



THE JOHNS HOPKINS UNIVERSITY  
G. W. C. WHITING SCHOOL of ENGINEERING  
ELECTRICAL ENGINEERING PROGRAM



## MICROWAVE ENGINEERING

MMIC DESIGN 525.787

----STUDENT CHIP DATA----  
SUMMER 1989 AND FALL 1989

INSTRUCTORS:  
CRAIG MOORE AND JOHN PENN

JULY 16, 1990

INITIAL TEST REPORT

EE\_787 Semester: Fall '89 TriQuint Submission # 786A

Chip # 4.3 Type: PWR AMP

Designers: ROUSSEY / BOULANGER

Testing: PENN Date: 7-2-90

Problem:

Bias gate with care - draws  
 $\sim 30 \text{ mA}$  @  $-1.8 \text{ V}$

Comments:

Bias:  $6 \text{ V}$  @  $145 \text{ mA}$

Gain  $13.6 \text{ dB}$  @ ~~2.5~~  $2.3 \text{ GHz}$

Small signal

MODEL: MM10.787  
DEVICE ID: 205\_LNA - PAMP

DATE: 7/02/98  
OPERATOR: CHHG

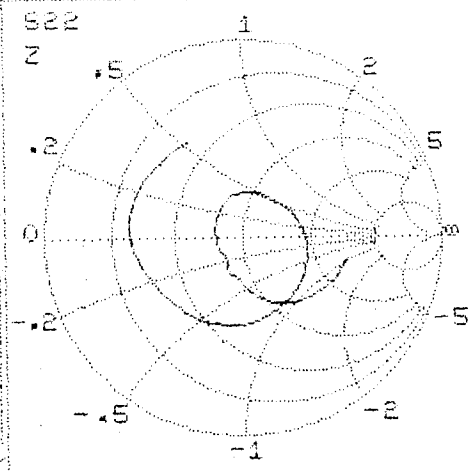
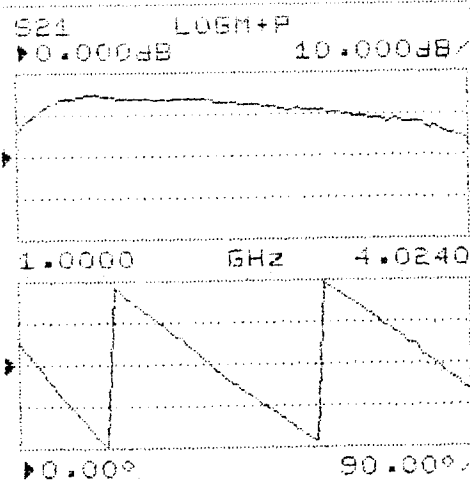
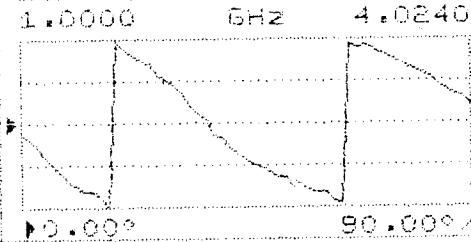
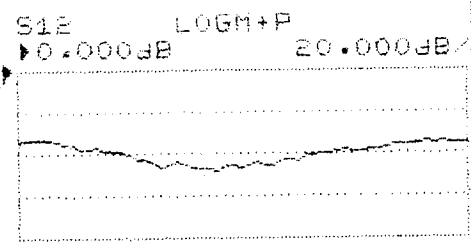
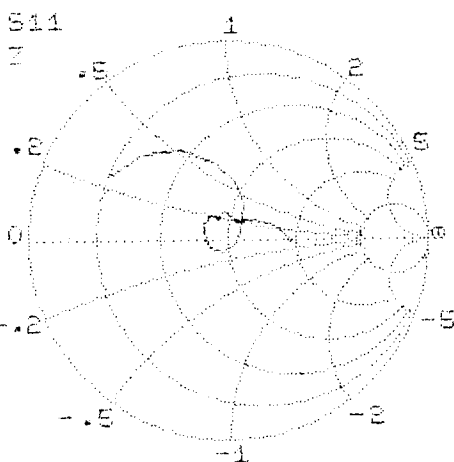
SWEEP DATA

START: 1.0000 GHz  
STOP: 4.0240 GHz  
STEP: 0.0040 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



- SELECT OUTPUT DEVICE
- PRINTER
- PLOTTER
- SELECT PRINTER OUTPUT TYPE
- FULL SCREEN
- GRAPH ONLY
- TABULAR DATA
- OUTPUT OPTIONS
- SETUP OUTPUT HEADERS
- DISK OUTPUT OPERATIONS
- PLOT OPTIONS
- PRESS <ENTER> TO SELECT

360 NETWORK ANALYZER

MODEL: MMIC 797  
DEVICE ID: 245 LNA PAMP

DATE: 7/02/90  
OPERATOR: CHENG

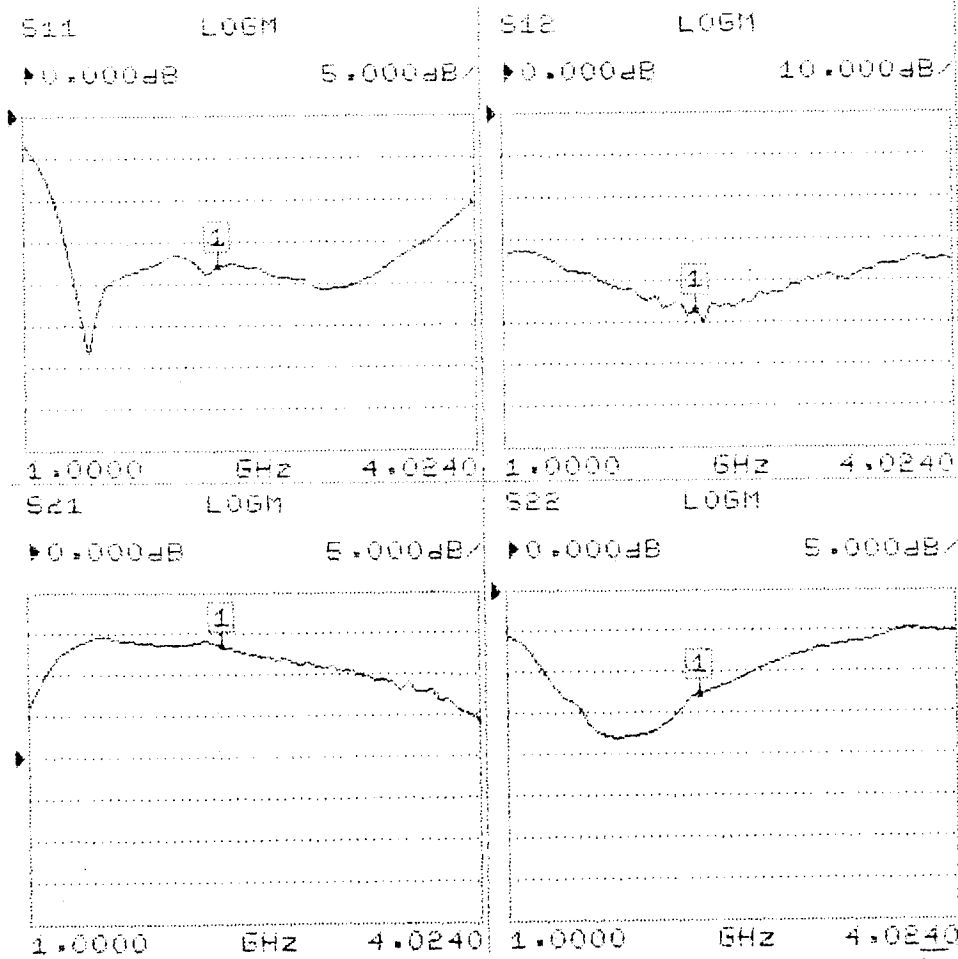
SWEEP DATA

START: 1.0000 GHz  
STOP: 4.0240 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



CH 2 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
2.2960 GHz  
13.433 dB

MARKER TO MAX  
MARKER TO MIN

# INITIAL TEST REPORT

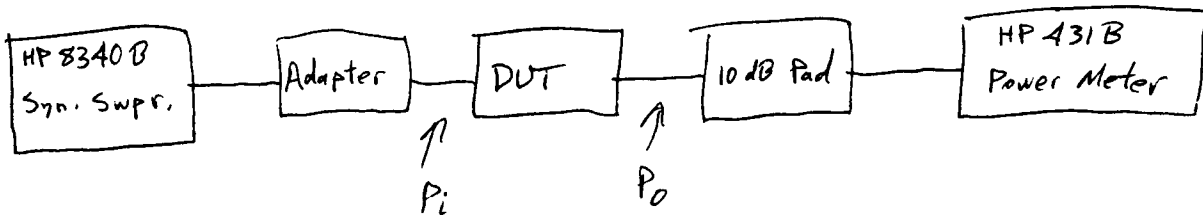
EE\_787 Semester: Fall 89 TriQuint Submission # 786 A

Chip # 4.3/1 Type: Medium Power Amplifier

Designers: Jason Roussos and Denis Boulanger

Testing: Jason Roussos Date: 7/12/89

**Problem:**



$V_{DD} = 6V$   
 $V_{DS} = 4V$   
 $I_{DD} = 145mA$

**Comments:**

$f$ (GHz)	$P_i$ (dBm)	$P_o$ (dBm)	$G$ (dB)	$P_{out}$ (dBm)
2.0 ↓ ↙	-5.0	8.5	13.5	
	-4.0	9.5	13.5	
	-3.0	10.5	13.5	
	-2.0	11.4	13.4	
	-1.0	12.3	13.3	
	0.0	13.2	13.2	
	1.0	14.1	13.1	
	2.0	15.0	13.0	-4.6
	3.0	15.7	12.7	<del>-4.1</del>
	4.0	16.3	12.3	-2.1
	5.0	16.7	11.7	-0.5
	6.0	16.8	10.8	0.8

## INITIAL TEST REPORT

EE\_787 Semester: Summer '89 TriQuint Submission # 786 A

Chip # 2.6 Type: LNA

Designers: Sheng Cheng, Peter Goettle

Testing: Sheng Cheng Date: 7/2/90

Problem:  
1st chip is zapped by static.  
2nd chip fails, reason unclear.  
in both cases, no currents were drawn.  
3rd chip works.

Gain at 2.3 GHz : 15.8 dB

60 mA currents drawn from 5V supplied.

Currents ~~drawn~~ & gain stays at same level with  
Supply up to 7V.

Comments:

Gain is about 10% lower than designed.  
current drawn is about 15% higher.

NF is not tested this time.

360 NETWORK ANALYZER

MODEL: MMIC\_787  
DEVICE ID: ZHG\_LNA

DATE: 7/02/90  
OPERATOR: CHENG

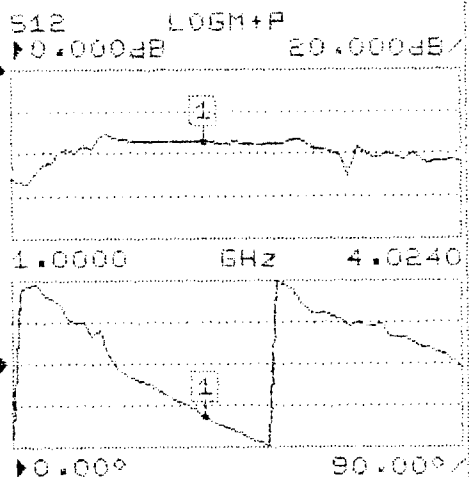
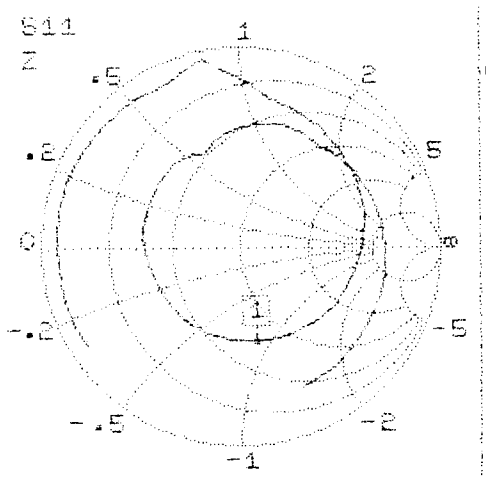
SWEEP DATA

START: 1.0000 GHz  
STOP: 4.0240 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

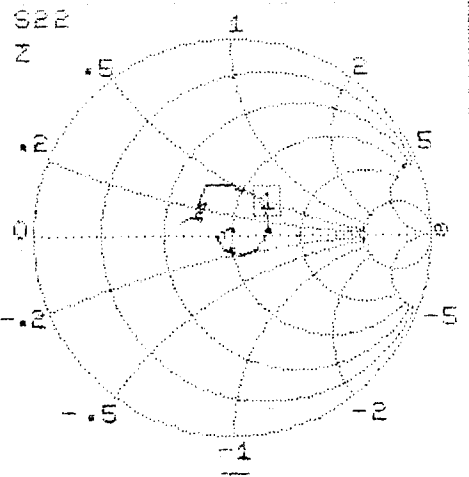
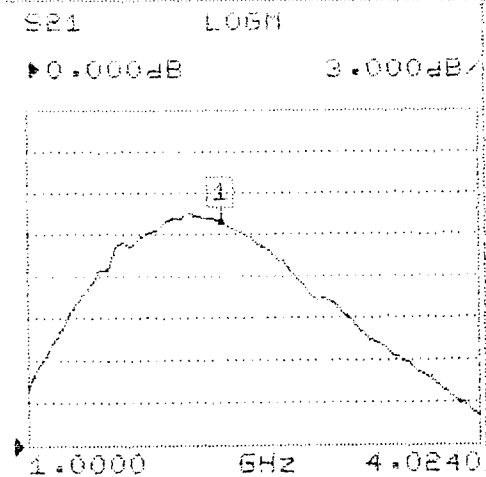
	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
2.2960 GHz  
15.831 dB

MARKER TO MAX  
MARKER TO MIN



## INITIAL TEST REPORT

EE\_787 Semester: FALL '89 TriQuint Submission # 786A

Chip # 4,4-1 Type: CIRCULATOR

Designers: George Polacek, Robert Meissner

Testing: George Polacek Date: 6/25/90

### Problem:

None. The first unit tested worked well, as did the third. The second unit failed.

### Comments:

The results were great. The device was symmetric about all three ports. Isolation measurements were better than our goal by 1dB. Insertion loss was 2dB higher than expected but still within reason. The device operated on  $\pm 5V$  and performance degraded as the  $-5V$  supply was varied.



PORTS  
1 → 2

MODEL: M101\_787  
DEVICE ID: 4#4/CIRC

S/N # 3

DATE: 6/25/90  
OPERATOR: G#POLACK

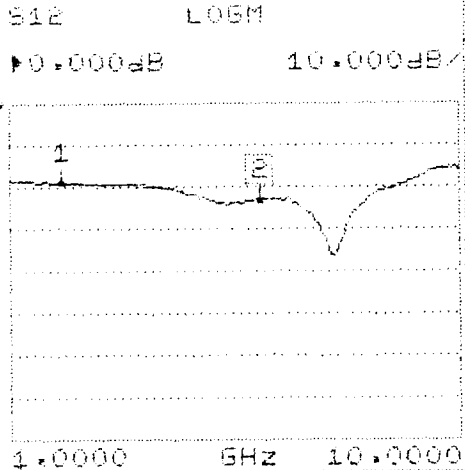
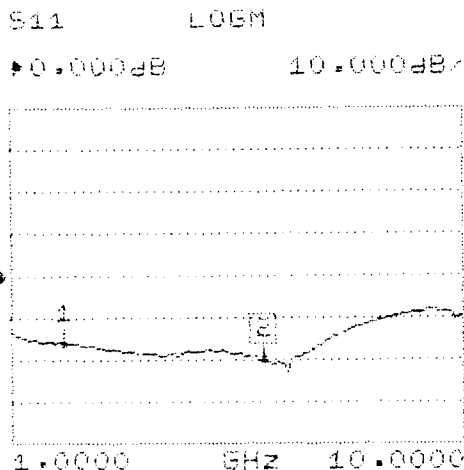
SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0500 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-

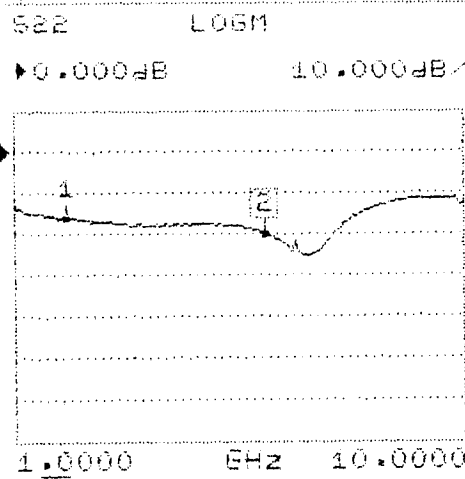
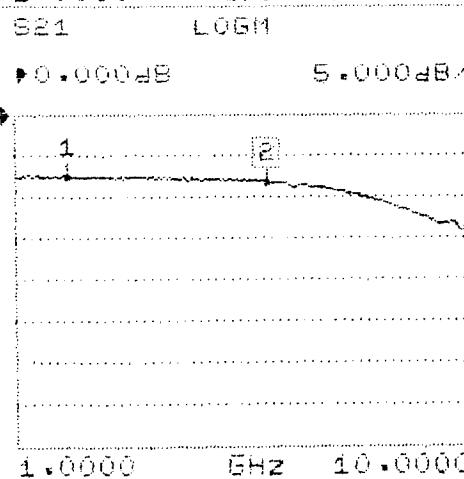


CH 2 - S12  
REF. PLANE  
0.0000 mm

MARKER 2  
6.0220 GHz  
-23.123 dB

MARKER TO MAX  
MARKER TO MIN

1 2.0260 GHz  
-19.870 dB



PORTS  
2-3

MODEL: MMIC\_787  
DEVICE ID: 4#4/CIRC  
S/N 43

DATE: 6/25/98  
OPERATOR: GAPOLACEK

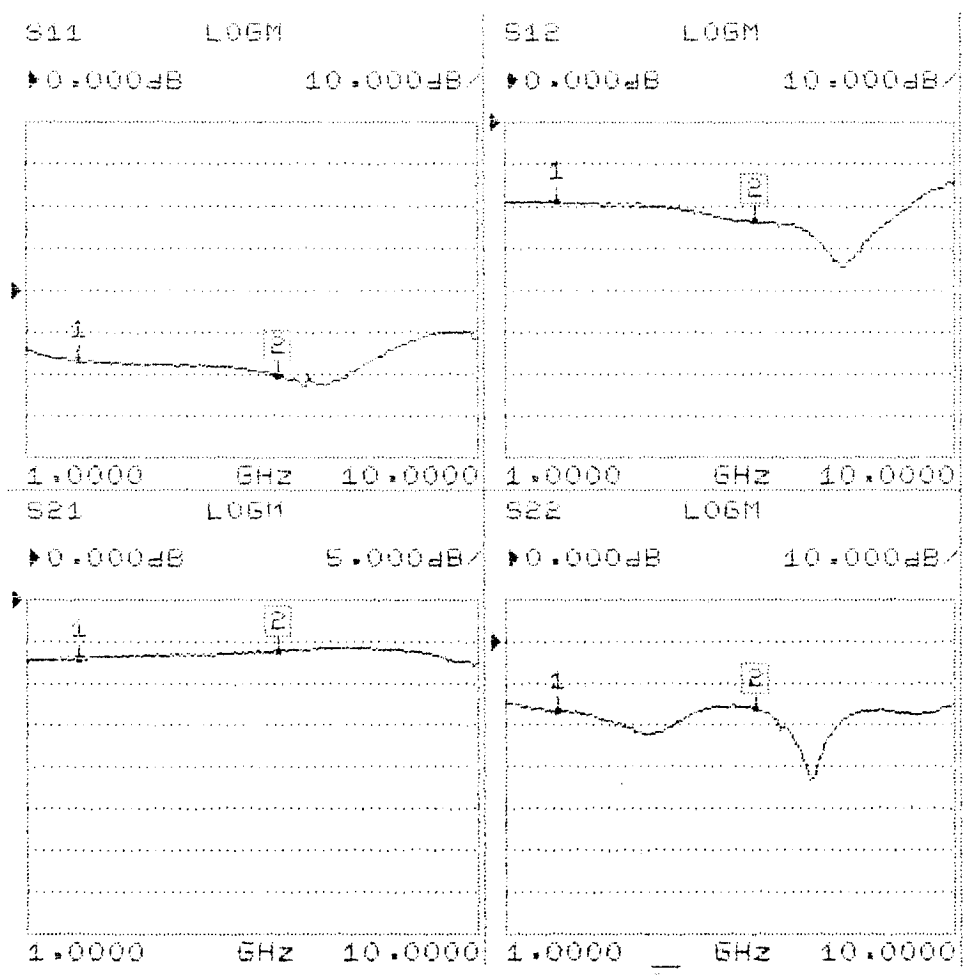
SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



CH 2 - S12  
REF. PLANE  
0.0000 mm

MARKER 2  
6.0220 GHz  
-23.547 dB

MARKER TO MAX  
MARKER TO MIN

1 2.0250 GHz  
-19.138 dB

## INITIAL TEST REPORT

EE\_787 Semester: Fall '89 TriQuint Submission # 786A

Chip # 4.5 Type: SWITCHED ATTN

Designers: Moskowitz/Turnquist - 2, 4dB; Faison/Pacek - 8, 16dB

Testing: KEVIN FAISON Date: 6/25/90

Problem: It works!

2/4 dB side of chip: Insertion loss  $\approx$  2dB

Attenuation	Measurement @ 4GHz	Flatness 1-8GHz (differential)
-2 dB	-2.16	$\pm$ 0.25dB
-4	-4.02	+1dB, -0dB
-6	-5.9	+1dB, -0dB

8/16 dB side of chip: Insertion loss  $\approx$  4dB

Attenuation	Measurement @ 4GHz	Flatness 1-8GHz (differential)
-8 dB	-8.0	+0dB, -0.75dB
-16dB	-15.4	-0.75dB, +2dB
-24dB	-20.6	-2, +4.5dB

Comments:

Step accuracy of lower attenuation settings is excellent. The 24dB step appears to be suffering from an isolation problem (leakage through Cds of switches) at the higher frequencies.

360 NETWORK ANALYZER

MODEL: MMIC\_787  
DEVICE ID: ~~3#5\_PHASE\_SH~~  
4.5 ATTEN

DATE: 6/25/90  
OPERATOR:

SWEEP DATA

START:	1.0000 GHz	GATE START:	-	ERROR CORR:	12 - TERM
STOP:	8.0200 GHz	GATE STOP:	-	AVERAGING:	1 PTS
STEP:	0.0540 GHz	GATE:	-	IF BANDWIDTH:	REDUCED
		WINDOW:	-		

-----CH3-----

PARAMETER: 521

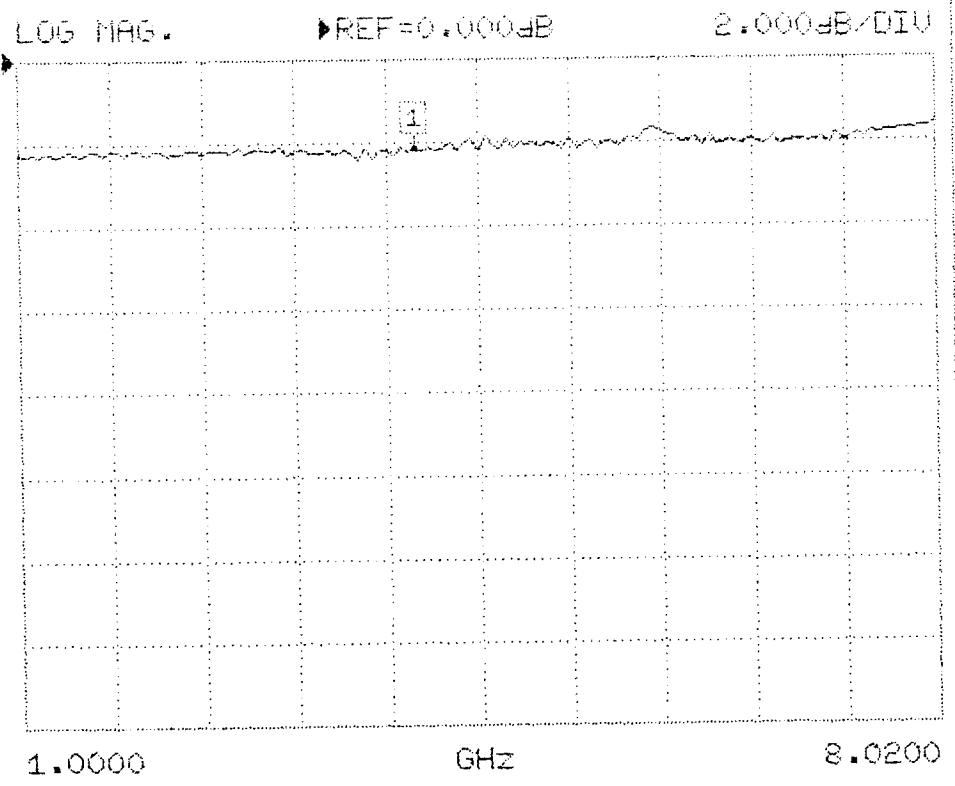
NORMALIZATION: DATA / MEMORY

REFERENCE PLANE: 0.0000 mm

SMOOTHING: 0.0 PERCENT

DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
REF. PLANE  
0.0000 mm

▶ MARKER 1  
4.0240 GHz  
-2.161 dB

MARKER TO MAX  
MARKER TO MIN

360 NETWORK ANALYZER

MODEL: MMIC\_787 DATE: 6/25/90  
DEVICE ID: ~~3#5\_PHASE SH~~ OPERATOR:  
4.5 ATTN

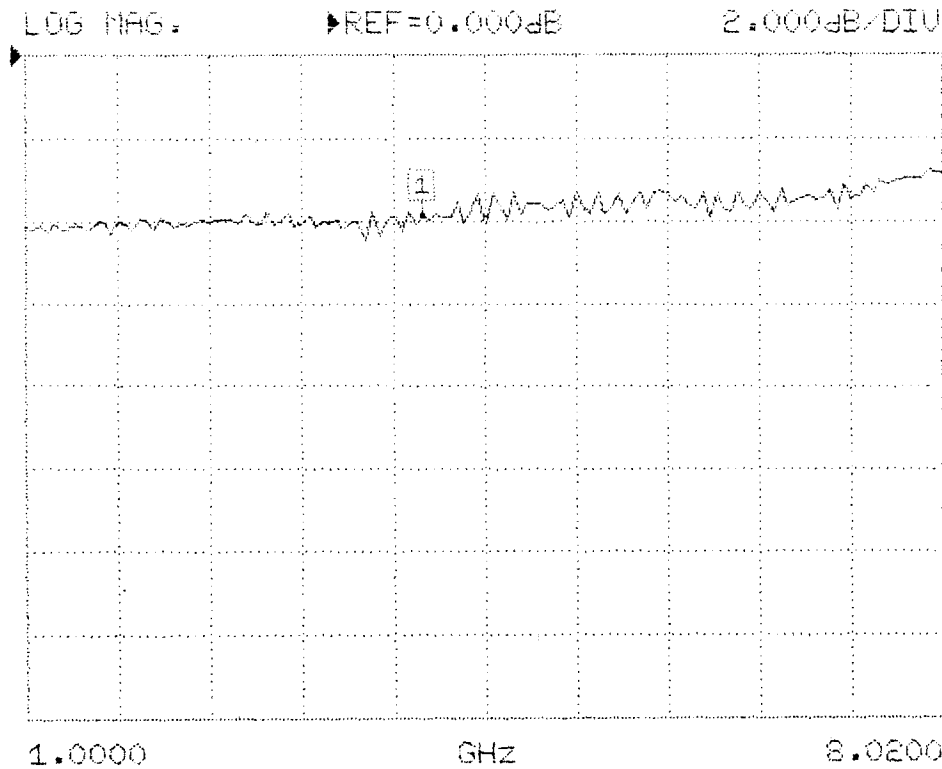
Page 1

SWEEP DATA

START: 1.0000 GHz GATE START: - ERROR CORR: 12 - TERM  
STOP: 8.0200 GHz GATE STOP: - AVERAGING: 1 PTS  
STEP: 0.0540 GHz GATE: - IF BANDWIDTH: REDUCED  
WINDOW: -

-----CH3-----  
PARAMETER: S21  
NORMALIZATION: DATA / MEMORY  
REFERENCE PLANE: 0.0000 mm  
SMOOTHING: 0.0 PERCENT  
DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-3.878 dB

MARKER TO MAX  
MARKER TO MIN

360 NETWORK ANALYZER

MODEL: MMIC\_787 DATE: 6/25/90 Page 1  
 DEVICE ID: ~~3#5\_PHASE\_SH~~ OPERATOR:  
 4.5 ATTU

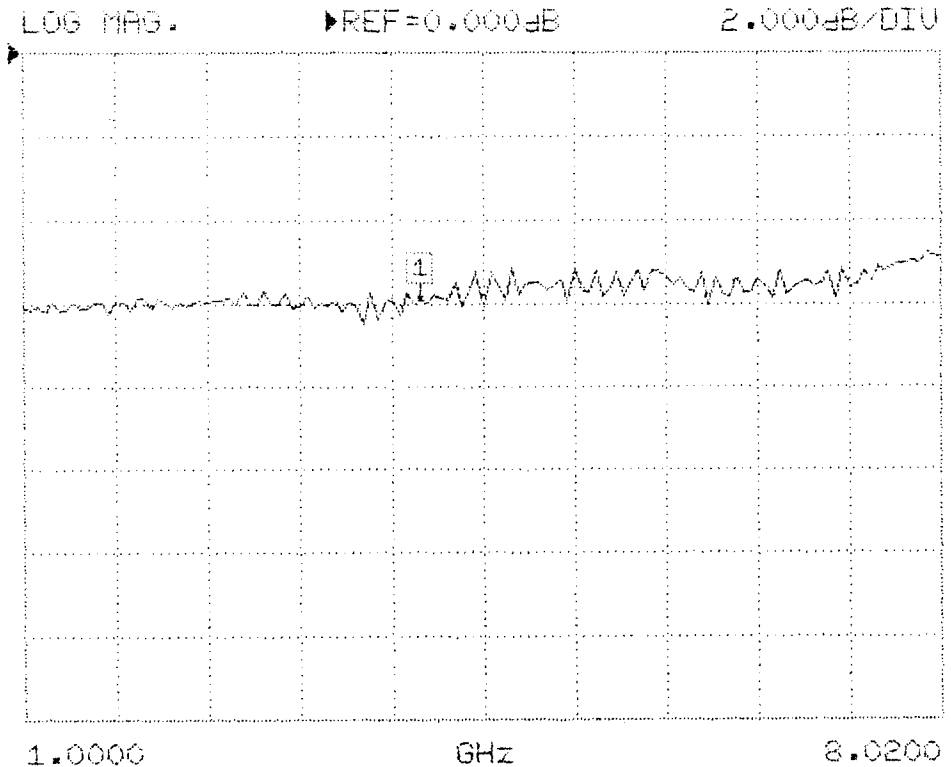
SWEEP DATA

START: 1.0000 GHz GATE START: - ERROR CORR: 12 - TERM  
 STOP: 8.0200 GHz GATE STOP: - AVERAGING: 1 PTS  
 STEP: 0.0540 GHz GATE: - IF BANDWIDTH: REDUCED  
 WINDOW: -

-----CH3-----

PARAMETER: S21  
 NORMALIZATION: DATA / MEMORY  
 REFERENCE PLANE: 0.0000 mm  
 SMOOTHING: 0.0 PERCENT  
 DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
 REF. PLANE  
 0.0000 mm

MARKER 1  
 4.0240 GHz  
 -5.886 dB

MARKER TO MAX  
 MARKER TO MIN

MODEL: MMIC\_787  
DEVICE ID: ~~2#5\_PHASE\_SH~~  
4.5 ATTEN

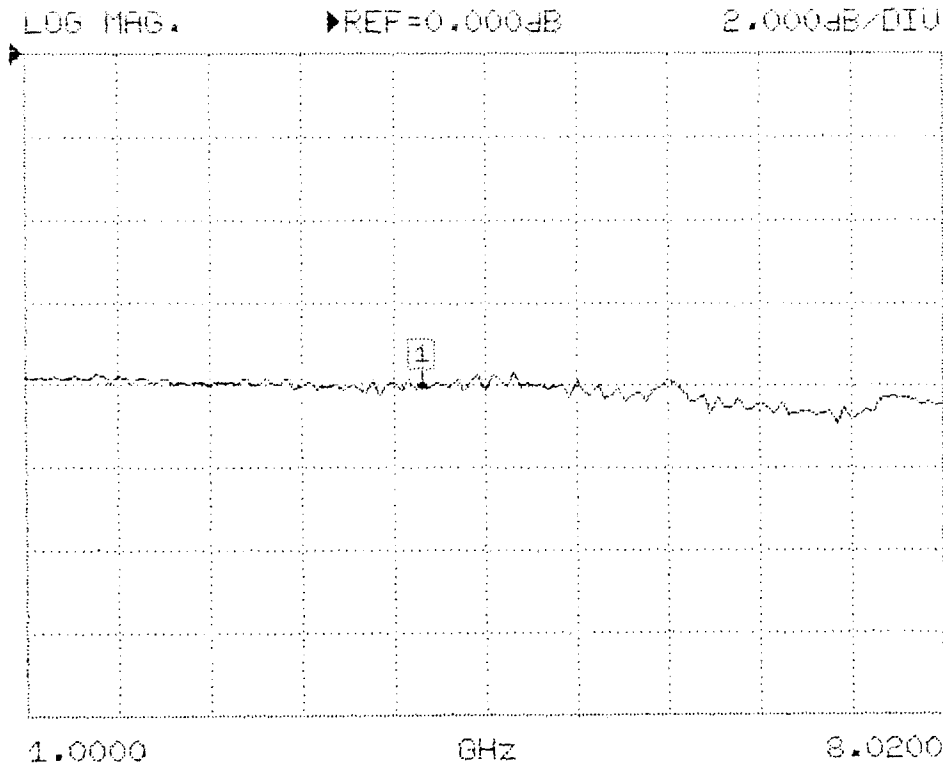
DATE: 8/25/90  
OPERATOR:

SWEEP DATA

START: 1.0000 GHz GATE START: - ERROR CORR: 12 - TERM  
STOP: 8.0200 GHz GATE STOP: - AVERAGING: 1 PTS  
STEP: 0.0540 GHz GATE: - IF BANDWIDTH: REDUCED  
WINDOW: -

-----CH3-----  
PARAMETER: S21  
NORMALIZATION: DATA / MEMORY  
REFERENCE PLANE: 0.0000 mm  
SMOOTHING: 0.0 PERCENT  
DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-8.008 dB

MARKER TO MAX  
MARKER TO MIN

360 NETWORK ANALYZER

MODEL: MMIC\_787  
DEVICE ID: ~~3#5 PHASE SW~~  
4.5 ATTN

DATE: 6/25/90  
OPERATOR:

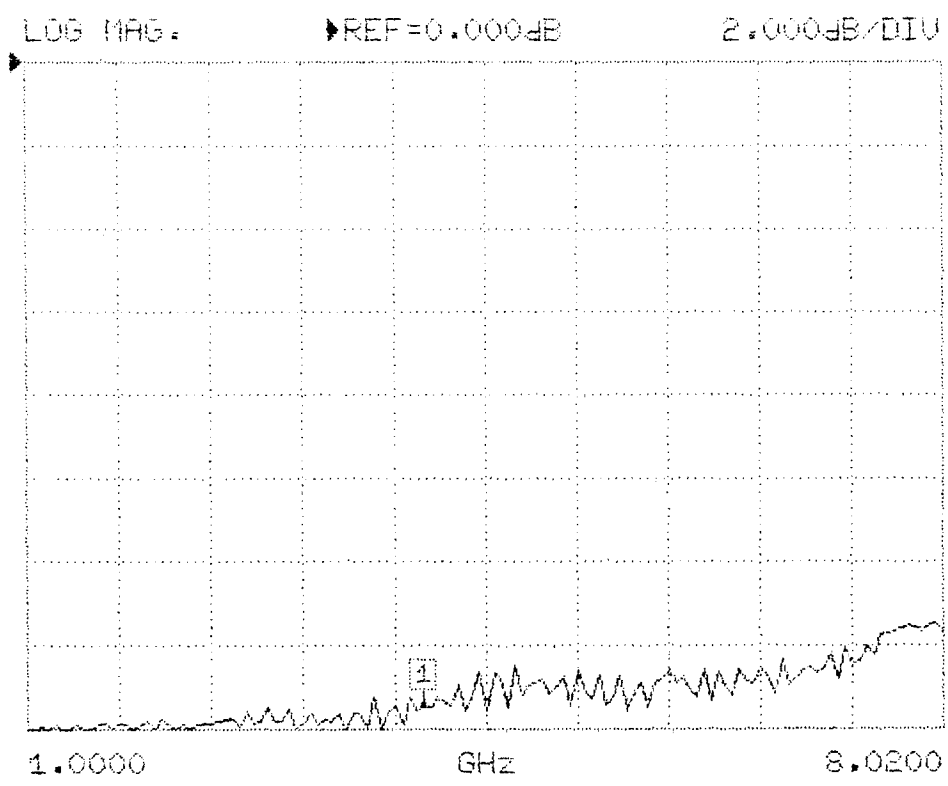
Page 1

SWEEP DATA

START: 1.0000 GHz GATE START: - ERROR CORR: 12 - TERM  
STOP: 8.0200 GHz GATE STOP: - AVERAGING: 1 PTS  
STEP: 0.0540 GHz GATE: - IF BNDWTH: REDUCED  
WINDOW: -

-----CH3-----  
PARAMETER: S21  
NORMALIZATION: DATA / MEMORY  
REFERENCE PLANE: 0.0000 mm  
SMOOTHING: 0.0 PERCENT  
DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-15.432 dB

MARKER TO MAX  
MARKER TO MIN



MODEL: MMIC\_787 DATE: 6/25/90  
DEVICE ID: ~~3#5\_PHASE\_SH~~ OPERATOR:

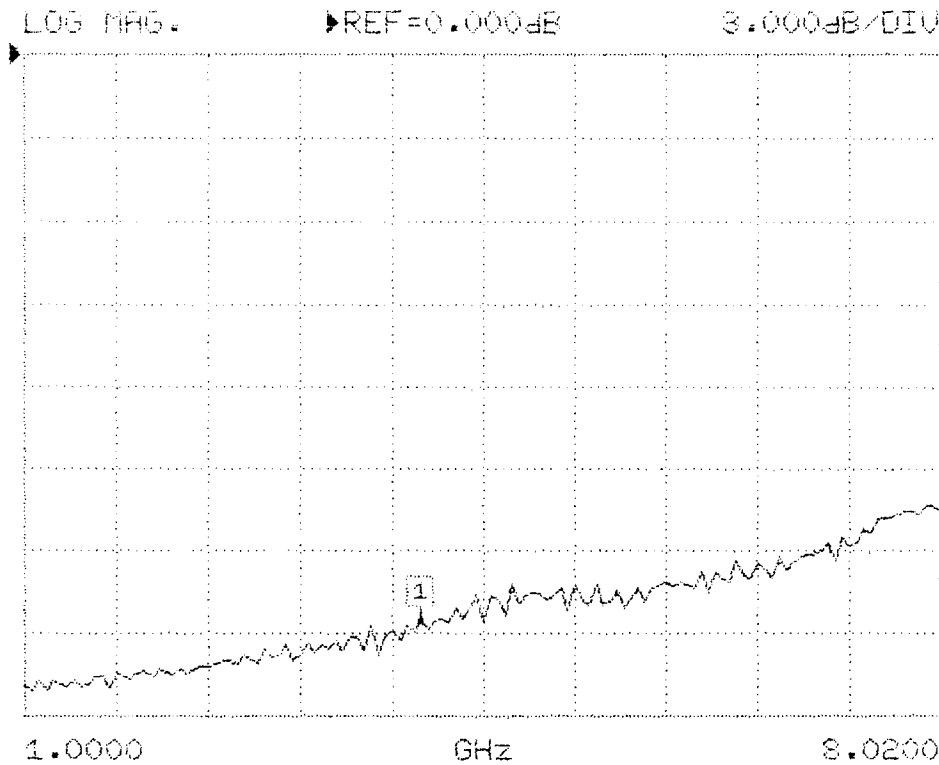
4.5 4+7u

SWEEP DATA

START: 1.0000 GHz GATE START: - ERROR CORR: 12 - TERM  
STOP: 8.0200 GHz GATE STOP: - AVERAGING: 1 PTS  
STEP: 0.0540 GHz GATE: - IF BNDWTH: REDUCED  
WINDOW: -

-----CH3-----  
PARAMETER: S21  
NORMALIZATION: DATA / MEMORY  
REFERENCE PLANE: 0.0000 mm  
SMOOTHING: 0.0 PERCENT  
DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-20.576 dB

MARKER TO MAX  
MARKER TO MIN

SWITCHED ATTENUATOR

measurements made at

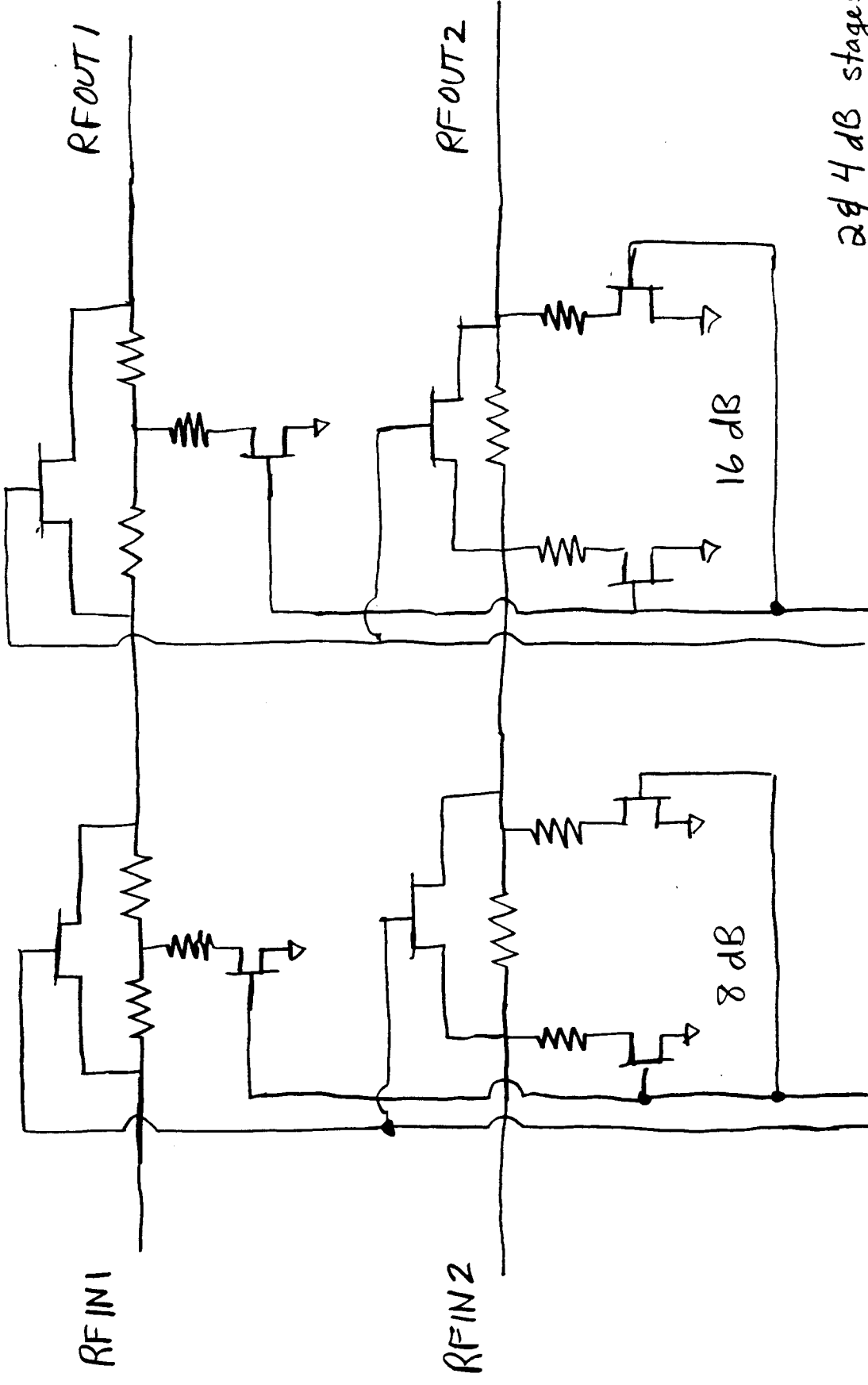
WESTINGHOUSE

by

KEVIN FAISSON

4dB

2dB



2 & 4 dB stages are  
 "TEE" PADS

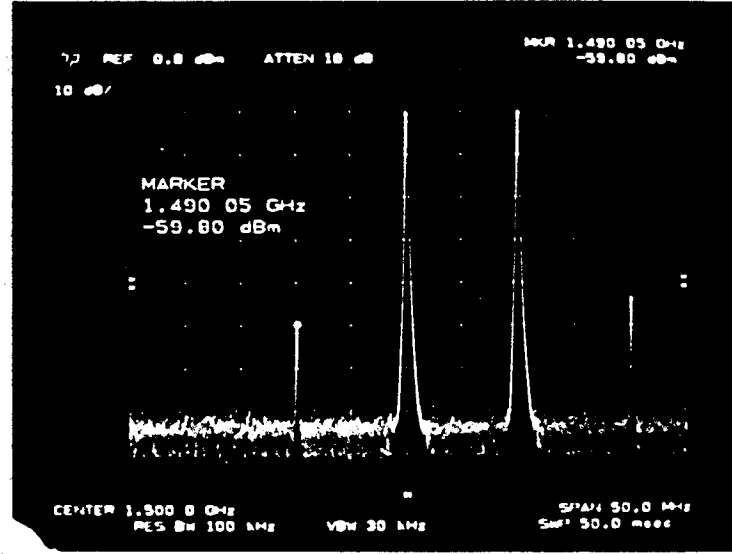
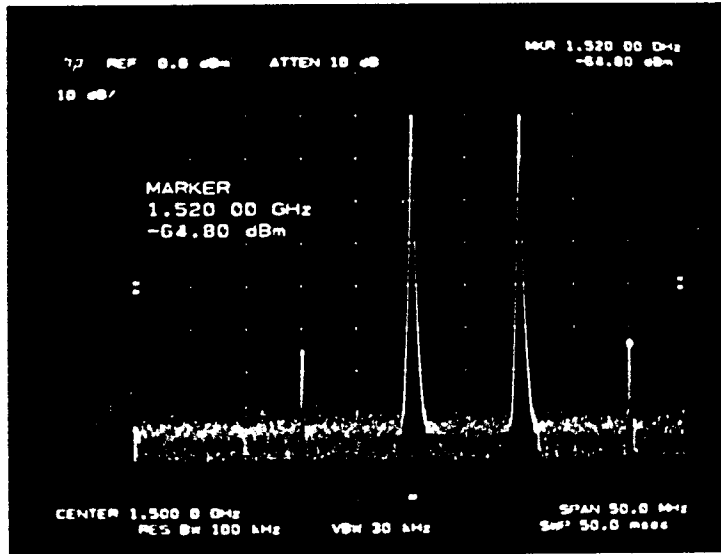
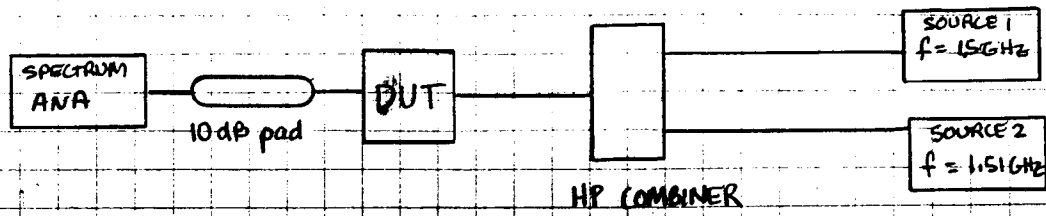
8 & 16 dB stages are  
 "PI" PADS

CONTROLS FOR  
 4 & 16 dB stages

CONTROLS FOR  
 2 & 8 dB stages

# MMIC STEP ATTENUATOR Test Setup

7/11/90 KGT



Output Intercept point  
of 2 & 4 dB attenuator stages

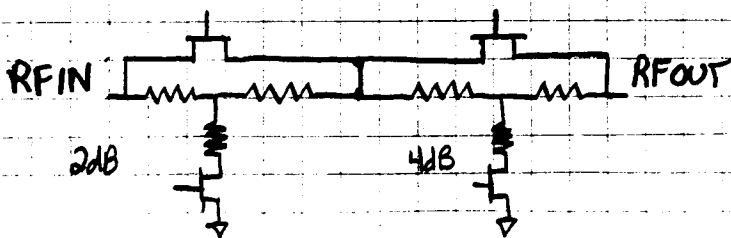
$$IP_3 = P_0 \text{ dBm} + \frac{IM}{2}$$

$$P_0 \text{ dBm} = \emptyset \text{ dBm}$$

$$IM = 54 \text{ dB}$$

$$IP_3 = \emptyset + 54/2 = \underline{27 \text{ dBm}}$$

CIRCUIT



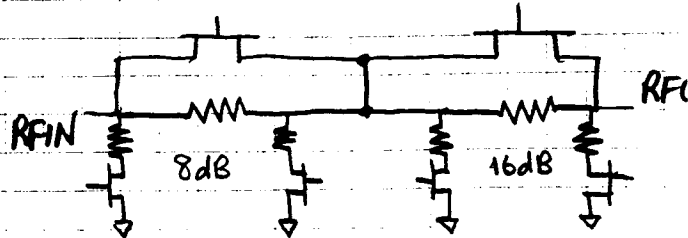
Output Intercept point of  
8 & 16 dB attenuator stages

$$P_0 \text{ dBm} = \emptyset \text{ dBm}$$

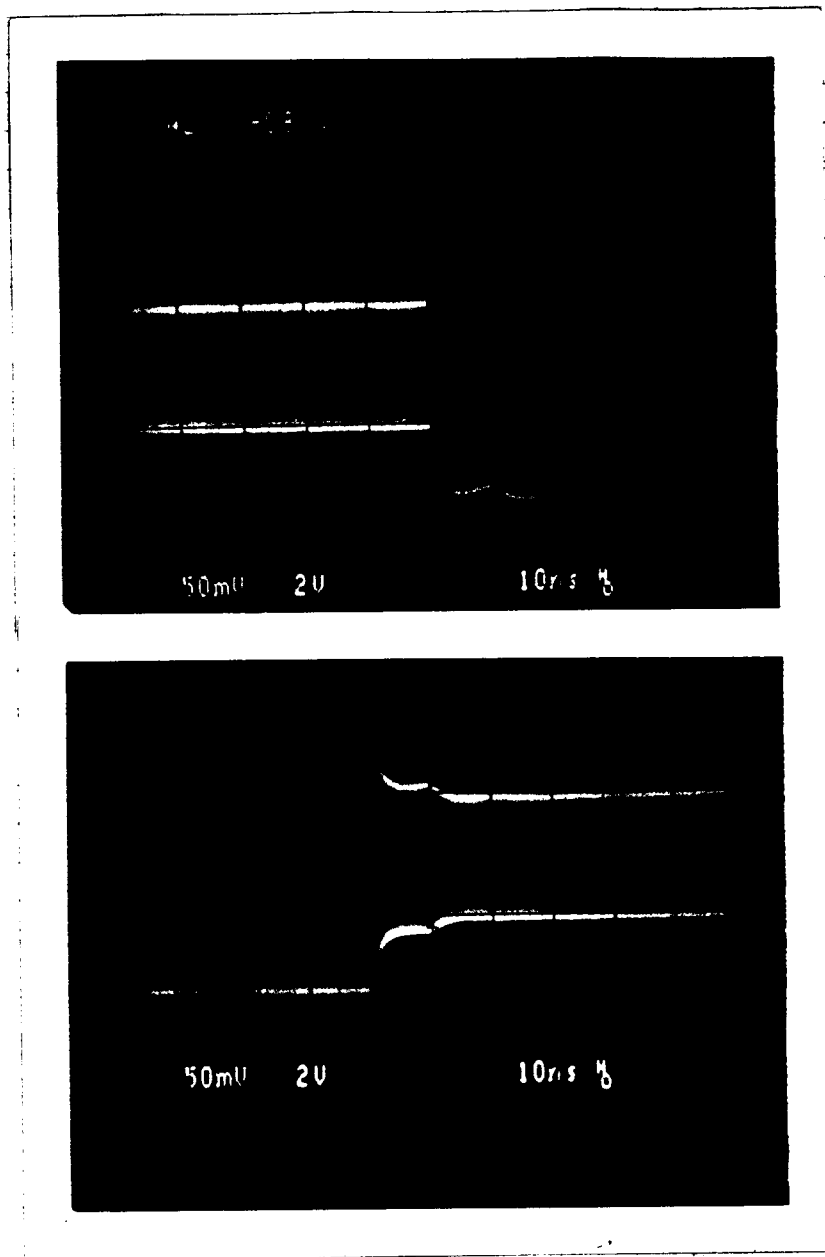
$$IM = 44 \text{ dB}$$

$$IP_3 = \emptyset + 44/2 = \underline{22 \text{ dBm}}$$

Circuit



7/6/90 KGF

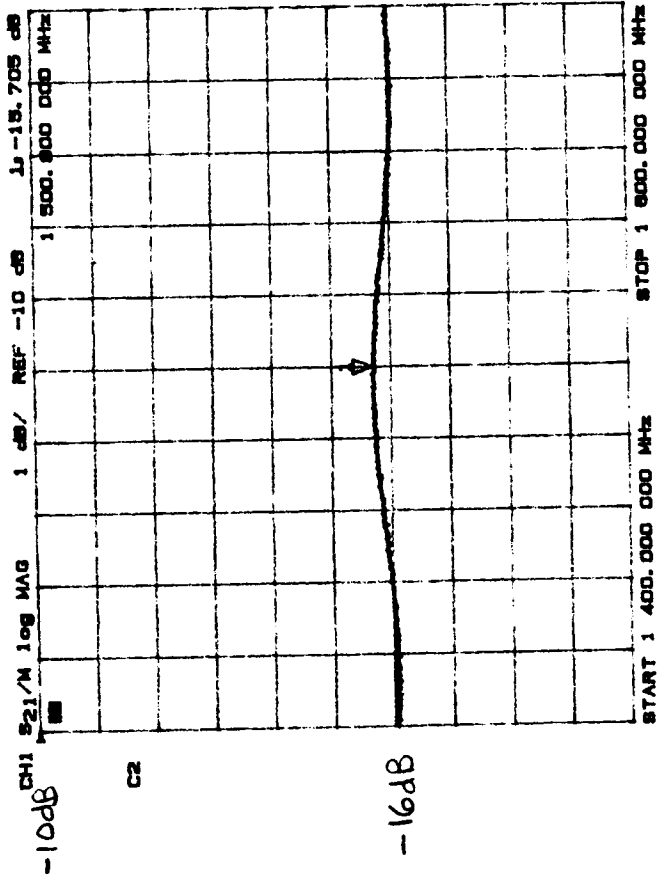
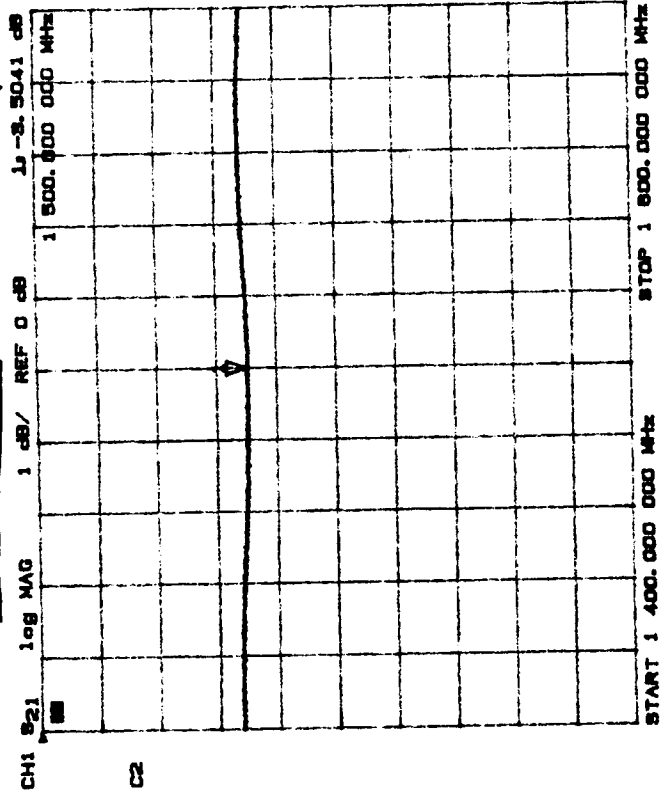


Switching Speed of 8dB stage in MMIC attenuator

Comment: Differential control signals at GaAs switching levels (0, -4V) are required to drive the device. For optimum switching speed the differential switch controls should have fast rise times and minimal skew. The HP Pulse generator used in this measurement had rise times of  $\sim 10\text{ns}$  and  $\sim 7\text{ns}$  of skew

Insertion loss

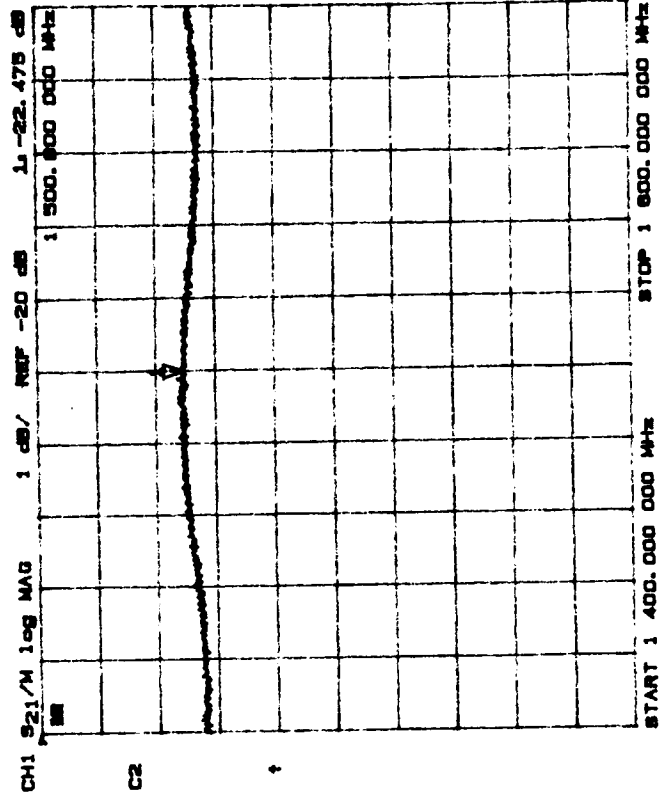
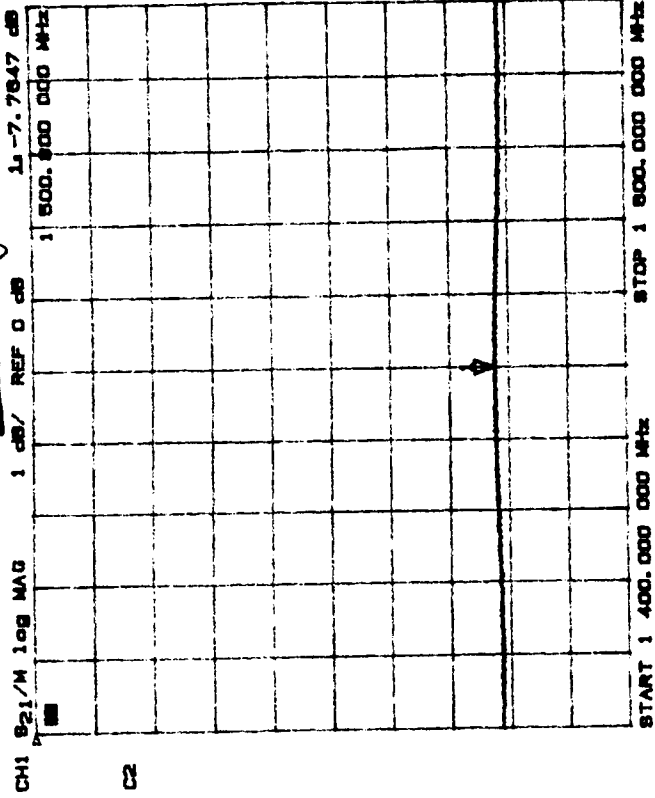
8/16dB stages



16dB stage

Relative Attenuation

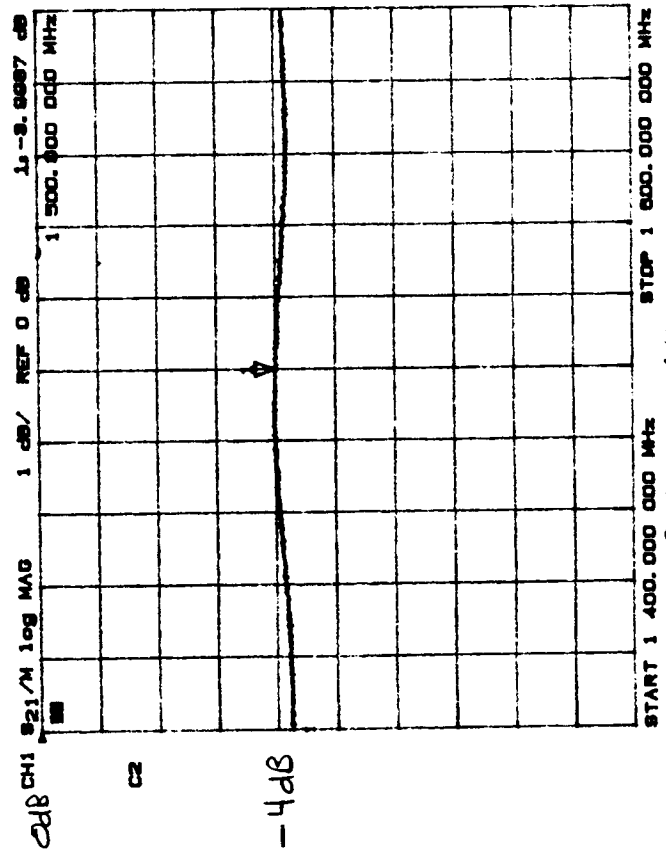
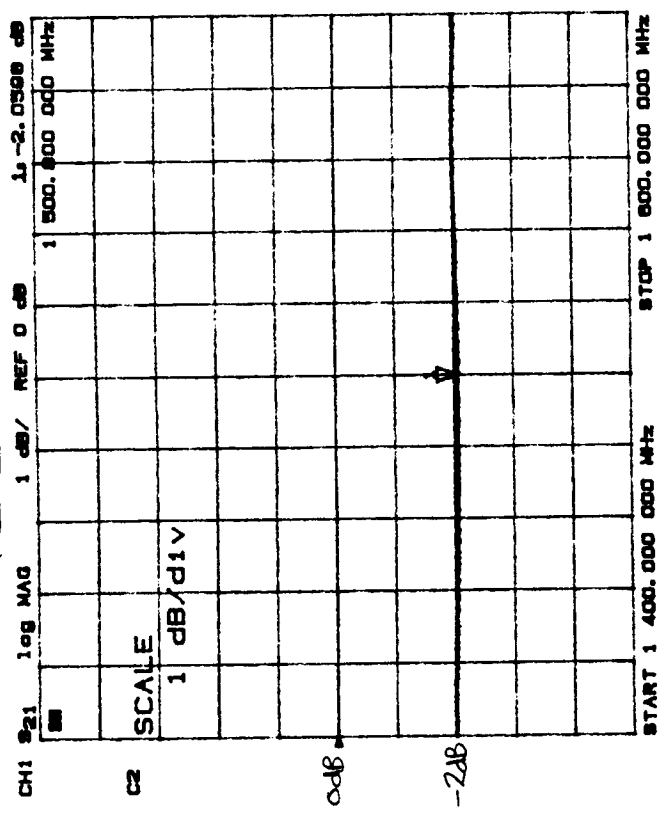
8dB stage



leakage in package, causes some error

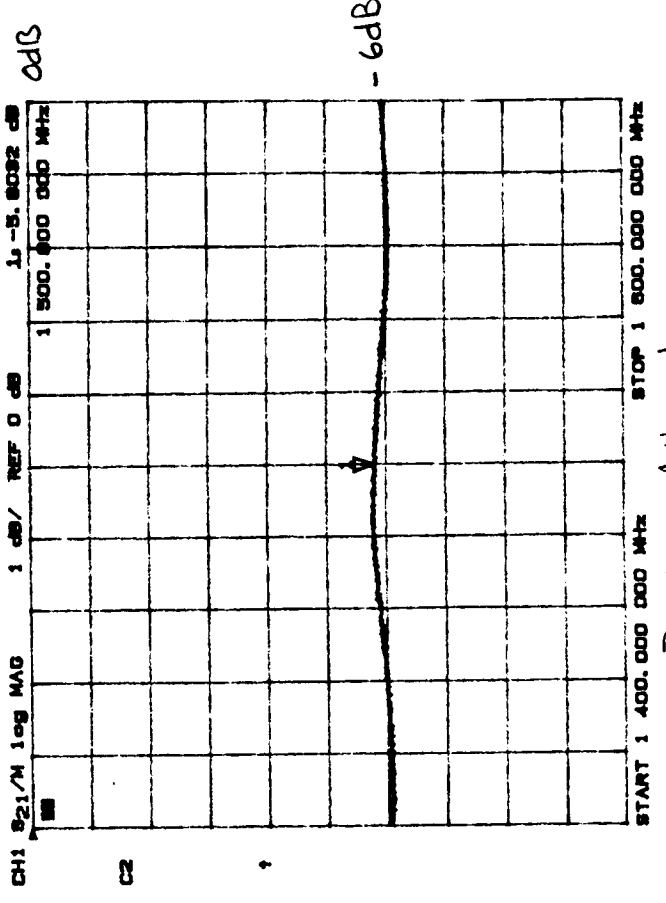
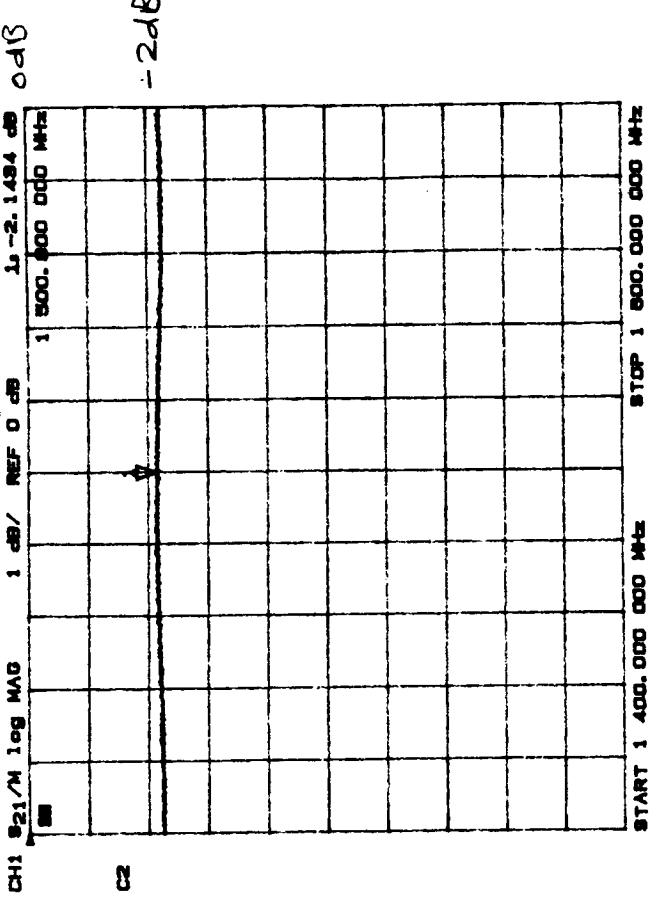
8 + 16dB stage

Insertion loss 2/4 dB stages



Relative Attenuation 1/4 dB stage

Relative Attenuation (Thru path calibrated out)  
2dB stage



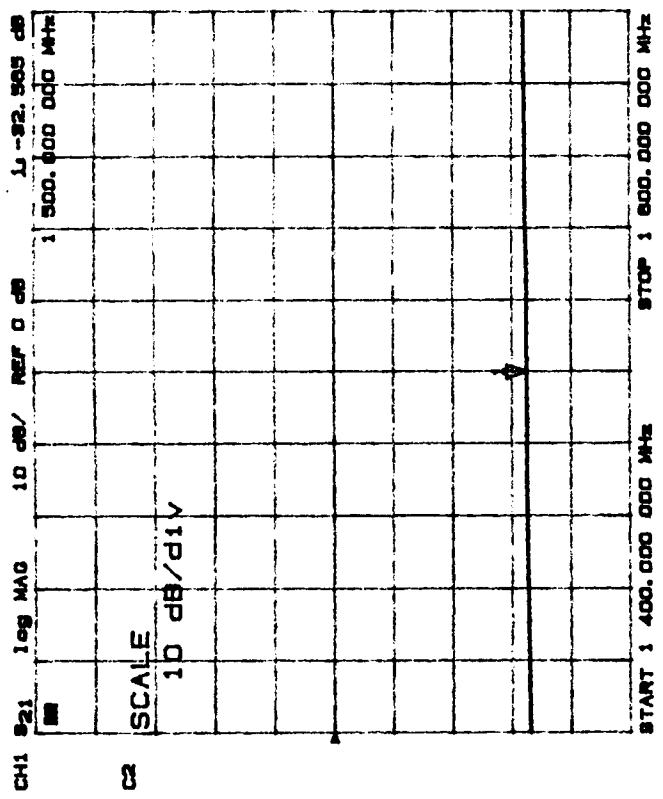
Relative Attenuation 1/4 dB stage

70790502

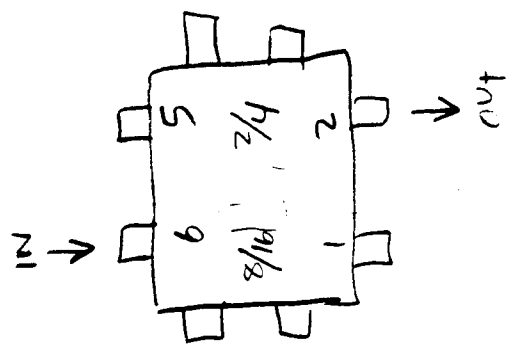
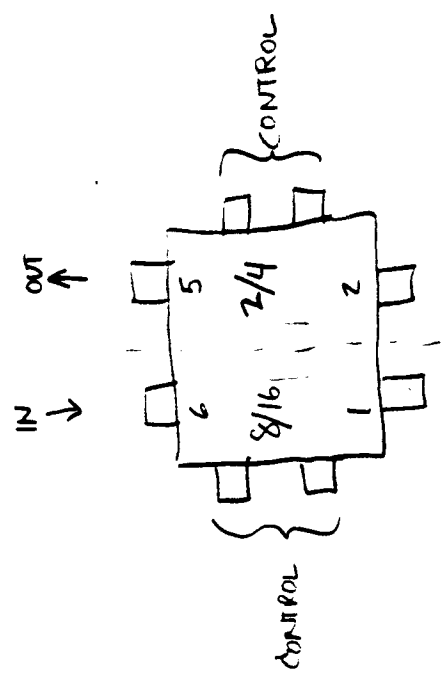
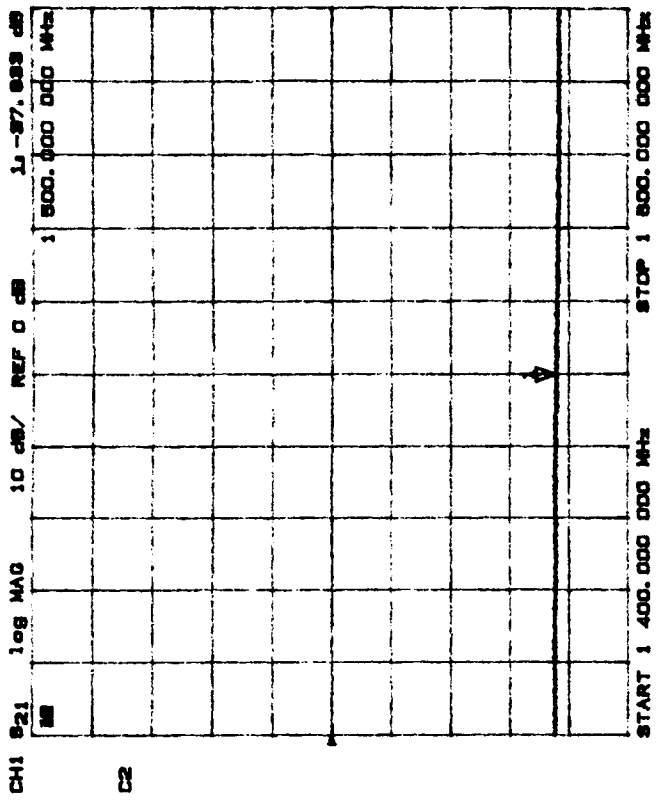
Package / fixture / chip

Isolation of

Port 6 → 5

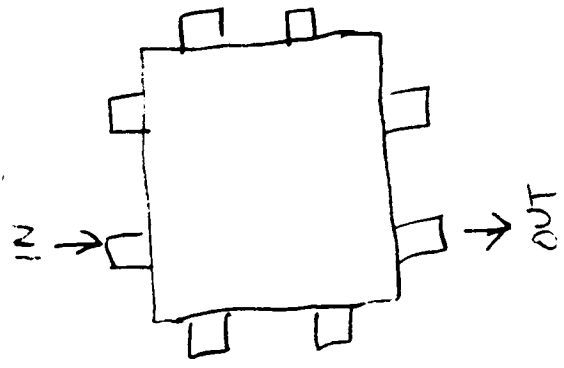
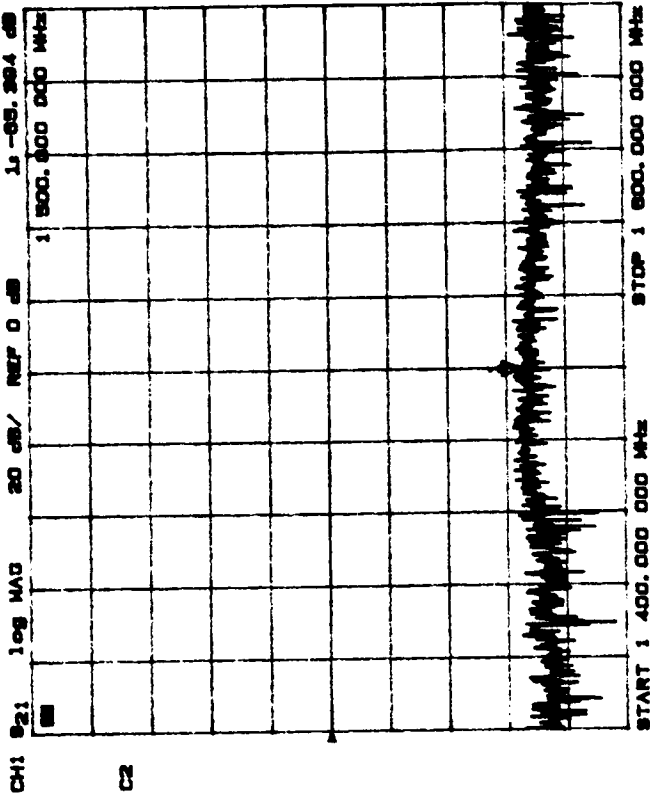
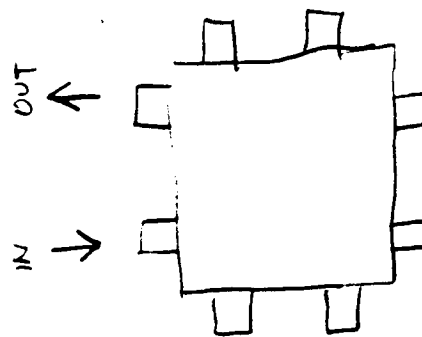
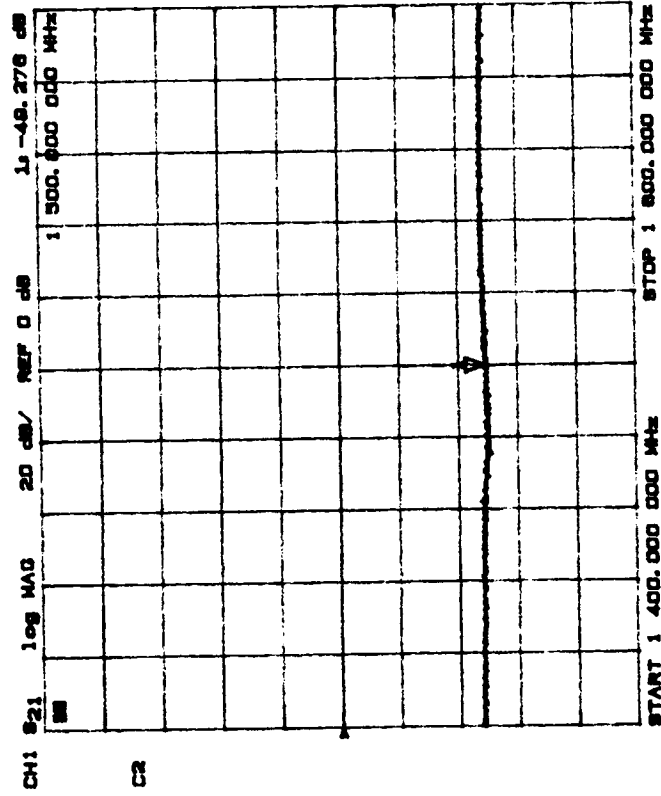


Ports 6 → 2





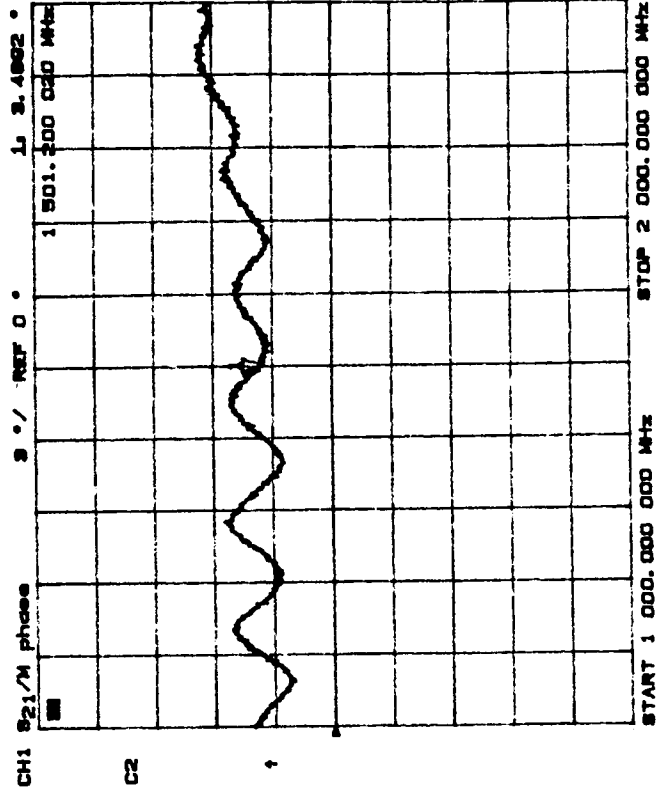
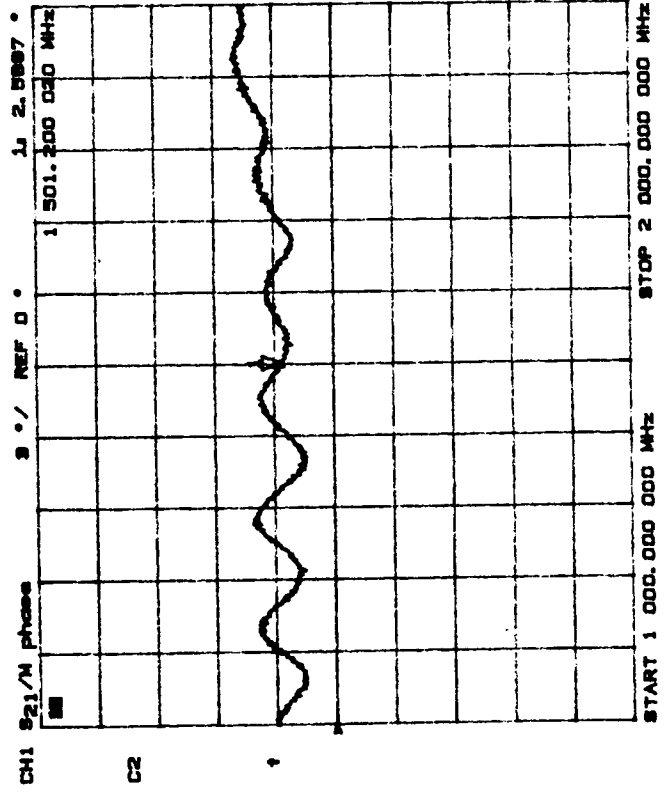
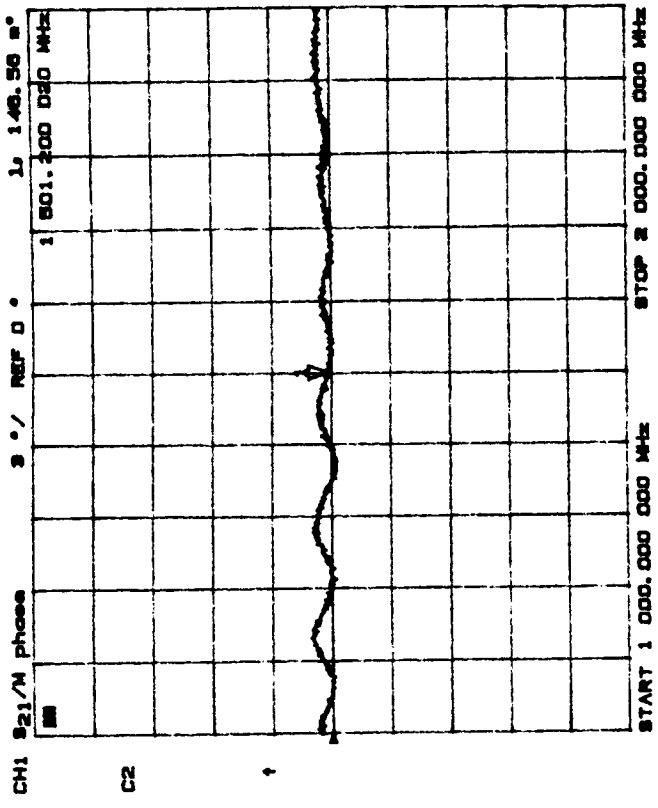
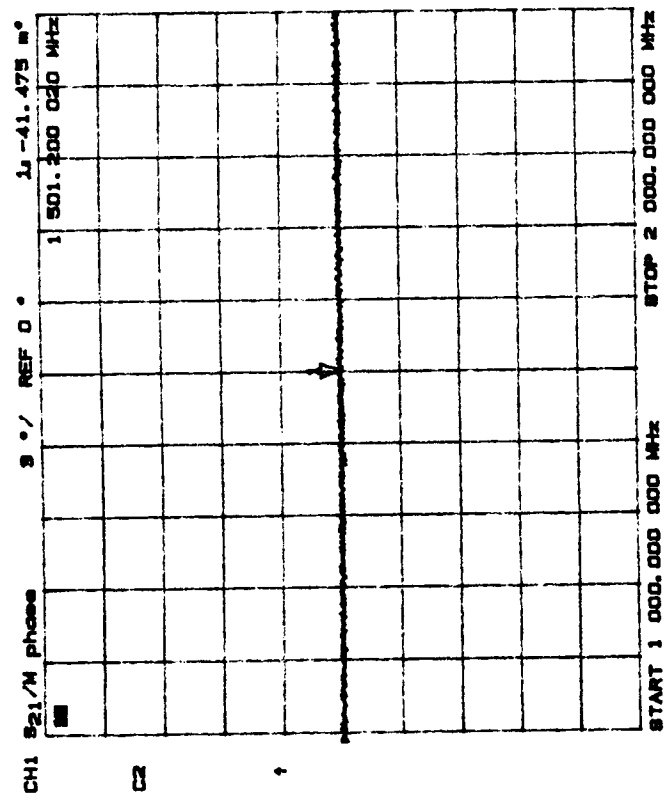
Isolation of fixture alone



Phase Delta (Thru phase calibrated out) 2/4 dB stages

Thru

2dB



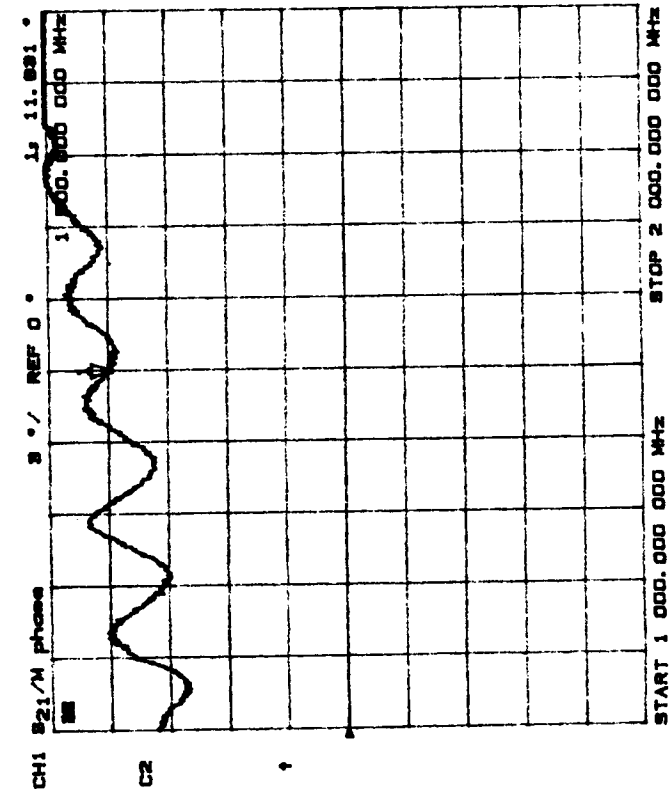
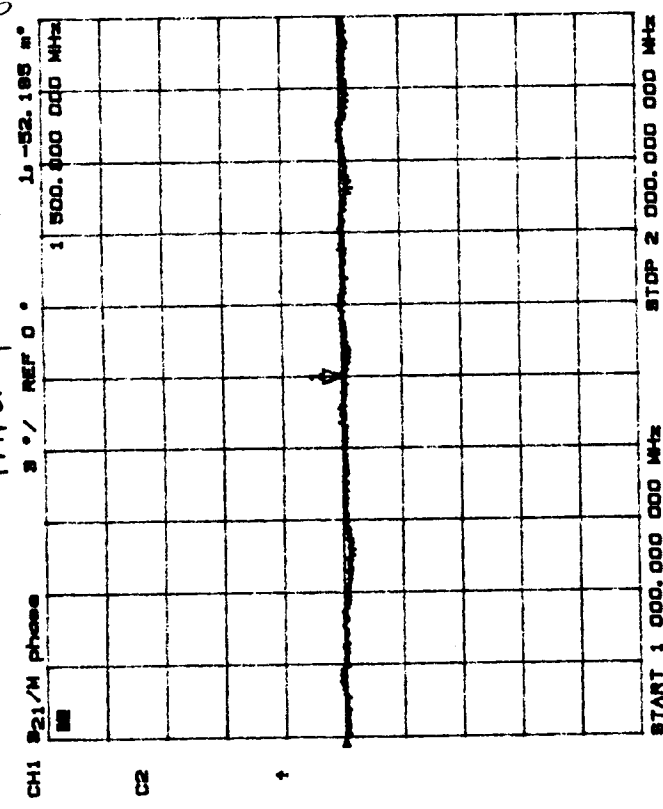
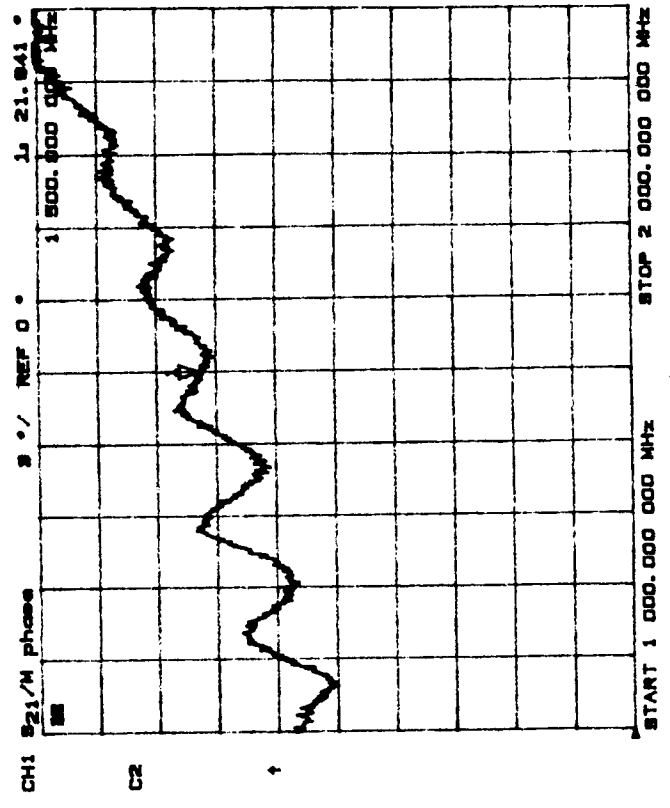
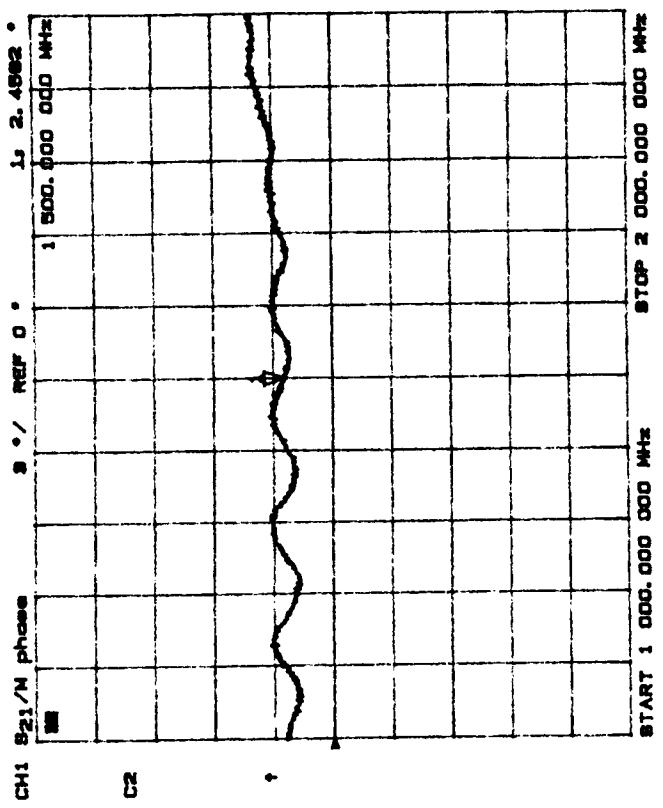
4dB

2 + 4dB

Phase Delta (thru phase combiners)

8dB

Thru phase (8816dB stages)

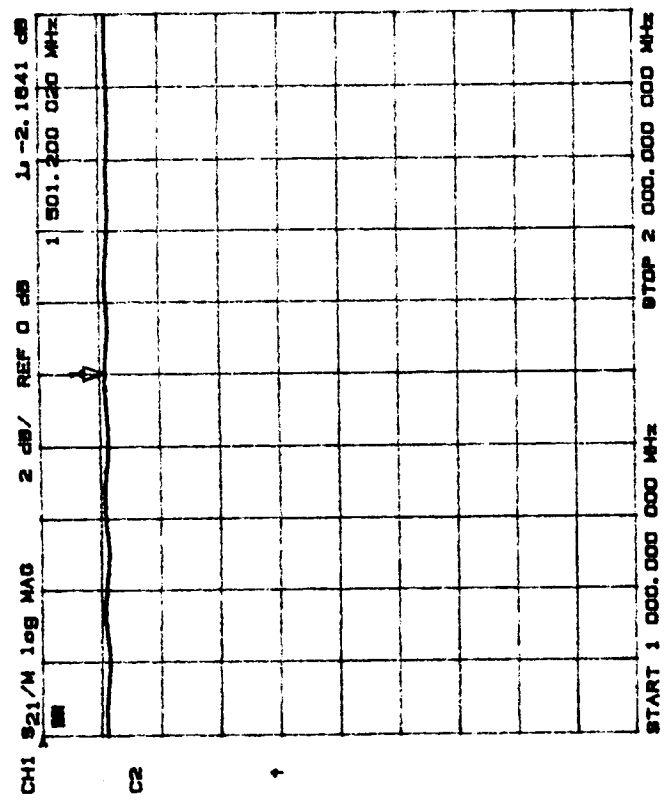


8 of 16

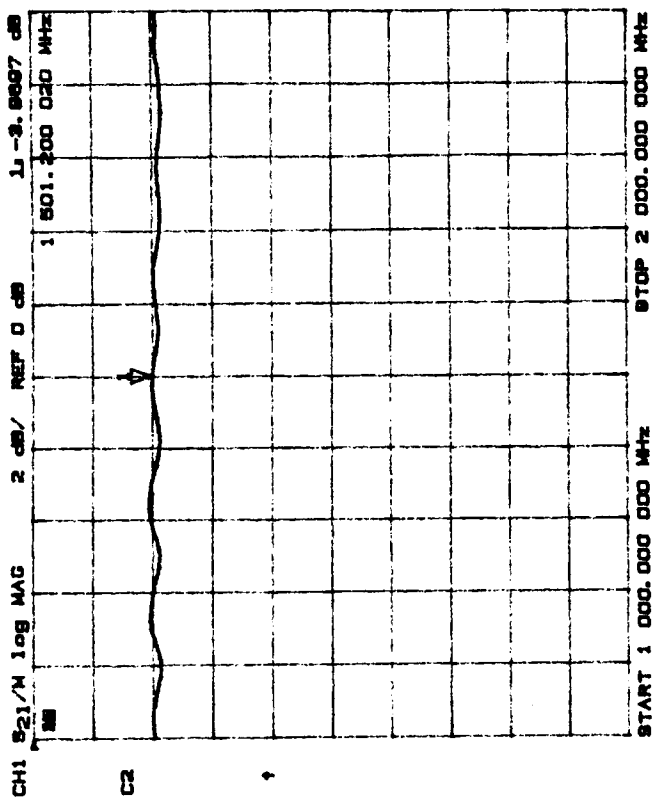
16dB

Relative Attenuation 27.4dB = stages

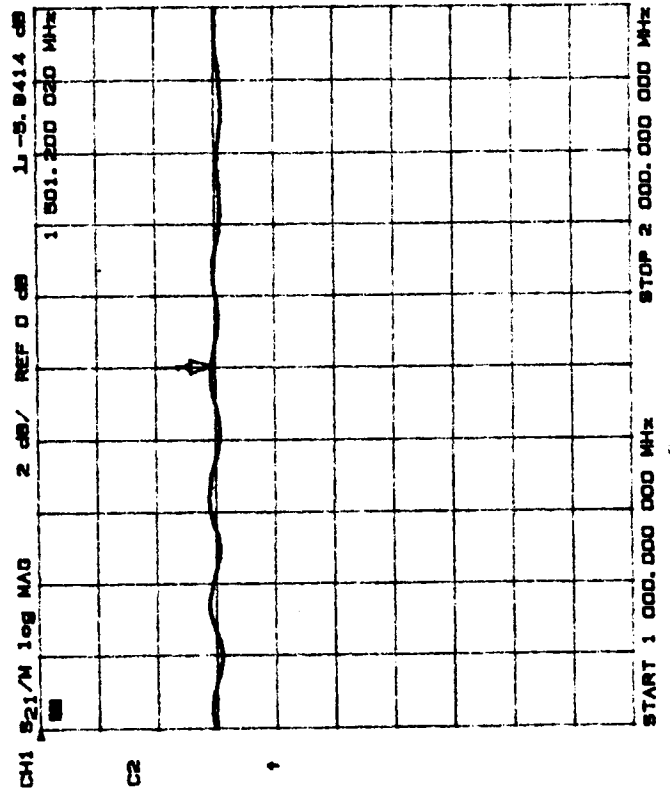
2dB



4dB



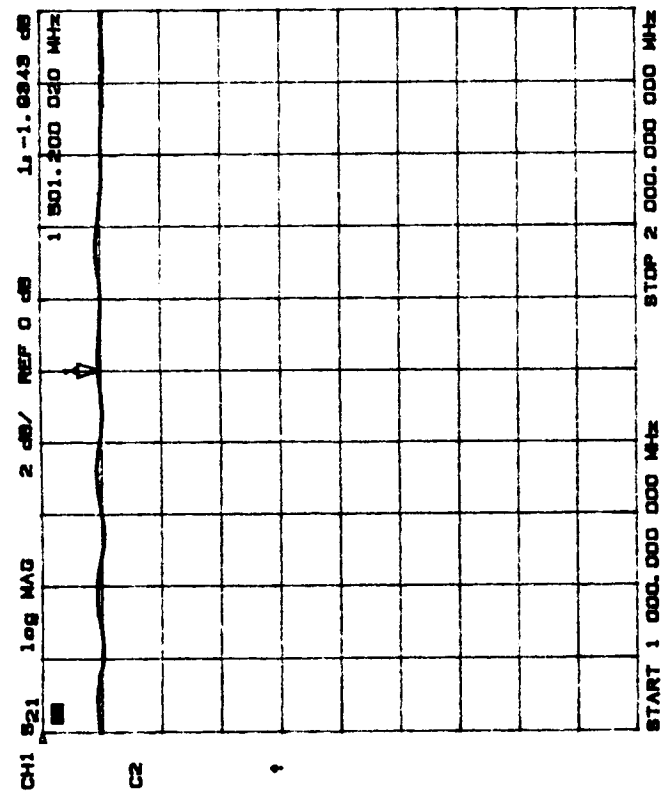
6dB



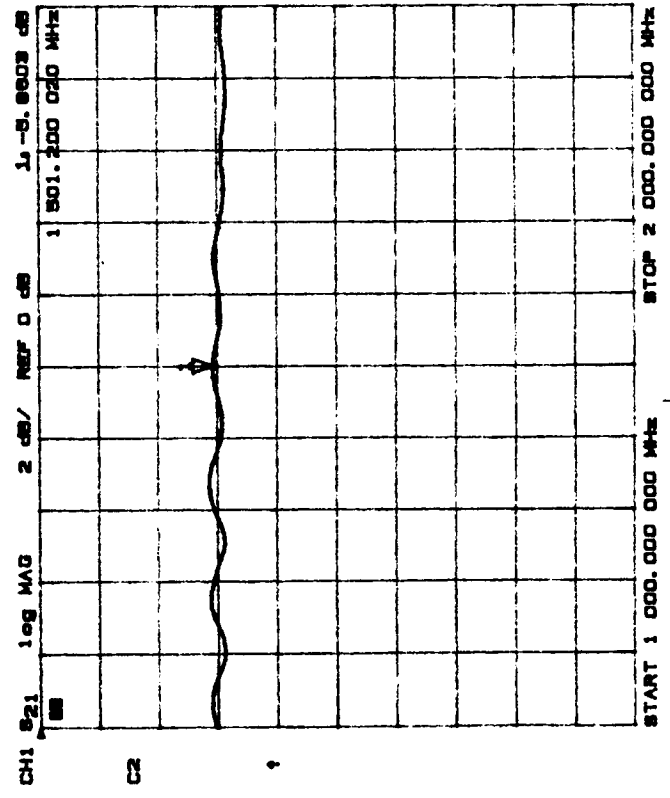
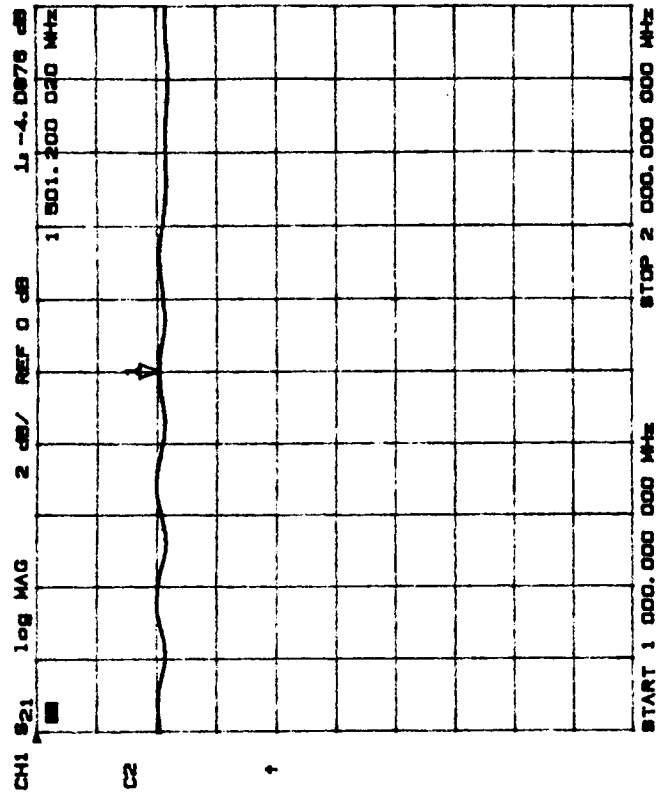
6dB

Absolute Attenuation 2 & 4 dB stages

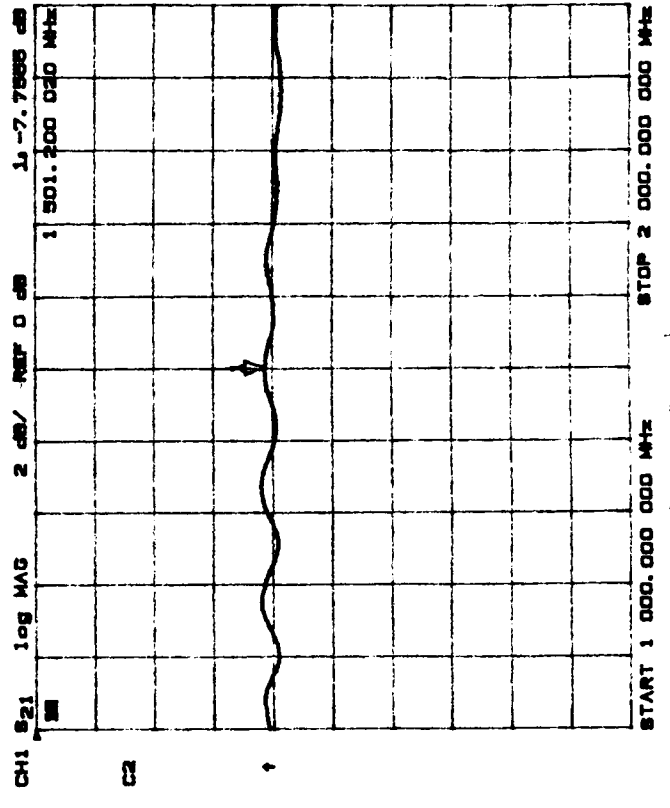
Thru Path



2dB



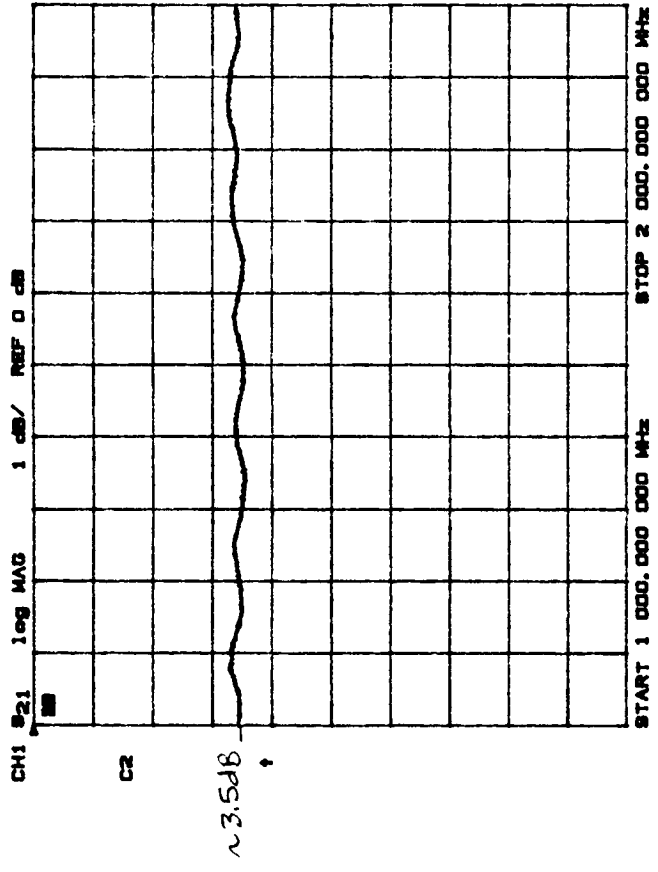
1dB stage



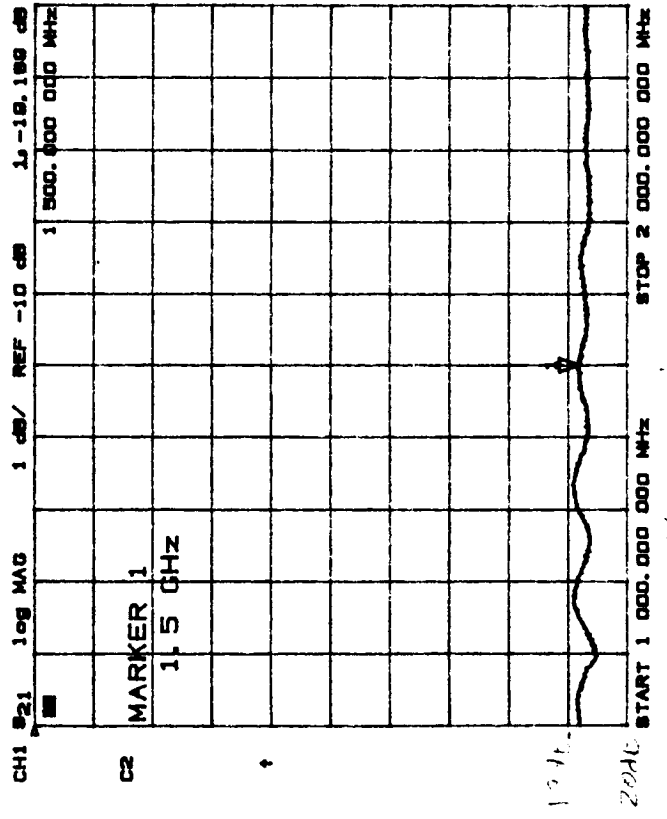
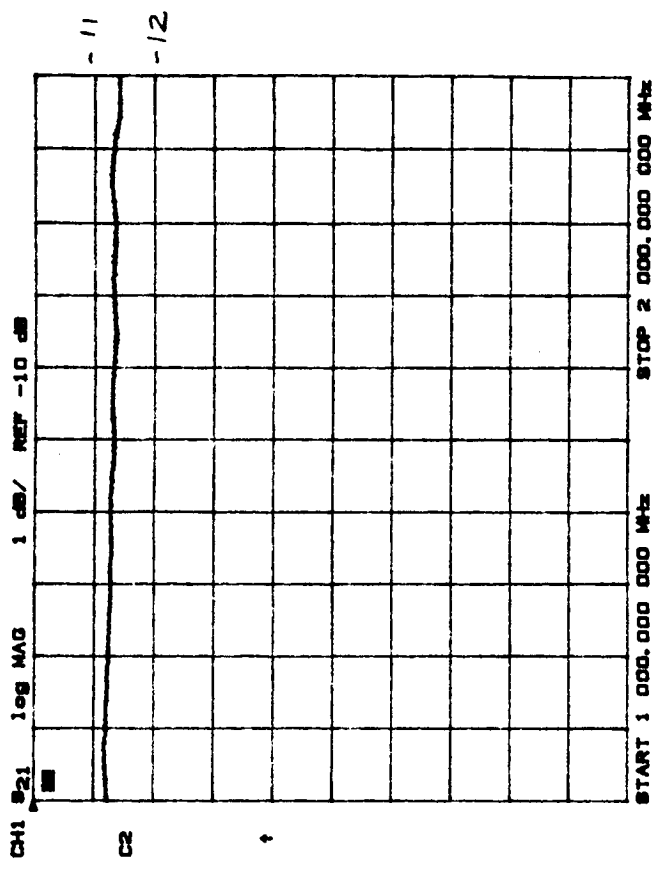
2dB stage

Absolute

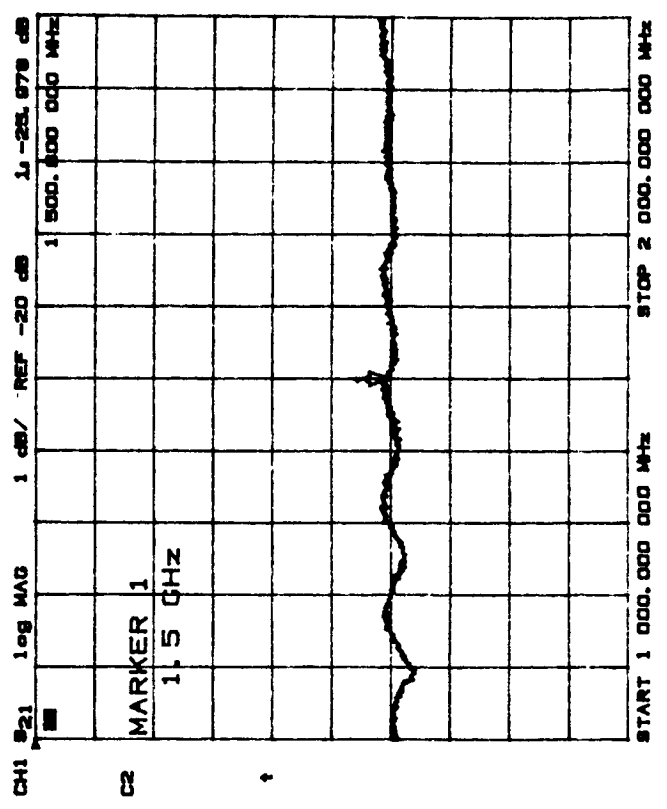
Insertion loss thru 8/16dB



8dB stage



16dB stage

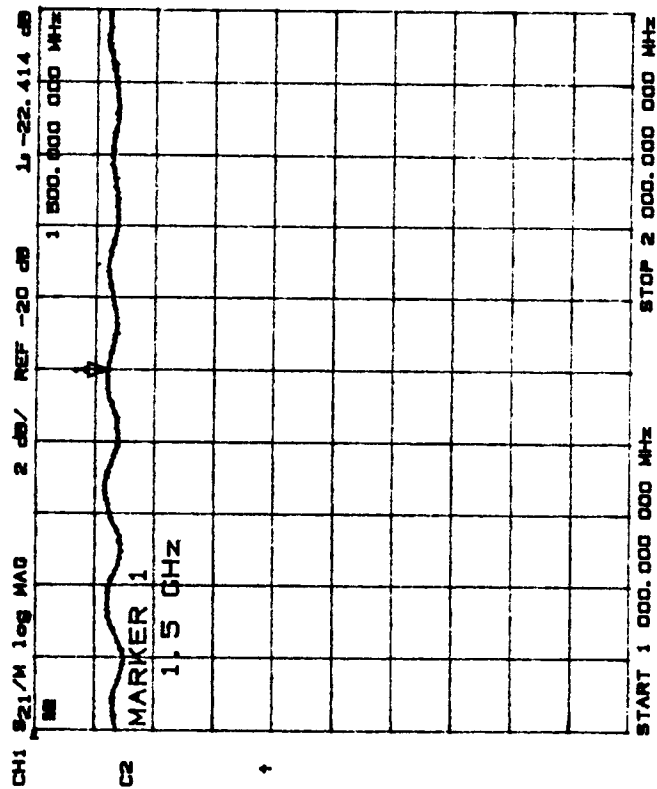
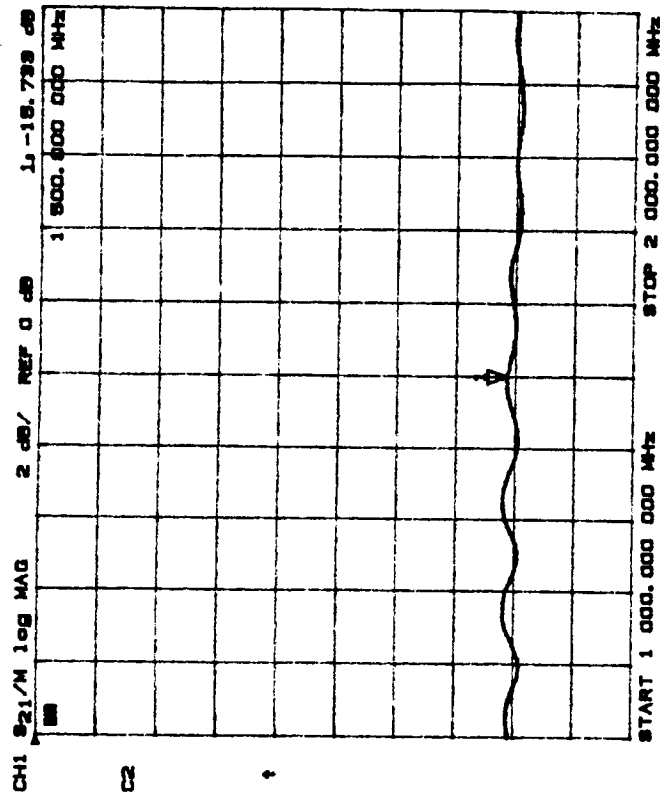
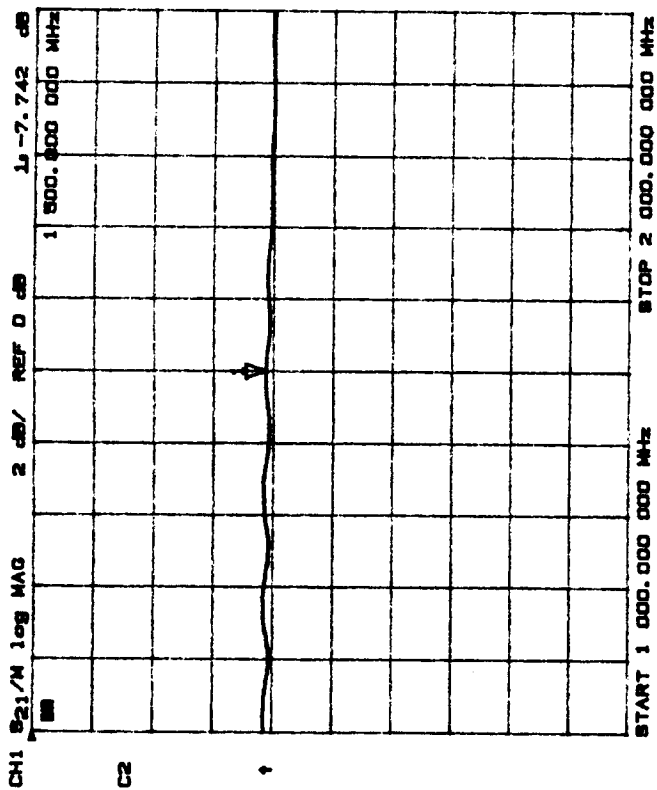


25dB stage

Attenuation with thru path calibrated out  
(Relative Attenuation)

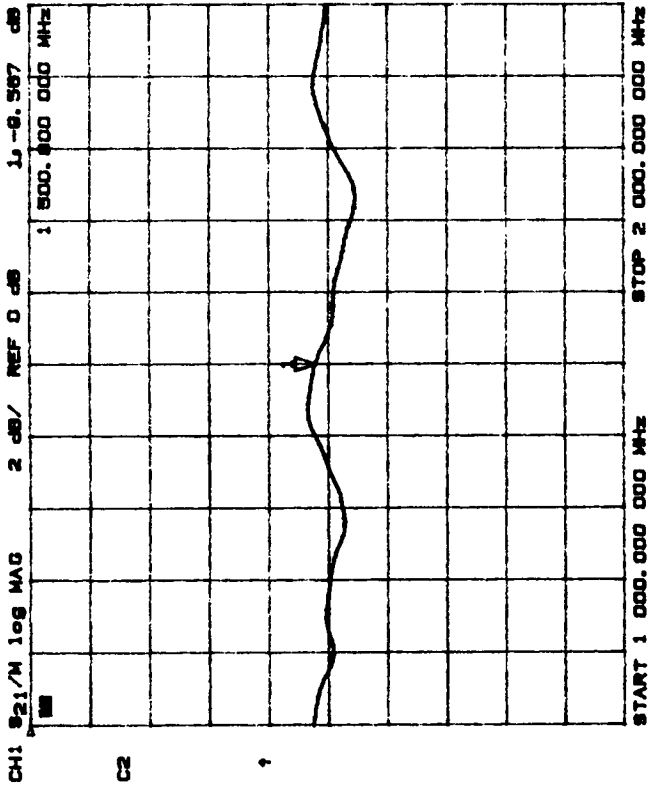
8dB step

16dB

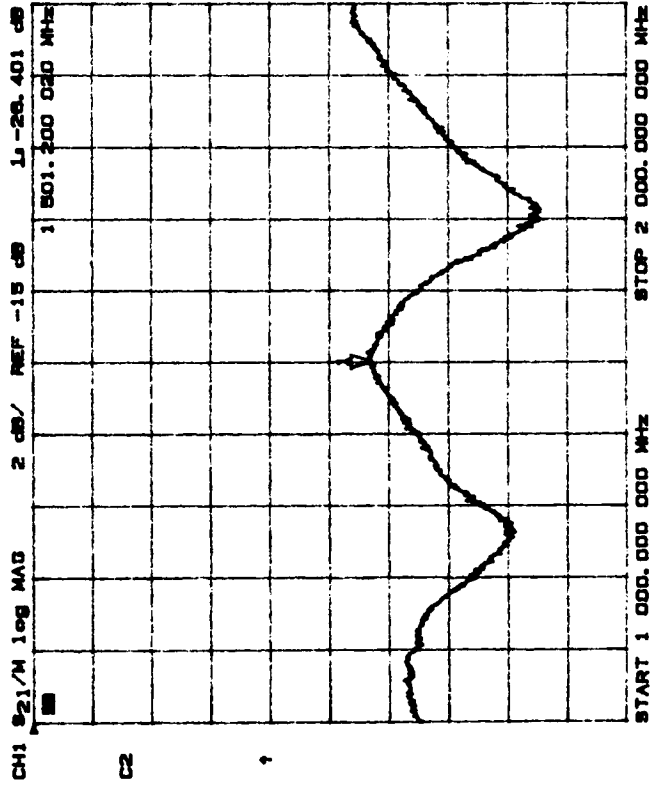
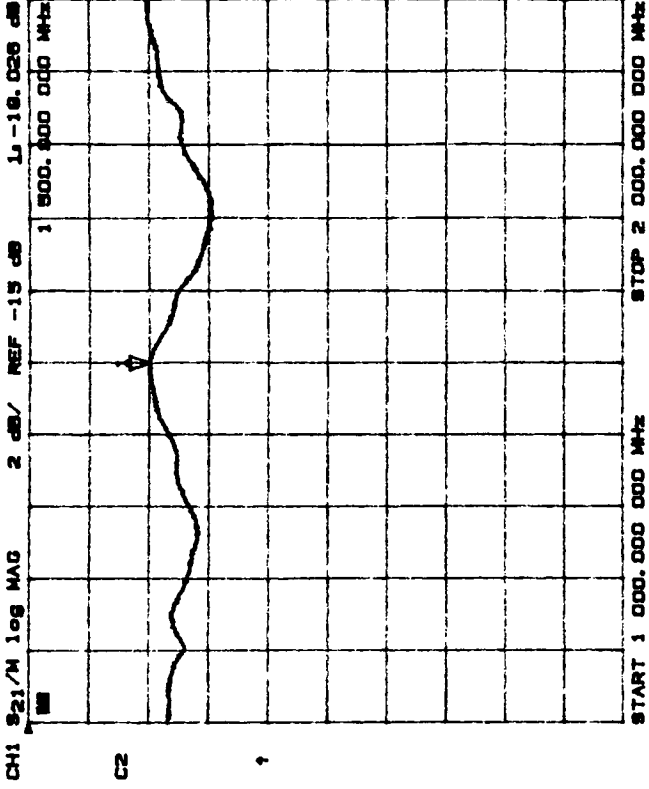


8dB + 16dB

2dB + 8dB



4dB + 16dB

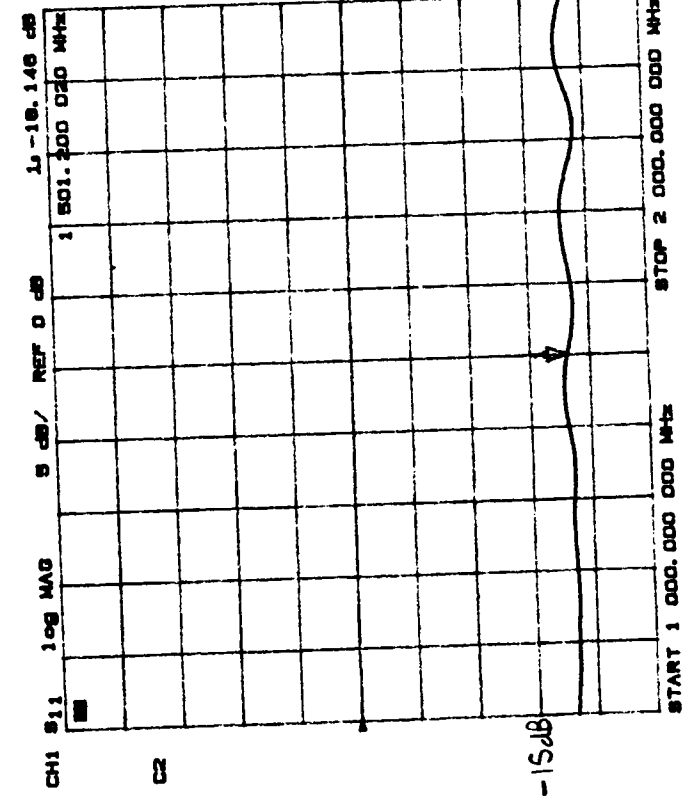
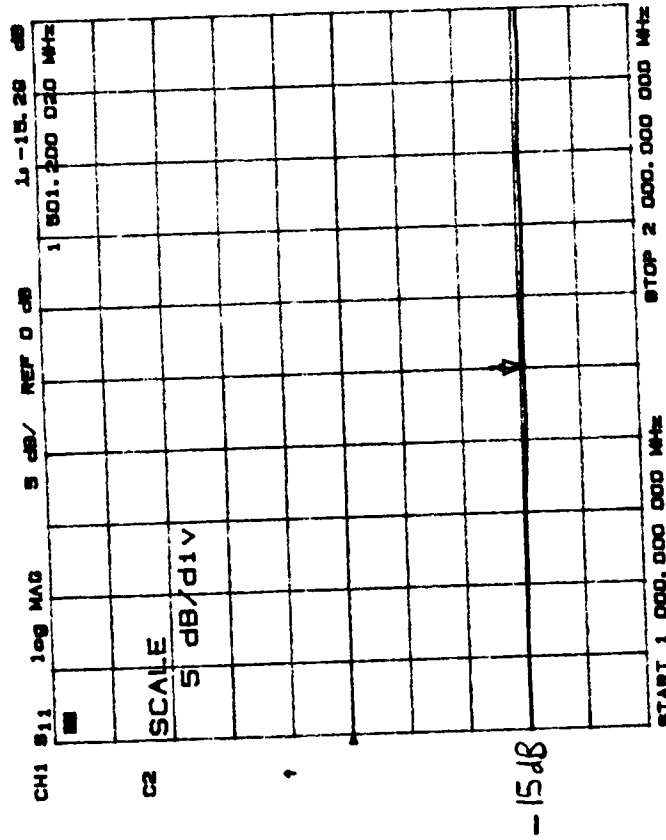


2 + 4 + 8 + 16dB



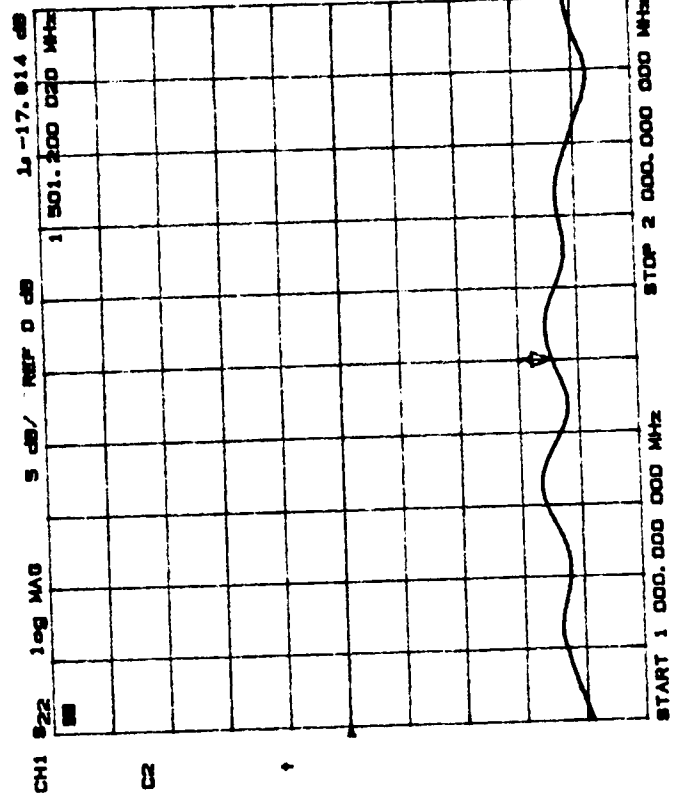
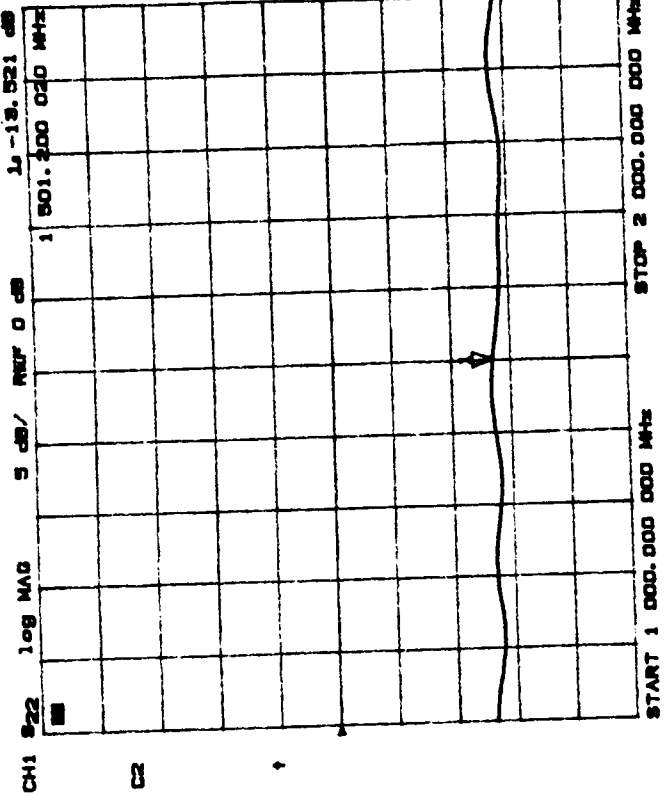
return 1055 (2 + 4 dB stages) 1/6/1007

S11 2 + 4 dB stage ON



S11 Thru

S22 2 + 4 dB stage ON



S22 Thru

INITIAL TEST REPORT

EE\_787 Semester: SUMMER 89 TriQuint Submission # 786A

Chip # 3.5 Type: Phase Shifter

Designers: Michael Angert + Kyung Yoo

Testing: ABGVQ Date: 6/20/90

Problem: None

Comments:  
Circuit worked as predicted, See attached data.

HIL TRGR

HIGHPASS  
6/20/90

360 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: L0R0A9

DATE: 6/18/90  
OPERATOR:

Page 1

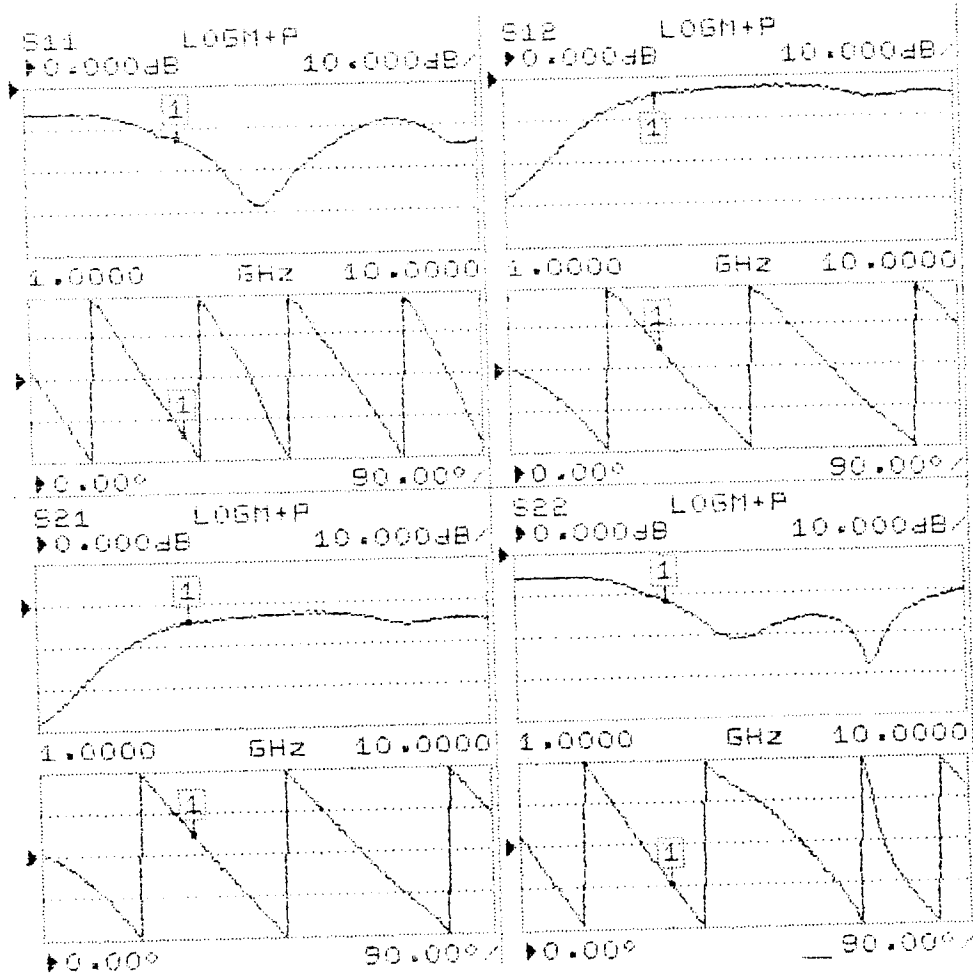
SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



- SELECT OUTPUT DEVICE
- PRINTER
- PLOTTER
- SELECT PRINTER OUTPUT TYPE
- FULL SCREEN
- GRAPH ONLY
- TABULAR DATA
- OUTPUT OPTIONS
- SETUP OUTPUT HEADERS
- DISK OUTPUT OPERATIONS
- PLOT OPTIONS
- PRESS <ENTER> TO SELECT

366 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: L08049

DATE: 6/18/90  
OPERATOR:

Page 1

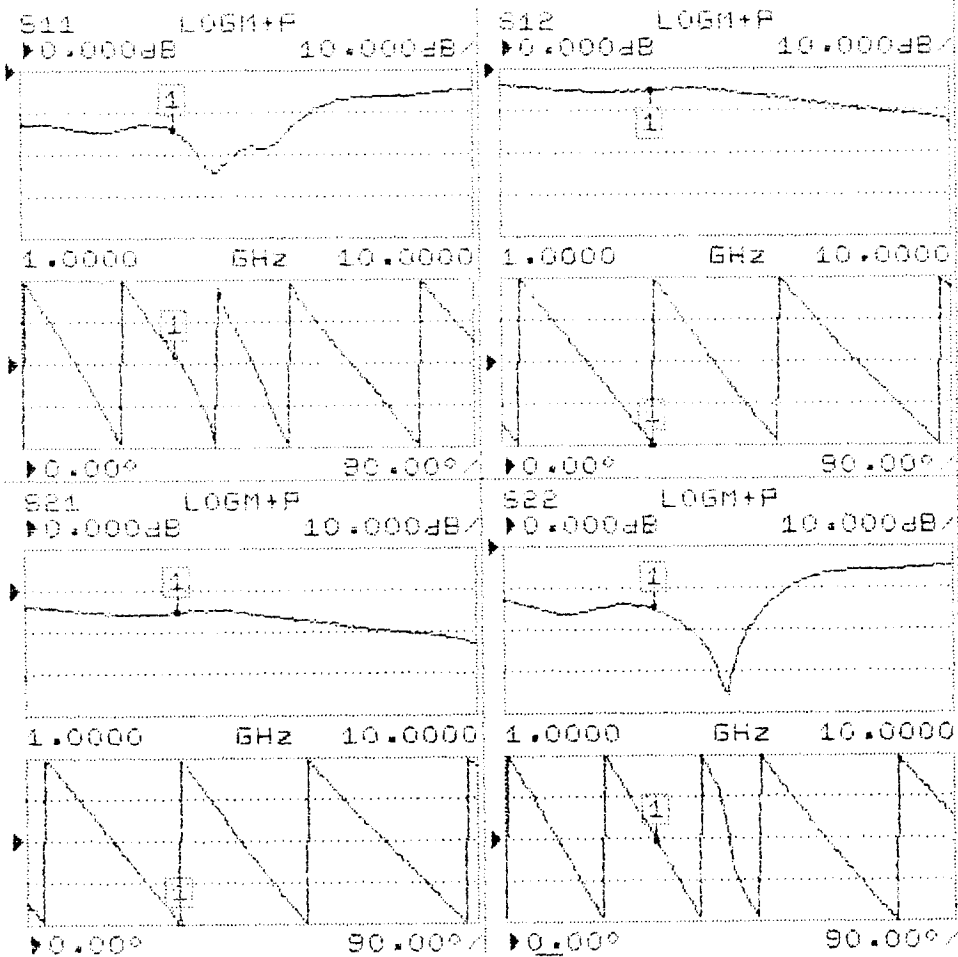
SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 P1S  
IF SMOOTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 MHz	0.0000 MHz	0.0000 MHz	0.0000 MHz
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-	-	-



- SELECT OUTPUT DEVICE
- PRINTER
- PLOTTER
- SELECT PRINTER OUTPUT TYPE
- FULL SCREEN
- GRAPH ONLY
- TABULAR DATA
- OUTPUT OPTIONS
- SETUP OUTPUT HEADERS
- DISK OUTPUT OPERATIONS
- PLOT OPTIONS
- PRESS <ENTER> TO SELECT

360 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: LOAD#9

DATE: 6/18/90  
OPERATOR:

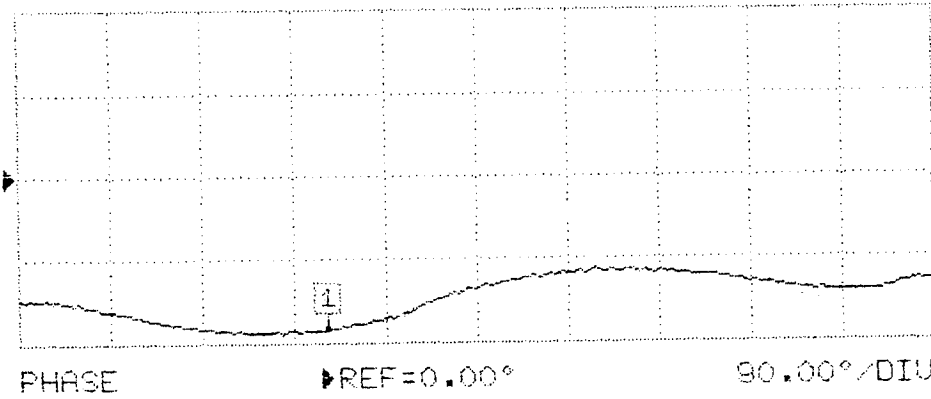
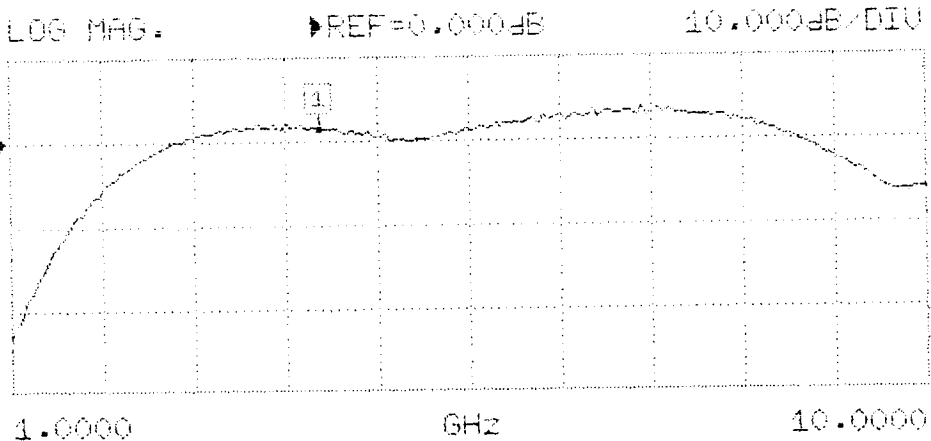
Page 1

SWEEP DATA

START:	1.0000 GHz	GATE START:	-	ERROR CORR:	12 - TERM
STOP:	10.0000 GHz	GATE STOP:	-	AVERAGING:	1 PTS
STEP:	0.0540 GHz	GATE:	-	IF BNDWTH:	REDUCED
		WINDOW:	-		

-----CH3-----  
 PARAMETER: S21  
 NORMALIZATION: DATA / MEMORY  
 REFERENCE PLANE: 0.0000 mm  
 SMOOTHING: 0.0 PERCENT  
 DELAY APERTURE: -

S21 FORWARD TRANSMISSION



CH 3 - S21  
 REF. PLANE  
 0.0000 mm  
 MARKER 1  
 4.0240 GHz  
 -166.05 dB  
 -166.05 °  
 MARKER TO MAX  
 MARKER TO MIN

360 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: LORG#9

DATE: 6/18/90  
OPERATOR:

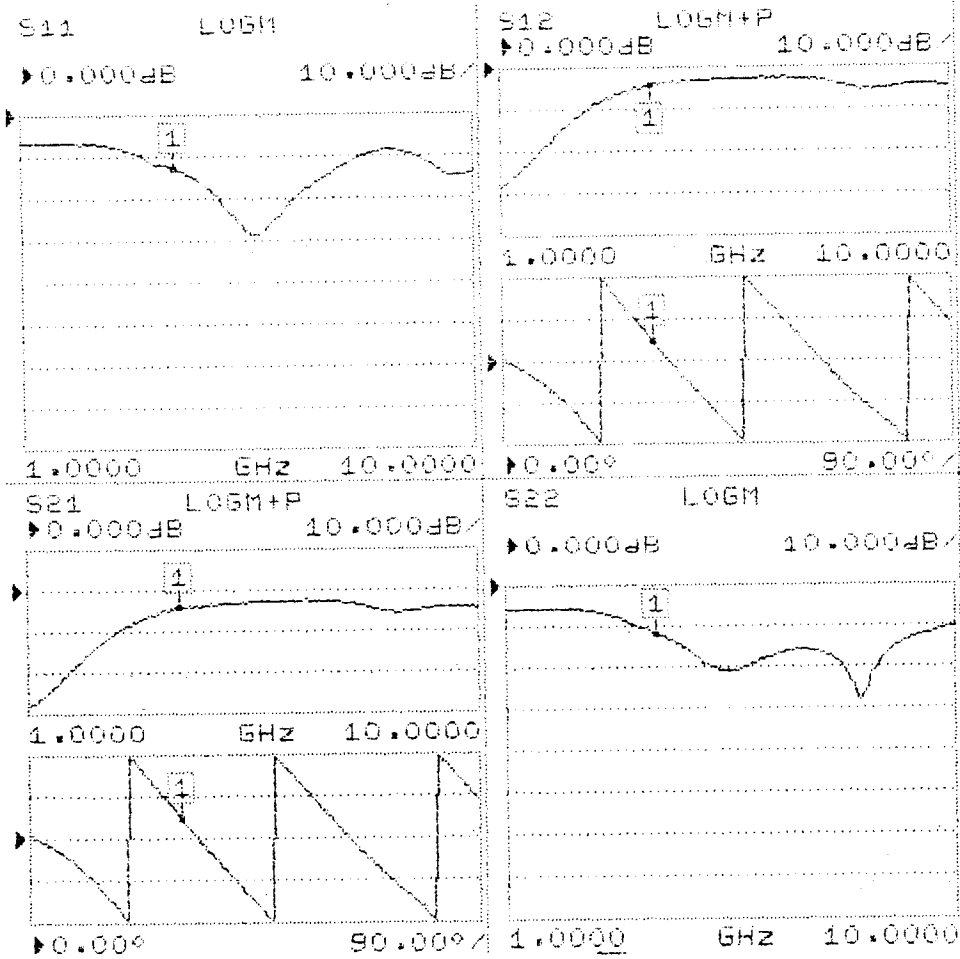
SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 1Z - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:				



CH 2 - S12  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-4.518 dB  
41.88 °

MARKER TO MAX  
MARKER TO MIN

MODEL: TEST  
DEVICE ID: LOAD#9

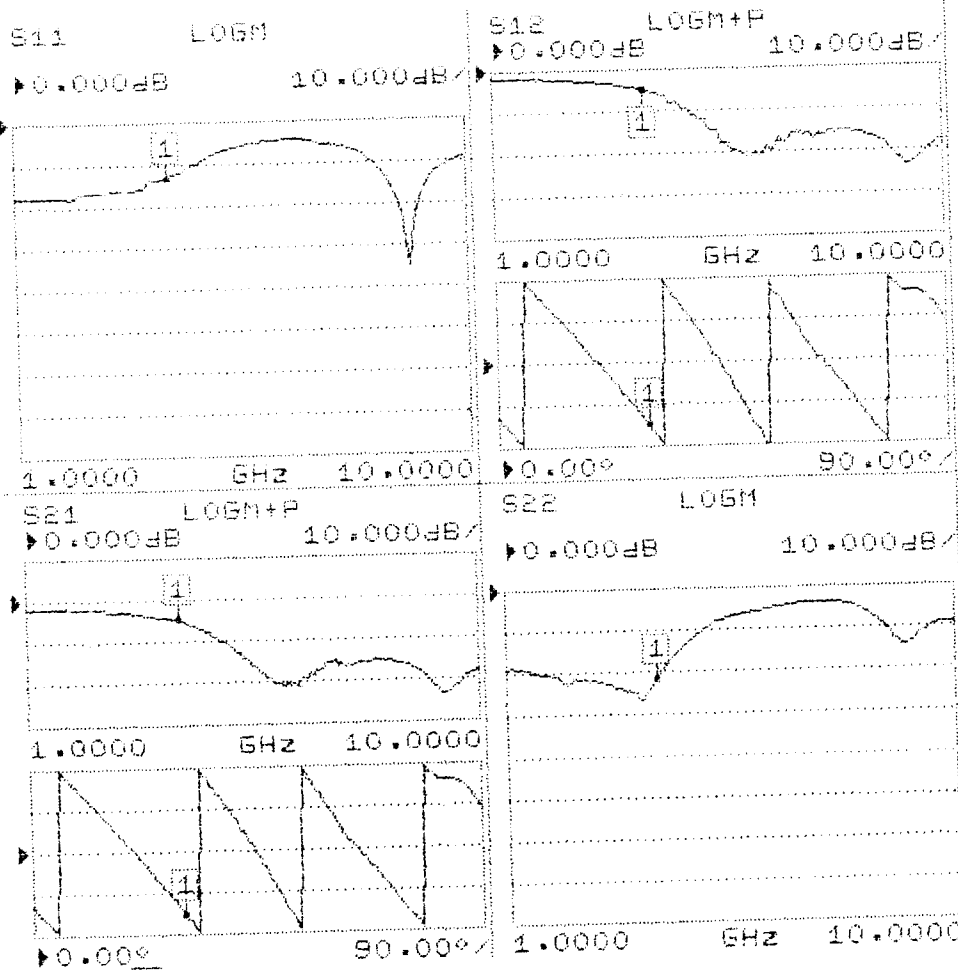
DATE: 6/18/90  
OPERATOR:

SWEEP DATA  
START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0510 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:				



CH 2 - S12  
REF. PLANE  
0.0000 mm

MARKER 1  
4.0240 GHz  
-4.850 dB  
-134.99 °

MARKER TO MAX  
MARKER TO MIN

WILTRON

PHASE  
6/20/90

360 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: LOAD#B

DATE: 6/18/90  
OPERATOR:

Page 1

SWEEP DATA

START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

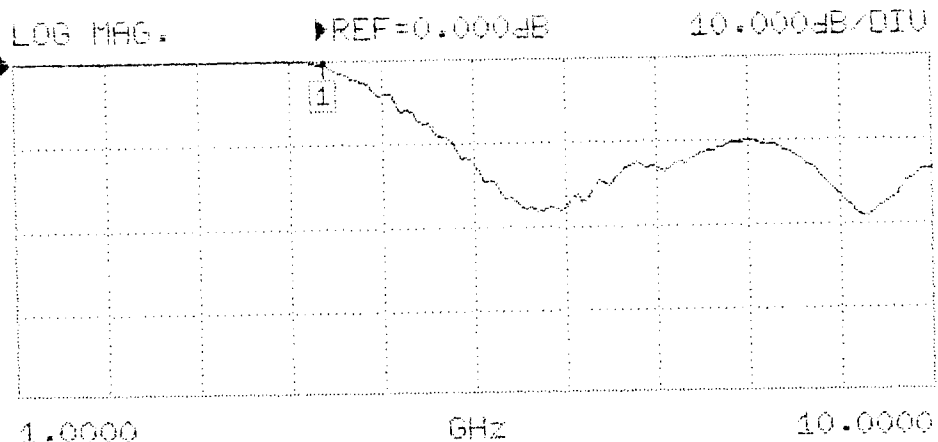
GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 PTS  
IF BANDWIDTH: REDUCED

PARAMETER:  
NORMALIZATION:  
REFERENCE PLANE:  
SMOOTHING:  
DELAY APERTURE:

-----CH2-----  
S12  
DATA / MEMORY  
0.0000 dB  
0.0 PERCENT

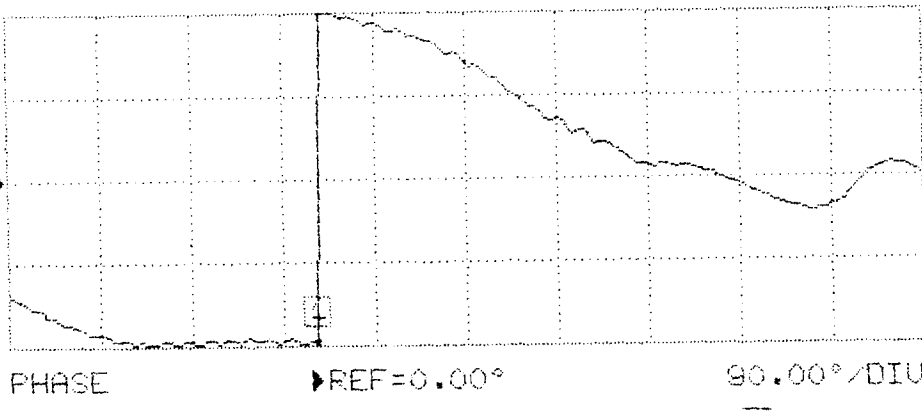
S12 REVERSE TRANSMISSION



CH 2 - S12  
REF. PLANE  
0.0000 dB

MARKER 1  
4.0240 GHz  
-0.352 dB  
-176.73 °

MARKER TO MAX  
MARKER TO MIN





## INITIAL TEST REPORT

EE\_787 Semester: Summer '89 TriQuint Submission # 786A

Chip # 4.6-1 Type: Tapered D-Amp

Designers: Feggeler / Bayals

Testing: C. Moore Date: 6-5-90

### Problem:

None

### Comments:

- 1) Biased successfully to  $I_{ds} = 30 \text{ mA}$   
at  $V_{DD} = 5 \text{ Volt}$  with RF in/OUT  
terminated in  $50 \Omega$ .
- 2) Under above conditions yielded:  
RF Gain  $\approx 3 \text{ dB}$  from 4-8 GHz  
Rippled below 4 GHz!  
Input match good, output match far from  $50 \Omega$ !
- 3) DC Bias @  $5 \text{ V}$  &  $75 \text{ mA}$  for  
best RF - see plots

360 NETWORK ANALYZER

MODEL: TEST  
 DEVICE ID: LOADS DAMP #3  
 75 mA

DATE: 6/18/90  
 OPERATOR:

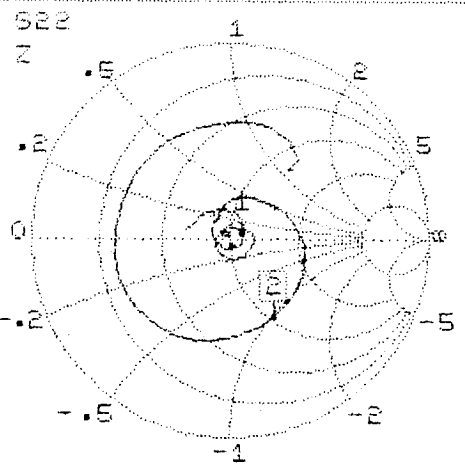
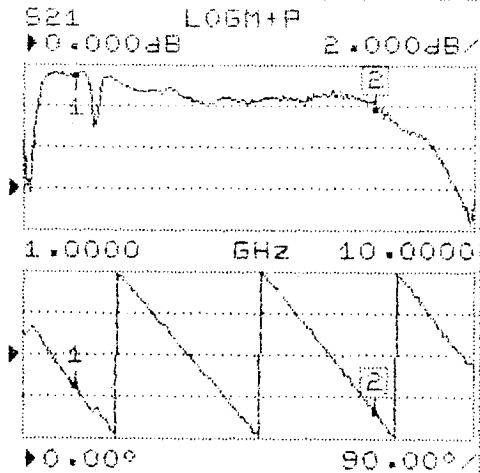
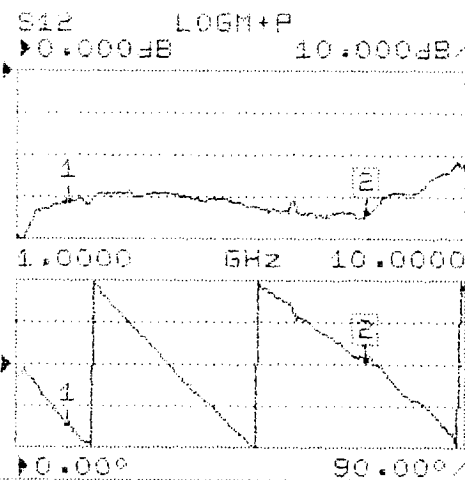
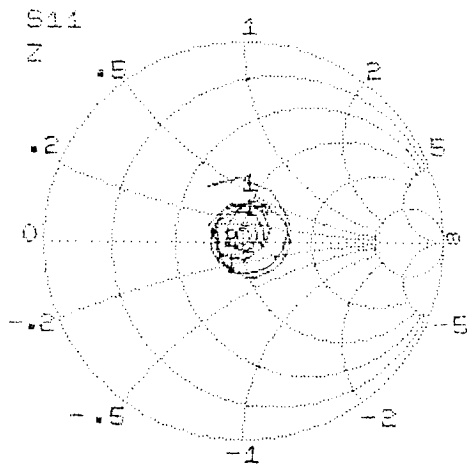
SWEEP DATA

START: 1.0000 GHz  
 STOP: 10.0000 GHz  
 STEP: 0.9540 GHz

GATE START: -  
 GATE STOP: -  
 GATE: -  
 WINDOW: -

ERROR CORR: 12 - TERM  
 AVERAGING: 1 PTS  
 IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:				



- SELECT GRAPH TYPE
- LOG MAGNITUDE
- PHASE
- LOG MAGNITUDE AND PHASE
- SMITH CHART (IMPEDANCE)
- SWR
- GROUP DELAY
- MORE
- PRESS <ENTER> TO SELECT

DAMP 3  
75 mA

HILTRON

360 NETWORK ANALYZER

MODEL: TEST  
 DEVICE ID: ~~LOAD#9~~ DAMP #3  
 75 mA

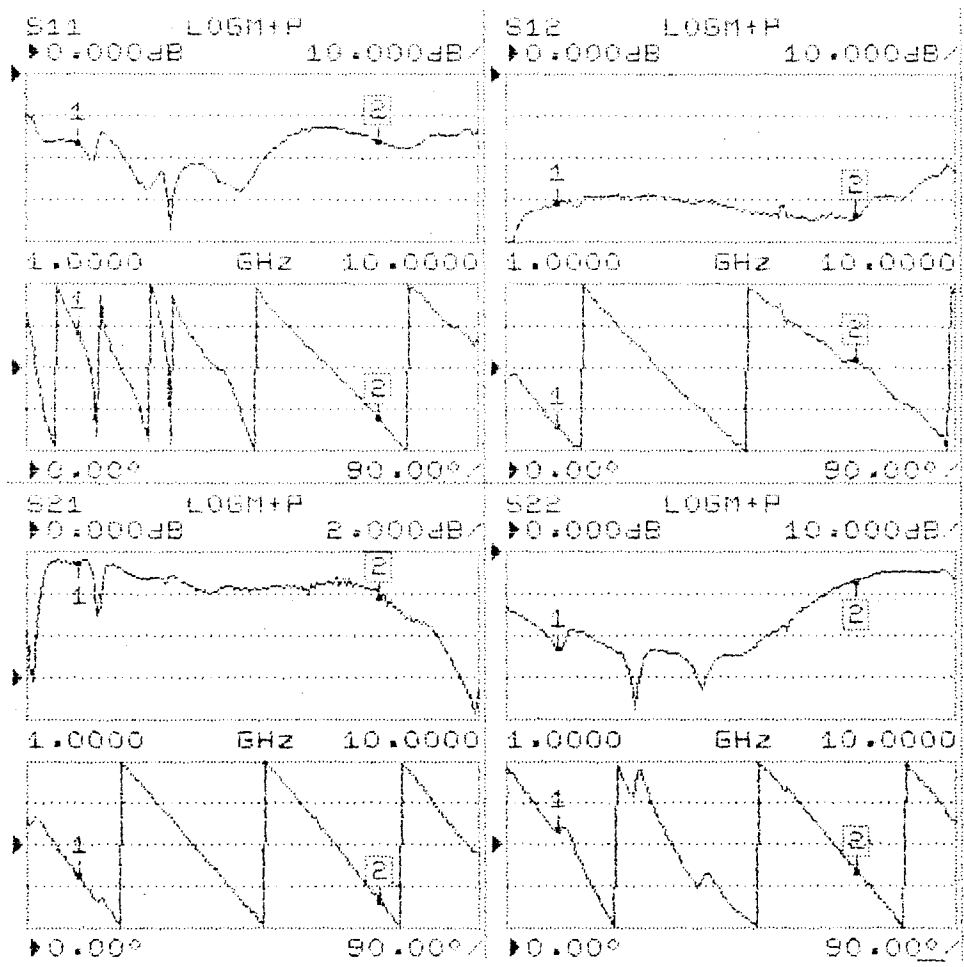
DATE: 6/18/90  
 OPERATOR:

SWEEP DATA  
 START: 1.0000 GHz  
 STOP: 10.0000 GHz  
 STEP: 0.9510 GHz

GATE START: -  
 GATE STOP: -  
 GATE: -  
 WINDOW: -

ERROR CORR: 12 - TERM  
 AVERAGING: 1 PTS  
 IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:				



- SELECT OUTPUT DEVICE
- PRINTER
- PLOTTER
- SELECT PRINTER OUTPUT TYPE
- FULL SCREEN
- GRAPH ONLY
- TABULAR DATA
- OUTPUT OPTIONS
- SETUP OUTPUT HEADERS
- DISK OUTPUT OPERATIONS
- PLOT OPTIONS
- PRESS <ENTER> TO SELECT

MIL TRON

51  
Edwin

360 NETWORK ANALYZER

MODEL: TEST  
DEVICE ID: LOAD#2 DAMP #2  
75 mA

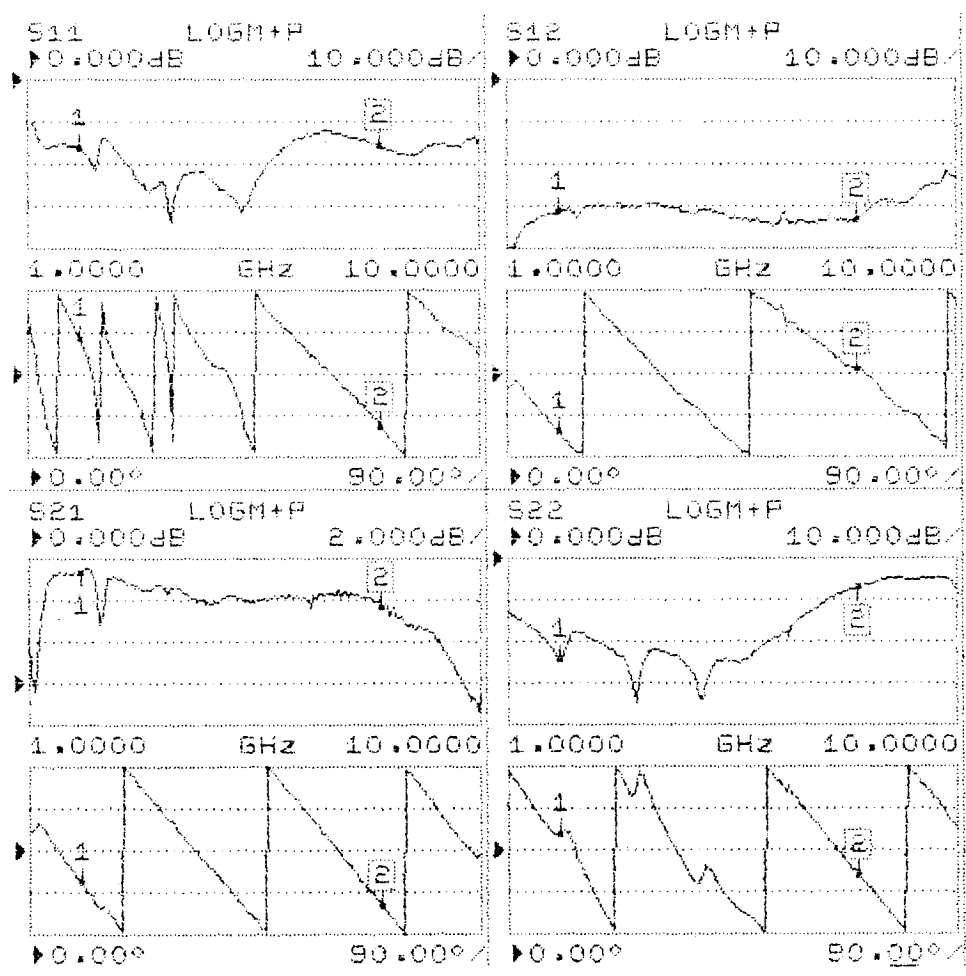
DATE: 6/19/98  
OPERATOR:

SWEEP DATA  
START: 1.0000 GHz  
STOP: 10.0000 GHz  
STEP: 0.0540 GHz

GATE START: -  
GATE STOP: -  
GATE: -  
WINDOW: -

ERROR CORR: 12 - TERM  
AVERAGING: 1 P15  
IF BANDWIDTH: REDUCED

	CH1	CH2	CH3	CH4
PARAMETER:	S11	S12	S21	S22
NORMALIZATION:	OFF	OFF	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:				



CH 3 - S21  
REF. PLANE  
0.0000 mm

MARKER 2  
8.0200 GHz  
3.593 dB  
-121.78 °

MARKER TO MAX  
MARKER TO MIN

1 2.0260 GHz  
5.294 dB  
-88.70 °