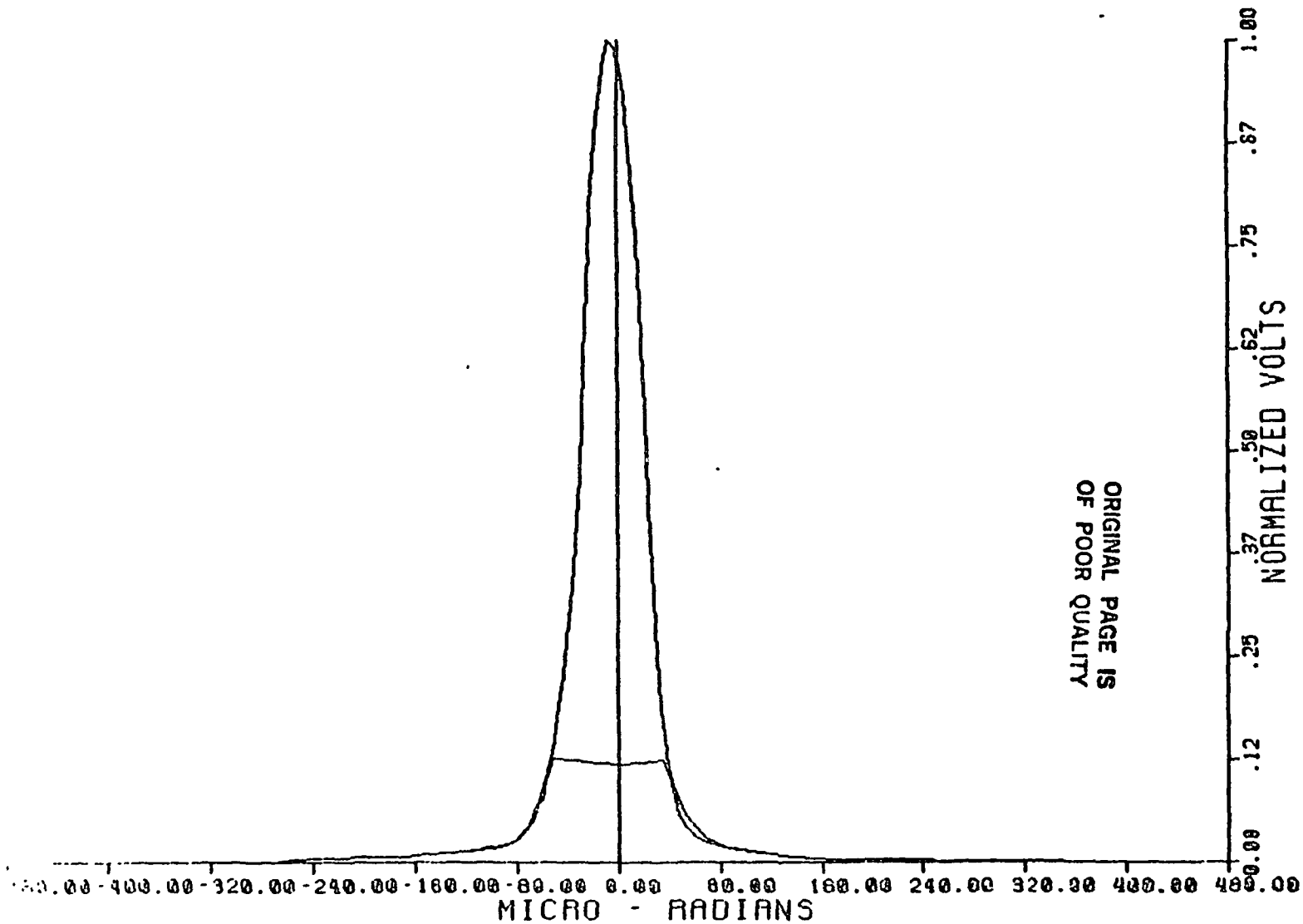


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12-JUN-82

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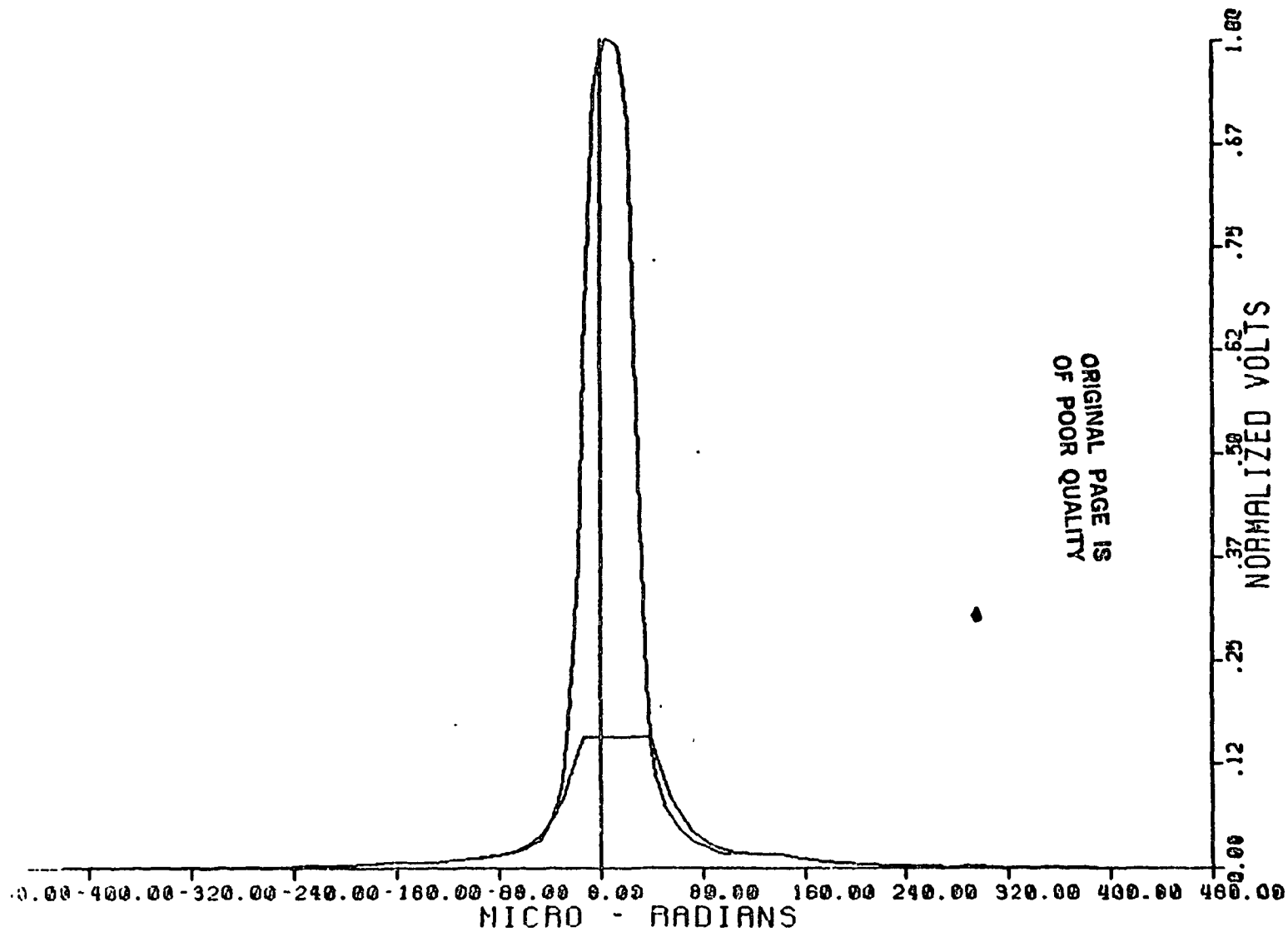


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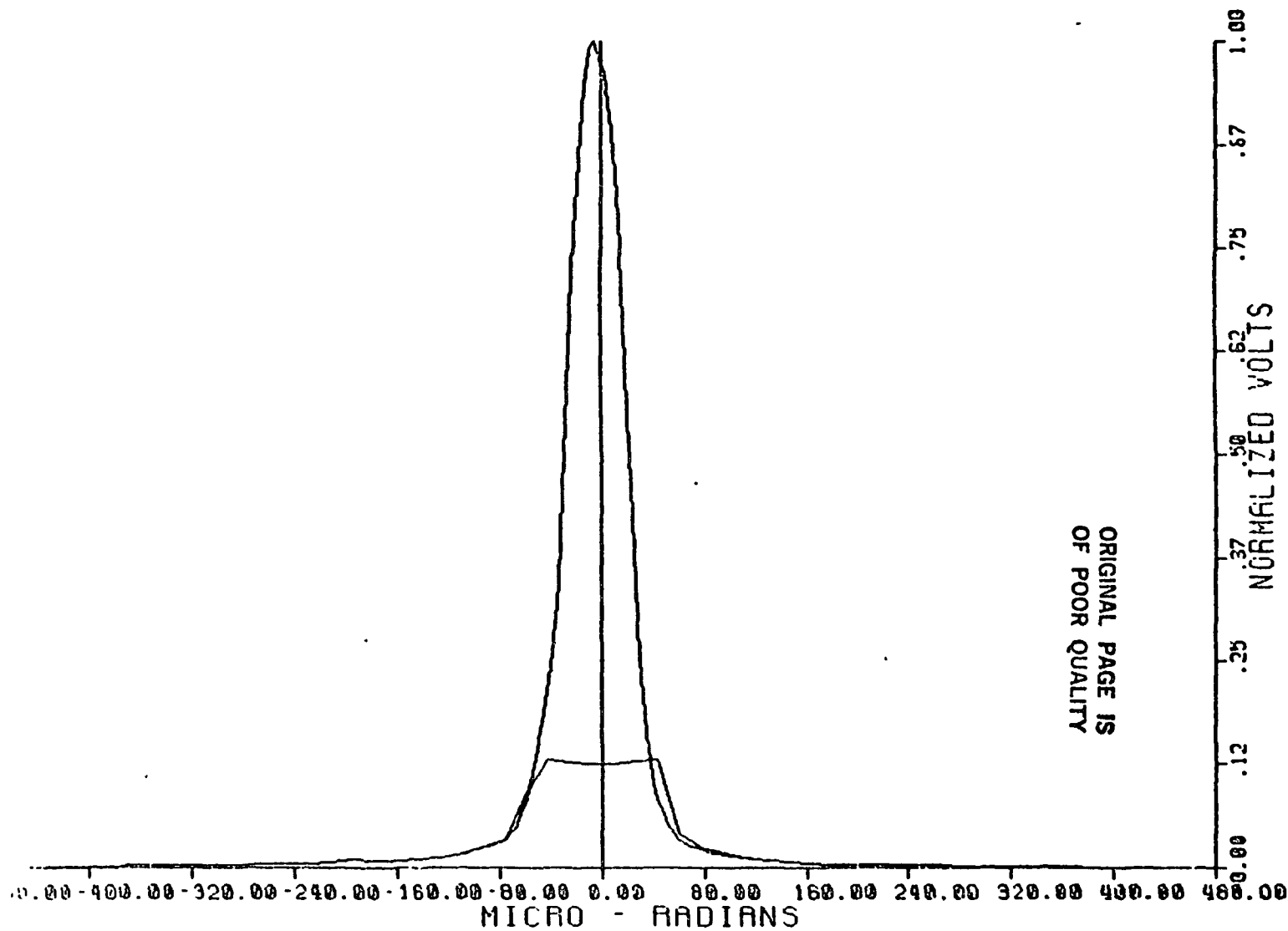


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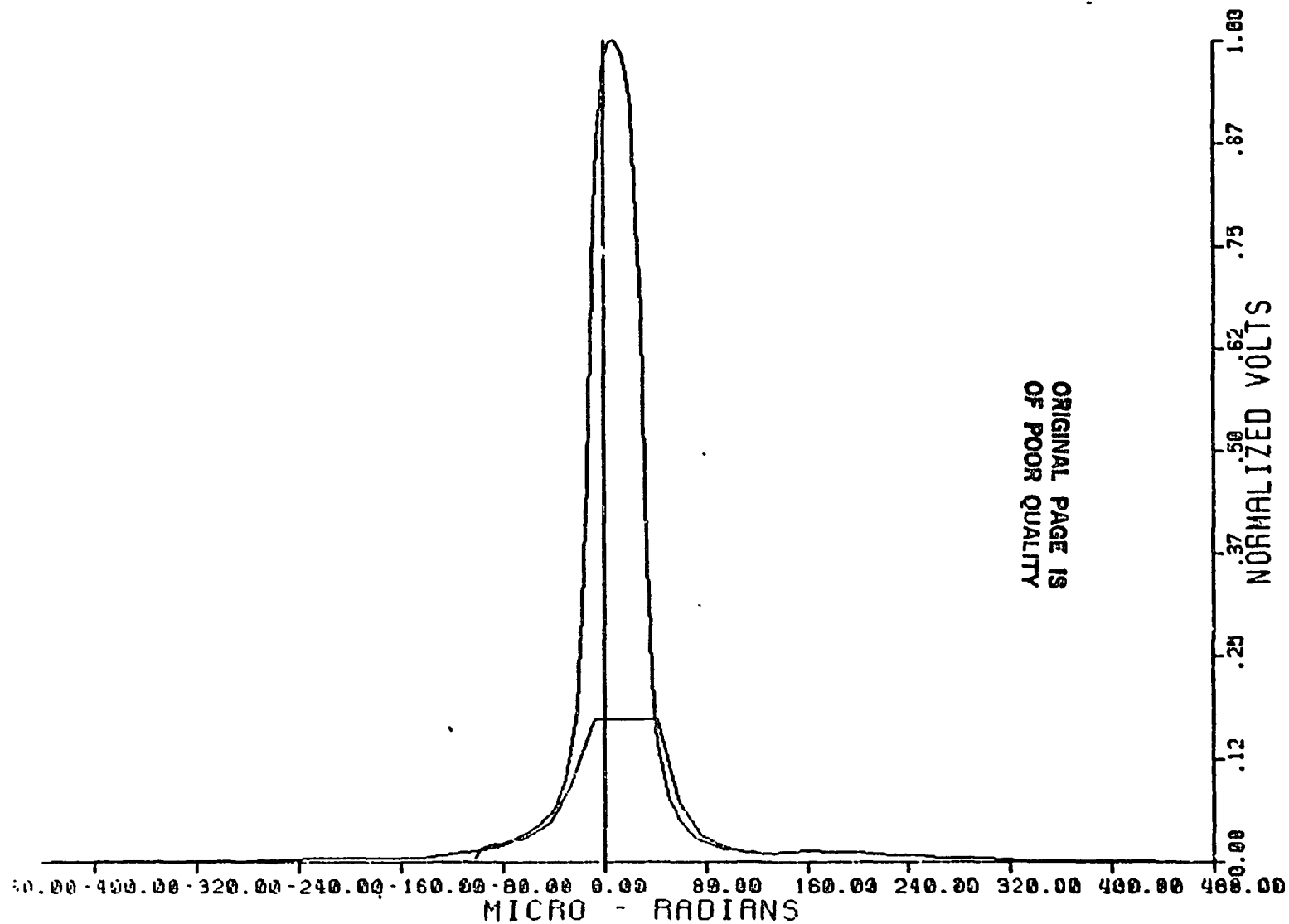


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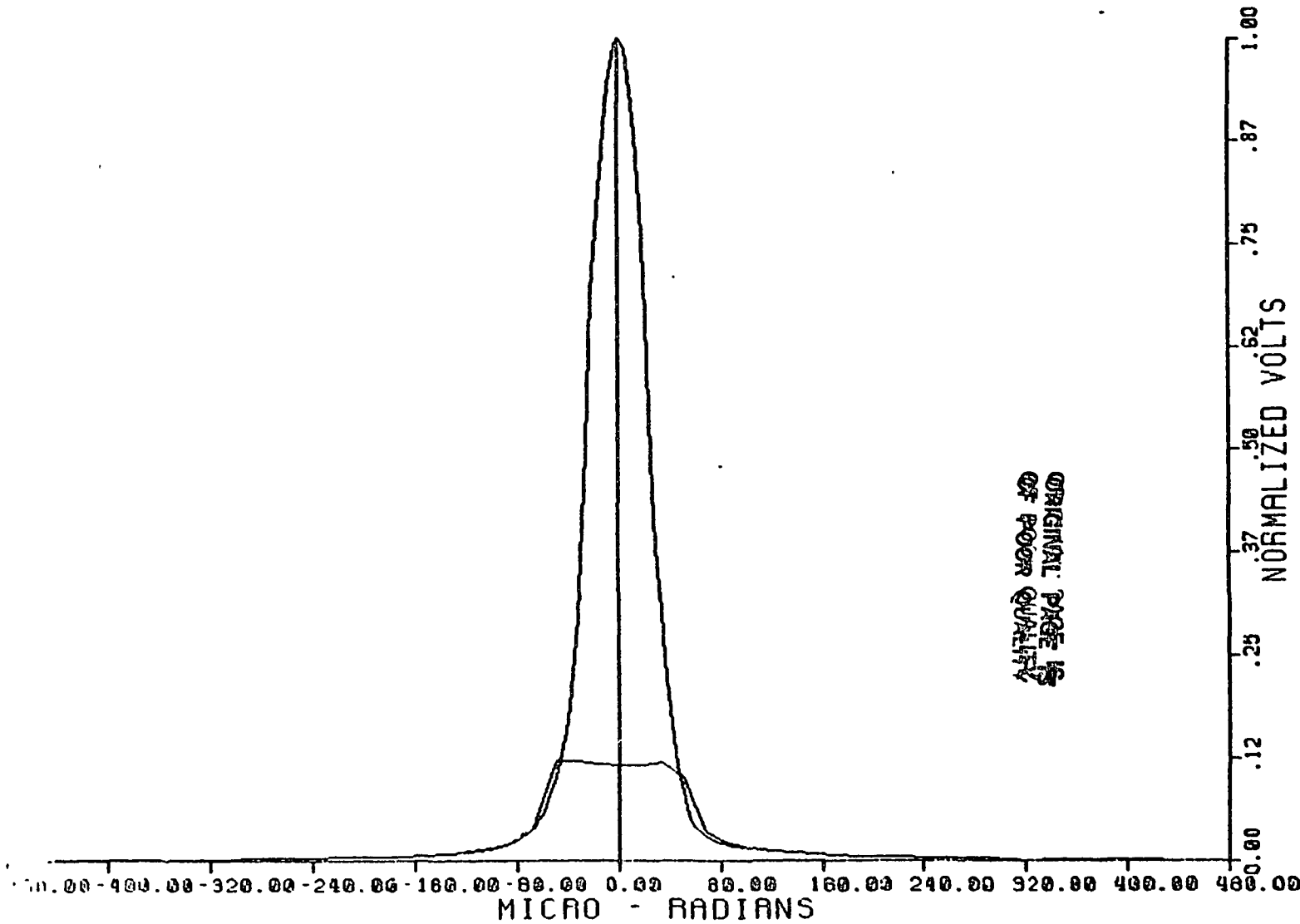


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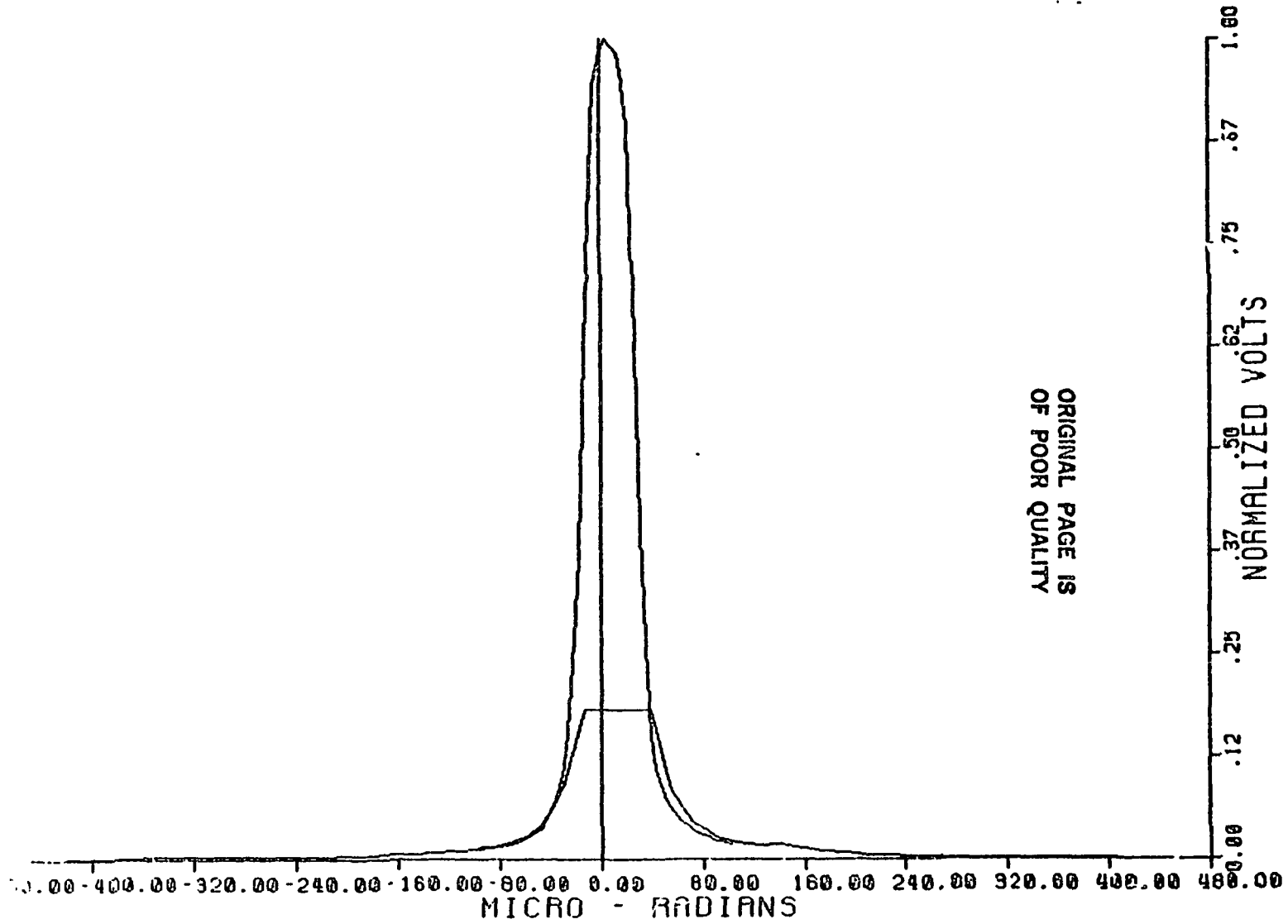


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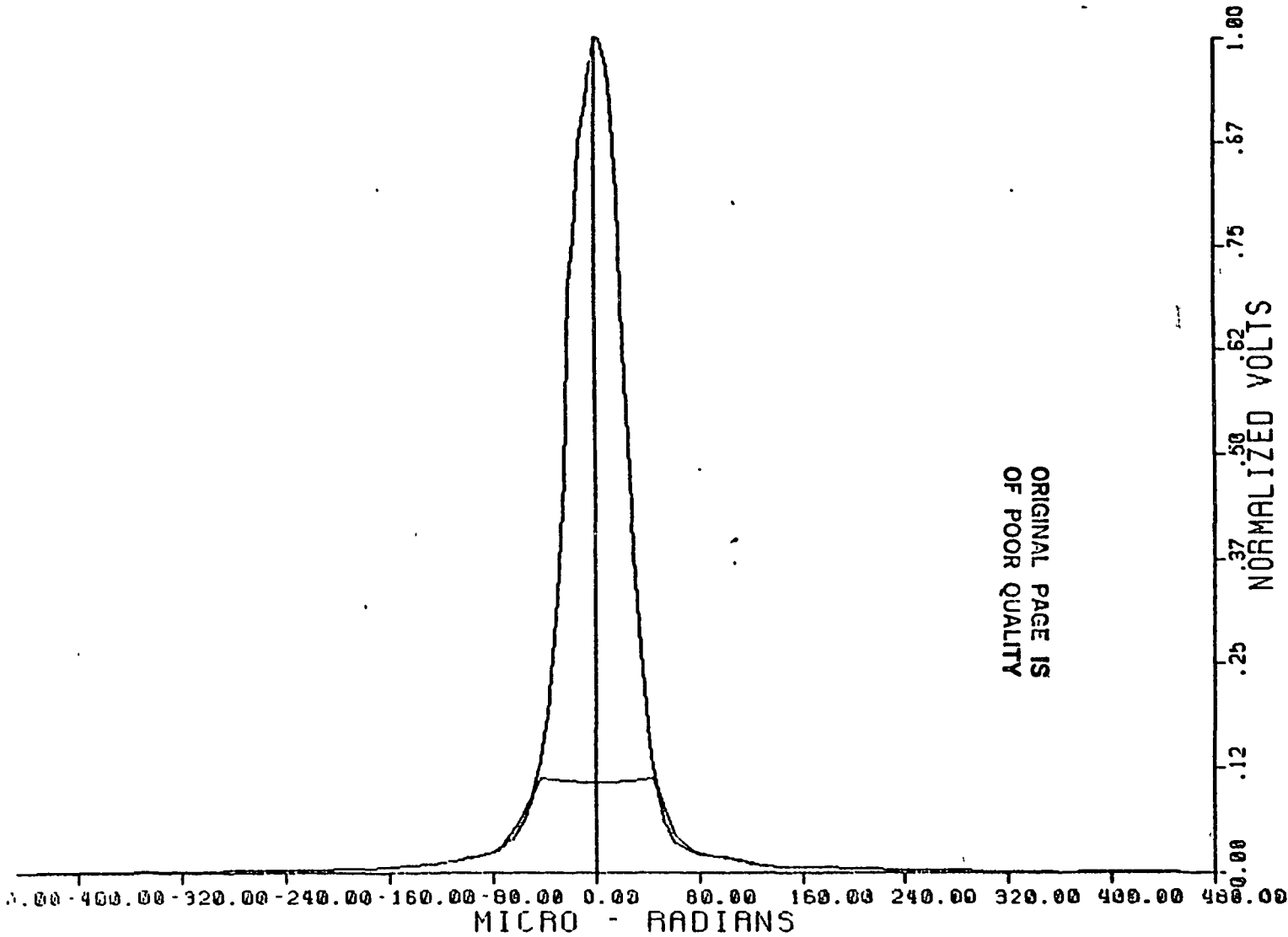


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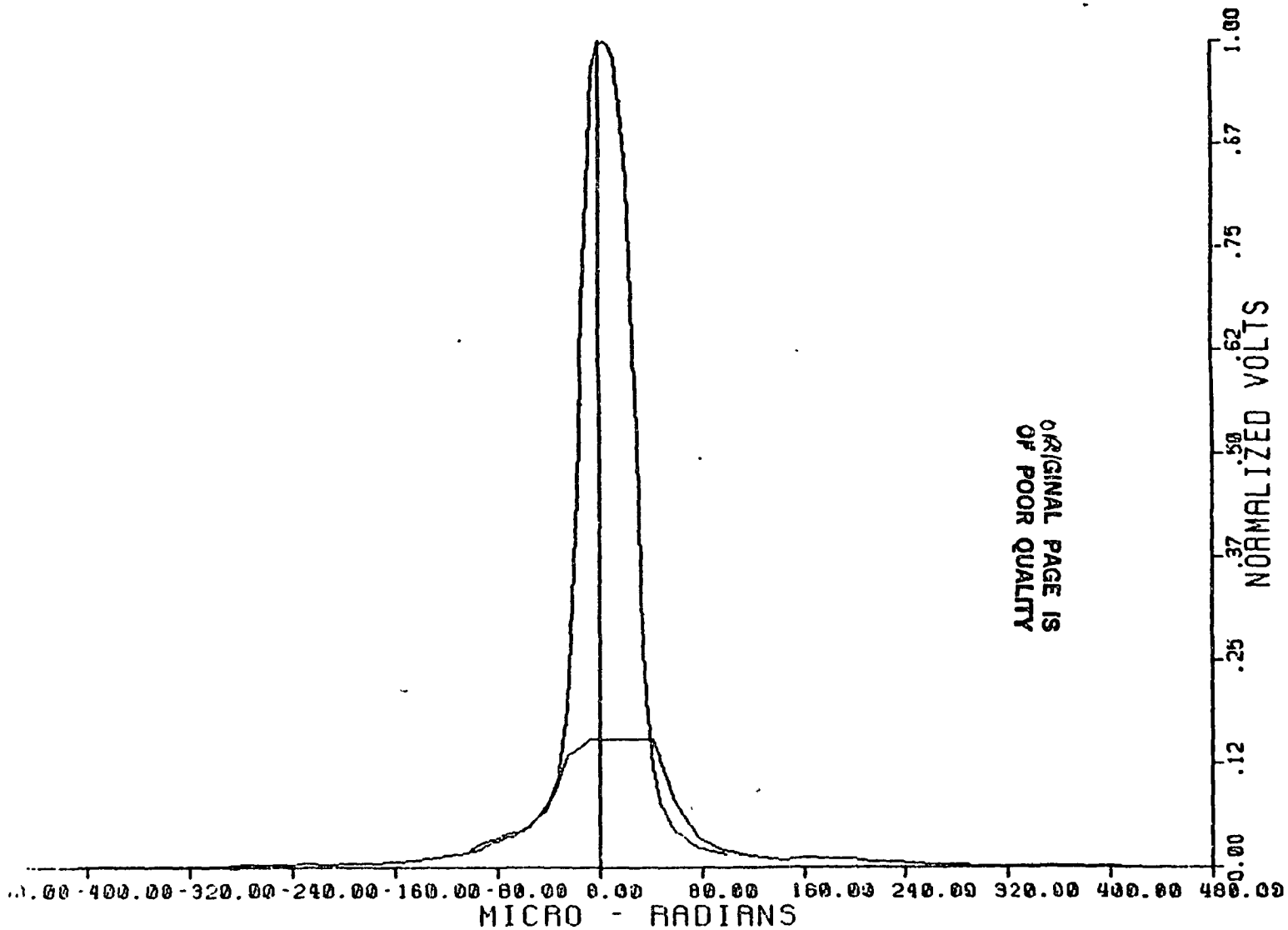


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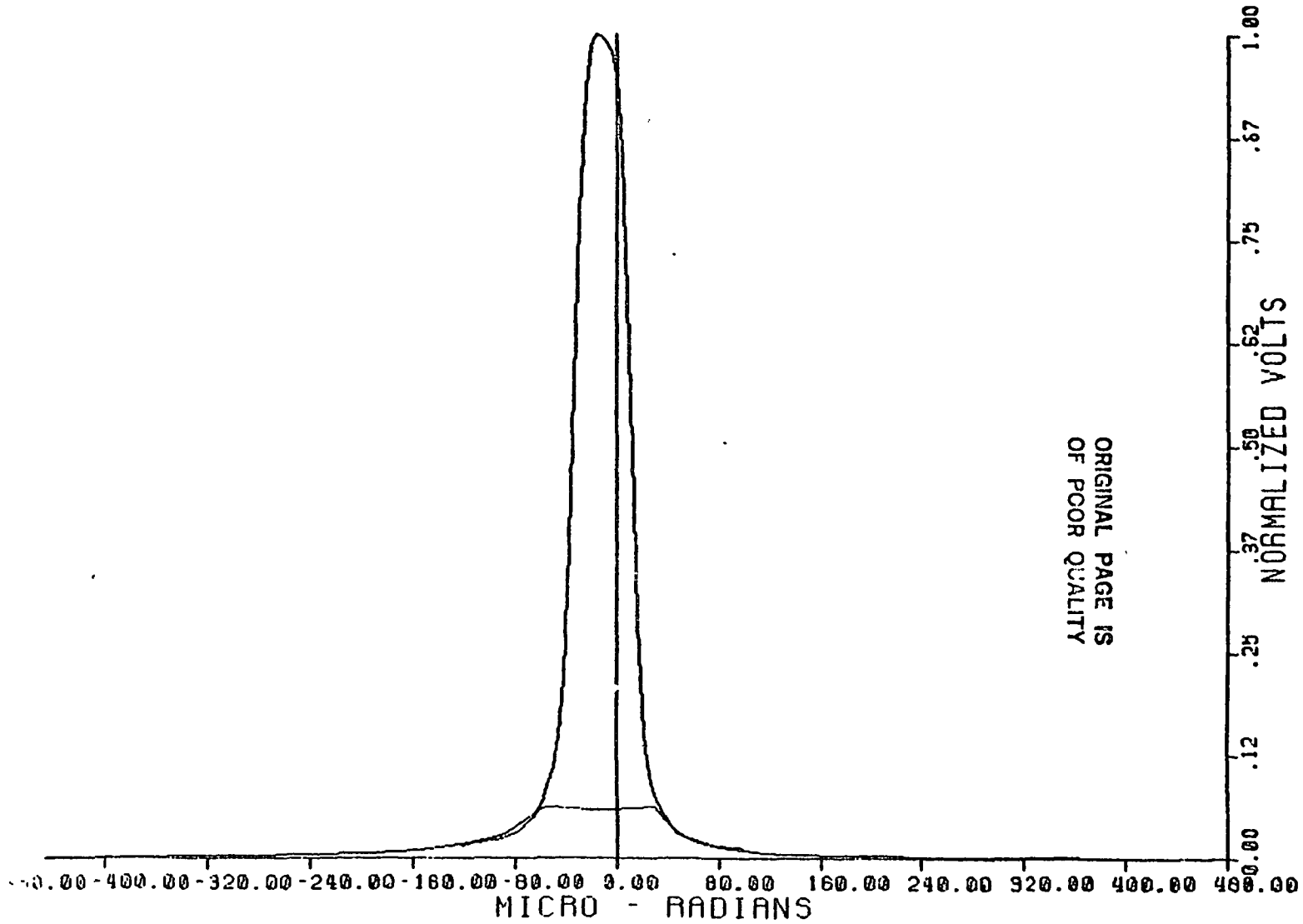
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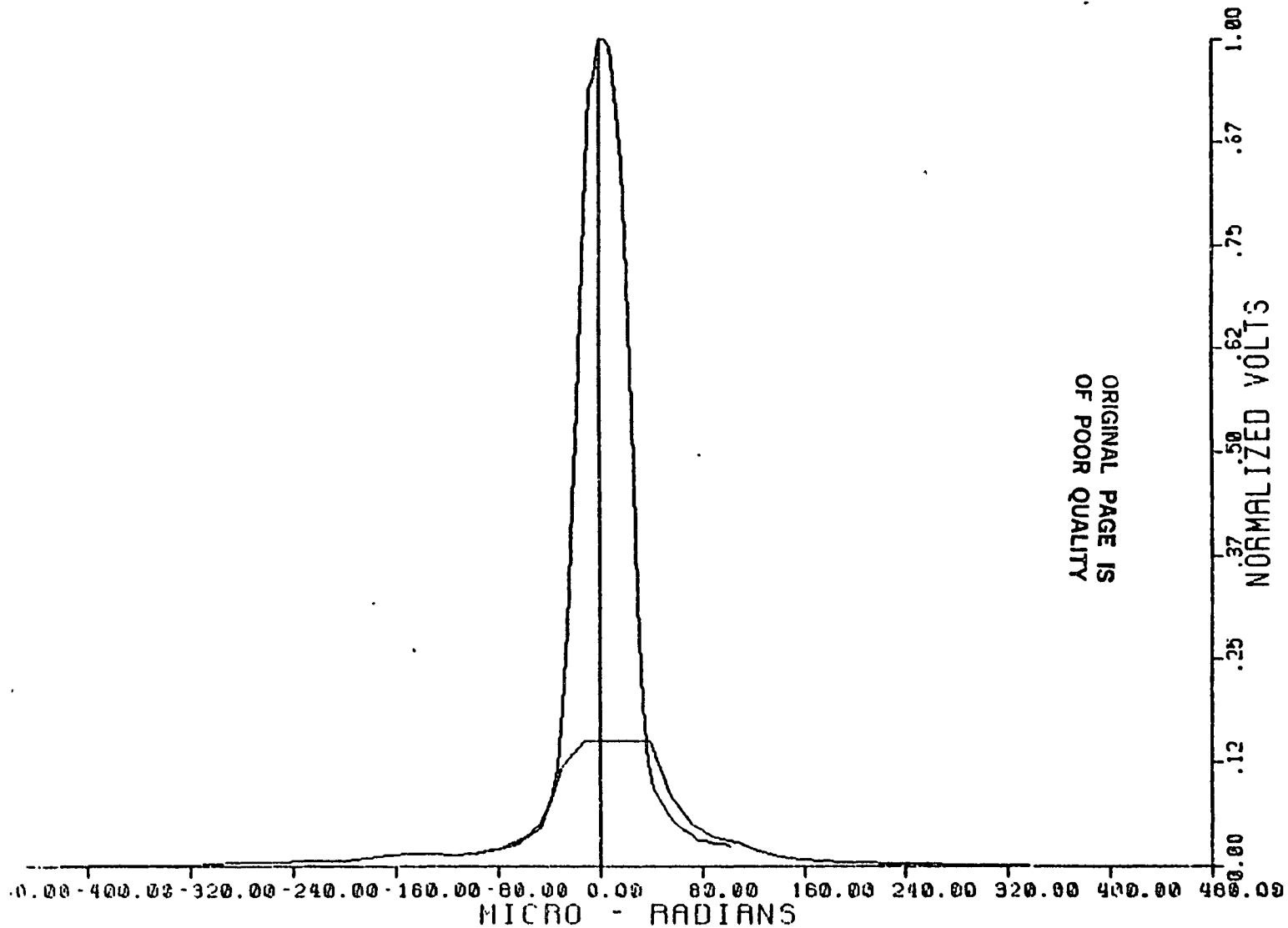


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12-JUN-82

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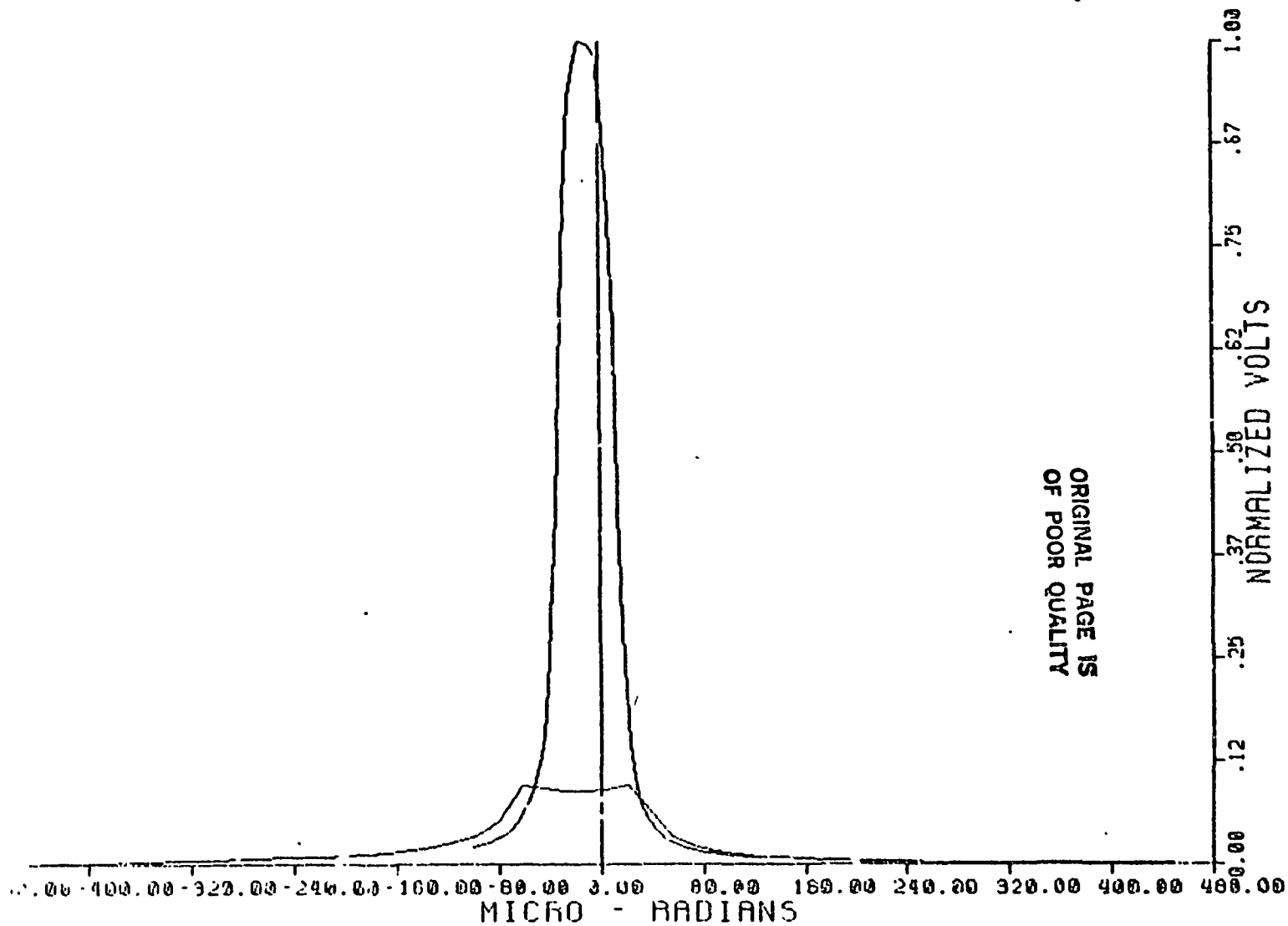


NEAR AND FAR FIELD DATA FOR

12-JUN-82

X AXIS, BAND 7 CHANNEL 2

21:11:33

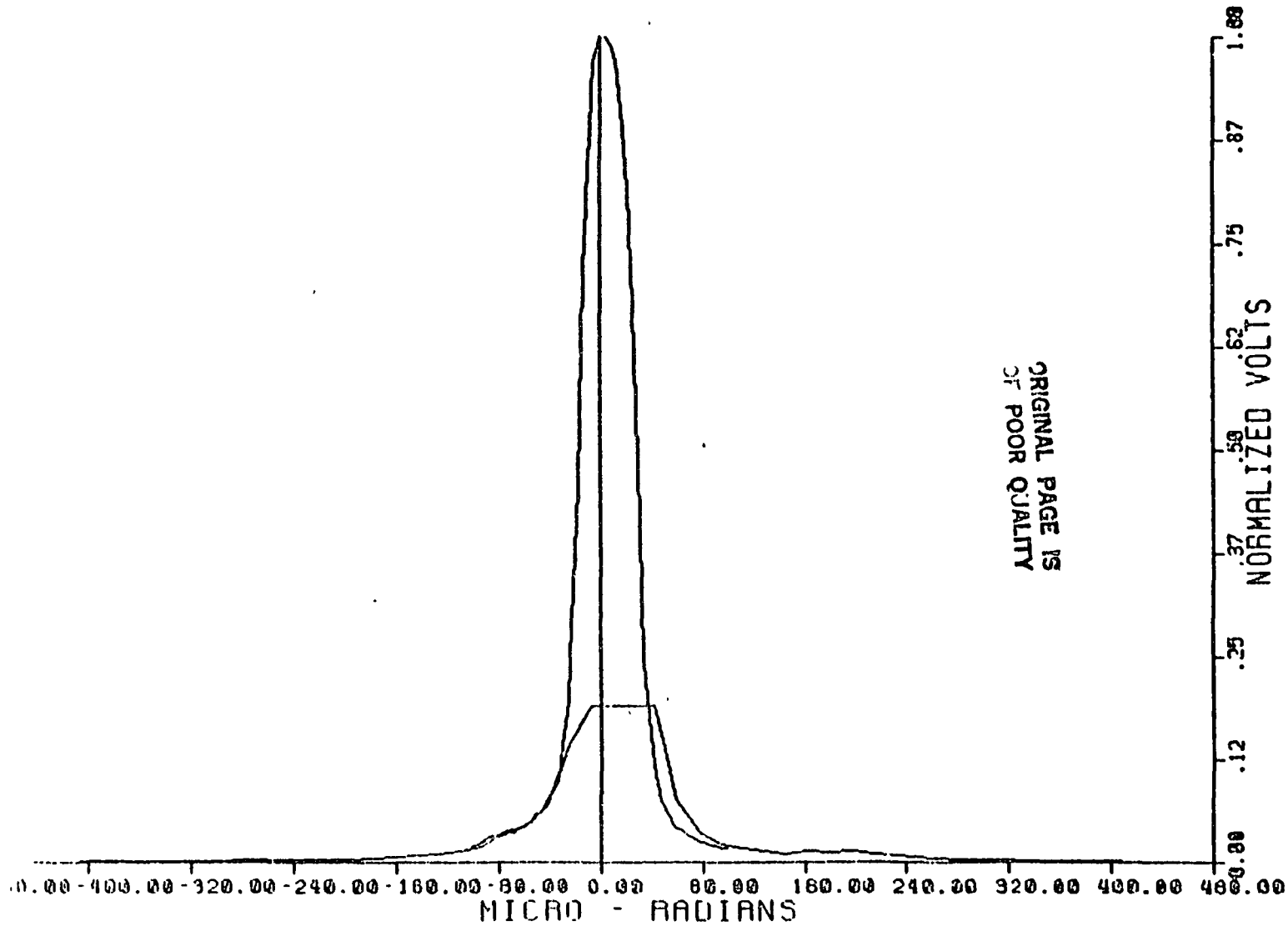


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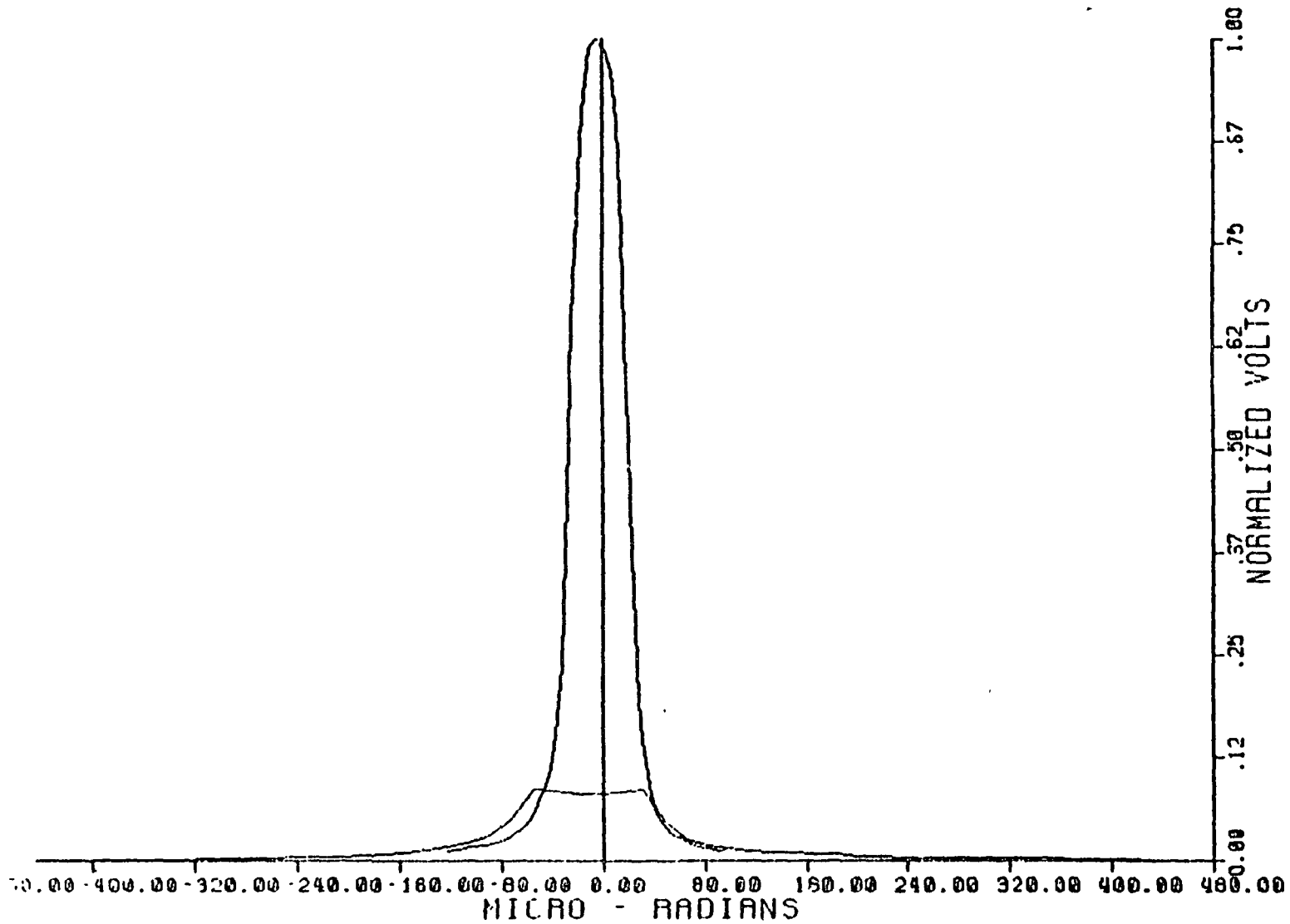


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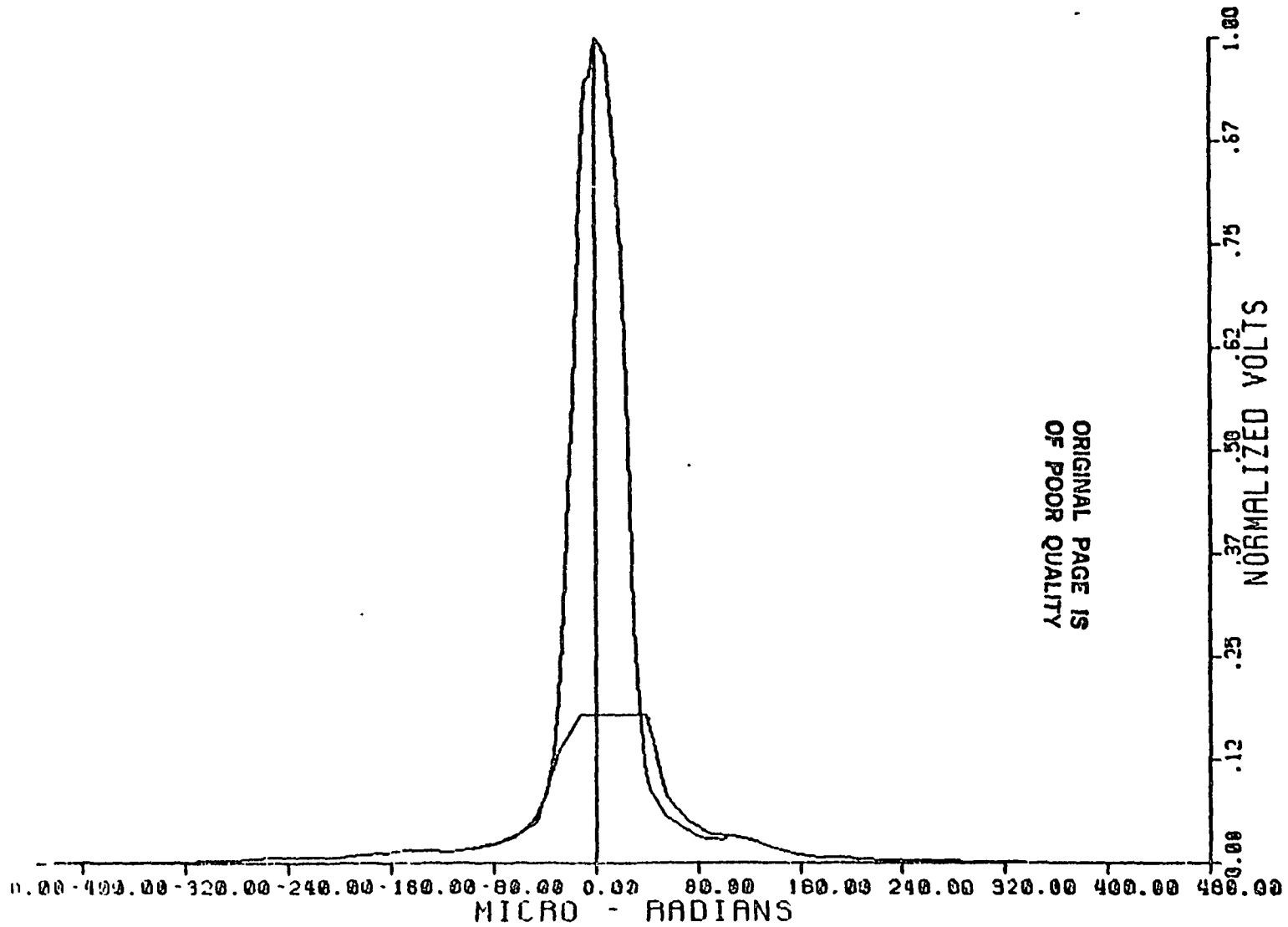
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NEAR AND FAR FIELD DATA FOR

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Y- AXIS, BAND 7 CHANNEL 16

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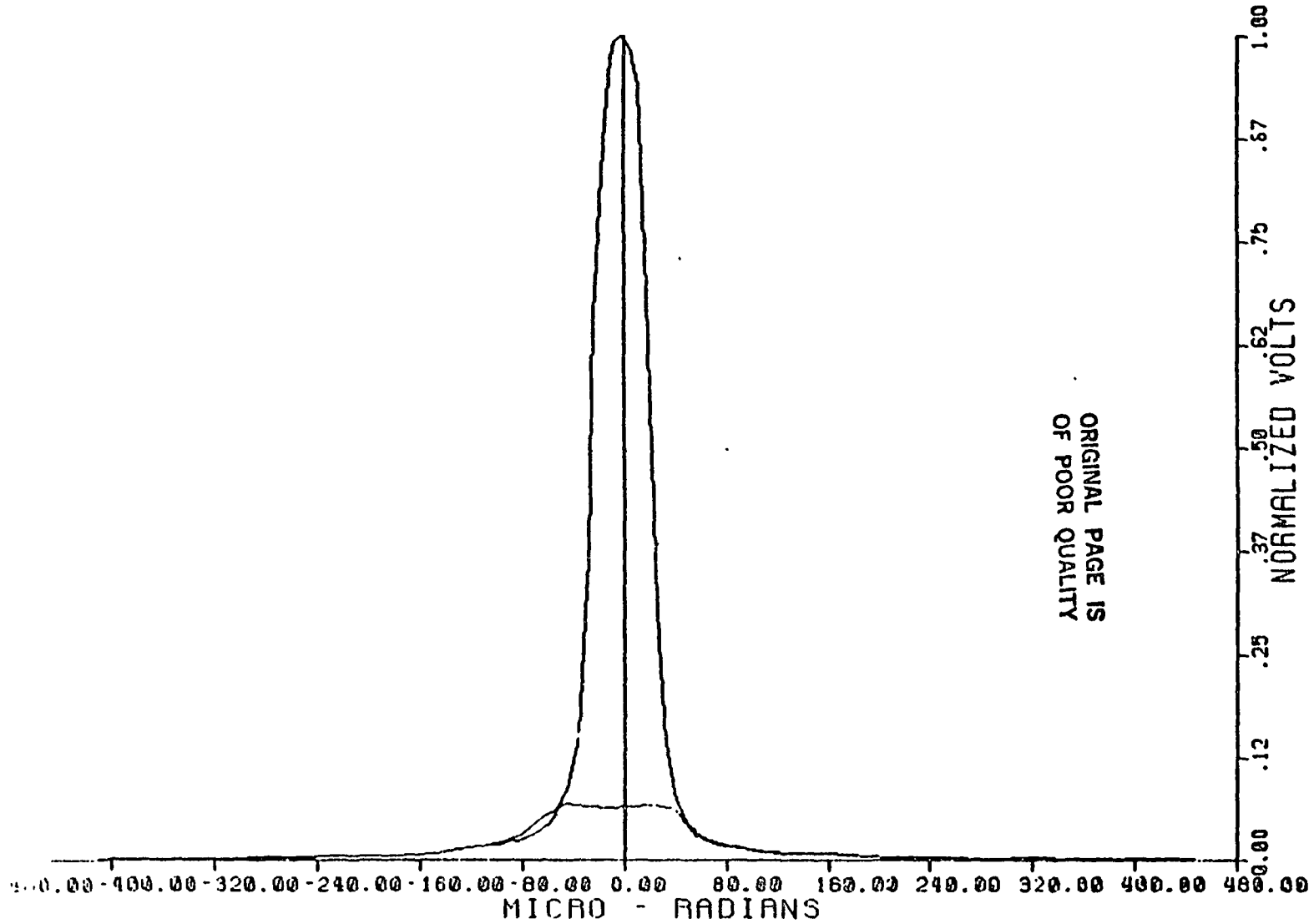


NEAR AND FAR FIELD DATA FOR

12-JUN-82

X - AXIS, BAND 7 CHANNEL 16

21:10:41



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3.2.9 BL07 TEST
RADIOMETRIC CALIBRATION OF CALIBRATOR

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

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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 *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	51.3	51.4
215	CALIBR MTF BB	24.4	24.3	24.1	24.1
250	CALIBR TEL	21.9	21.9	21.9	21.9
251					
253					

CHANNEL	CALIBRATOR REFERENCE	BLACKBODIES 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

CHANNEL	CALIBRATOR REFERENCE	BLACKBODIES MTF	INTERNAL (OBC) BLACKBODY	CAL SHUTTER	GAIN G	INTERNAL GAIN G'	G'/G
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

CHANNEL	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 $cts/(mW/cm^2 -sr-\mu m)$

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

TO: Distribution

CC:

DATE: 1 September 1982

REF: HS236-8121
SED-180

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

FROM: J. L. Engel

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

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

(Continued on Page 2)

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.

<u>Band</u>	<u>Channel</u>	<u>Amplitude (Pk Mux Cnts)</u>	<u>Frequency (Hz)</u>
1	2	.31	9144
2	13	.23	18492
3	5	.26	9144
4	All	$\leq .10$	> 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.

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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.

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

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TO: J. Engel

CC:

DATE: 20 Sept 1982

REF: HS236-8134

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

FROM: P. Thurlow

BLDG. B11 MAIL STA. 78
EXT. 1725

- 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 tabulation 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.

page 2
J. Engel

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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 $\Delta Z = 10.3$ mil shift of the collimator reticle, which would place the reticle at Z = -4 mils on the graph, with MTF = .426. The expected SWR at sharpest focus, SWR_{max} , in relation to de-convolved SWR in column 1 is, therefore, approximately:

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


P. Thurlow

/vs

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TABLE 1

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

<u>BAND</u>	<u>AVERAGE SWR</u>	<u>STANDARD DEVIATION</u>
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

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

FLIGHT MODEL - THOR FOCUS - AFTER SHIMMING

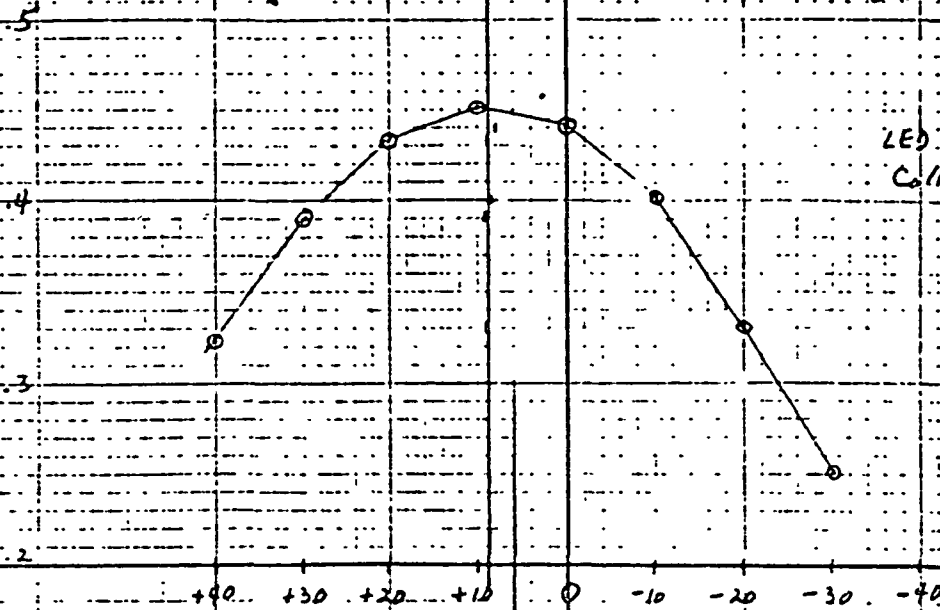
CROSS TRACK
① 30 METER BAR FREQUENCY
DETECTOR = BAND 4, CHANNEL 9
TRIAL RUN

P. Thurston 3/16/52

① RUN A. 3/16/52 78115

Z Dial Indicator
LED (Home) = 801
Collimator Fp = 807

MTF



ALONG TRACK

1.000
coll. fp

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MTF

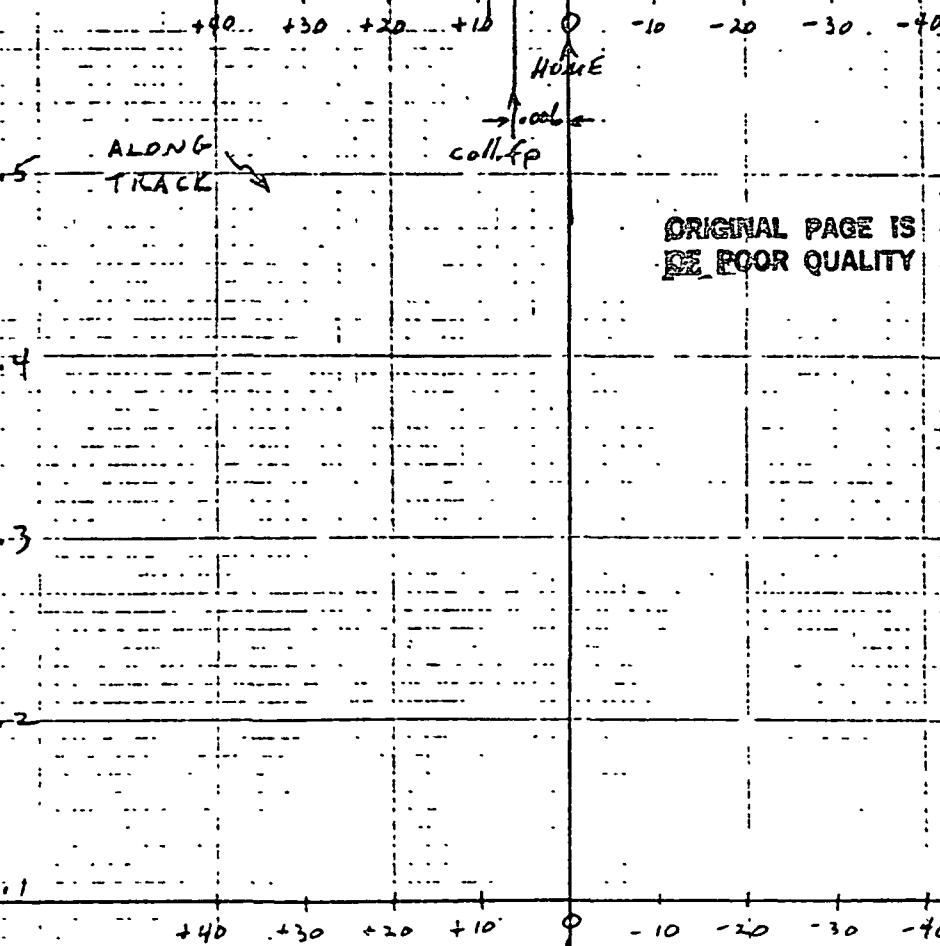


FIGURE 1

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PAGE 1 OF 7
32014-522

FROM DREPPC TASK 00122106 05-SEP-82
PHASED KNIFE EDGE

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

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.705E-03

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.141E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.302E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.9972	0.9967	0.9971	0.9963	0.9969	0.9960	0.9966	0.9960	0.9965	0.9960	0.9966	0.9969	0.9961	0.9961	0.9932	0.9976
0.0028	0.0033	0.0029	0.0037	0.0031	0.0040	0.0034	0.0040	0.0035	0.0040	0.0034	0.0031	0.0039	0.0039	0.0069	0.0023

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.588E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.9470	0.9054	0.9027	0.9042	0.9042	0.9028	0.9030	0.9068	0.9074	0.9050	0.9068	0.9064	0.9037	0.9067	0.9222	0.9271
0.0530	0.0946	0.0973	0.0958	0.0958	0.0972	0.0970	0.0932	0.0926	0.0950	0.0932	0.0936	0.0963	0.0933	0.0778	0.0729

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.788E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.7704	0.8404	0.8109	0.8477	0.7801	0.7704	0.7947	0.7947	0.8017	0.7850	0.8024	0.7896	0.7849	0.7549	0.7271	0.7721
0.2296	0.1596	0.1891	0.1523	0.2199	0.2296	0.2053	0.2053	0.1983	0.2150	0.1976	0.2104	0.2151	0.2451	0.2729	0.2279

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.8R2E-02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7247	0.6809	0.7454	0.7109	0.7167	0.6913	0.6784	0.6966	0.7075	0.7066	0.6935	0.6994	0.6931	0.6576	0.6402	0.6600	
0.6704	0.6731	0.6103	0.6183	0.6203	0.6255	0.6151	0.6244	0.6204	0.6169	0.6201	0.6307	0.6231	0.6180	0.6277	0.6245	

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.101E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.6013	0.5818	0.6102	0.5858	0.5935	0.5717	0.5697	0.5819	0.5958	0.5916	0.5822	0.5658	0.5884	0.5511	0.5609	0.5501	
0.6226	0.6232	0.6176	0.6258	0.6163	0.6215	0.6151	0.6213	0.6190	0.6249	0.6205	0.6193	0.6191	0.6237	0.6286	0.6176	

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.104E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5885	0.5452	0.5776	0.5516	0.5584	0.5319	0.5318	0.5458	0.5652	0.5632	0.5535	0.5617	0.5557	0.5307	0.5251	0.5216	
0.6200	0.6179	0.6161	0.6234	0.6180	0.6187	0.6126	0.6197	0.6182	0.6217	0.6198	0.6174	0.6206	0.6171	0.6242	0.6173	

RAND NUMBER = 1
SPATIAL FREQUENCY = 0.118E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.4140	0.4080	0.4209	0.4127	0.4039	0.4003	0.4042	0.4217	0.4310	0.4278	0.4199	0.4114	0.4228	0.4230	0.4075	0.4128	
0.6222	0.6191	0.6212	0.6288	0.6232	0.6280	0.6232	0.6243	0.6157	0.6250	0.6201	0.6228	0.6200	0.6214	0.6198	0.6222	

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RAND NUMBER = 1
SPATIAL FREQUENCY = 0.141E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7231	0.7240	0.7168	0.7270	0.7162	0.7133	0.7390	0.7391	0.7558	0.7748	0.7638	0.7579	0.7730	0.7580	0.7608	0.7420	
0.6158	0.6278	0.6274	0.6370	0.6304	0.6312	0.6240	0.6436	0.6313	0.6353	0.6453	0.6417	0.6369	0.6350	0.6352	0.6268	

4159
0.0018

PHASED KNIFE EDGE

KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 1-8FP-82
VIDEO FILE CREATION TIME: 15142115

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.705F-03

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
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
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

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.141E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
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
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

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.392F-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0.9997 0.9998 0.9976 0.9974 0.9952 0.9974 0.9986 0.9969 0.9992 0.9975 0.9980 0.9963 0.9982 0.9978 0.9979 0.9982
0.0003 0.0002 0.0024 0.0026 0.0048 0.0026 0.0014 0.0031 0.0011 0.0025 0.0020 0.0037 0.0018 0.0021 0.0021 0.0018

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.498F-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0.9747 0.9719 0.9668 0.9670 0.9676 0.9692 0.9645 0.9632 0.9741 0.9670 0.9689 0.9610 0.9547 0.9636 0.9606 0.9925
0.0253 0.0381 0.0332 0.0330 0.0324 0.0308 0.0355 0.0368 0.0259 0.0330 0.0311 0.0390 0.0453 0.0364 0.0394 0.0075

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.784F-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0.9151 0.8797 0.8459 0.8017 0.8510 0.8152 0.8597 0.8310 0.8278 0.8444 0.8450 0.8022 0.8185 0.8085 0.8249
0.0849 0.1283 0.1541 0.1983 0.1490 0.1448 0.1403 0.1690 0.1722 0.1556 0.1550 0.1978 0.1815 0.1915 0.1751 0.1751

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RAND NUMBER = 7
SPATIAL FREQUENCY = 0.8821-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7117	0.7791	0.7353	0.7413	0.7183	0.7418	0.7161	0.7546	0.7162	0.7279	0.7426	0.7363	0.7082	0.7250	0.7229	0.7349
0.0177	0.0174	0.0168	0.0148	0.0230	0.0187	0.0123	0.0124	0.0166	0.0158	0.0149	0.0123	0.0170	0.0147	0.0197	0.0134

RAND NUMBER = 7
SPATIAL FREQUENCY = 0.101F-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5597	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
0.0127	0.0156	0.0179	0.0108	0.0197	0.0128	0.0173	0.0164	0.0185	0.0127	0.0156	0.0195	0.0141	0.0171	0.0112	

RAND NUMBER = 7
SPATIAL FREQUENCY = 0.104F-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5297	0.5187	0.5550	0.5496	0.5456	0.5483	0.5443	0.5803	0.5603	0.5505	0.5676	0.5783	0.5536	0.5869	0.5549	0.5837
0.0138	0.0161	0.0147	0.0104	0.0197	0.0138	0.0166	0.0166	0.0226	0.0138	0.0170	0.0124	0.0166	0.0124	0.0193	0.0136

RAND NUMBER = 2
SPATIAL FREQUENCY = 0.111F-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.3100	0.4013	0.4184	0.4076	0.3046	0.4186	0.4028	0.4265	0.4205	0.4029	0.4043	0.4318	0.4138	0.4349	0.4022	0.4254
0.0134	0.0184	0.0210	0.0194	0.0128	0.0131	0.0188	0.0168	0.0161	0.0159	0.0155	0.0107	0.0147	0.0140	0.0165	0.0138

RAND NUMBER = 7
SPATIAL FREQUENCY = 0.141F-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.2115	0.2166	0.2100	0.2158	0.2027	0.2100	0.2291	0.2318	0.2278	0.2188	0.2067	0.2474	0.2327	0.2506	0.2188	0.2399
0.0164	0.0228	0.0206	0.0170	0.0111	0.0134	0.0222	0.0190	0.0165	0.0198	0.0170	0.0152	0.0152	0.0325	0.0269	0.0357

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FRON PREPDC TASK 06119141 04-SFP-B7
PHASED KNIFE EDGE
KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 3-SFP-02
VIDEO FILE CREATION TIME: 151431.7

BAND NUMBER = 3
SPATIAL FREQUENCY = 0.705F-03

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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 = 0.141F-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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 = 0.302F-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.9064	0.9059	0.9071	0.9081	0.9091	0.9076	0.9059	0.9069	0.9090	0.9071	0.9068	0.9063	0.9074	0.9064	0.9070	0.9053
0.0015	0.0028	0.0030	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 = 0.588F-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.3065	0.3065	0.3087	0.3070	0.3070	0.3042	0.3016	0.3011	0.3020	0.3016	0.3015	0.3016	0.3016	0.3016	0.3017	0.3017
0.0150	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 = 0.794F-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.7041	0.7041	0.7051	0.7016	0.7000	0.7018	0.7018	0.7018	0.7015	0.7004	0.7006	0.7016	0.7015	0.7063	0.7064	0.7057
0.0115	0.0116	0.0093	0.0150	0.0180	0.0170	0.0167	0.0125	0.0184	0.0152	0.0110	0.0284	0.0176	0.0165	0.0183	0.0220

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RAND NUMBR # 3
SPATIAL FREQUENC # 0.8827E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.6056	0.7134	0.7103	0.7184	0.7155	0.6707	0.7360	0.7151	0.7228	0.6944	0.7038	0.7217	0.6900	0.7026	0.7254	0.6988
0.0113	0.0112	0.0148	0.0114	0.0216	0.0194	0.0176	0.0111	0.0127	0.0186	0.0099	0.0174	0.0157	0.0131	0.0288	0.0131

RAND NUMBR # 3
SPATIAL FREQUENC # 0.101F-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5075	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	0.5937
0.0156	0.0115	0.0137	0.0110	0.0157	0.0106	0.0202	0.0162	0.0237	0.0129	0.0170	0.0201	0.0190	0.0115	0.0139	0.0121

RAND NUMBR # 3
SPATIAL FREQUENC # 0.104E-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5187	0.5127	0.5448	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
0.0150	0.0002	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

RAND NUMBR # 3
SPATIAL FREQUENC # 0.118E-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.3005	0.3847	0.3885	0.3994	0.3954	0.3852	0.3942	0.3942	0.3997	0.3832	0.3762	0.3881	0.3981	0.3937	0.4040	0.4007
0.0162	0.0136	0.0171	0.0116	0.0137	0.0150	0.0140	0.0146	0.0177	0.0127	0.0156	0.0134	0.0166	0.0160	0.0217	0.0213

3910
6 = .0075

RAND NUMBR # 3
SPATIAL FREQUENC # 0.141E-01

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.2234	0.1970	0.2004	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
0.0154	0.0182	0.0215	0.0201	0.0270	0.0267	0.0237	0.0238	0.0184	0.0144	0.0218	0.0321	0.0338	0.0403	0.0684	0.0454

FROM PKRPG TASK 0414410R 04-SFP-R7
PHASE11 KNIFE FDGP
KNIFE FDGP REPORT
VIDEO FILE CREATION DATE: 3-SFP-02
VIDEO FILE CREATION TIME: 15143115

RAND NUMBER = 4
SPATIAL FREQUENCY = 0.705E-03

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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

RAND NUMBER = 4
SPATIAL FREQUENCY = 0.141E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
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
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

RAND NUMBER = 4
SPATIAL FREQUENCY = 0.392F-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.0076	0.0061	0.0061	0.0067	0.0067	0.0057	0.0083	0.0076	0.0082	0.0075	0.0069	0.0074	0.0077	0.0062	0.0067	0.0067
0.0070	0.0077	0.0071	0.0077	0.0070	0.0070	0.0070	0.0071	0.0072	0.0070	0.0070	0.0075	0.0070	0.0070	0.0070	0.0070

RAND NUMBER = 4
SPATIAL FREQUENCY = 0.588E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.0774	0.0948	0.0806	0.0935	0.0900	0.0987	0.0745	0.0717	0.0547	0.0910	0.0835	0.0862	0.0938	0.0930	0.0977	0.0969
0.0005	0.0065	0.0088	0.0070	0.0110	0.0030	0.0105	0.0151	0.0100	0.0099	0.0113	0.0114	0.0217	0.0087	0.0125	0.0047

RAND NUMBER = 4
SPATIAL FREQUENCY = 0.784E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
0.0114	0.0418	0.0515	0.0541	0.0177	0.0921	0.0143	0.0216	0.0069	0.0371	0.0256	0.0302	0.0782	0.0722	0.0760	0.0015
0.0061	0.0157	0.0103	0.0133	0.0167	0.0155	0.0120	0.0235	0.0180	0.0200	0.0195	0.0175	0.0238	0.0233	0.0145	0.0000

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BAND NUMBER = 4
SPATIAL FREQUENCY = 0.082E-02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
AVERAGE	0.7244	0.7402	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
STANDARD	0.0152	0.0162	0.0176	0.0146	0.0118	0.0133	0.0152	0.0120	0.0152	0.0139	0.0228	0.0184	0.0140	0.0211	0.0308	0.0212

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.101E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
AVERAGE	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	0.5943	0.5908
STANDARD	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

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
AVERAGE	0.5366	0.5637	0.5555	0.5635	0.5338	0.5879	0.5578	0.5447	0.5485	0.5616	0.5561	0.5705	0.5300	0.5840	0.5525	0.5701
STANDARD	0.0088	0.0087	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

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
AVERAGE	0.3422	0.4088	0.3911	0.3903	0.3857	0.4107	0.3984	0.3704	0.3901	0.3903	0.3880	0.4080	0.3861	0.4267	0.4038	0.4132
STANDARD	0.0131	0.0181	0.0102	0.0125	0.0111	0.0162	0.0129	0.0152	0.0104	0.0121	0.0121	0.0147	0.0104	0.0117	0.0102	0.0150

0.3155
0.0141

BAND NUMBER = 4
SPATIAL FREQUENCY = 0.141E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
.....
AVERAGE	0.3431	0.4084	0.3750	0.3852	0.3917	0.4188	0.3958	0.3664	0.3882	0.3902	0.3900	0.2037	0.2226	0.2306	0.2393	0.2410
STANDARD	0.0206	0.0242	0.0245	0.0232	0.0162	0.0171	0.0157	0.0170	0.0094	0.0148	0.0311	0.0278	0.0200	0.0403	0.0431	0.0388

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RAND NUMBER = 5
SPATIAL FREQUENCY = 0.882F-02

R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7157	0.7151	0.7455	0.7713	0.7511	0.7650	0.7697	0.7216	0.7444	0.7282	0.7742	0.8090	0.7333	0.6843	0.7074	0.6638	
0.0247	0.0186	0.0186	0.0276	0.0728	0.0310	0.0310	0.0354	0.0393	0.0507	0.0399	0.0444	0.0364	0.0371	0.0469	0.0360	

RAND NUMBER = 5
SPATIAL FREQUENCY = 0.101E-01

R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.6167	0.5806	0.6123	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	
0.0181	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	

RAND NUMBER = 5
SPATIAL FREQUENCY = 0.104F-01

R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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	
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	

RAND NUMBER = 5
SPATIAL FREQUENCY = 0.118E-01

R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.4260	0.4209	0.4183	0.4214	0.4107	0.4289	0.4315	0.4170	0.4638	0.4594	0.4708	0.5168	0.4472	0.4391	0.4425	0.4272	
0.0235	0.0189	0.0189	0.0205	0.0190	0.0190	0.0263	0.0337	0.0281	0.0634	0.0214	0.0234	0.0271	0.0232	0.0281	0.0239	

RAND NUMBER = 5
SPATIAL FREQUENCY = 0.141E-01

R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.2620	0.2678	0.2492	0.2434	0.2355	0.2520	0.2676	0.2513	0.2768	0.3079	0.3025	0.3309	0.2879	0.2910	0.3016	0.3145	
0.0258	0.0189	0.0371	0.0310	0.0361	0.0310	0.0472	0.0485	0.0770	0.0499	0.0572	0.0453	0.0501	0.0531	0.0531	0.0531	

0.8389
0.025

FROM PREPPC TASK 10107119 07-SEP-82
PHASFD KNIFE ENCF

KNIFE FOCE REPORT
VIDEO FILE CREATION DATE 13-SEP-82
VIDEO FILE CREATION TIME 171291 7

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.100E-03

1 7 1 4 5 6 7 8 9 10 11 12 13 14 15 16
1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.170E-03

1 7 1 4 5 6 7 8 9 10 11 12 13 14 15 16
1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.400E-03

1 7 1 4 5 6 7 8 9 10 11 12 13 14 15 16
1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.600E-03

1 7 1 4 5 6 7 8 9 10 11 12 13 14 15 16
1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.800E-03

1 7 1 4 5 6 7 8 9 10 11 12 13 14 15 16
1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000

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BAND NUMBER = 6
SPATIAL FREQUENCY = 0.100E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.0184 0.0165 0.0258 0.0105
.....

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.147E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.0960 0.0745 0.0753 0.0242
0.0275 0.0426 0.0393 0.0291
.....

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.194E-02

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

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.200E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.7500 0.7395 0.7062 0.7598
0.0251 0.0267 0.0294 0.0277
.....

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BAND NUMBER = 6
SPATIAL FREQUENCY = 0.250E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.5770 0.6020 0.5557 0.5971
0.0218 0.0206 0.0295 0.0280
.....

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.296E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.4241 0.4354 0.4072 0.4434
0.0233 0.0231 0.0243 0.0206
.....
4275
σ = 1.013

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.350E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.7406 0.2820 0.7463 0.2781
0.0204 0.0284 0.0307 0.0281

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.400E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.1624 0.1708 0.1652 0.1816
0.0277 0.0431 0.0320 0.0429

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.450E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.1280 0.1074 0.1204 0.1220
0.0270 0.0280 0.0378 0.0284

BAND NUMBER = 6
SPATIAL FREQUENCY = 0.500E-02

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
.....
0.1276 0.1165 0.1417 0.1191
0.0260 0.0206 0.0278 0.0322

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KNIFE EDGE REPORT
VIDEO FILE CREATION DATE: 1-SEP-82
VIDEO FILE CREATION TIME: 15143136

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.705E-03

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.141E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.392E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.9997	0.9977	0.9964	0.9951	0.9938	0.9925	0.9912	0.9899	0.9886	0.9873	0.9860	0.9847	0.9834	0.9821	0.9808	0.9795

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.598E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.798E-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977

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0.014

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.0025-02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7407	0.7003	0.6492	0.6241	0.6111	0.6182	0.6258	0.6339	0.6257	0.6493	0.6144	0.6322	0.6294	0.6360	0.6250	0.6272	0.6216

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.1015-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5700	0.5711	0.5842	0.6010	0.5848	0.6279	0.6237	0.6352	0.6231	0.6405	0.6305	0.6278	0.6135	0.6507	0.5813	0.5727	0.5727

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.1045-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.5476	0.5316	0.5447	0.5662	0.5490	0.5944	0.5875	0.5920	0.5994	0.5938	0.5976	0.5896	0.5758	0.6072	0.5495	0.5439	0.5439

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.1182-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.4174	0.3943	0.4185	0.4387	0.4173	0.4503	0.4300	0.4279	0.4201	0.4303	0.4307	0.4269	0.4267	0.4328	0.4001	0.4046	0.4046

BAND NUMBER = 7
SPATIAL FREQUENCY = 0.1412-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.7198	0.7658	0.7410	0.7495	0.7514	0.7510	0.7377	0.7484	0.7310	0.7633	0.7395	0.7470	0.7352	0.7460	0.7447	0.7634	0.7634

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3.2.13 BL19/20 TEST

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

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

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3.3 THERMAL VACUUM TESTS

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF PUBLICATION.

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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

SUBJECT: EMI/EMC Test
TM Flight Model

CC: See Distribution
attached

DATE: 2 August 1982
REF: HS236-8092
SED-161
FROM: Yas Bar
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)

Page 2
HS 236-8092
2 August 1982

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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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Page 3
HS236-8092
2 August 1982

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.

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3.5 MASS PROPERTIES

TEST RESULT SUMMARY NOT COMPLETE AT TIME OF
PUBLICATION