RADOME PANEL TRANSMISSIVITY AND REFLECTIVITY MEASUREMENTS

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Report No. 389617-1-F
8 February 1988

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389617-1-F = RL-2570

SUMMARY

Reflectivity and transmissivity measurements have been made on two panels (-1 and -3) supplied by E-systems. In general, the best results were obtained at near-normal incidence angles. Data results for 1.6 GHz are plotted on the next page.

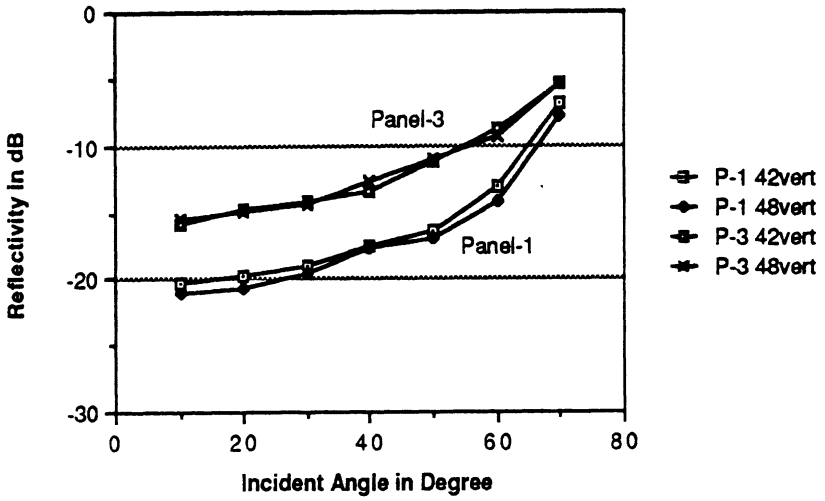
The reflectivity measurements provided results which followed theoretical expectations well. Increasing angle of incidence shows a consistent trend towards lower reflection loss as expected. Panel-1 exhibits a higher reflection loss than Panel-3. Numerical values are approximately 21 dB at normal incidence for Panel-1 and 16 dB at normal incidence for Panel-3.

The transmissivity measurements using a direct transmission method resulted in some variability in the results especially at higher incidence angles. This result was anticipated at the outset since the transmission loss was expected to be quite small. As a result, energy travelling "around" the panel is significant due to the finite size of the samples and interferes with the direct measurement, especially as angle increases. For angles near normal, the results behave reasonably well.

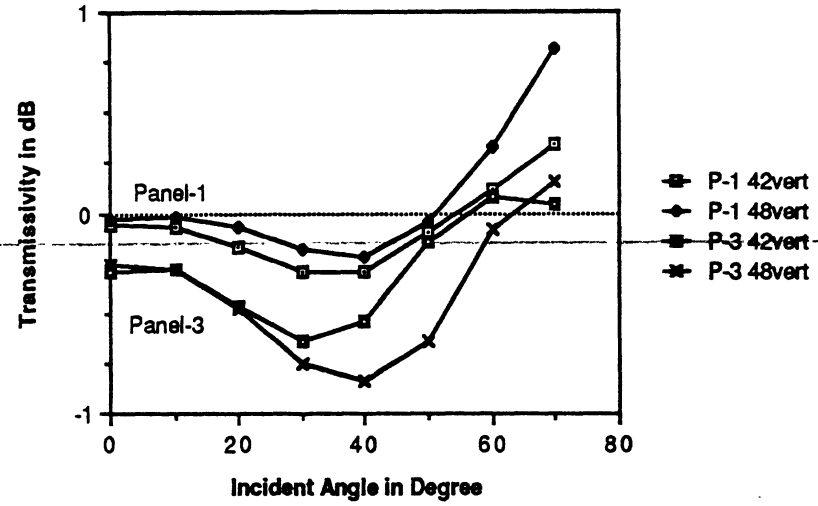
An alternative method was proposed and used to calculate transmissivity in anticipation of these problems, however, this method proved even less effective than the first. As a result, the transmissivity measurements are judged to be somewhat inconclusive. Nevertheless, transmissivity loss is estimated to be approximately .05 dB for Panel-1 and .25 dB for Panel-3 from the direct method at normal incidence.

From experience gained in making these measurements and from examination of various alternative measurements, we believe that a more accurate technique, though limited to a specific angle of incidence at given frequency, would be to measure the panel samples in L-band waveguide. This, however, was beyond the scope of this project, since it would require construction of special calibration fixtures and development of associated techniques and software.

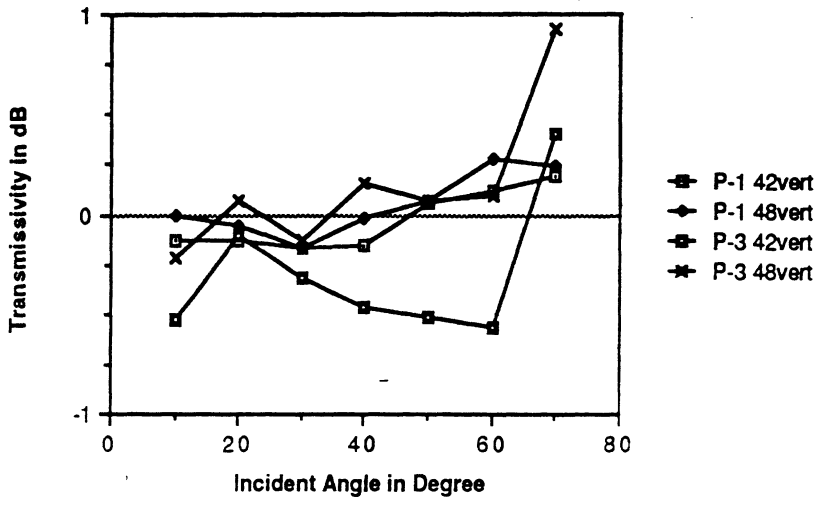
Reflectivity of Radome at 1.6GHz



Transmissivity-1 of Radome at 1.6GHz



Transmissivity-2 of Radome at 1.6GHz



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DATA REPORT FOR RADOME PANEL TRANSMISSIVITY AND REFLECTIVITY MEASUREMENTS

INTRODUCTION

This document outlines the approach used in making transmissivity and reflectivity measurements on material samples under contract to E-systems. It contains a general description of the data collection effort and a presentation of the resultant data.

GENERAL TEST DESCRIPTION

The measurements were made in the anechoic chamber at the University of Michigan Radiation Laboratory using an HP8753A Network Analyzer and an HP9000-236 Computer to collect and process the data. A block diagram of equipment used is shown in Figure 1.

A mounting fixture using strings suspended from the ceiling and guys attached to a floor-based positioner were used to minimize interference of the mount with the desired data and to facilitate accurate angle positioning. The same fixture was used for both the sample panels (2) and the reference panel, an aluminum plate.

For the reflection measurements, rectangular horns supplied by E-systems were used as transmitting and receiving antennas. A 4x8 foot isolation wall constructed using a 8-inch pyramidal absorber was used to minimize the coupling between antennas. Angular positioning of the antennas was done by triangulation measurements to insure accuracy. Figure 2 shows the configuration of this setup.

The transmission measurements were performed using a horn antenna supplied by the Radiation Laboratory as a transmitting antenna located at the tapered end of the anechoic chamber. The receiving antenna was open rectangular waveguide fitted with absorber around it to minimize antenna-sample interaction, and was located directly behind the sample. The configuration is shown in Figure 3.

A reference measurement was made with each data collection for later comparison to the sample data. Each panel was measured in two orthogonal positions (i.e. panel measured in one position, then rotated 90°) with vertical polarization.

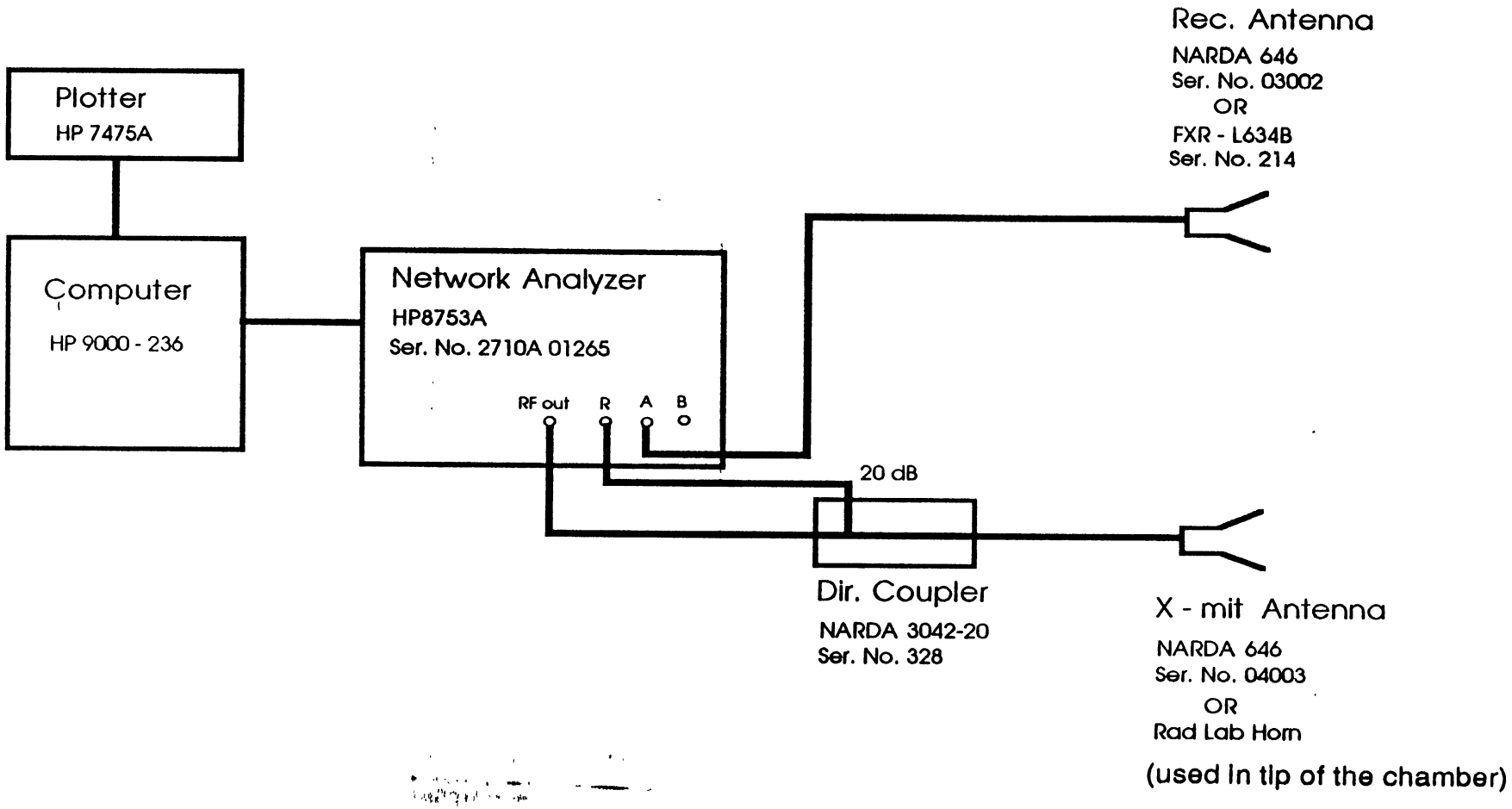


Fig. 1. Equipment block diagram

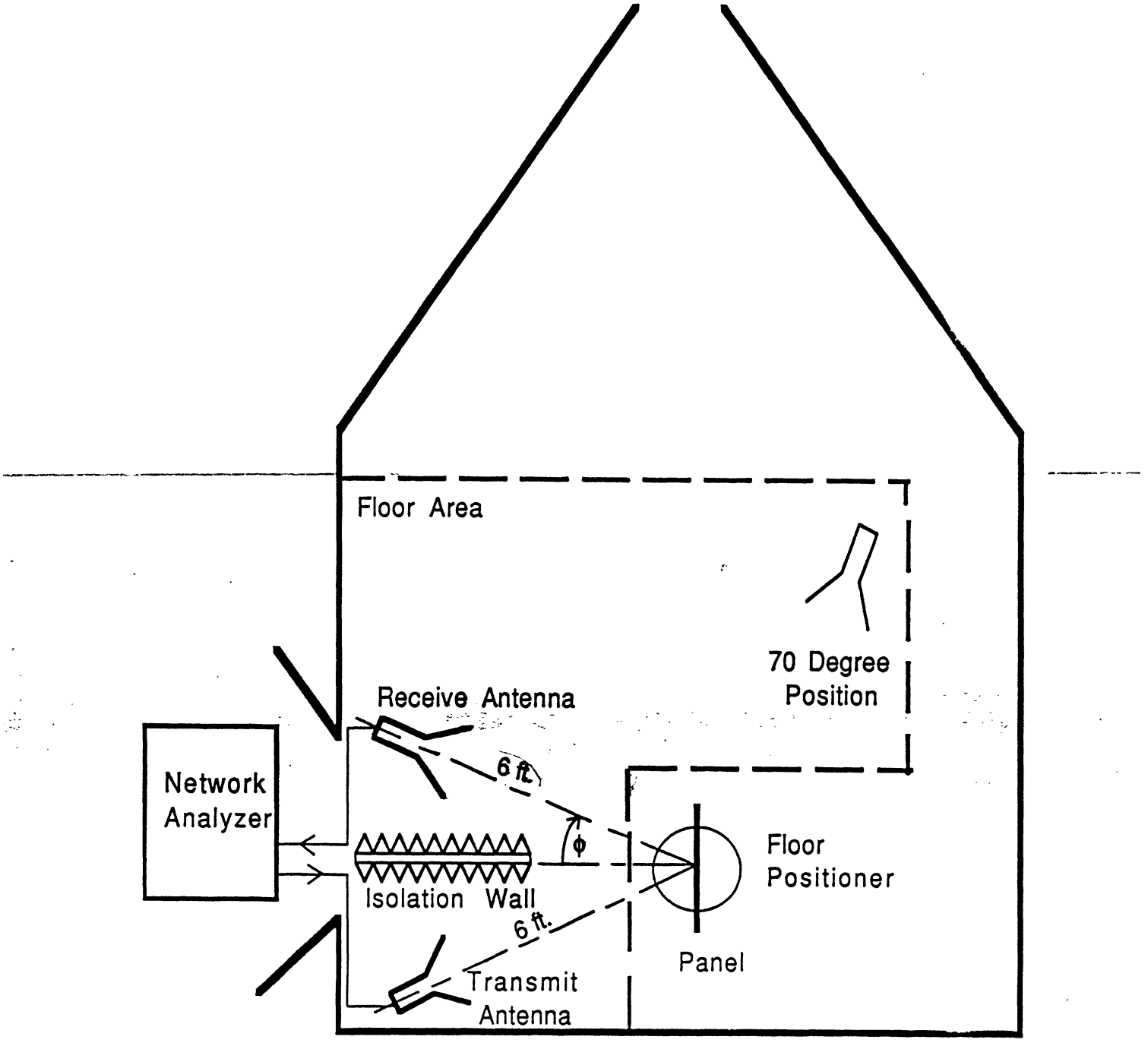


Fig. 2. Reflectivity Measurement Set-up.

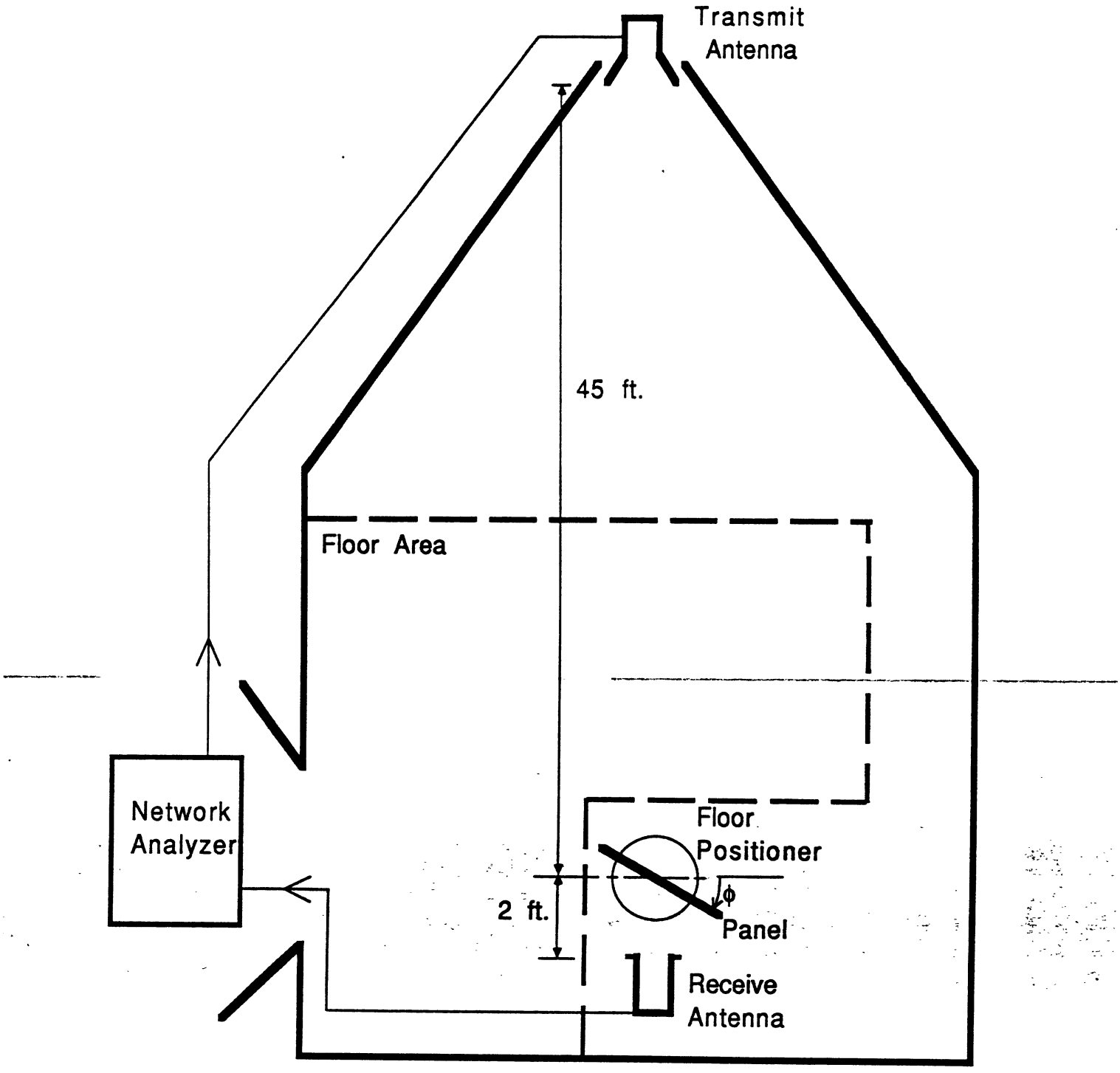


Fig. 3. Transmissivity Measurement Set-up.

OUTLINE OF PROCEDURE

I. TRANSMISSIVITY MEASUREMENT - METHOD I
(data TRANS 1)

A. Setup

1. Setup transmit antenna at the tapered end of the anechoic chamber.

2. Place open waveguide antenna with fitted absorber in position at the measurement site.

B. Measurement

1. Collect background measurement data

2. Install Panel -1 in the fixture (data -1)

a) collect angular data in 10° increments from 0° - 70° (data 0 deg. to 70 deg.)

b) rotate panel in fixture 90° and repeat. (data 42 vert or 48 vert)

3. Install Panel -3 and repeat Step 2. (data -3)

II. REFLECTIVITY MEASUREMENT
(data REFL)

A. Setup

1. Position one of the rectangular horns in the transmit position indicated in Figure 2.

2. Position the other rectangular horn at the 10 degree position (20° degrees from the transmit horn position measured by triangulation from the sample center point).

3. Position the isolation wall (by experimentation) between the antennas so as to minimize the coupling between the antennas while allowing clear illumination of the panel fixture.

B. Measurement

1. Install metal plate in fixture and collect data for the maximum return angle. (The maximum return angle is determined experimentally by using the positioner and watching the network analyzer display for the largest return).

2. Install Panel -1 in the fixture.

   a) collect data at the maximum return angle.

   b) rotate panel 90° and repeat Step 1.

3. Install Panel -3 in the fixture and repeat Step 2.

C. Move Angle

-Move receive antenna horn 20° to the next position (up to 140° between antennas) and repeat the measurement procedure in B.

III. TRANSMISSIVITY MEASUREMENT - METHOD II
(data TRANS 2)

A. Setup

1. Setup antennas as indicated in the reflectivity measurement description as in Part II.

2. Hang sample panel in string fixture together with the aluminum sheet behind. Attach the two together with tape so that the space between them is minimum.

B. Measurement

1. Position the fixture to illuminate the aluminum side. Collect reference data for the maximum return angle as in Part II.

2. Rotate the fixture 180 degrees and collect data at the maximum return angle for the panel side.

C. Move angle

-Move receive antenna progressively in 20° increments as in Part II and repeat the measurements.

D. Change orientation

-Rotate the panel and metal sheet 90° and repeat procedure.

E. Repeat for Panel -3.

IV. PANEL WITH LIGHTNING STRIPS

A. Setup

-Set up antennas as in Part I: Transmissivity Measurements - Method I

B. Measurement

1. Install Panel -1 at normal incidence angle and collect transmission data.

2. Install lightning strip at center and ±20 inches vertically on panel and repeat measurement.

C. Polarization

-Repeat measurement procedure with both antennas rotated 90°. (data V-pol., H-pol.)

DATA

1. DISCUSSION

The data presented herein are for Part I (Reflectivity), Part II (Transmissivity 1), Part III (Transmissivity 2) and Part IV. All measurements were made over 1300 - 1800 Mhz.

Reflectivity data was measured as discussed above. Presented here are the processed results obtained by dividing linear scale panel reflection by aluminum panel reflection. In addition, a 8ns window equivalent time domain gating was applied to remove unwanted signal interactions.

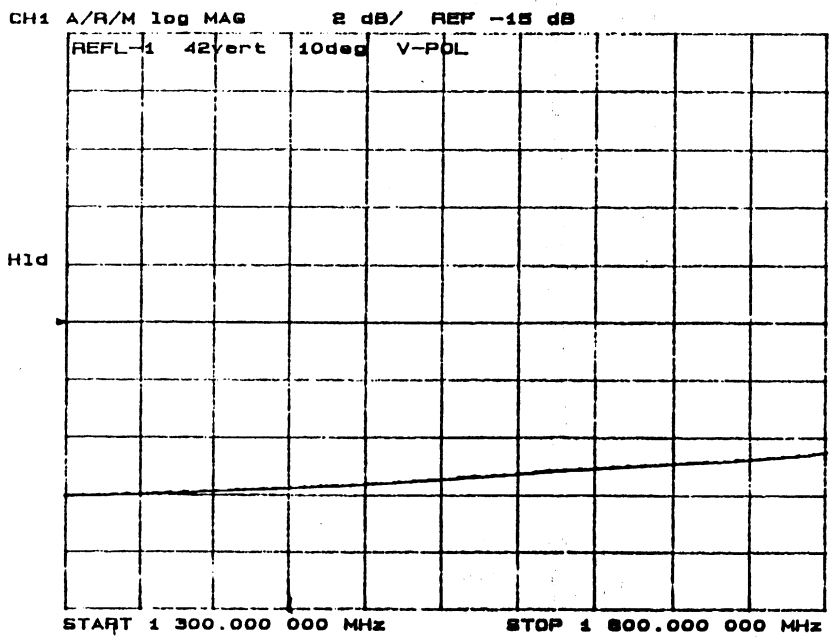
The processed Transmissivity 1 results were obtained by dividing panel transmission by free space (no panel) measurement. Again, 8ns gating was applied.

The Transmissivity 2 data was first processed by dividing the panel measurement (panel and aluminum) by the aluminum panel measurement. Gating was also applied. This (reduced) data, contained a combination of transmissivity and reflectivity, and needed further data processing to extract the individual parameters. This data was taken to provide alternative measurements, in case discrepancies or questions arise on reflectivity and transmissivity data. Using equation (3) of Appendix C the data was reduced to give the transmissivity results.

The data for the panel with the lightning strips was processed by dividing the panel measurement with the strips installed by the panel measurement without the strips. Gating was used as before.

DATA INDEX

MEASUREMENT TYPE	ORIENTATION	PLOT PAGES	DATA PAGES
REFL -1	42	10	35
	48	12	37
TRANS 1-1	42	14	39
	48	16	41
REFL -3	42	18	43
	48	20	45
TRANS 1-3	42	22	47
	48	24	49
TRANS 2 1	42	26	51
	48	28	53
TRANS 2-3	42	30	55
	48	32	57
TRANS 1-1 (Dot - Dot)	V-pol. H-pol.	34	59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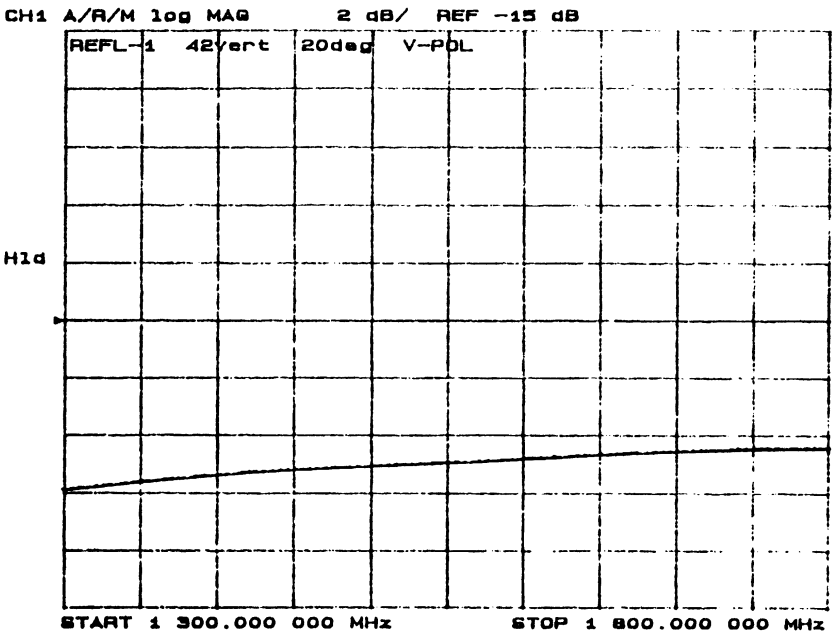
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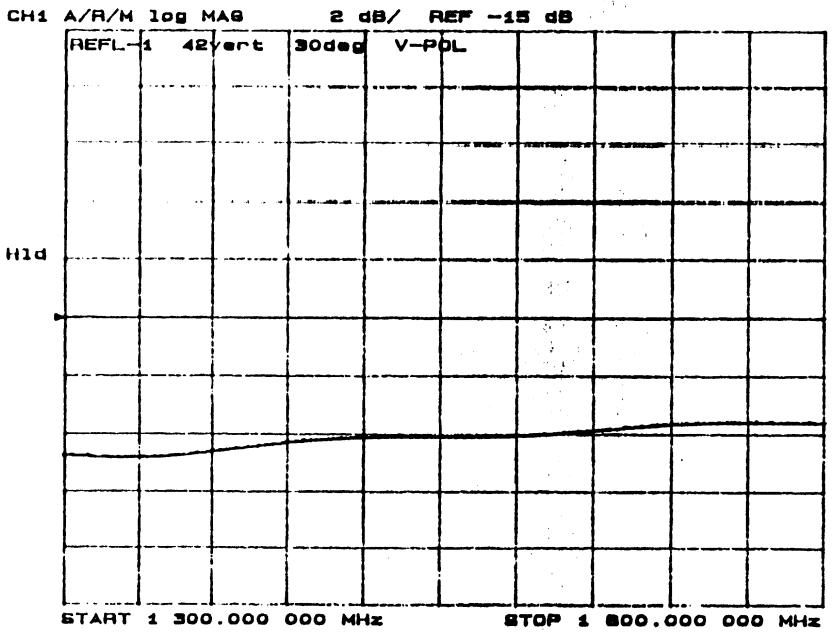
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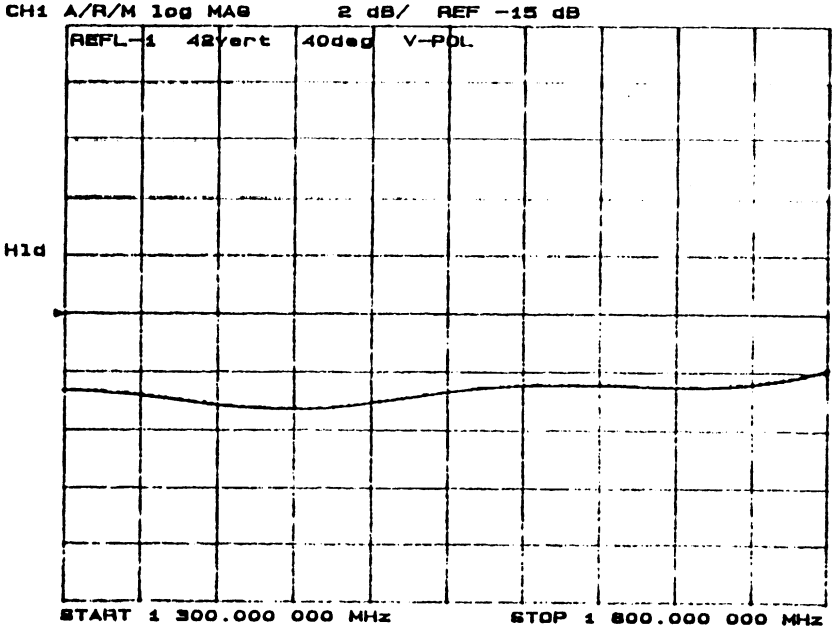
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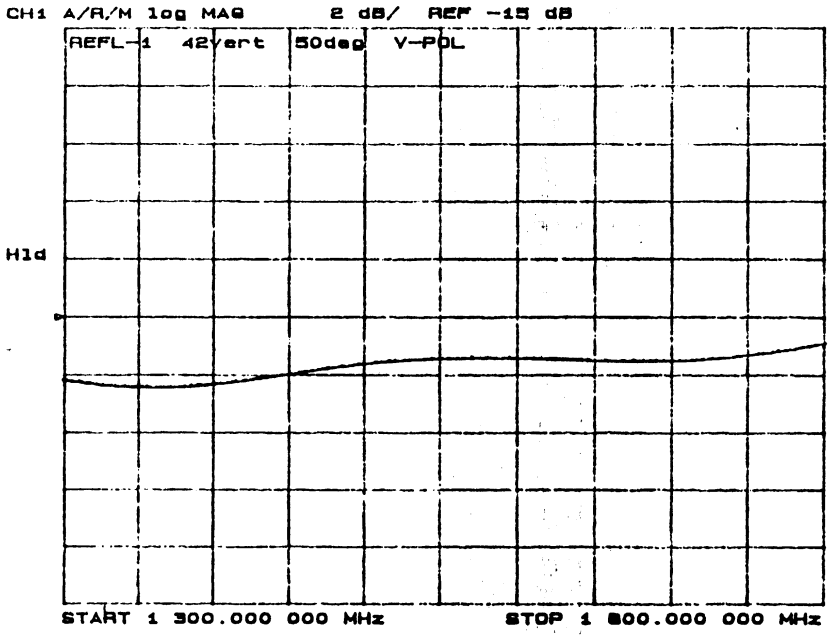
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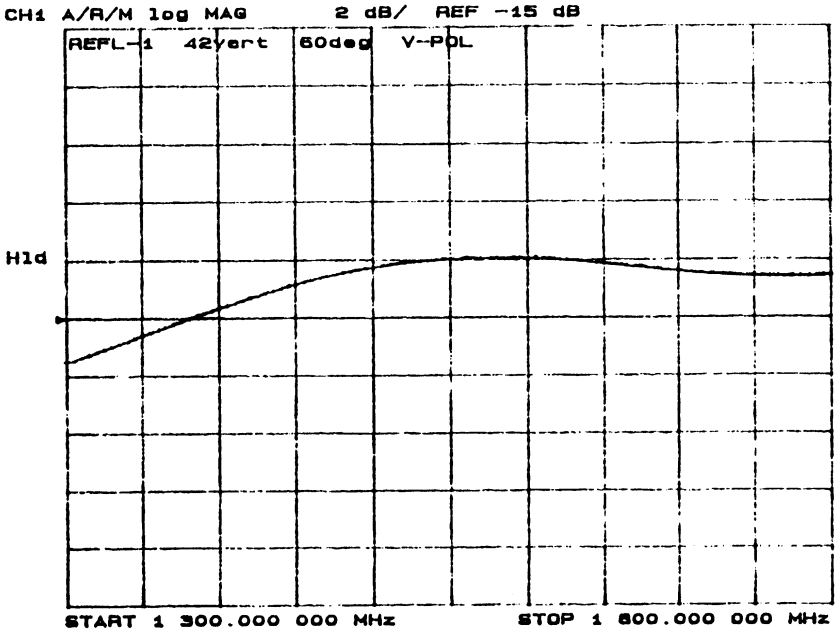
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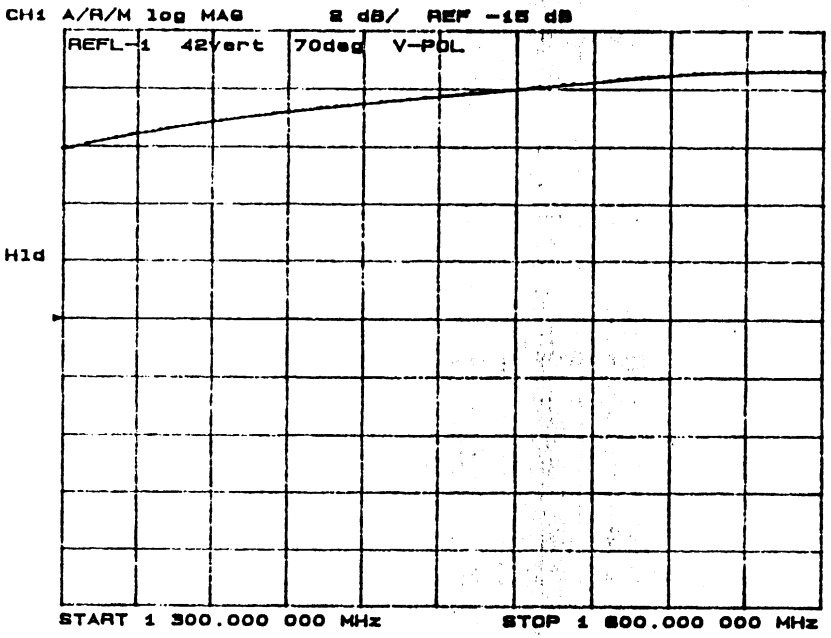
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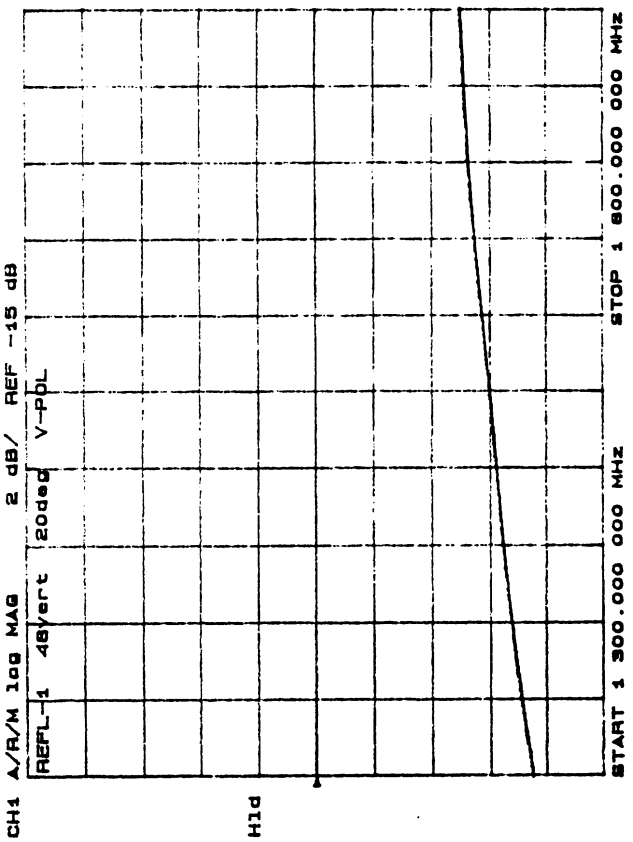
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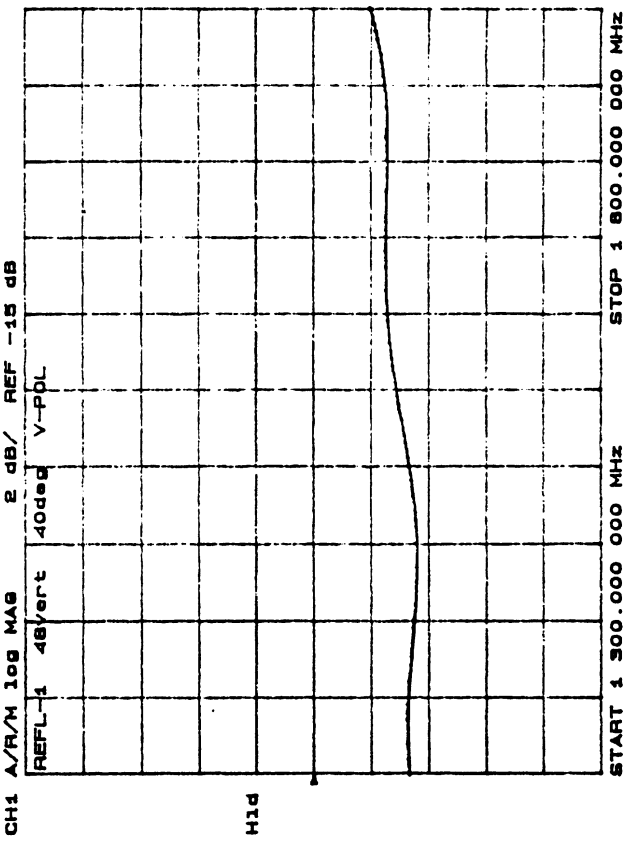
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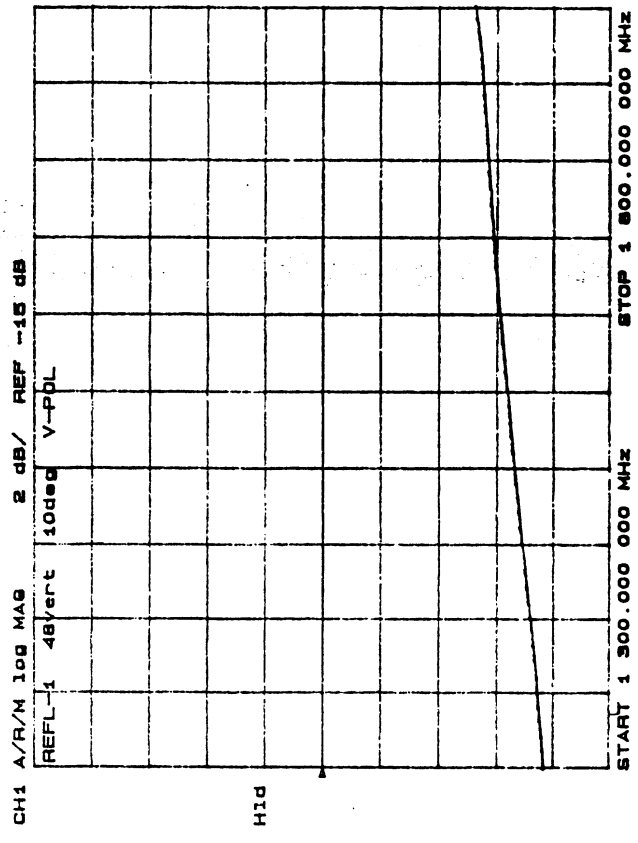
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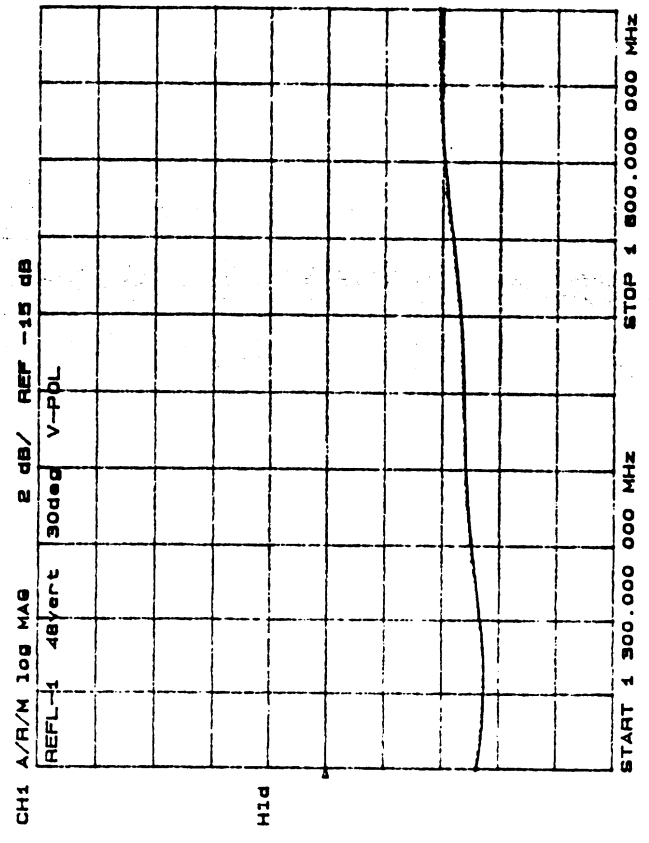
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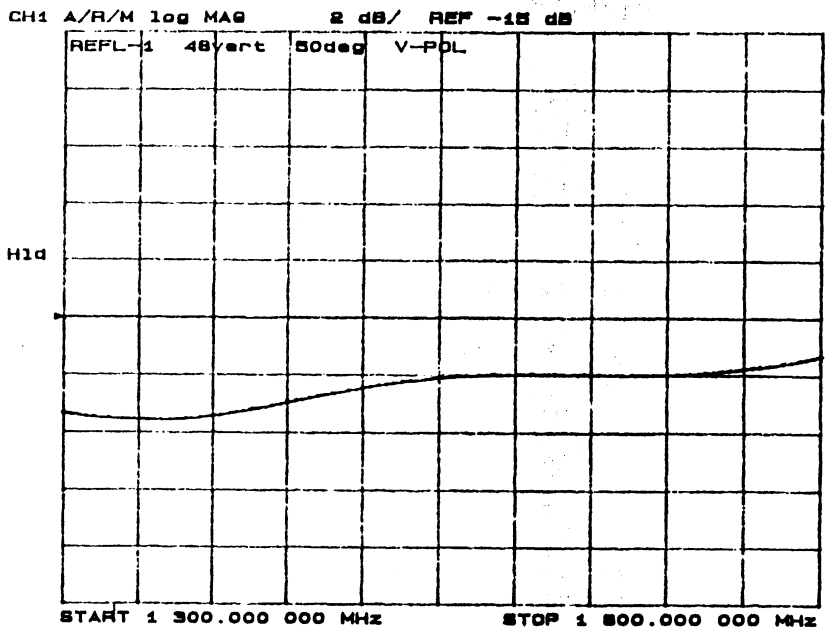
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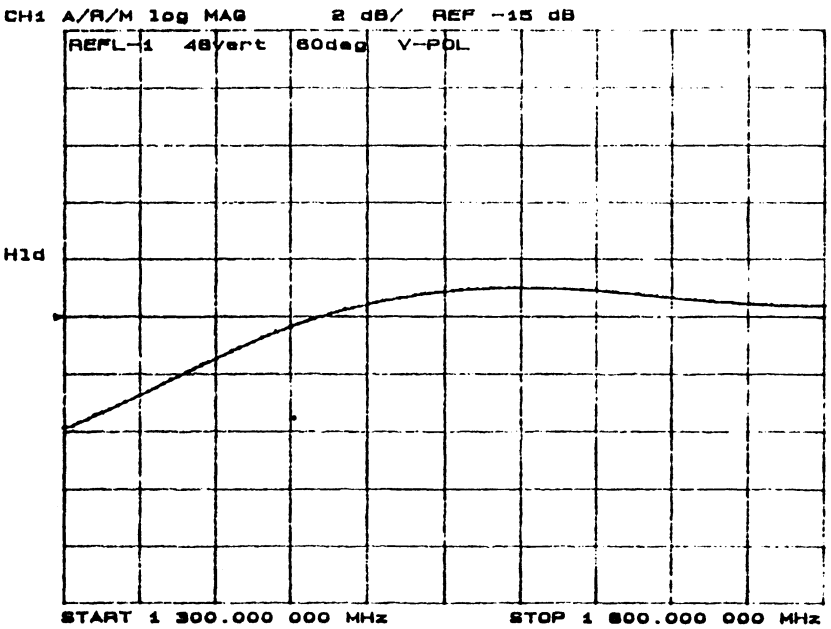
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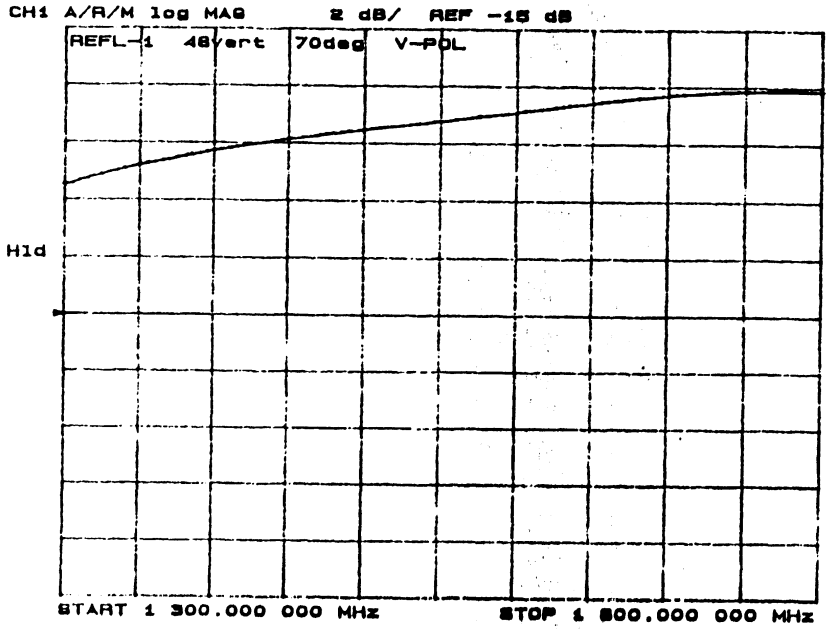
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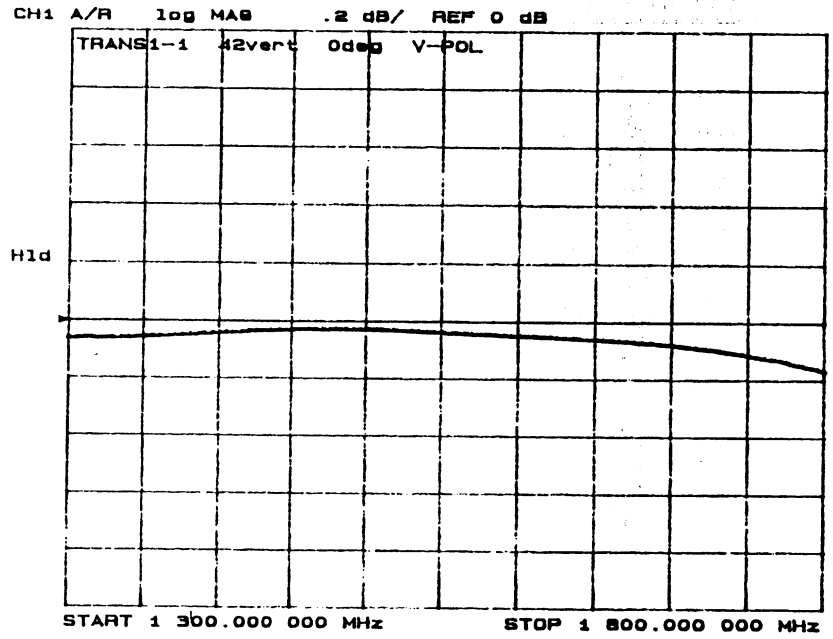
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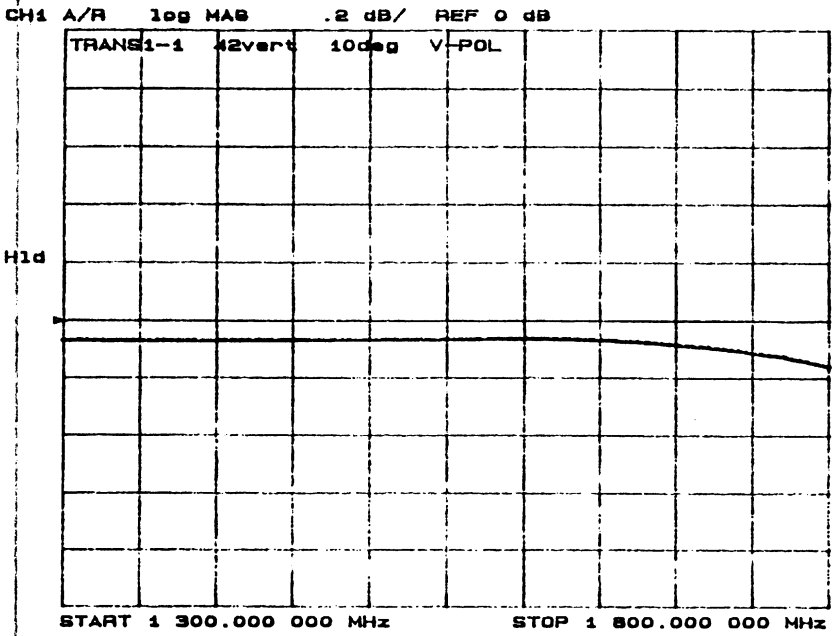
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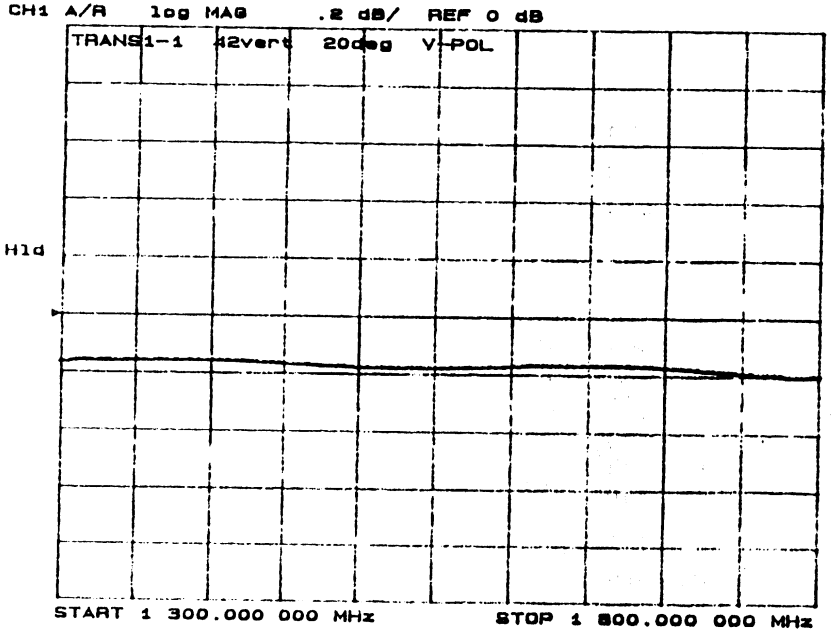
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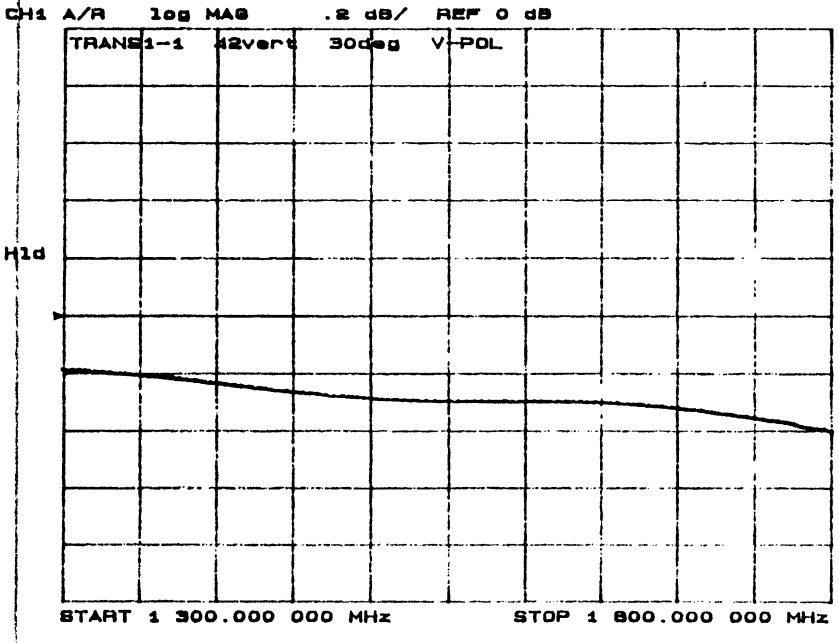
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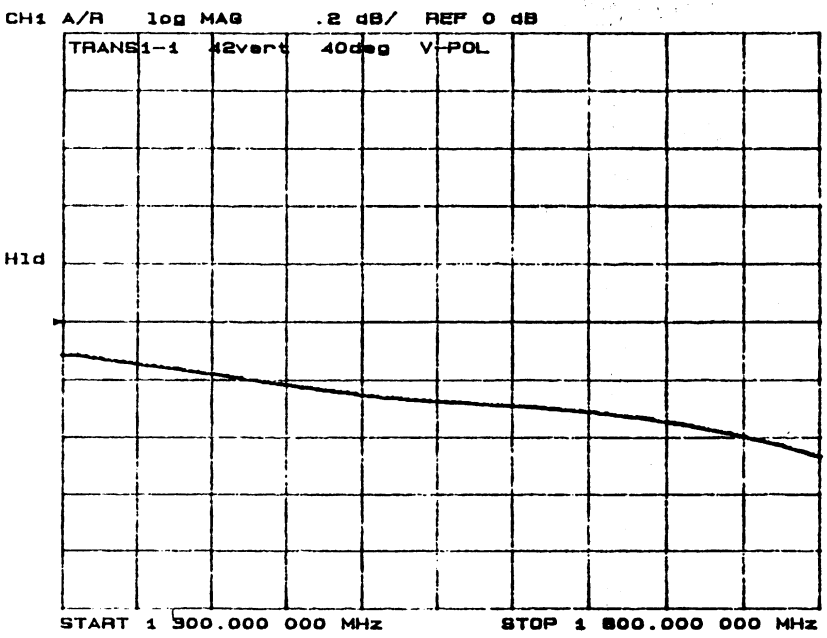
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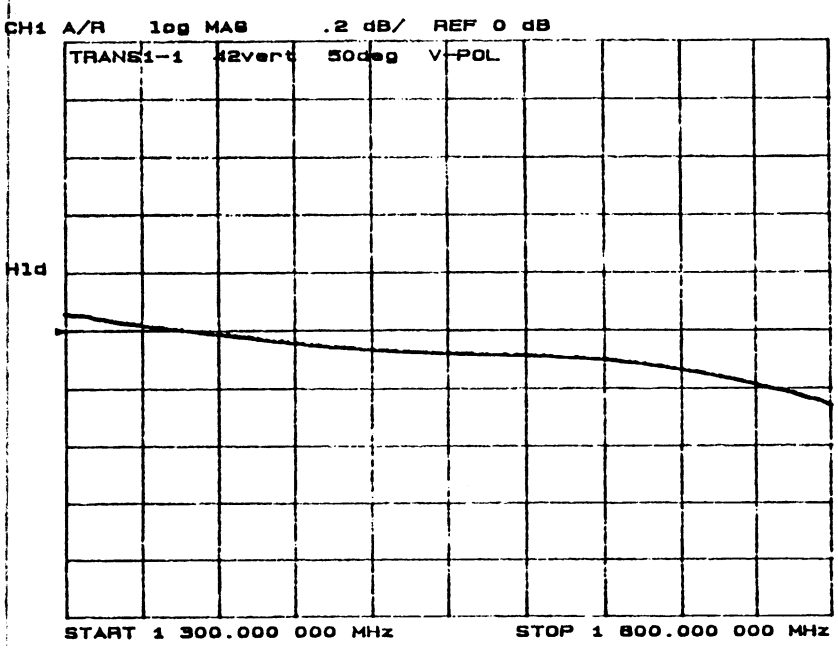
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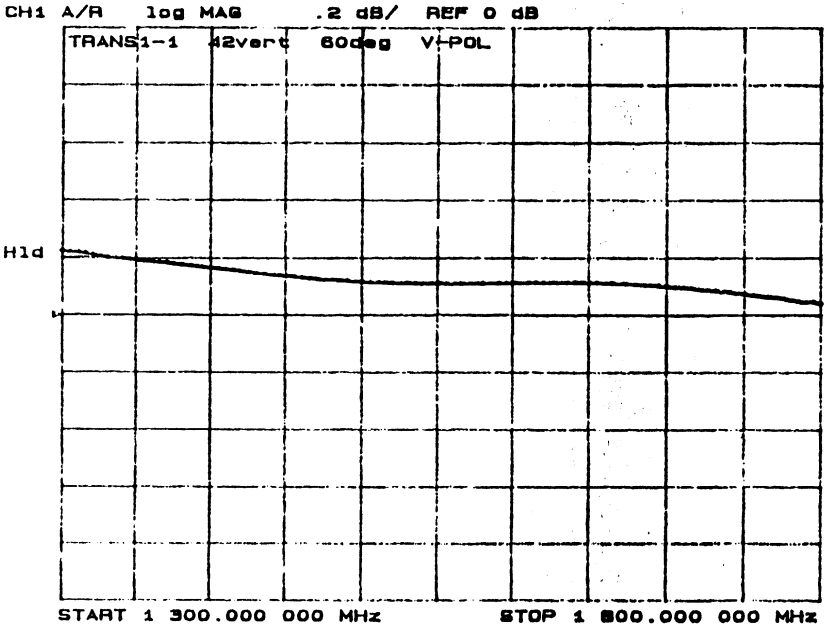
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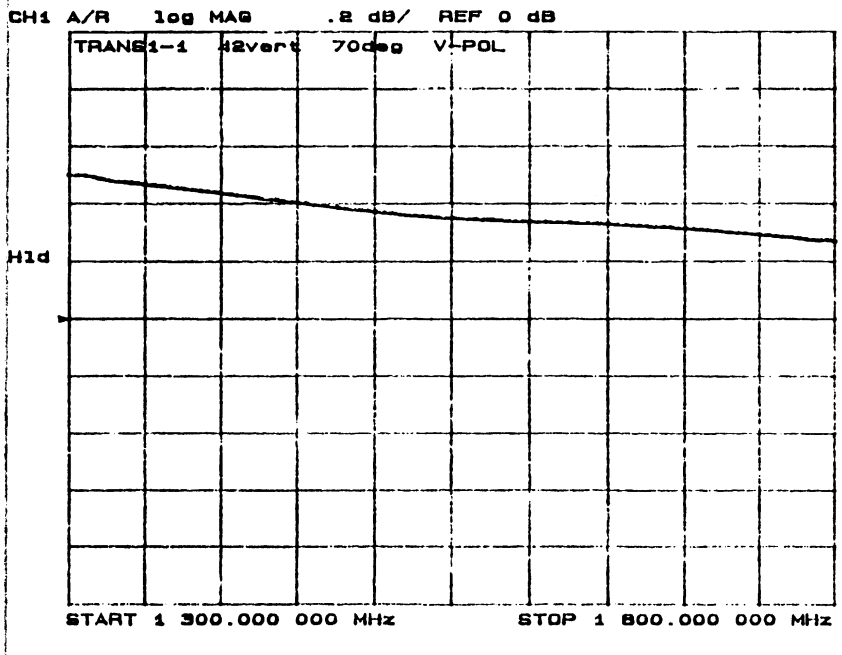
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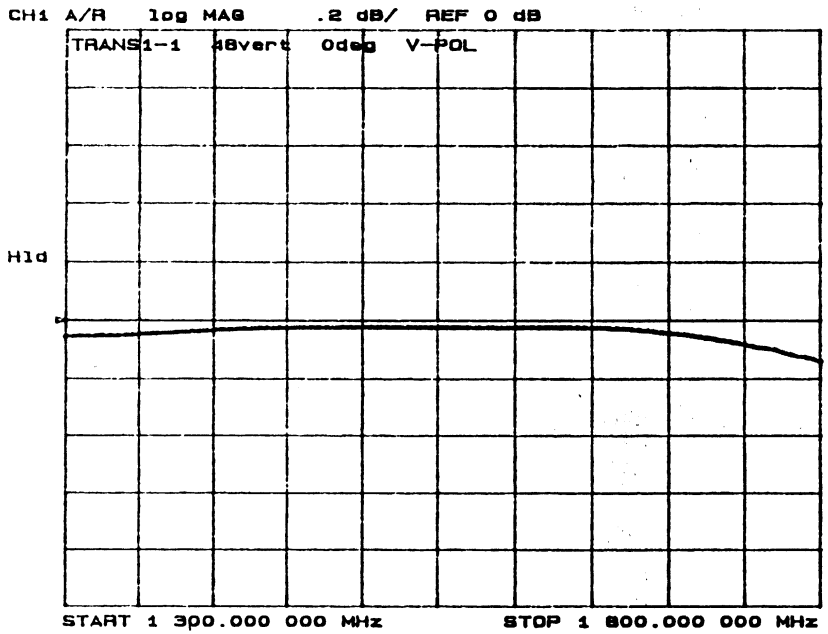
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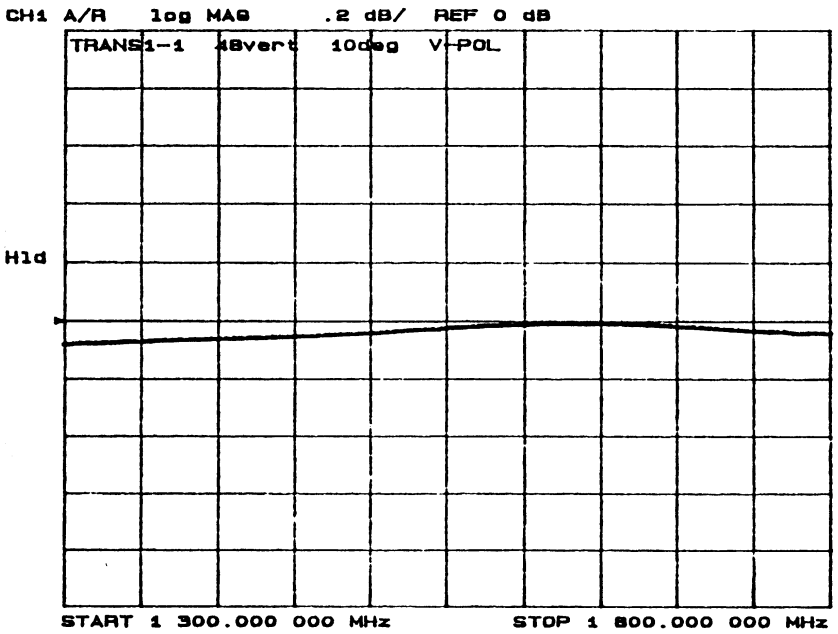
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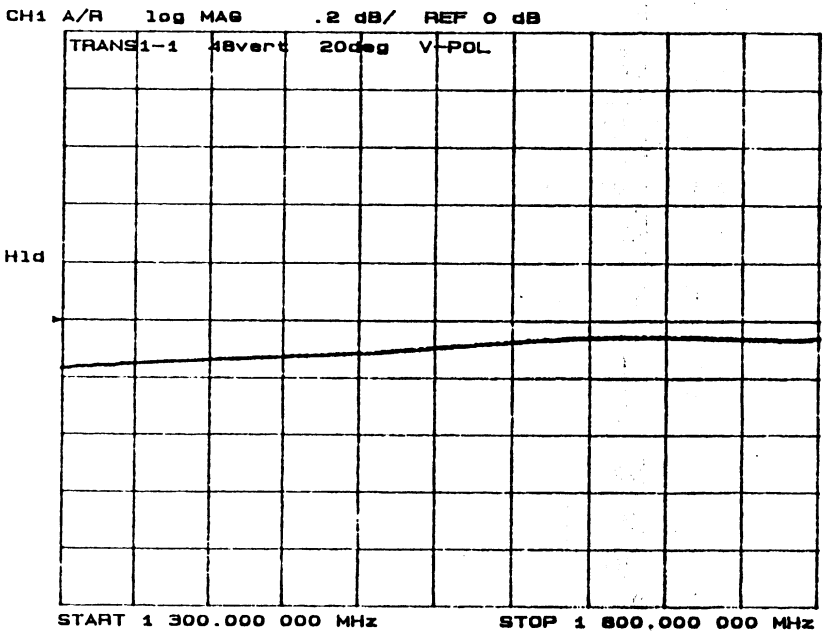
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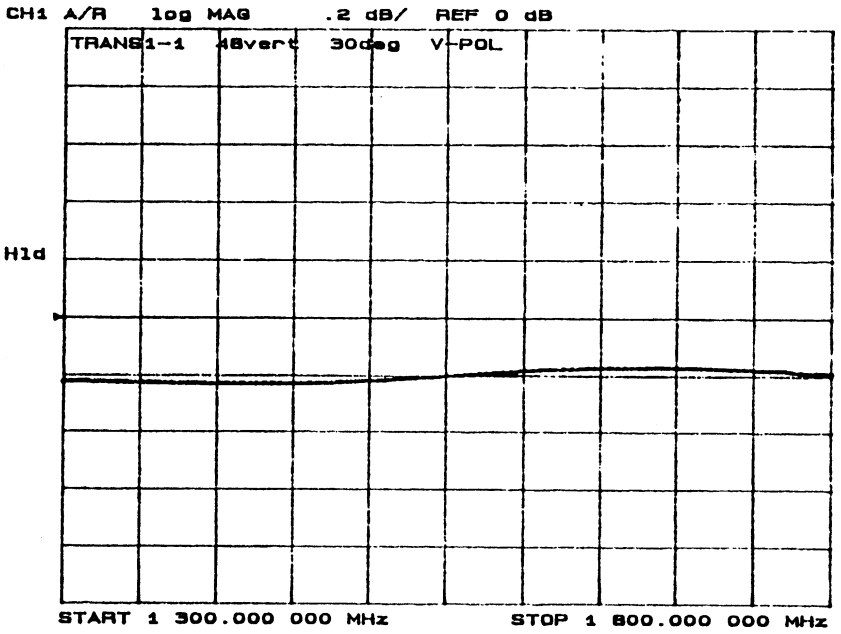
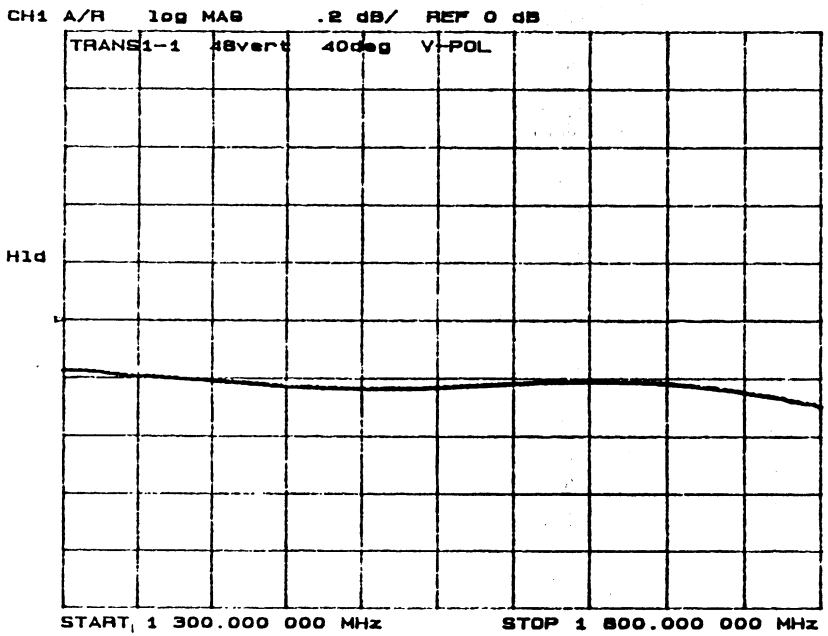
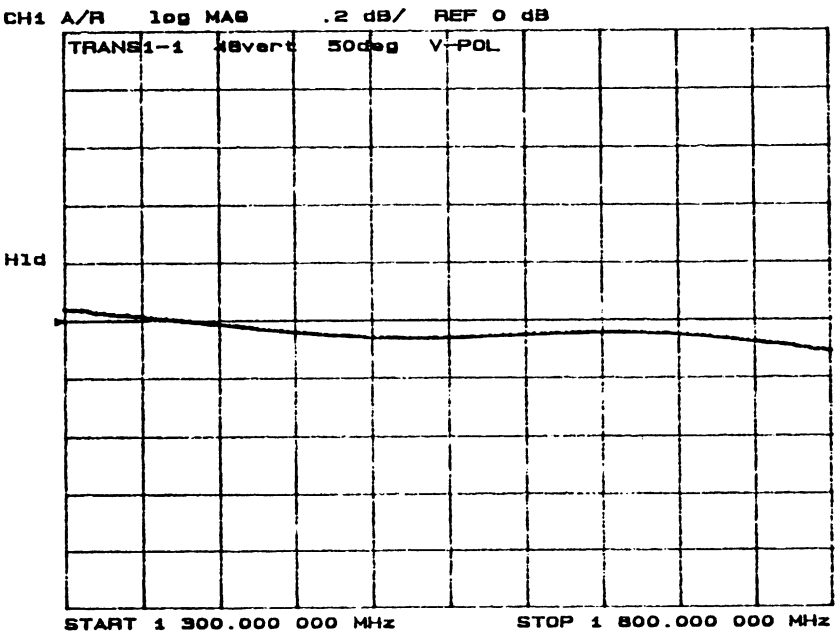

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS 1-1 48vert 30deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS 1-1 48vert 40deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS 1-1 48vert 50deg V-POL
Hld
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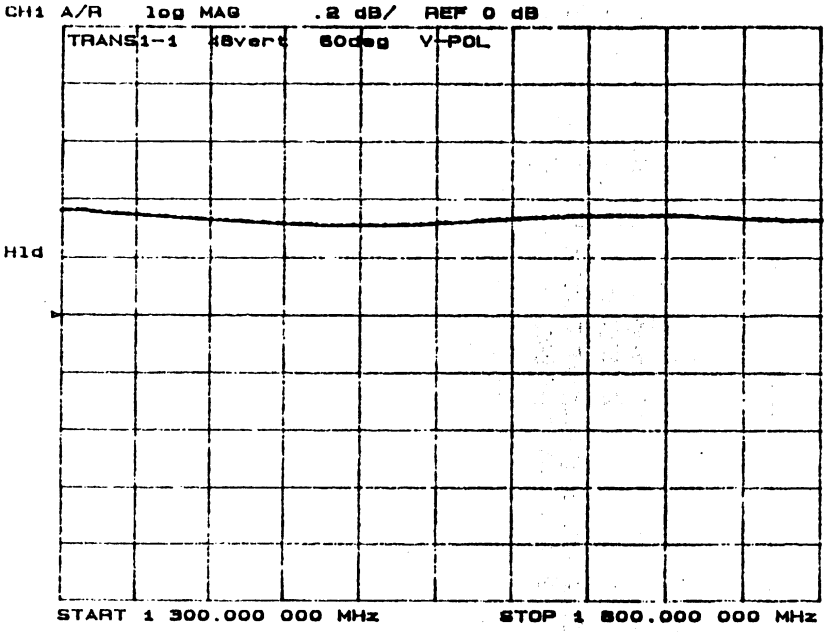
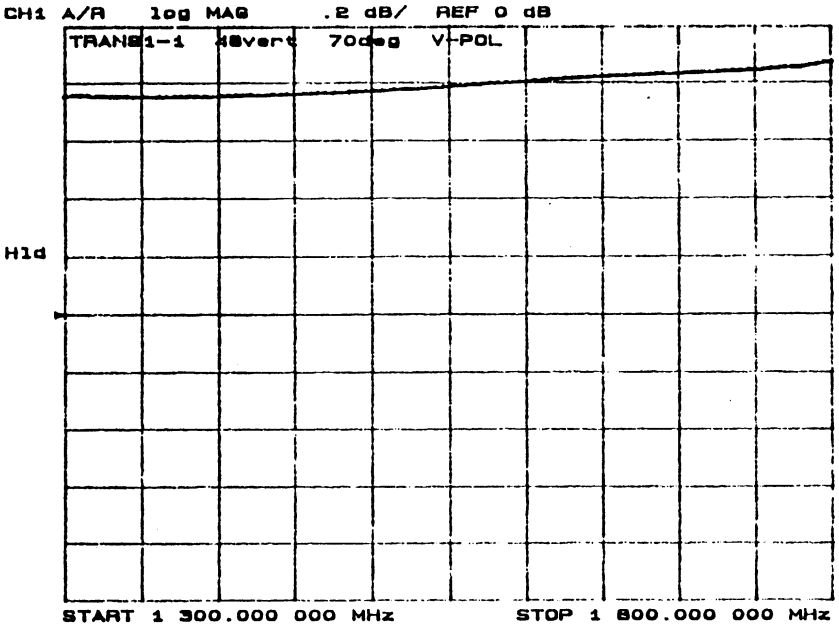
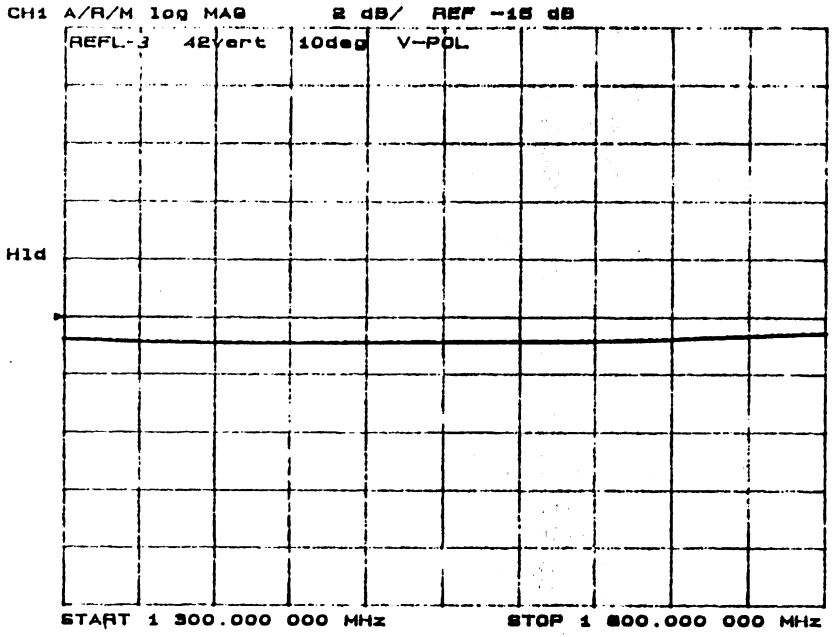
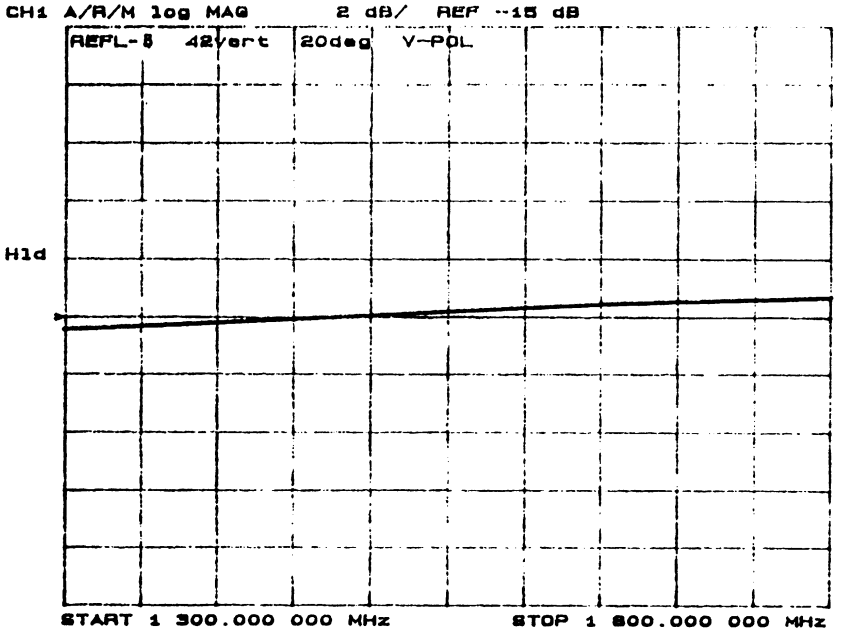
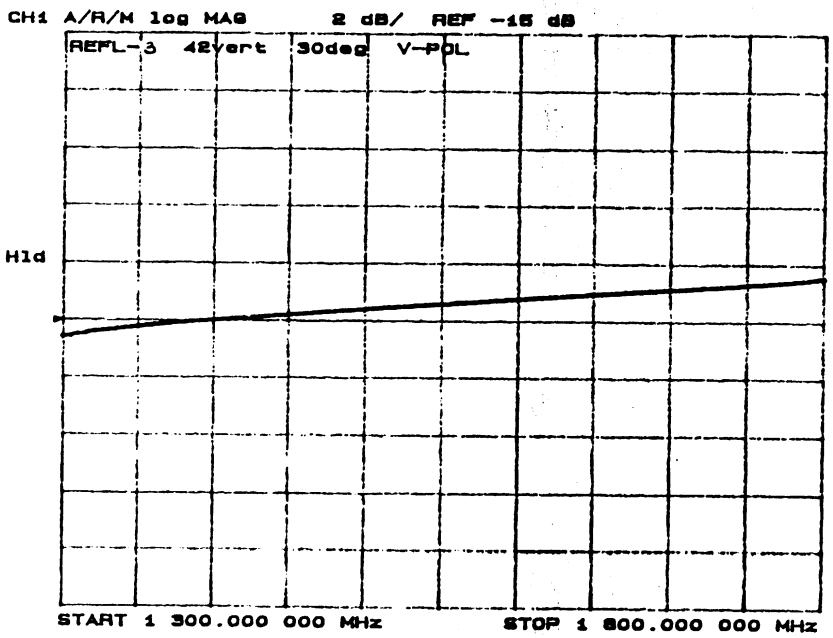
STOP 1 800.000 000 MHz

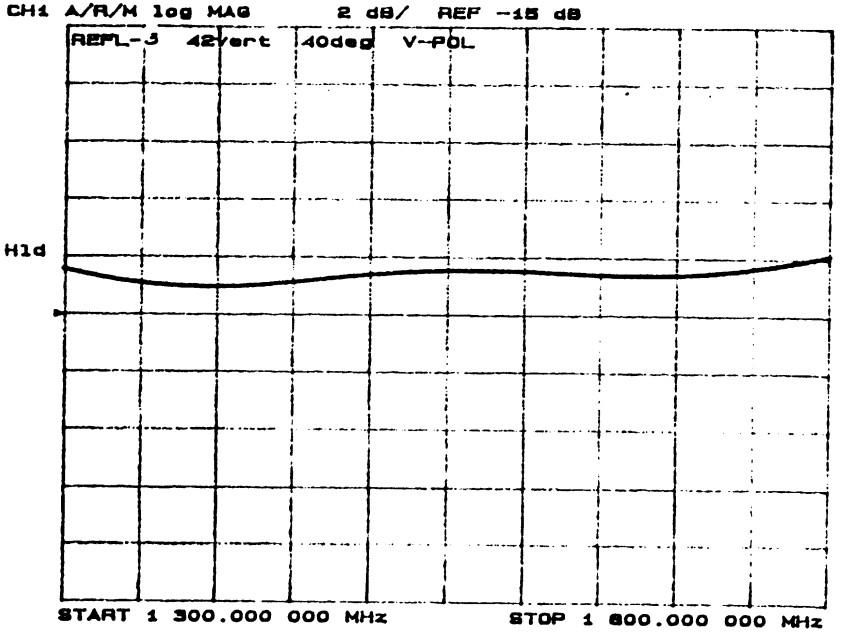

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS 1-1 48vert 60deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

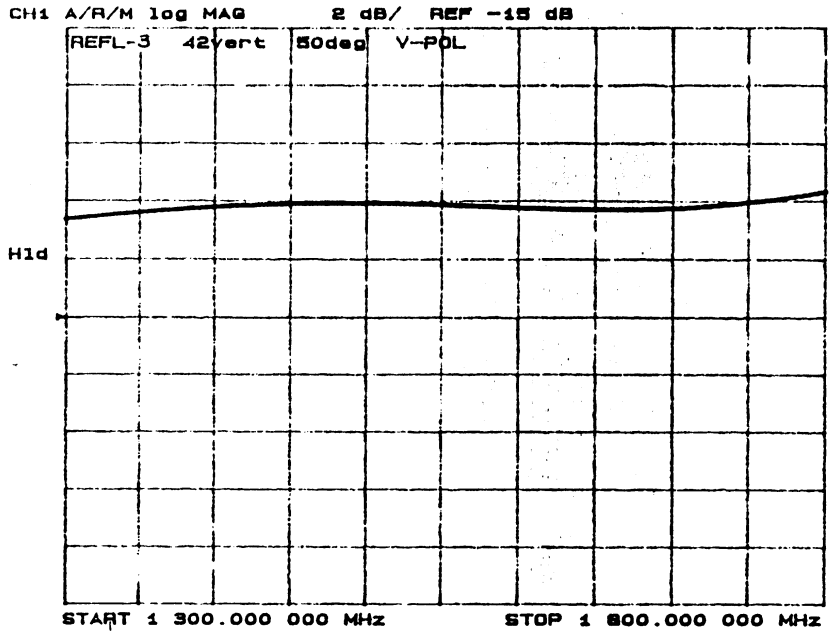

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS 1-1 48vert 70deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

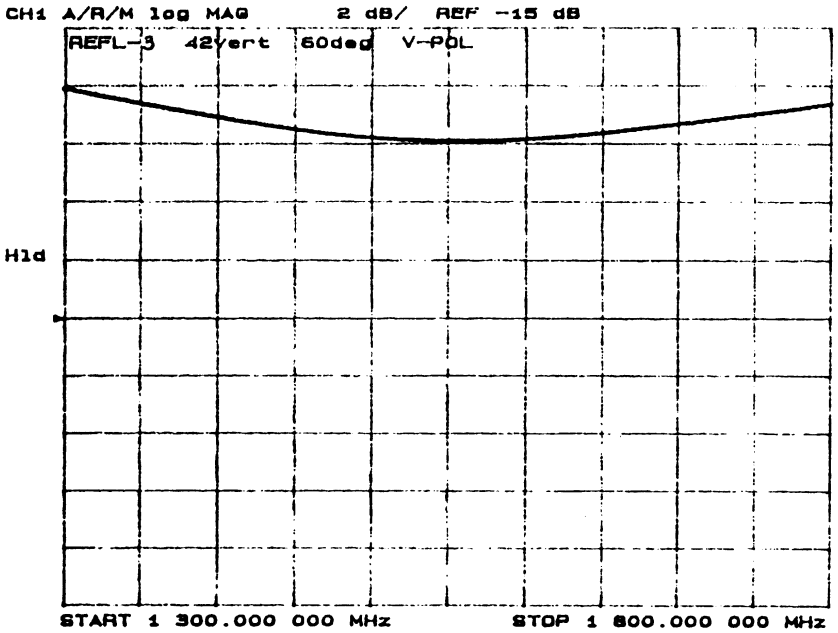

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 10deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

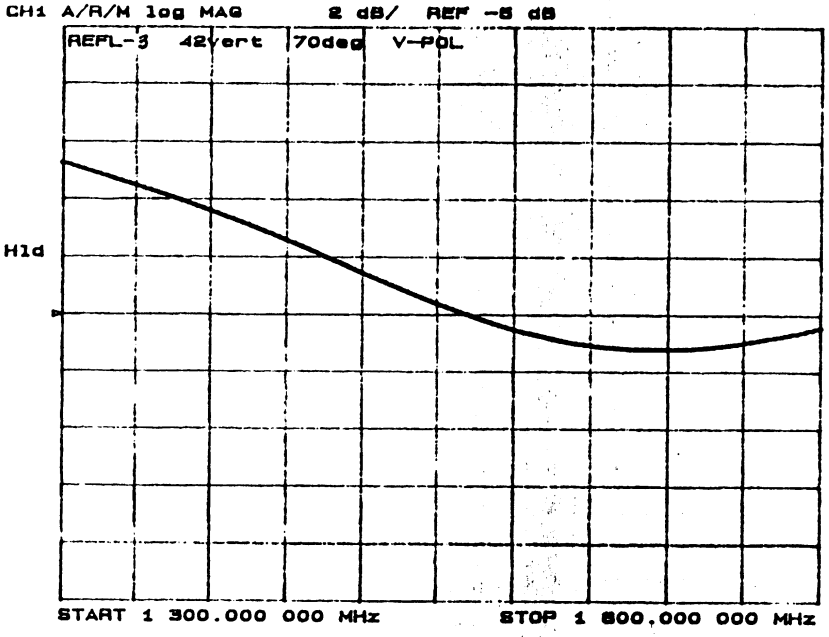

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 20deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

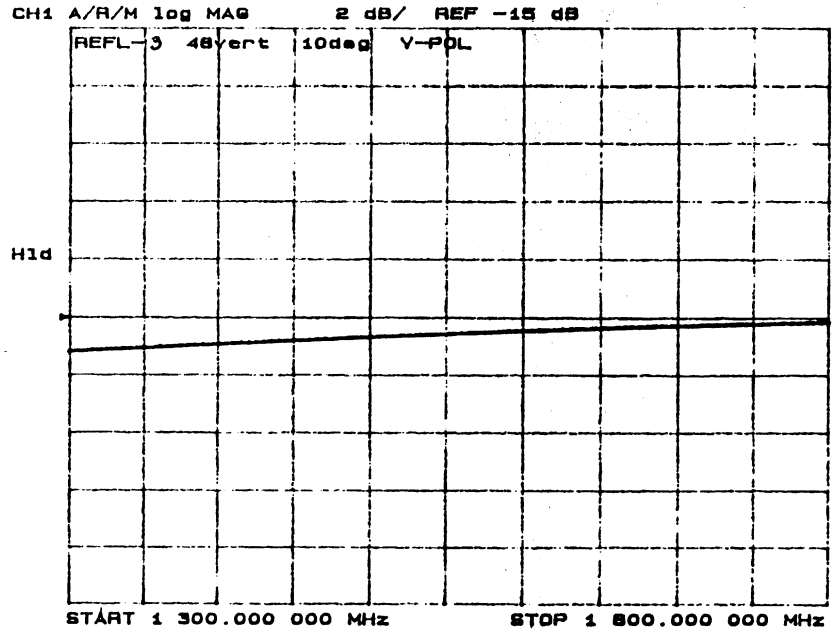

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 30deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

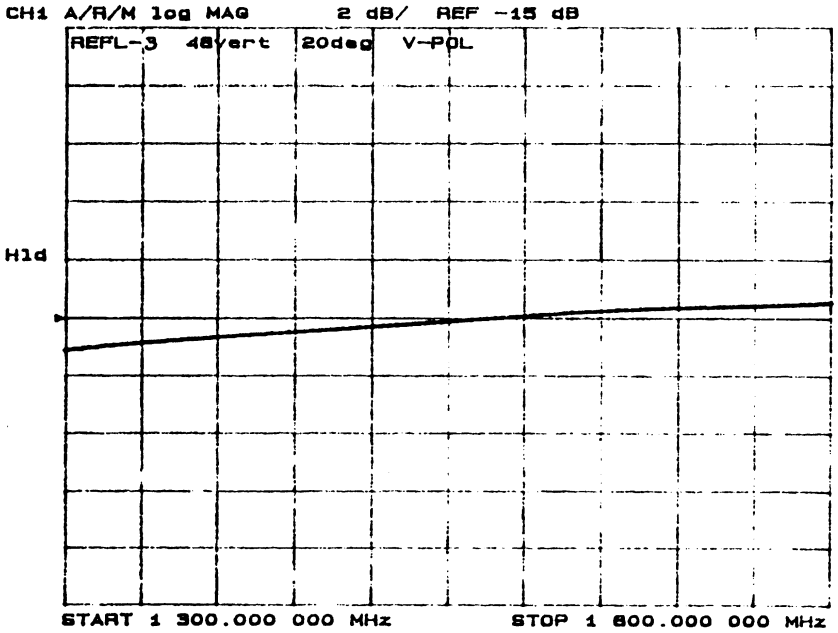

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 40deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

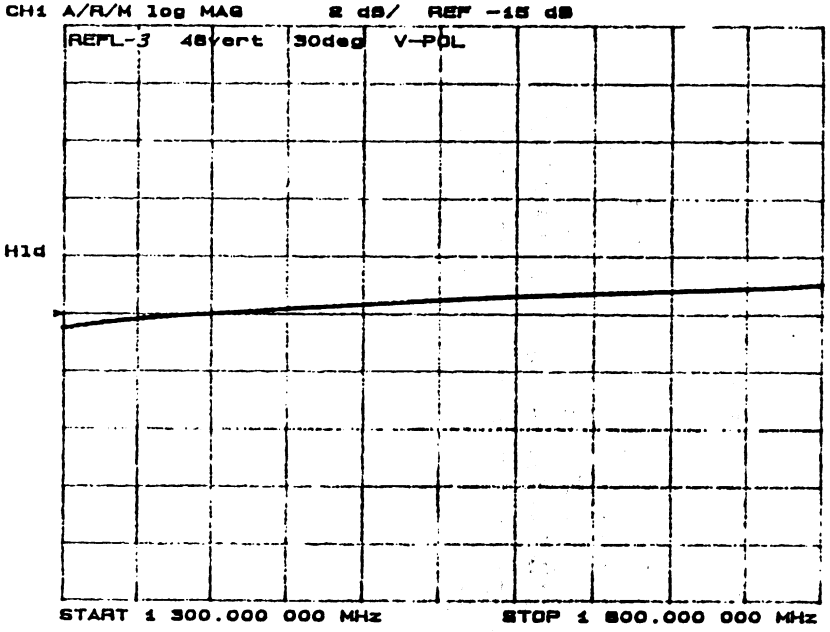

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 50deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

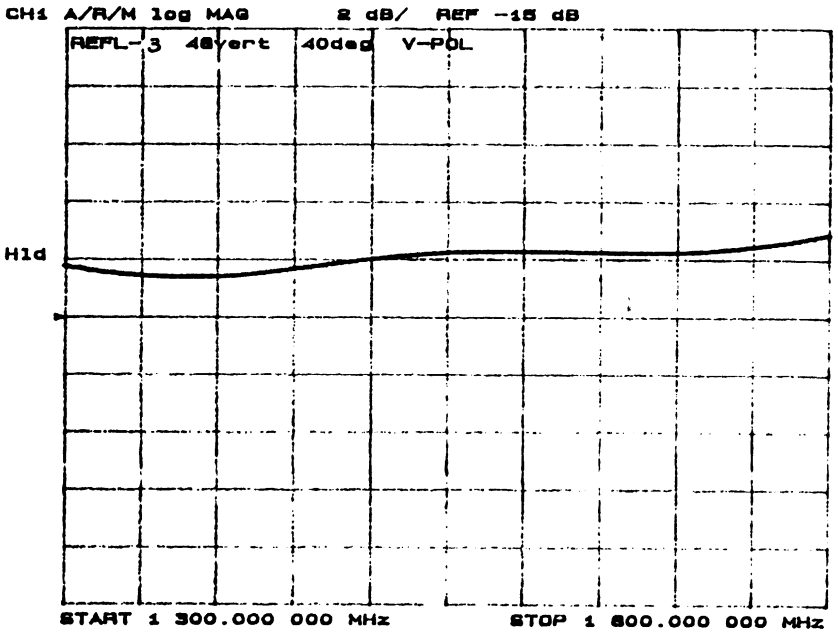

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 42vert 60deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

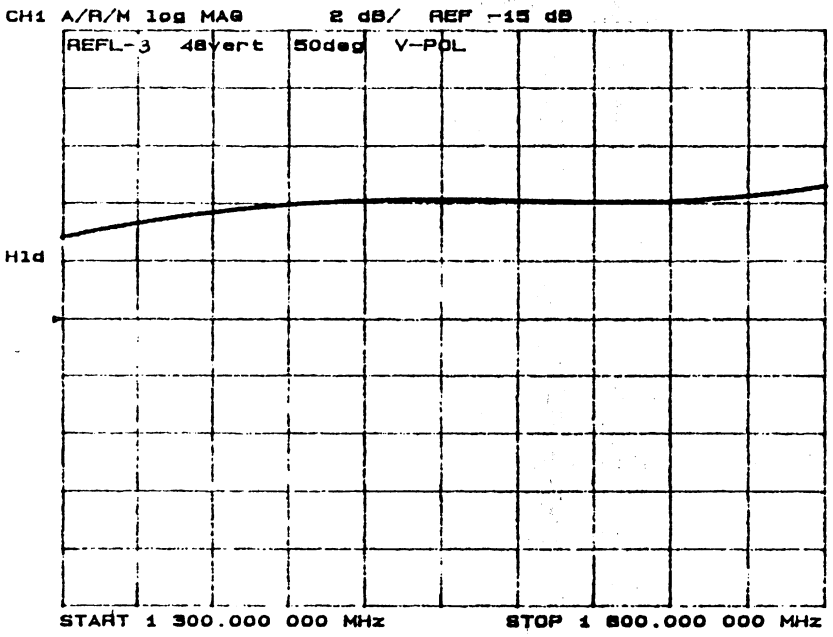

CH1 A/R/M log MAG 2 dB/ REF -6 dB
REFL-3 42vert 70deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

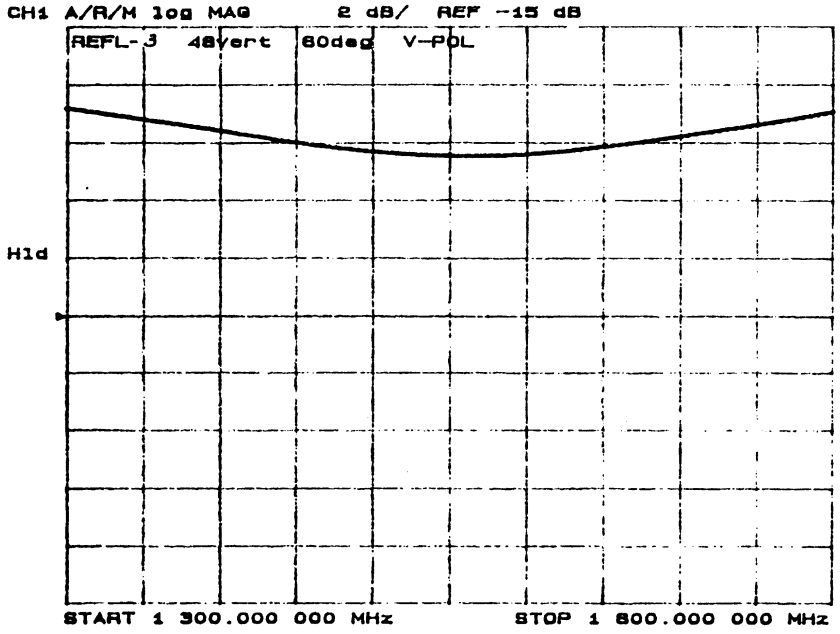

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 10deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

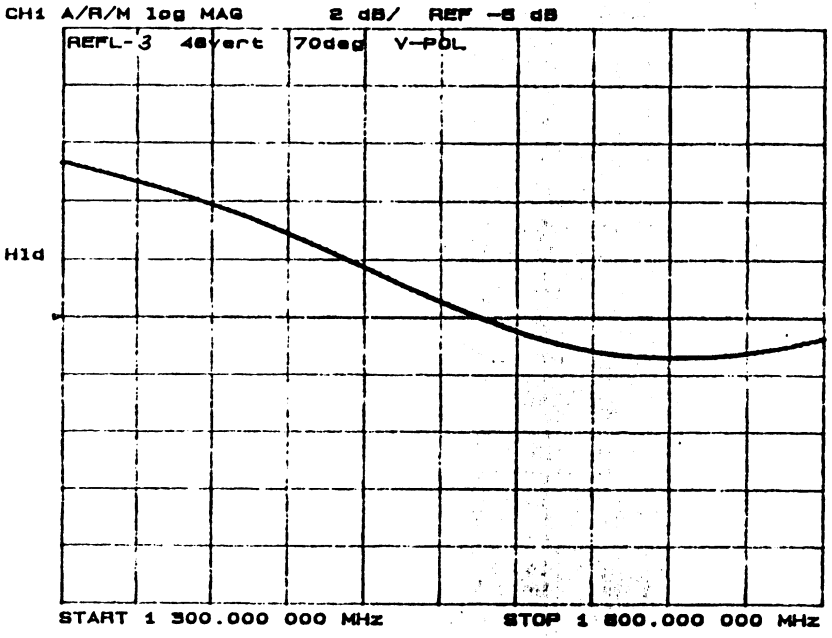

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 20deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

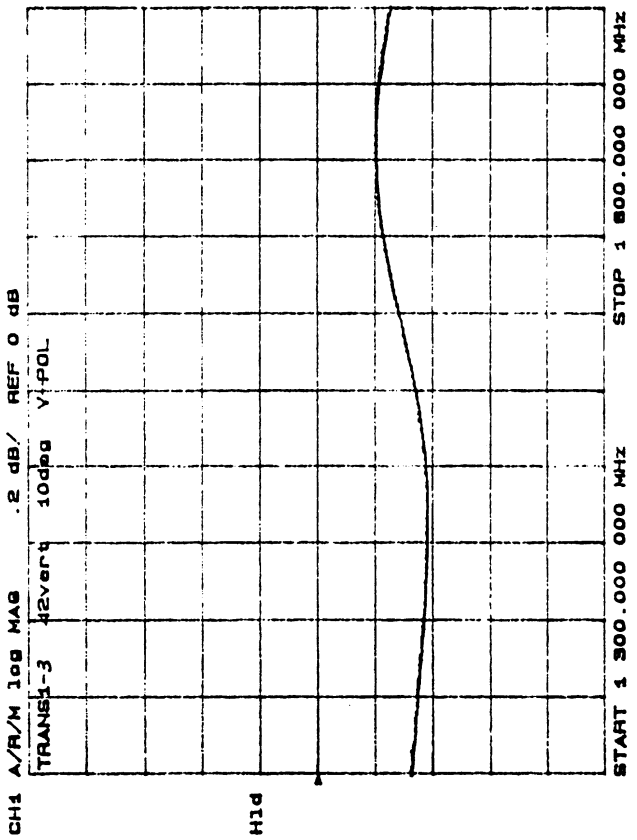

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 30deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

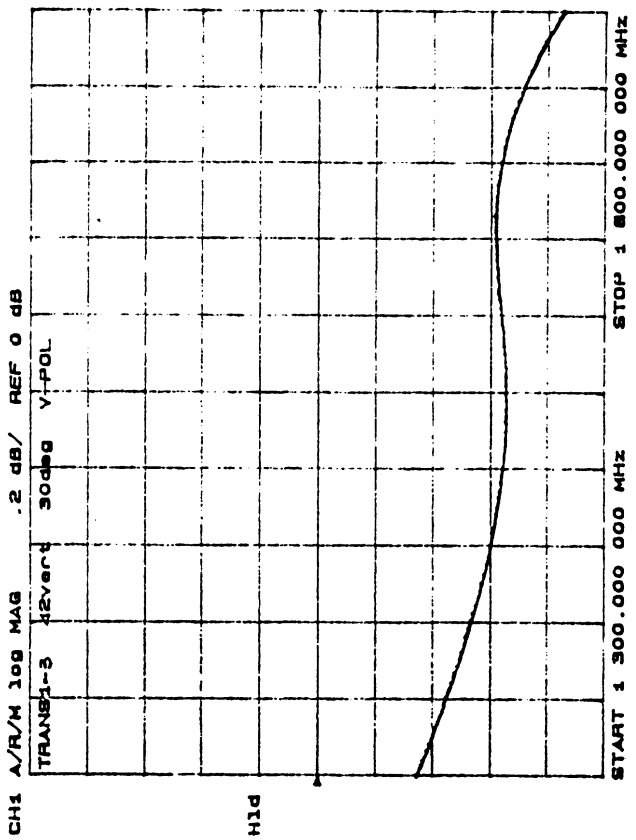

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 40deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

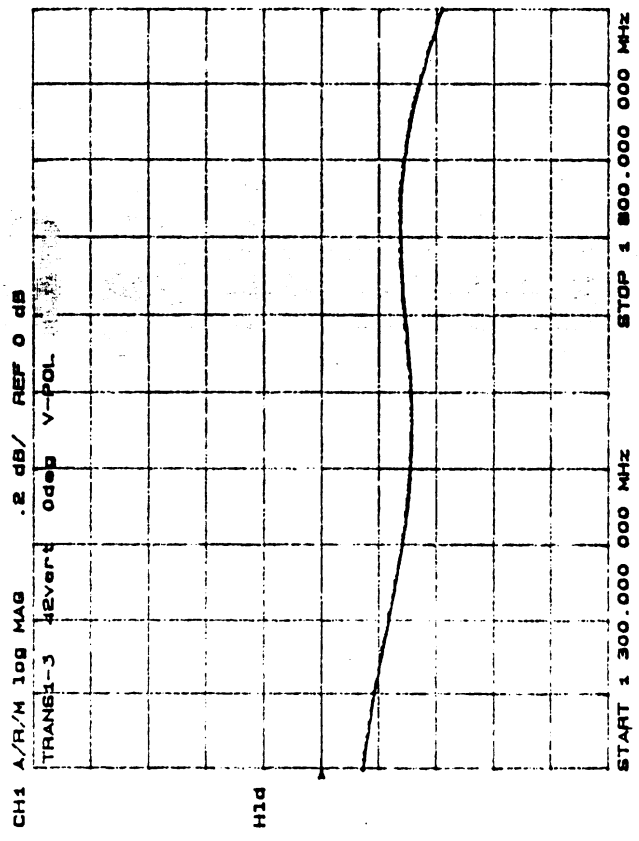

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 50deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

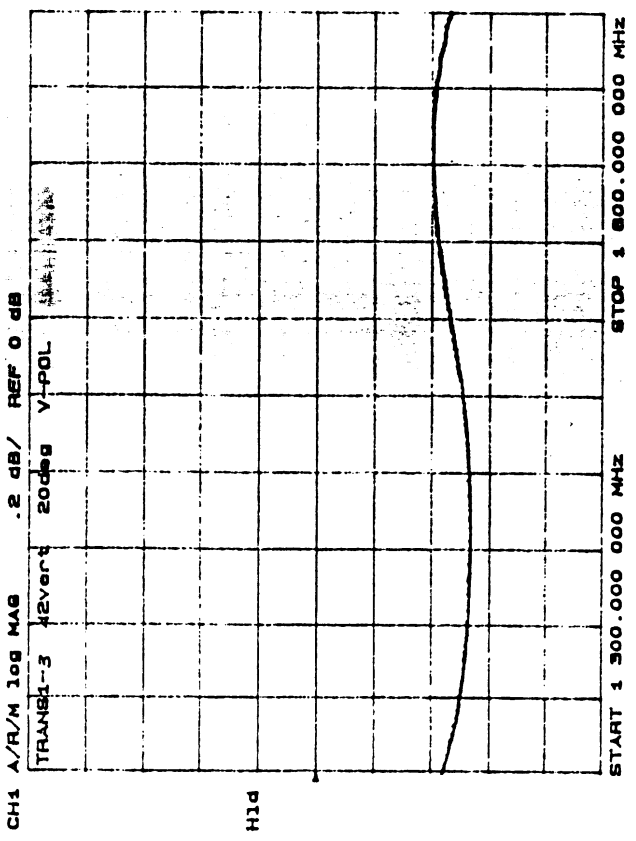

CH1 A/R/M log MAG 2 dB/ REF -15 dB
REFL-3 48vert 60deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

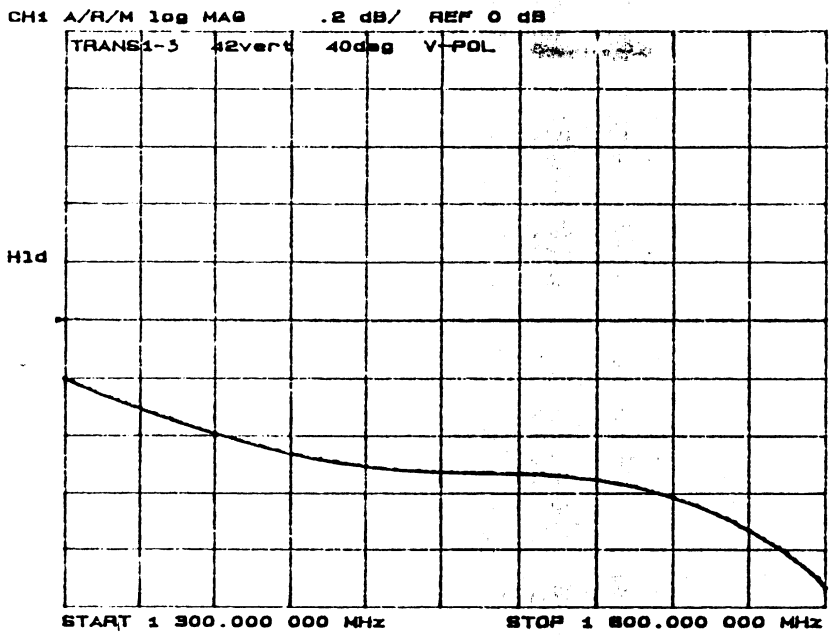

CH1 A/R/M log MAG 2 dB/ REF -8 dB
REFL-3 48vert 70deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

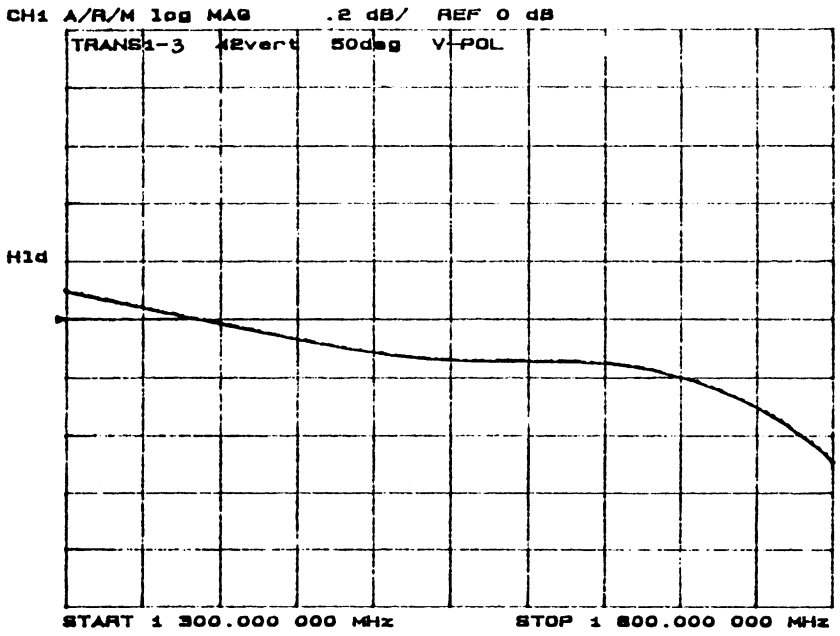

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 10deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

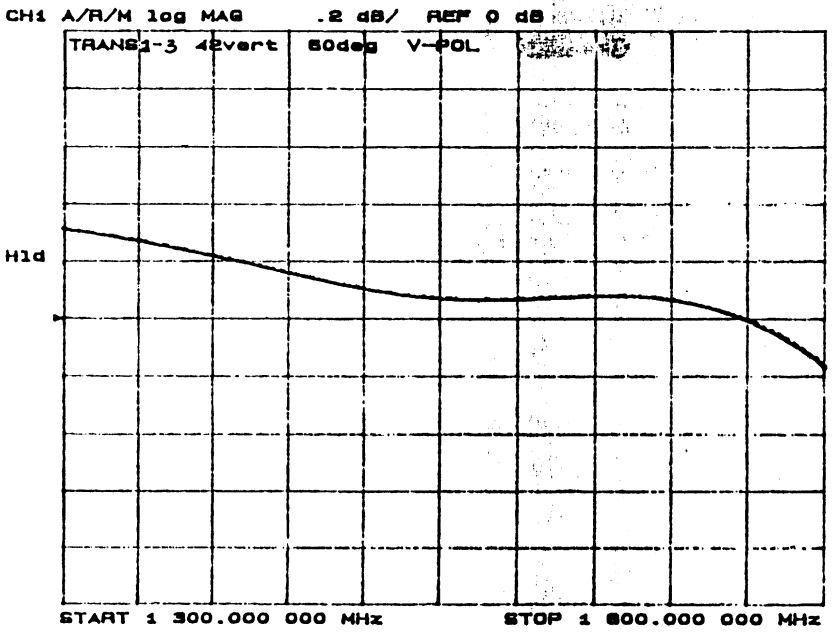

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 30deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

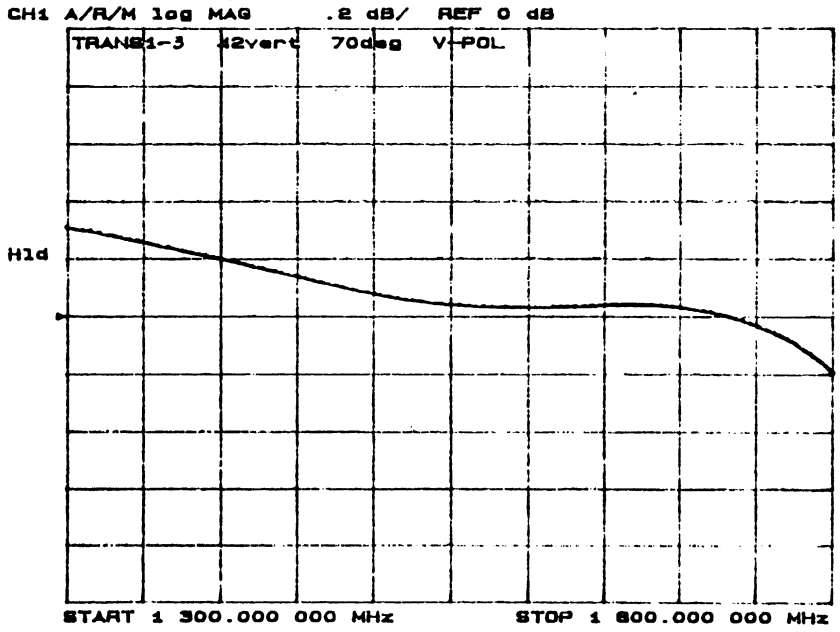

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 0deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 20deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 40deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 50deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 60deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 42vert 70deg V-POL
H1d
START 1 300.000 000 MHz
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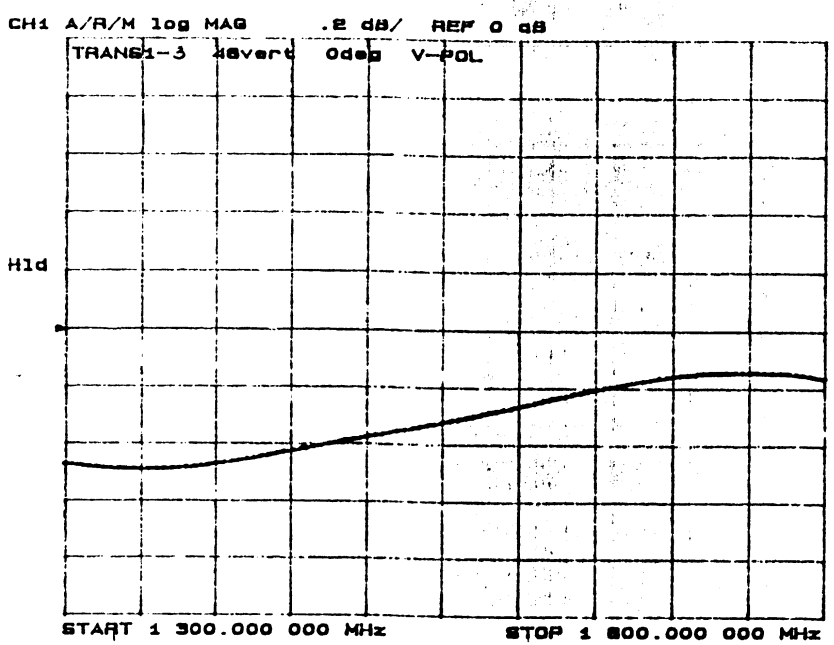
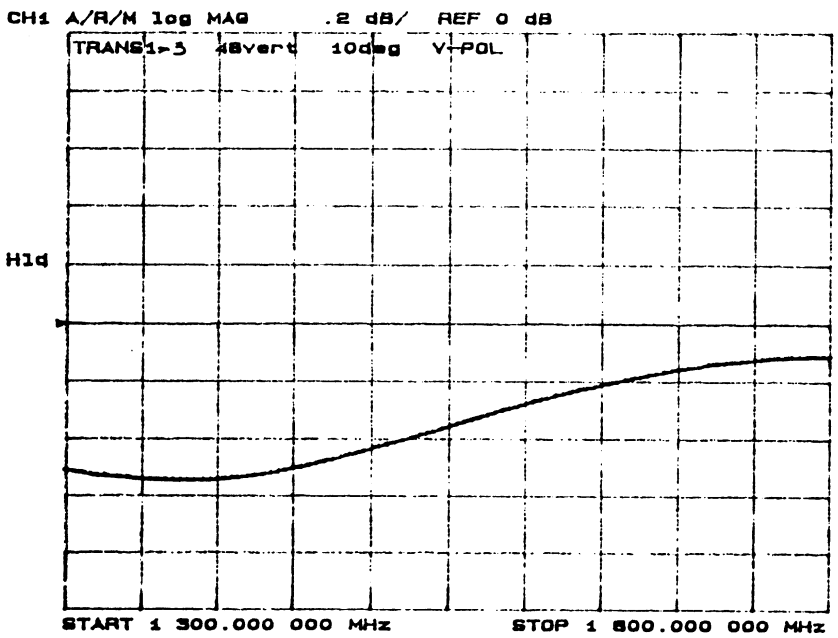
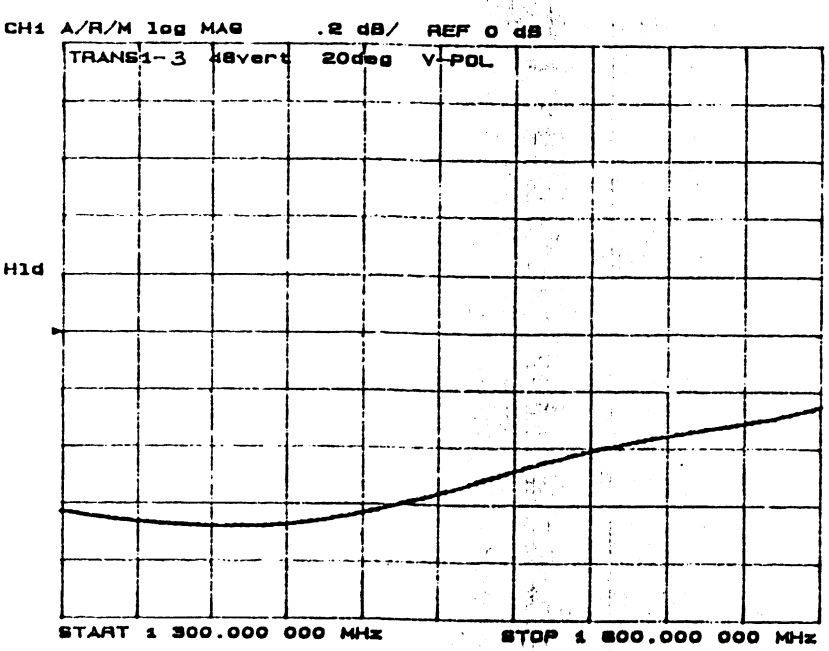
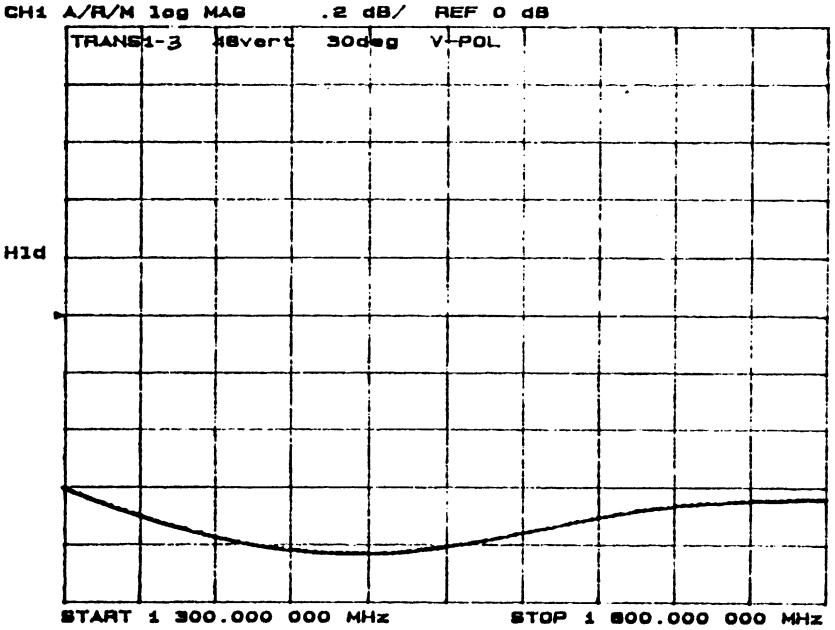
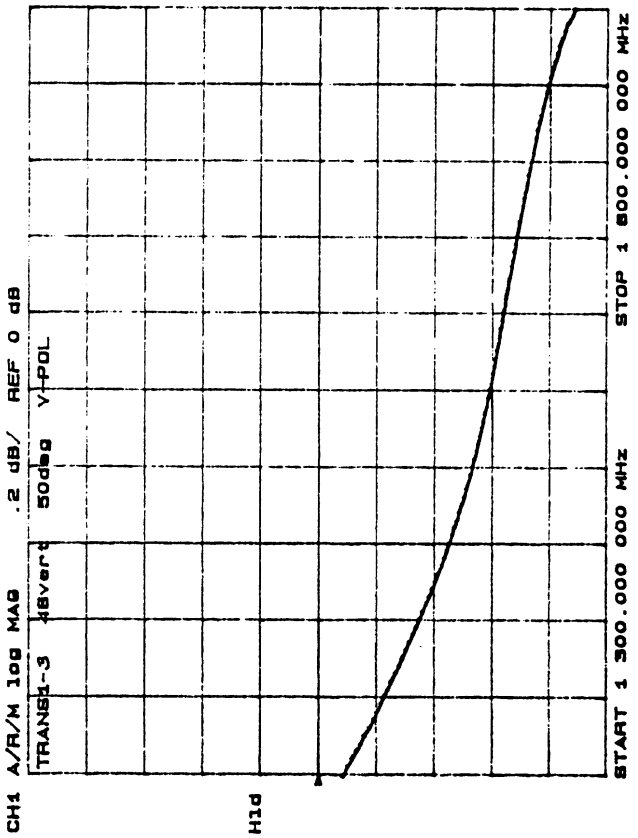
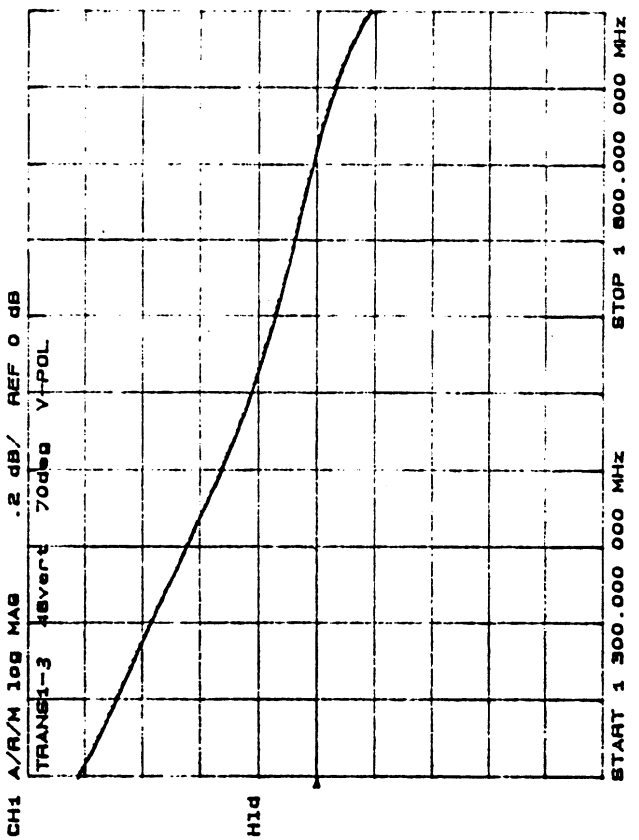

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 0deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

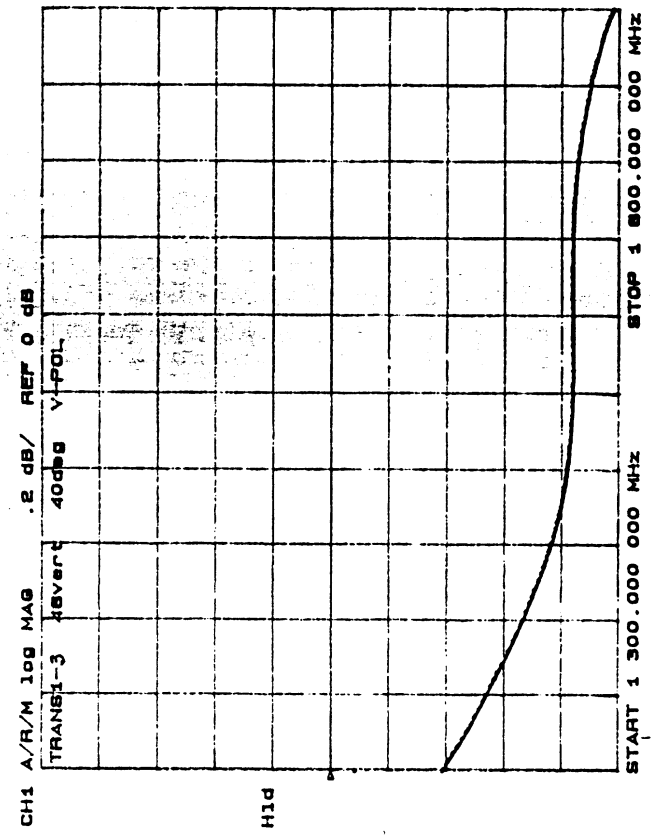

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 10deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

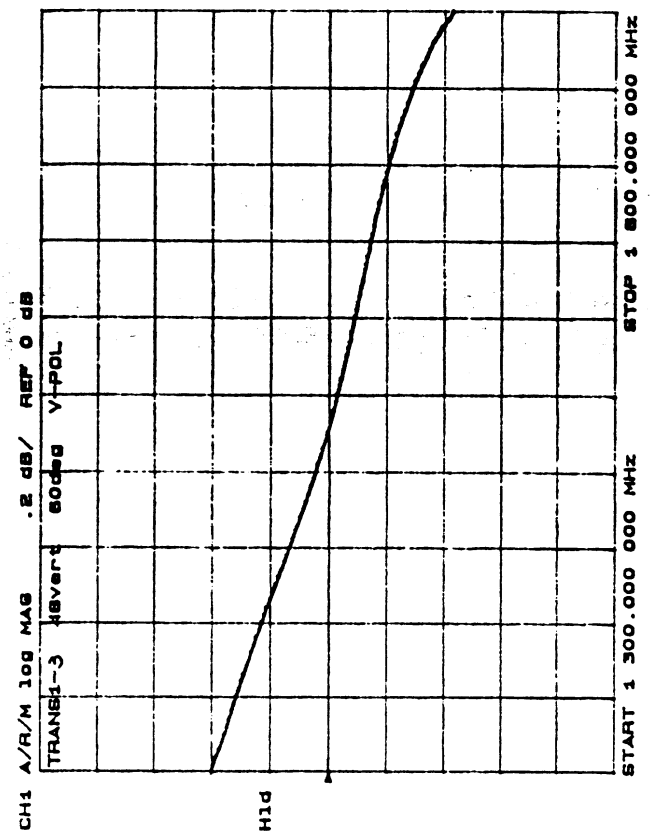

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 20deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

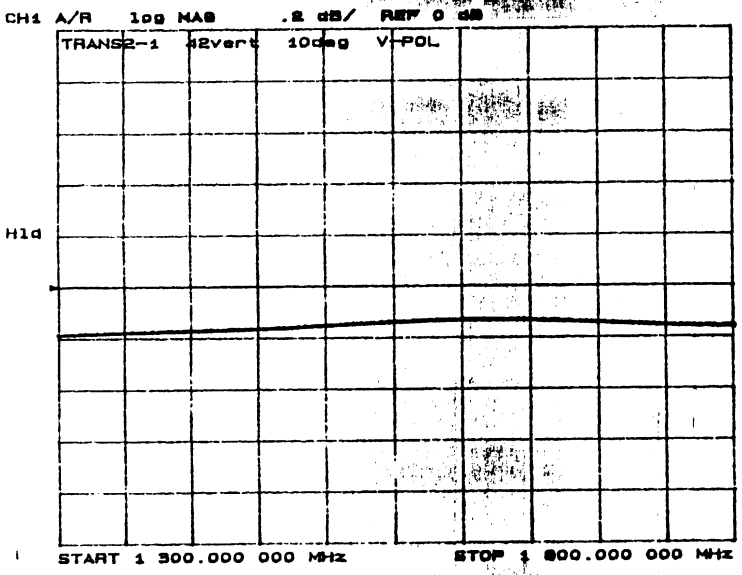

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 30deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

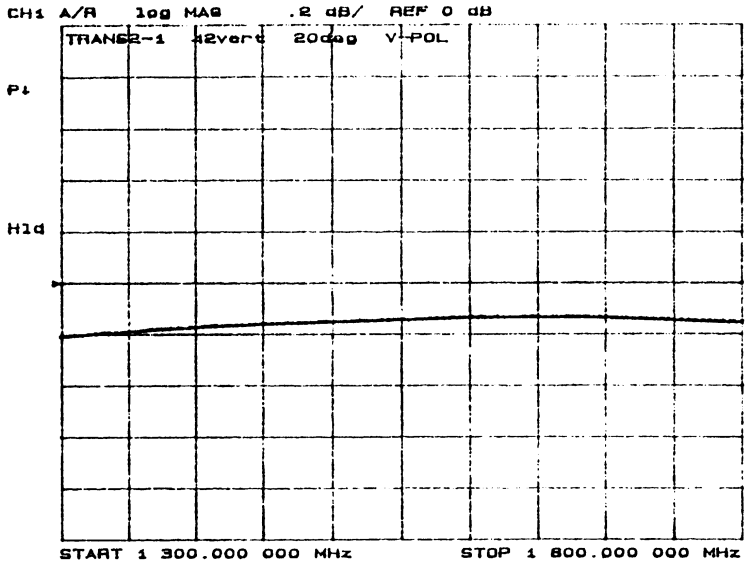

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 50deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

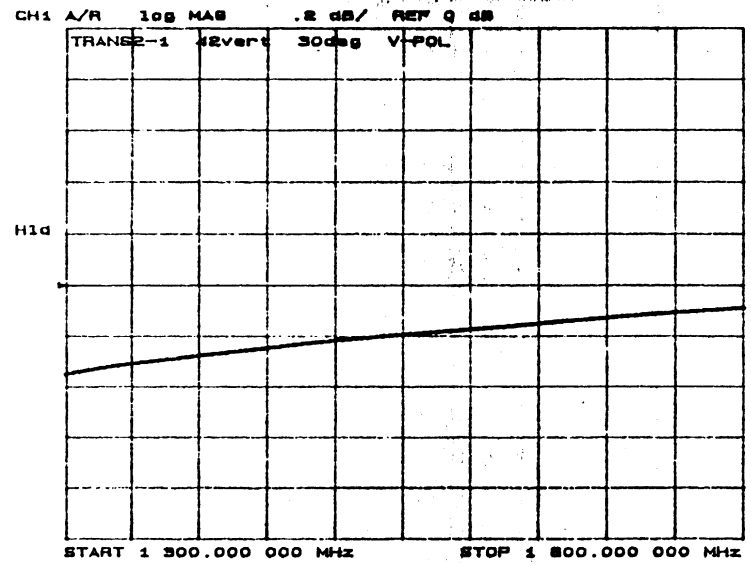

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 70deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

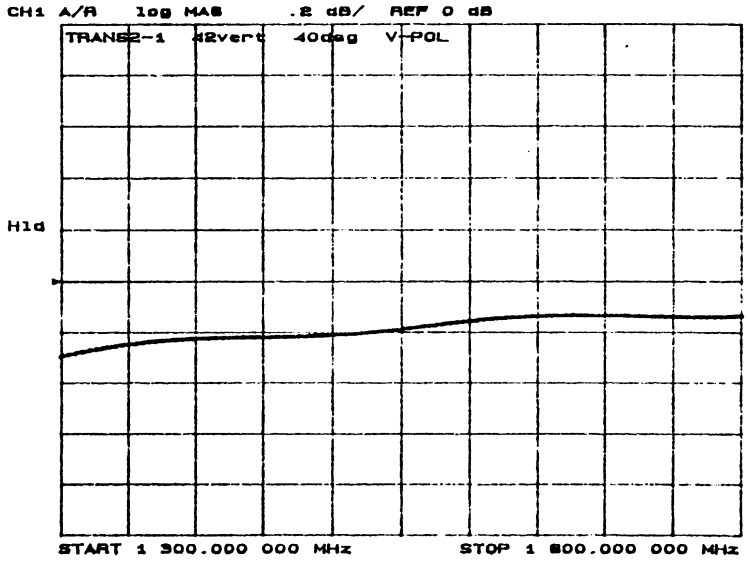

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 40deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

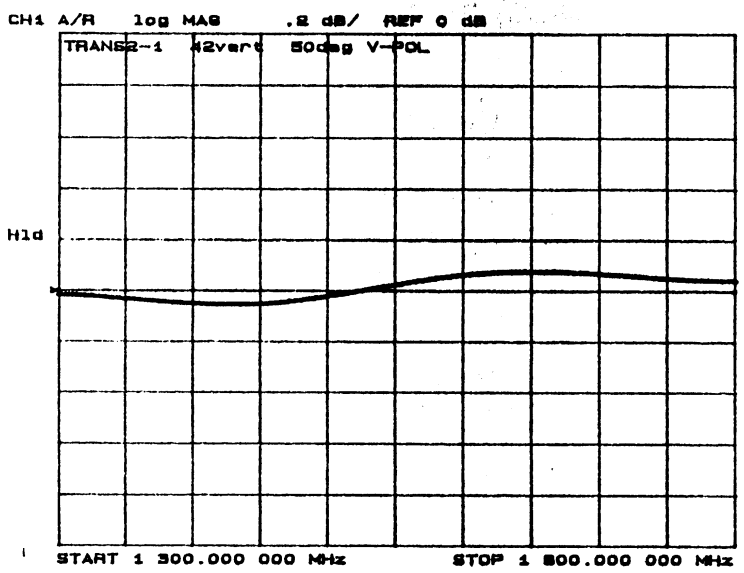

CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-3 48vert 60deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

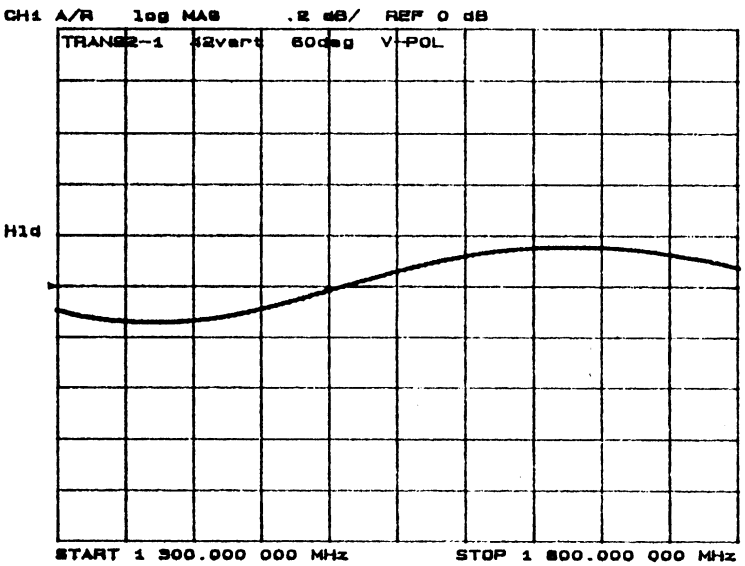

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 10deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

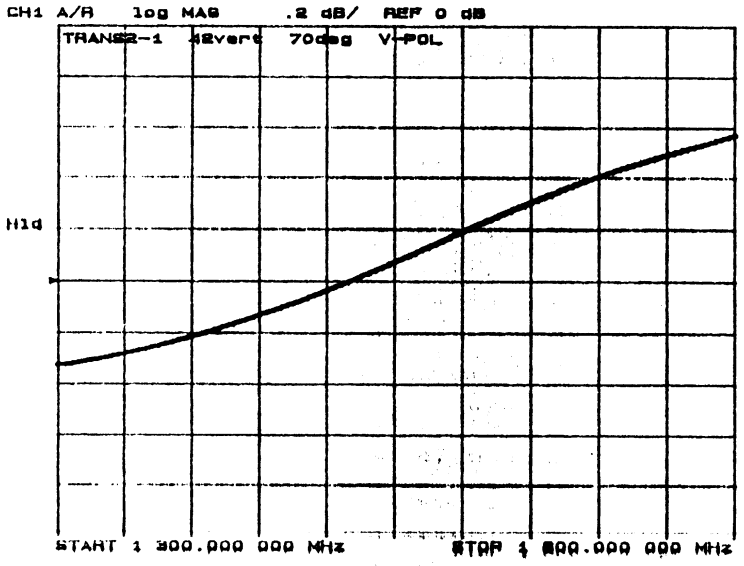

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 20deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

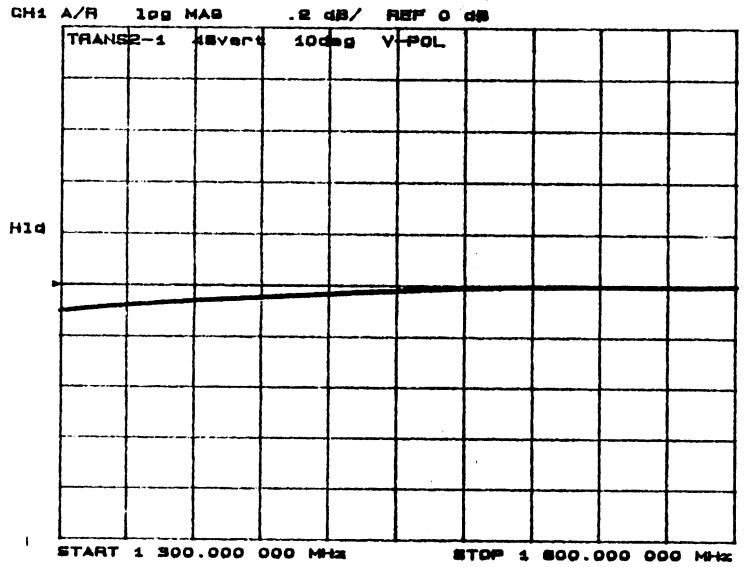

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 30deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

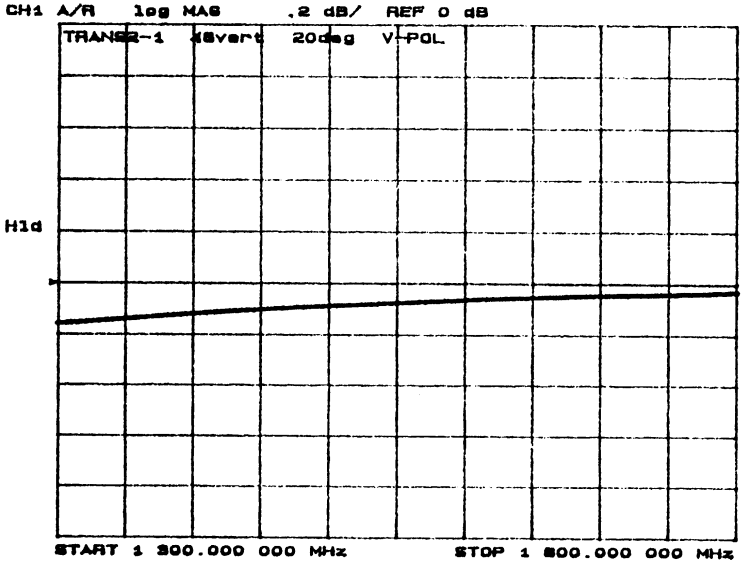

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 40deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

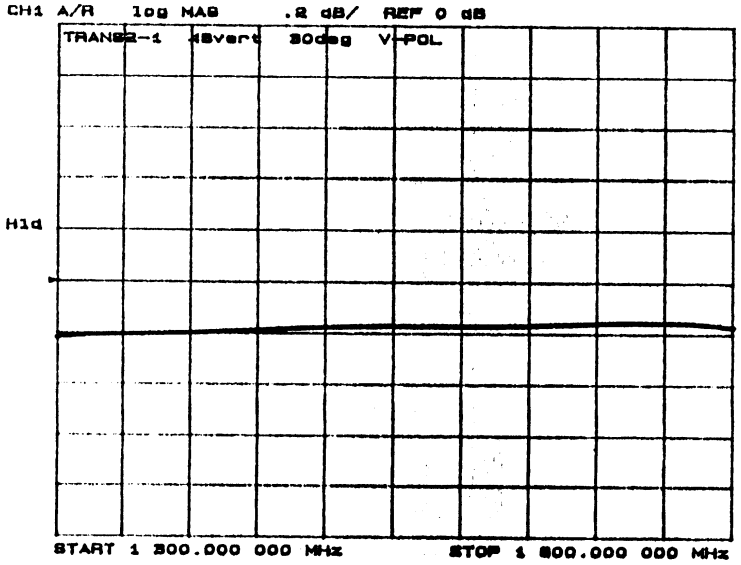

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 50deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

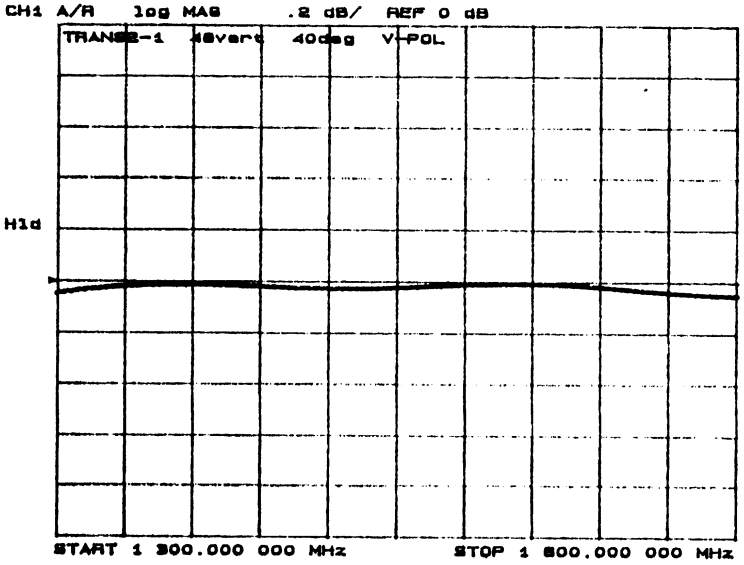

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 60deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

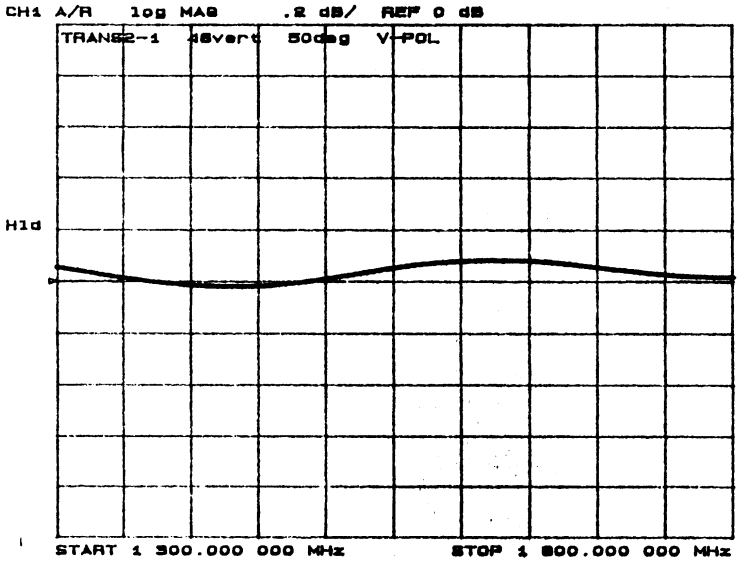

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 42vert 70deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

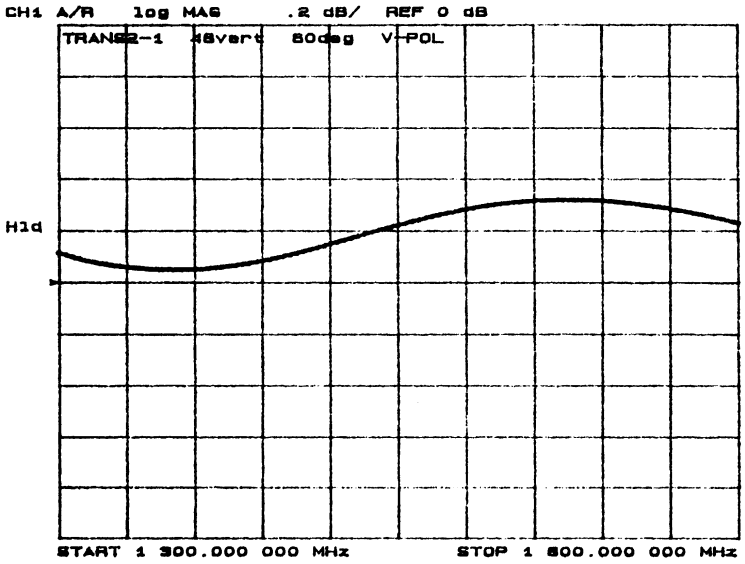

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 45vert 10deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

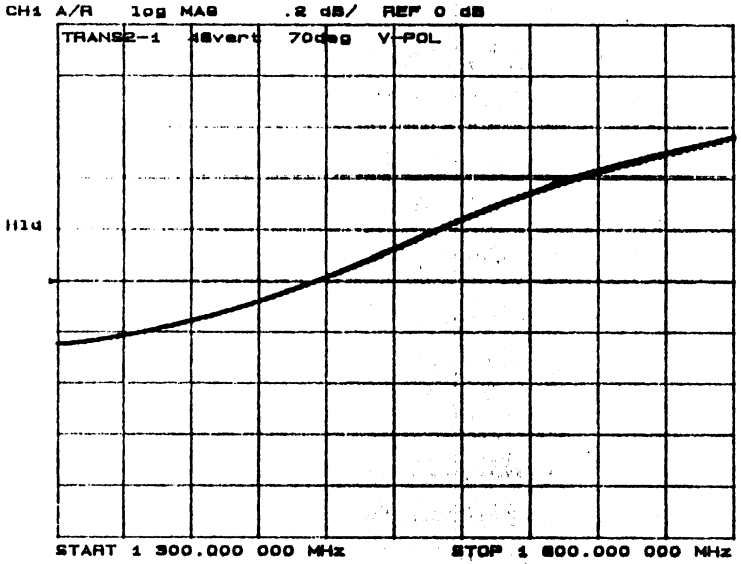

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 45vert 20deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

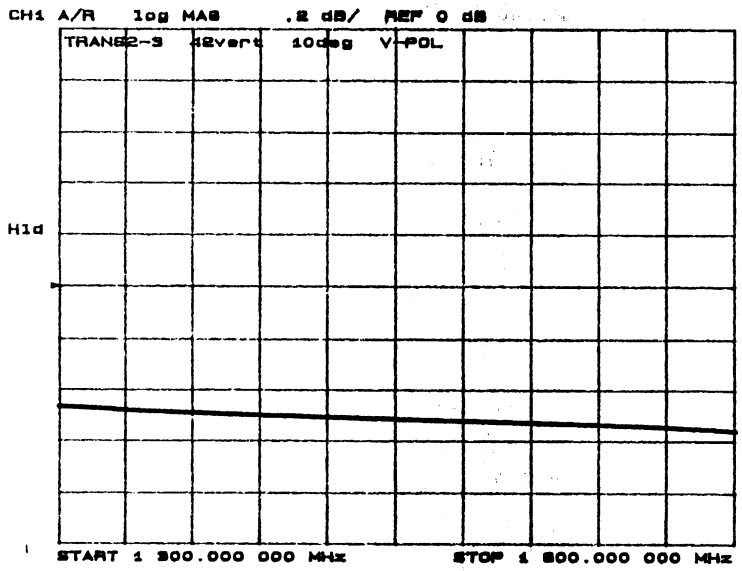

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 45vert 30deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

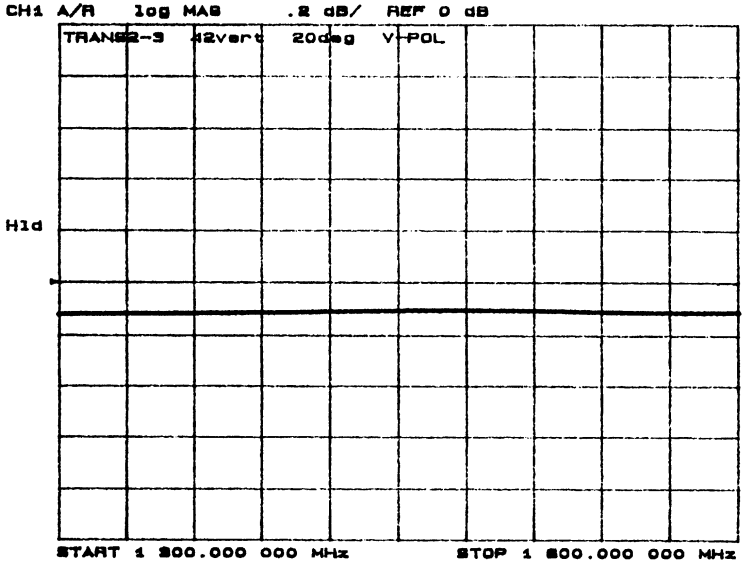

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 45vert 40deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

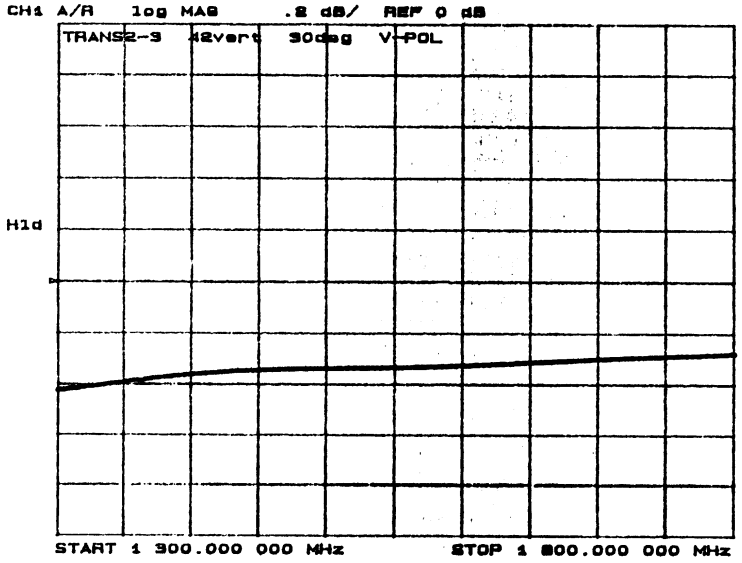

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 48vert 50deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

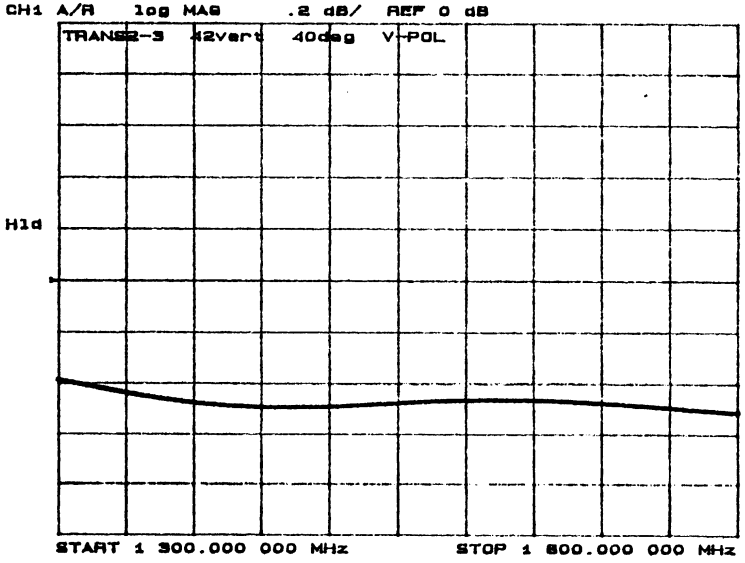

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 48vert 60deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

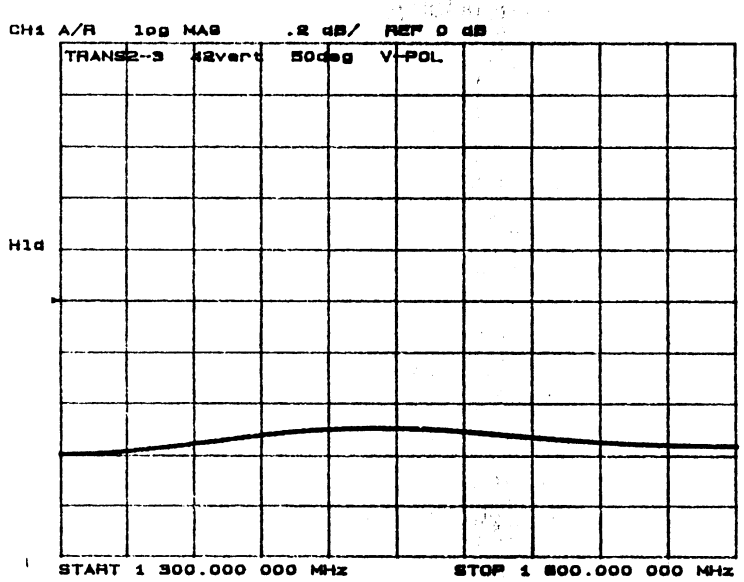

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-1 48vert 70deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

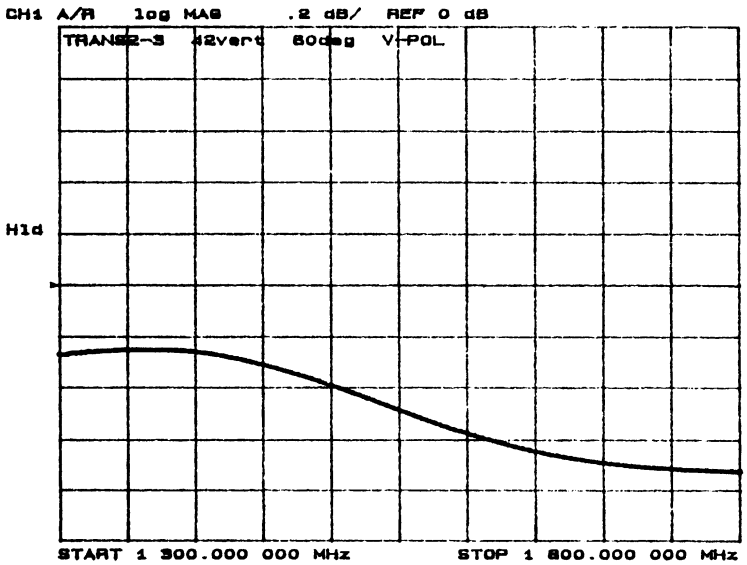

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 10deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

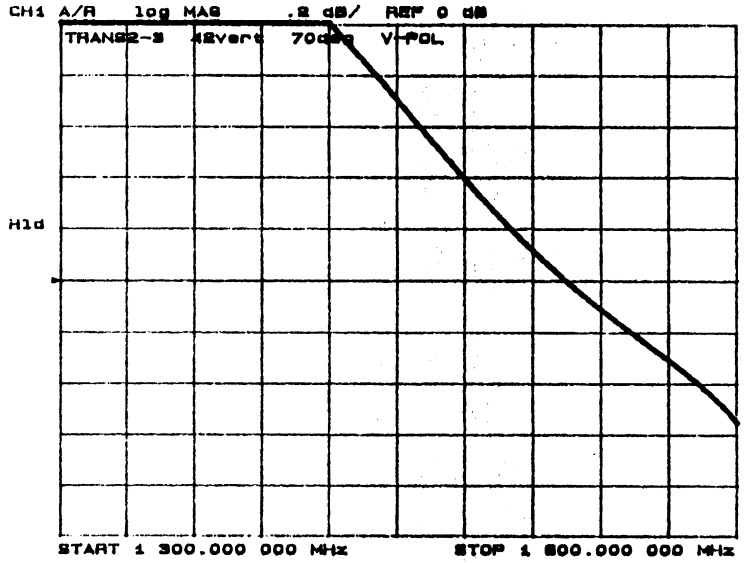

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 20deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

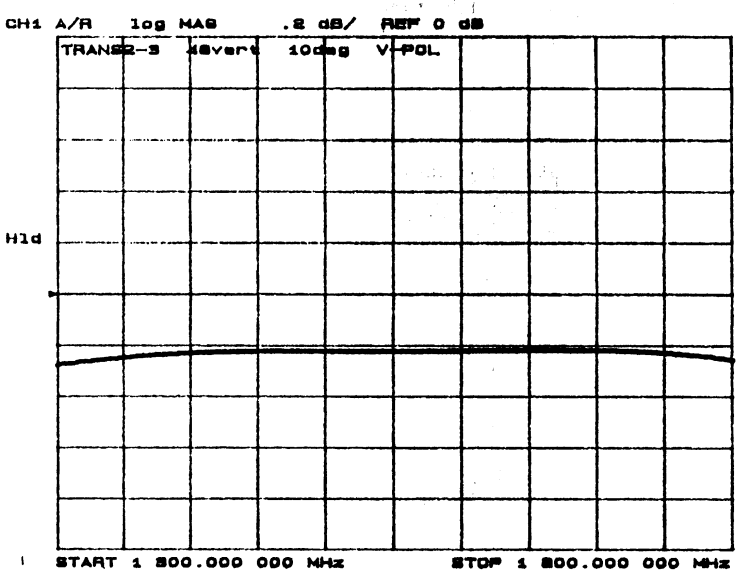

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 30deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

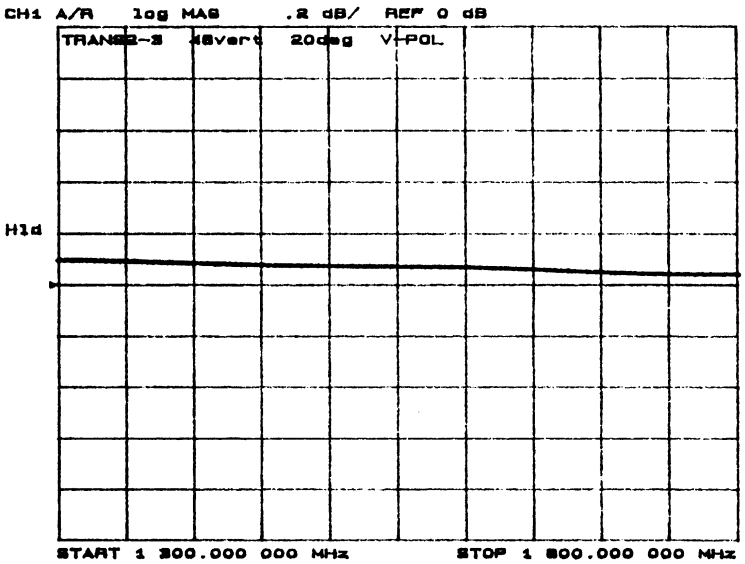

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 40deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

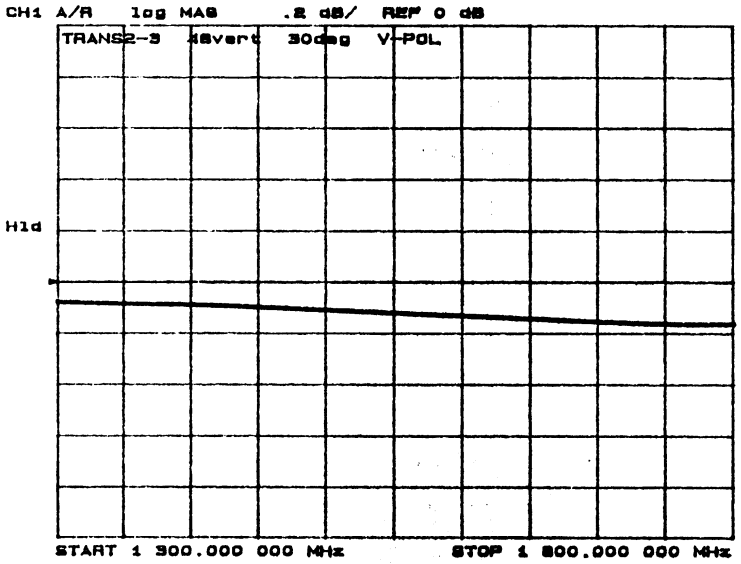

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 50deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz

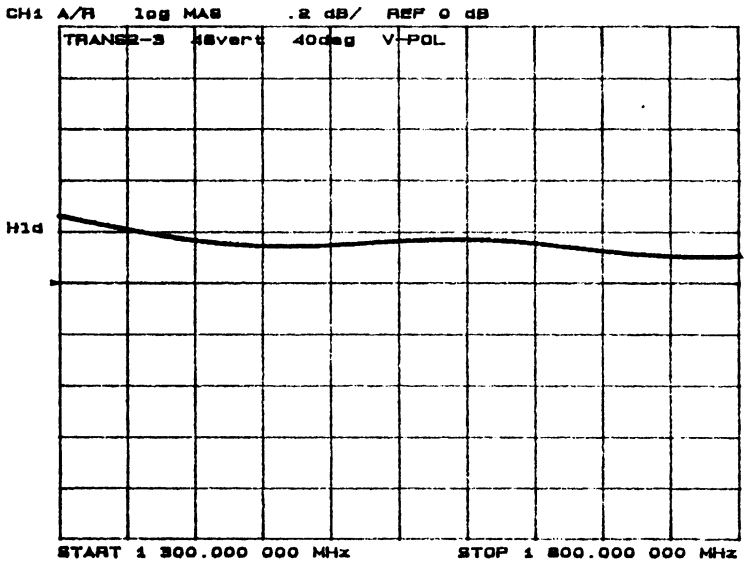

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 60deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz

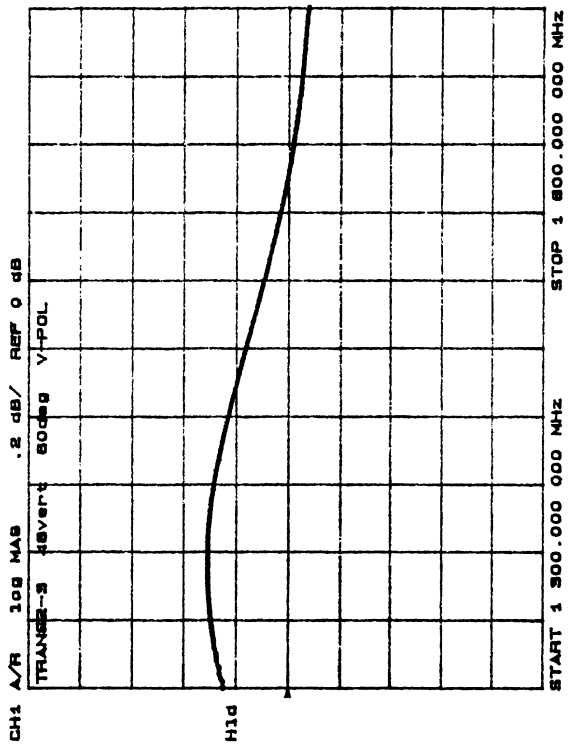

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 42vert 70deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 600.000 000 MHz

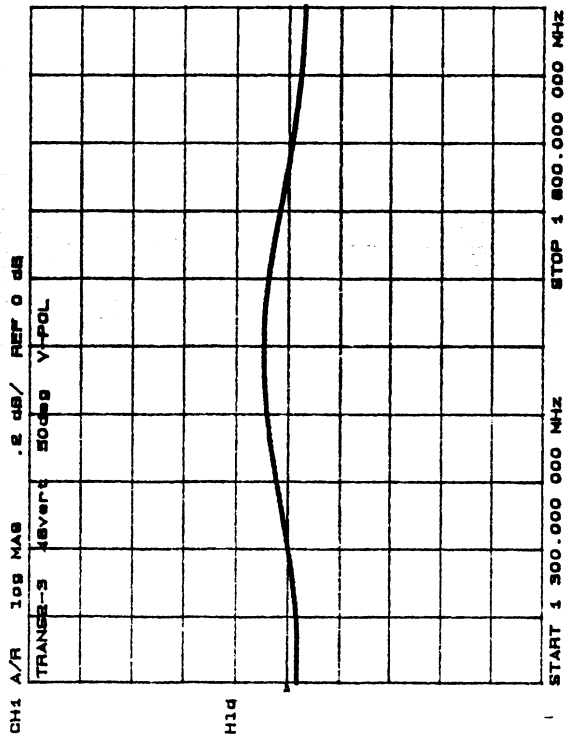

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 48vert 10deg V-POL
H1d
START 1 800.000 000 MHz
STOP 1 800.000 000 MHz

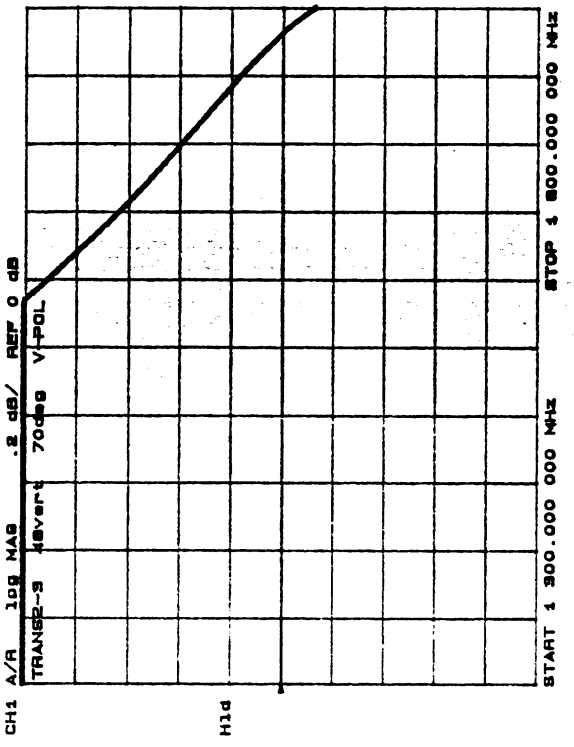

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 48vert 20deg V-POL
H1d
START 1 800.000 000 MHz
STOP 1 800.000 000 MHz

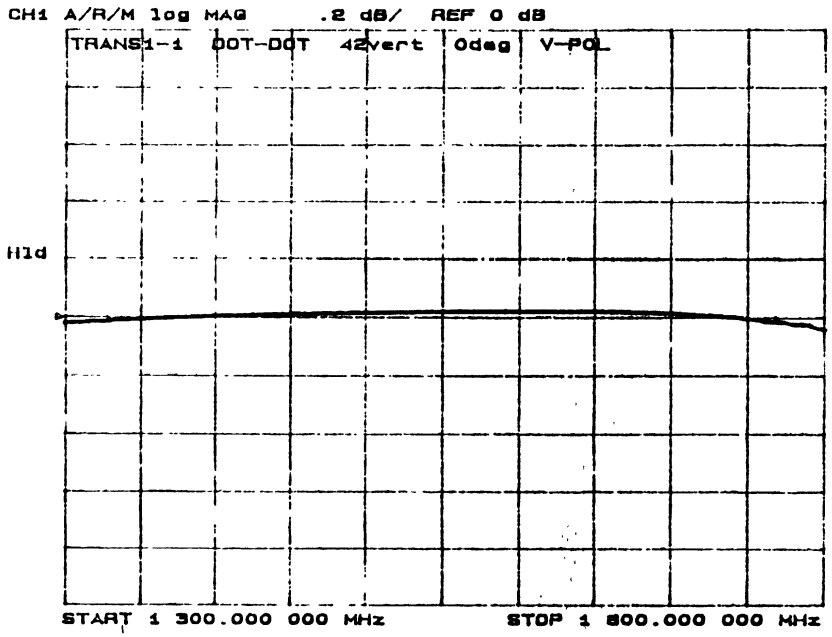

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 48vert 30deg V-POL
H1d
START 1 800.000 000 MHz
STOP 1 800.000 000 MHz

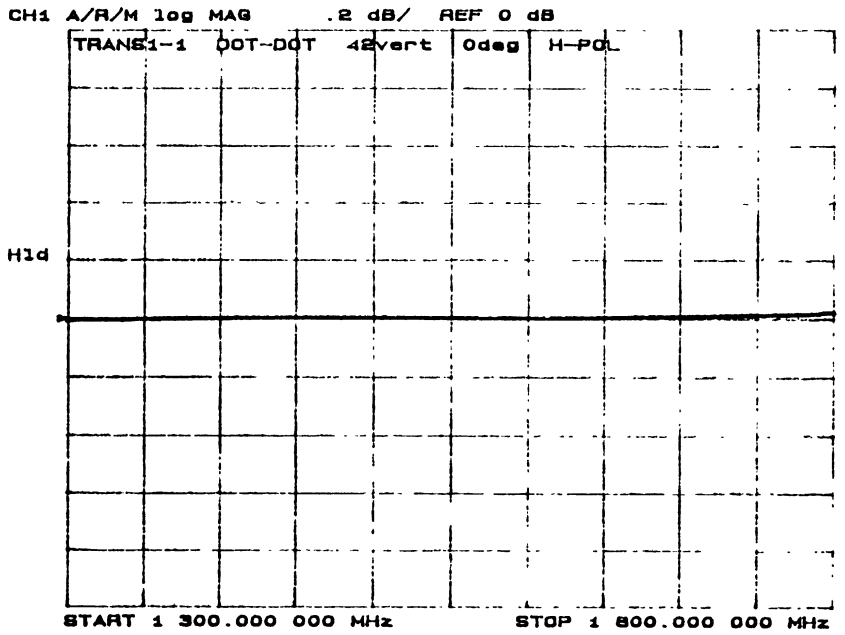

CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 48vert 40deg V-POL
H1d
START 1 800.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 46vert 80deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 46vert 50deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R log MAG .2 dB/ REF 0 dB
TRANS2-3 46vert 70deg V-POL
H1d
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-1 DOT-DOT 42vert 0deg V-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz


CH1 A/R/M log MAG .2 dB/ REF 0 dB
TRANS1-1 DOT-DOT 42vert 0deg H-POL
Hld
START 1 300.000 000 MHz
STOP 1 800.000 000 MHz

FILE NAME: PLT1_10RA
FILE TITLE: REFL-1 42vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-20.4780	Phase:	+71.53
Frequency:	1.539250000	MAGNITUDE:	-20.4635	Phase:	+71.57
Frequency:	1.543500000	MAGNITUDE:	-20.4483	Phase:	+71.59
Frequency:	1.636500000	MAGNITUDE:	-20.0843	Phase:	+71.36
Frequency:	1.640750000	MAGNITUDE:	-20.0686	Phase:	+71.32
Frequency:	1.645000000	MAGNITUDE:	-20.0532	Phase:	+71.27

FILE NAME: PLT1_20RA
FILE TITLE: REFL-1 42vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-19.9531	Phase:	+91.63
Frequency:	1.539250000	MAGNITUDE:	-19.9440	Phase:	+91.66
Frequency:	1.543500000	MAGNITUDE:	-19.9321	Phase:	+91.71
Frequency:	1.636500000	MAGNITUDE:	-19.6788	Phase:	+92.70
Frequency:	1.640750000	MAGNITUDE:	-19.6677	Phase:	+92.74
Frequency:	1.645000000	MAGNITUDE:	-19.6553	Phase:	+92.78

FILE NAME: PLT1_30RA
FILE TITLE: REFL-1 42vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-19.0683	Phase:	+87.12
Frequency:	1.539250000	MAGNITUDE:	-19.0708	Phase:	+87.10
Frequency:	1.543500000	MAGNITUDE:	-19.0699	Phase:	+87.07
Frequency:	1.636500000	MAGNITUDE:	-18.8893	Phase:	+86.49
Frequency:	1.640750000	MAGNITUDE:	-18.8733	Phase:	+86.52
Frequency:	1.645000000	MAGNITUDE:	-18.8526	Phase:	+86.55

FILE NAME: PLT1_40RA
FILE TITLE: REFL-1 42vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-17.7656	Phase:	+80.84
Frequency:	1.539250000	MAGNITUDE:	-17.7349	Phase:	+80.94
Frequency:	1.543500000	MAGNITUDE:	-17.7028	Phase:	+81.05
Frequency:	1.636500000	MAGNITUDE:	-17.4151	Phase:	+83.95
Frequency:	1.640750000	MAGNITUDE:	-17.4208	Phase:	+84.03
Frequency:	1.645000000	MAGNITUDE:	-17.4258	Phase:	+84.10

FILE NAME: PLT1_50RA
FILE TITLE: REFL-1 42vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-16.4199	Phase:	+94.58
Frequency:	1.539250000	MAGNITUDE:	-16.4066	Phase:	+94.83
Frequency:	1.543500000	MAGNITUDE:	-16.3981	Phase:	+95.11
Frequency:	1.636500000	MAGNITUDE:	-16.1571	Phase:	+98.37
Frequency:	1.640750000	MAGNITUDE:	-16.1621	Phase:	+98.39
Frequency:	1.645000000	MAGNITUDE:	-16.1687	Phase:	+98.31

FILE NAME: PLT1_60RA
FILE TITLE: REFL-1 42vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-12.9780	Phase:	+87.44
Frequency:	1.539250000	MAGNITUDE:	-12.9606	Phase:	+87.70
Frequency:	1.543500000	MAGNITUDE:	-12.9439	Phase:	+87.97
Frequency:	1.636500000	MAGNITUDE:	-13.0473	Phase:	+92.64
Frequency:	1.640750000	MAGNITUDE:	-13.0689	Phase:	+92.76
Frequency:	1.645000000	MAGNITUDE:	-13.0888	Phase:	+92.88

FILE NAME: PLT1_70RA
FILE TITLE: REFL-1 42vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-7.3010	Phase:	+76.08
Frequency:	1.539250000	MAGNITUDE:	-7.2793	Phase:	+76.31
Frequency:	1.543500000	MAGNITUDE:	-7.2581	Phase:	+76.56
Frequency:	1.636500000	MAGNITUDE:	-6.7845	Phase:	+82.07
Frequency:	1.640750000	MAGNITUDE:	-6.7617	Phase:	+82.31
Frequency:	1.645000000	MAGNITUDE:	-6.7410	Phase:	+82.56

FILE NAME: PLT1_10RB
FILE TITLE: REFL-1 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-21.3901	Phase:	+100.50
Frequency:	1.539250000	MAGNITUDE:	-21.3681	Phase:	+100.52
Frequency:	1.543500000	MAGNITUDE:	-21.3458	Phase:	+100.54
Frequency:	1.636500000	MAGNITUDE:	-20.8907	Phase:	+100.25
Frequency:	1.640750000	MAGNITUDE:	-20.8729	Phase:	+100.21
Frequency:	1.645000000	MAGNITUDE:	-20.8554	Phase:	+100.16

FILE NAME: PLT1_20RB
FILE TITLE: REFL-1 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-21.0195	Phase:	+94.97
Frequency:	1.539250000	MAGNITUDE:	-20.9988	Phase:	+95.02
Frequency:	1.543500000	MAGNITUDE:	-20.9773	Phase:	+95.08
Frequency:	1.636500000	MAGNITUDE:	-20.4910	Phase:	+96.04
Frequency:	1.640750000	MAGNITUDE:	-20.4708	Phase:	+96.06
Frequency:	1.645000000	MAGNITUDE:	-20.4492	Phase:	+96.09

FILE NAME: PLT1_30RB
FILE TITLE: REFL-1 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-19.7470	Phase:	+82.77
Frequency:	1.539250000	MAGNITUDE:	-19.7446	Phase:	+82.81
Frequency:	1.543500000	MAGNITUDE:	-19.7380	Phase:	+82.84
Frequency:	1.636500000	MAGNITUDE:	-19.4156	Phase:	+83.56
Frequency:	1.640750000	MAGNITUDE:	-19.3918	Phase:	+83.65
Frequency:	1.645000000	MAGNITUDE:	-19.3653	Phase:	+83.73

FILE NAME: PLT1_40RB
FILE TITLE: REFL-1 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-17.9707	Phase:	+93.00
Frequency:	1.539250000	MAGNITUDE:	-17.9342	Phase:	+93.05
Frequency:	1.543500000	MAGNITUDE:	-17.8949	Phase:	+93.10
Frequency:	1.636500000	MAGNITUDE:	-17.4797	Phase:	+95.47
Frequency:	1.640750000	MAGNITUDE:	-17.4827	Phase:	+95.55
Frequency:	1.645000000	MAGNITUDE:	-17.4844	Phase:	+95.62

FILE NAME: PLT1_50RB
FILE TITLE: REFL-1 48vert 50deg V-POL

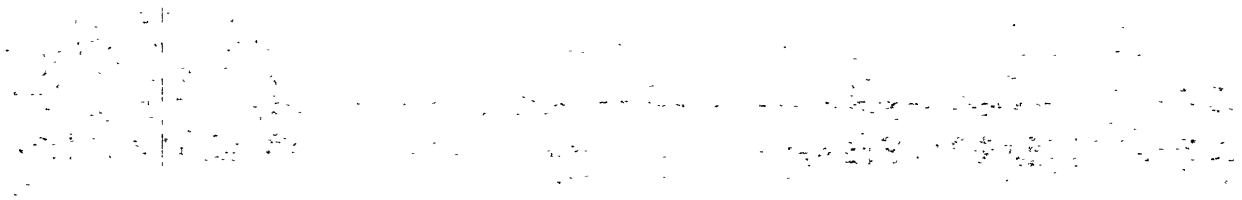
	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-17.1406	Phase:	+105.97
Frequency:	1.539250000	MAGNITUDE:	-17.1141	Phase:	+106.23
Frequency:	1.543500000	MAGNITUDE:	-17.0930	Phase:	+106.52
Frequency:	1.636500000	MAGNITUDE:	-16.9557	Phase:	+110.65
Frequency:	1.640750000	MAGNITUDE:	-16.9573	Phase:	+110.72
Frequency:	1.645000000	MAGNITUDE:	-16.9613	Phase:	+110.71

FILE NAME: PLT1_60RB
FILE TITLE: REFL-1 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-14.1856	Phase:	+95.89
Frequency:	1.539250000	MAGNITUDE:	-14.1561	Phase:	+96.21
Frequency:	1.543500000	MAGNITUDE:	-14.1276	Phase:	+96.53
Frequency:	1.636500000	MAGNITUDE:	-14.0354	Phase:	+102.47
Frequency:	1.640750000	MAGNITUDE:	-14.0510	Phase:	+102.65
Frequency:	1.645000000	MAGNITUDE:	-14.0659	Phase:	+102.81

FILE NAME: PLT1_70RB
FILE TITLE: REFL-1 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-8.2763	Phase:	+77.56
Frequency:	1.539250000	MAGNITUDE:	-8.2498	Phase:	+77.83
Frequency:	1.543500000	MAGNITUDE:	-8.2229	Phase:	+78.11
Frequency:	1.636500000	MAGNITUDE:	-7.6100	Phase:	+84.04
Frequency:	1.640750000	MAGNITUDE:	-7.5817	Phase:	+84.28
Frequency:	1.645000000	MAGNITUDE:	-7.5552	Phase:	+84.53



FILE NAME: PLAT1_0AT
FILE TITLE: TRANST-1 42vert 0deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2[illegible]	Phase:	-3.05
Frequency:	1.539250000	MAGNITUDE:	-.2[illegible]	Phase:	-3.09
Frequency:	1.543500000	MAGNITUDE:	-.2[illegible]	Phase:	-3.11
Frequency:	1.636500000	MAGNITUDE:	-.2[illegible]	Phase:	-3.63
Frequency:	1.640750000	MAGNITUDE:	-.2[illegible]	Phase:	-3.65
Frequency:	1.645000000	MAGNITUDE:	-.2[illegible]	Phase:	-3.68

FILE NAME: PLAT1_10AT
FILE TITLE: TRANS1-1 42vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2[illegible]	Phase:	-7.49
Frequency:	1.539250000	MAGNITUDE:	-.2[illegible]	Phase:	-7.51
Frequency:	1.543500000	MAGNITUDE:	-.2[illegible]	Phase:	-7.53
Frequency:	1.636500000	MAGNITUDE:	-.2[illegible]	Phase:	-8.10
Frequency:	1.640750000	MAGNITUDE:	-.2[illegible]	Phase:	-8.13
Frequency:	1.645000000	MAGNITUDE:	-.2[illegible]	Phase:	-8.16

FILE NAME: PLAT1_20AT
FILE TITLE: TRANS1-1 42vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1768	Phase:	-7.65
Frequency:	1.539250000	MAGNITUDE:	-.1770	Phase:	-7.66
Frequency:	1.543500000	MAGNITUDE:	-.1771	Phase:	-7.68
Frequency:	1.636500000	MAGNITUDE:	-.1625	Phase:	-8.03
Frequency:	1.640750000	MAGNITUDE:	-.1625	Phase:	-8.05
Frequency:	1.645000000	MAGNITUDE:	-.1625	Phase:	-8.08

FILE NAME: PLAT1_30AT
FILE TITLE: TRANS1-1 42vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2949	Phase:	-8.86
Frequency:	1.539250000	MAGNITUDE:	-.2953	Phase:	-8.87
Frequency:	1.543500000	MAGNITUDE:	-.2950	Phase:	-8.88
Frequency:	1.636500000	MAGNITUDE:	-.2982	Phase:	-9.16
Frequency:	1.640750000	MAGNITUDE:	-.2982	Phase:	-9.18
Frequency:	1.645000000	MAGNITUDE:	-.3003	Phase:	-9.19

FILE NAME: PLAT1_40AT
FILE TITLE: TRANS1-1 42vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.[illegible]	Phase:	-10.93
Frequency:	1.539250000	MAGNITUDE:	-.[illegible]	Phase:	-10.94
Frequency:	1.543500000	MAGNITUDE:	-.[illegible]	Phase:	-10.96
Frequency:	1.636500000	MAGNITUDE:	-.[illegible]	Phase:	-11.45
Frequency:	1.640750000	MAGNITUDE:	-.[illegible]	Phase:	-11.47
Frequency:	1.645000000	MAGNITUDE:	-.[illegible]	Phase:	-11.50

FILE NAME: PLAT1_50AT
FILE TITLE: TRANS1-1 42vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0774	Phase:	-13.07
Frequency:	1.539250000	MAGNITUDE:	-.0788	Phase:	-13.10
Frequency:	1.543500000	MAGNITUDE:	-.0801	Phase:	-13.13
Frequency:	1.636500000	MAGNITUDE:	-.0976	Phase:	-13.93
Frequency:	1.640750000	MAGNITUDE:	-.0996	Phase:	-13.98
Frequency:	1.645000000	MAGNITUDE:	-.1018	Phase:	-14.02

FILE NAME: PLAT1_60AT
FILE TITLE: TRANS1-1 42vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.1107	Phase:	-15.26
Frequency:	1.539250000	MAGNITUDE:	+.1103	Phase:	-15.30
Frequency:	1.543500000	MAGNITUDE:	+.1106	Phase:	-15.33
Frequency:	1.636500000	MAGNITUDE:	+.1166	Phase:	-16.25
Frequency:	1.640750000	MAGNITUDE:	+.1157	Phase:	-16.30
Frequency:	1.645000000	MAGNITUDE:	+.1151	Phase:	-16.36

FILE NAME: PLAT1_70AT
FILE TITLE: TRANS1-1 42vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.3551	Phase:	-19.39
Frequency:	1.539250000	MAGNITUDE:	+.3526	Phase:	-19.44
Frequency:	1.543500000	MAGNITUDE:	+.3507	Phase:	-19.48
Frequency:	1.636500000	MAGNITUDE:	+.3316	Phase:	-20.59
Frequency:	1.640750000	MAGNITUDE:	+.3307	Phase:	-20.65
Frequency:	1.645000000	MAGNITUDE:	+.3297	Phase:	-20.70

FILE NAME: PLAT1_0BT
FILE TITLE: TRANS1-1 48vert 0deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0238	Phase:	-4.53
Frequency:	1.539250000	MAGNITUDE:	-.0245	Phase:	-4.56
Frequency:	1.543500000	MAGNITUDE:	-.0247	Phase:	-4.58
Frequency:	1.636500000	MAGNITUDE:	-.0246	Phase:	-5.05
Frequency:	1.640750000	MAGNITUDE:	-.0251	Phase:	-5.08
Frequency:	1.645000000	MAGNITUDE:	-.0256	Phase:	-5.11

FILE NAME: PLAT1_10BT
FILE TITLE: TRANS1-1 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0277	Phase:	-3.85
Frequency:	1.539250000	MAGNITUDE:	-.0271	Phase:	-3.87
Frequency:	1.543500000	MAGNITUDE:	-.0260	Phase:	-3.89
Frequency:	1.636500000	MAGNITUDE:	-.0082	Phase:	-4.43
Frequency:	1.640750000	MAGNITUDE:	-.0083	Phase:	-4.45
Frequency:	1.645000000	MAGNITUDE:	-.0079	Phase:	-4.49

FILE NAME: PLAT1_20BT
FILE TITLE: TRANS1-1 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0999	Phase:	-3.91
Frequency:	1.539250000	MAGNITUDE:	-.0980	Phase:	-3.92
Frequency:	1.543500000	MAGNITUDE:	-.0960	Phase:	-3.94
Frequency:	1.636500000	MAGNITUDE:	-.0595	Phase:	-4.35
Frequency:	1.640750000	MAGNITUDE:	-.0588	Phase:	-4.38
Frequency:	1.645000000	MAGNITUDE:	-.0586	Phase:	-4.40

FILE NAME: PLAT1_30BT
FILE TITLE: TRANS1-1 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2033	Phase:	-4.75
Frequency:	1.539250000	MAGNITUDE:	-.2027	Phase:	-4.76
Frequency:	1.543500000	MAGNITUDE:	-.2014	Phase:	-4.77
Frequency:	1.636500000	MAGNITUDE:	-.1711	Phase:	-5.12
Frequency:	1.640750000	MAGNITUDE:	-.1704	Phase:	-5.15
Frequency:	1.645000000	MAGNITUDE:	-.1700	Phase:	-5.17

FILE NAME: PLAT1_40BT
FILE TITLE: TRANS1-1 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2344	Phase:	-6.33
Frequency:	1.539250000	MAGNITUDE:	-.2342	Phase:	-6.33
Frequency:	1.543500000	MAGNITUDE:	-.2333	Phase:	-6.30
Frequency:	1.636500000	MAGNITUDE:	-.2111	Phase:	-7.05
Frequency:	1.640750000	MAGNITUDE:	-.2109	Phase:	-7.08
Frequency:	1.645000000	MAGNITUDE:	-.2099	Phase:	-7.10

FILE NAME: PLAT1_50T
FILE TITLE: TRANS1-1 48vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0595	Phase:	-9.46
Frequency:	1.539250000	MAGNITUDE:	-.0605	Phase:	-9.47
Frequency:	1.543500000	MAGNITUDE:	-.0599	Phase:	-9.49
Frequency:	1.636500000	MAGNITUDE:	-.0411	Phase:	-10.05
Frequency:	1.640750000	MAGNITUDE:	-.0405	Phase:	-10.08
Frequency:	1.645000000	MAGNITUDE:	-.0400	Phase:	-10.12

FILE NAME: PLAT1_60T
FILE TITLE: TRANS1-1 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.3173	Phase:	-11.64
Frequency:	1.539250000	MAGNITUDE:	+.3179	Phase:	-11.68
Frequency:	1.543500000	MAGNITUDE:	+.3194	Phase:	-11.72
Frequency:	1.636500000	MAGNITUDE:	+.3457	Phase:	-12.59
Frequency:	1.640750000	MAGNITUDE:	+.3465	Phase:	-12.64
Frequency:	1.645000000	MAGNITUDE:	+.3473	Phase:	-12.69

FILE NAME: PLAT1_70BT
FILE TITLE: TRANS1-1 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.7859	Phase:	-14.13
Frequency:	1.539250000	MAGNITUDE:	+.7864	Phase:	-14.18
Frequency:	1.543500000	MAGNITUDE:	+.7880	Phase:	-14.23
Frequency:	1.636500000	MAGNITUDE:	+.8216	Phase:	-15.43
Frequency:	1.640750000	MAGNITUDE:	+.8228	Phase:	-15.49
Frequency:	1.645000000	MAGNITUDE:	+.8241	Phase:	-15.56

FILE NAME: PLT2_10RAC
FILE TITLE: REFL-3 42vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-15.8511	Phase:	+63.06
Frequency:	1.539250000	MAGNITUDE:	-15.8511	Phase:	+63.06
Frequency:	1.543500000	MAGNITUDE:	-15.8500	Phase:	+63.06
Frequency:	1.636500000	MAGNITUDE:	-15.8231	Phase:	+63.22
Frequency:	1.640750000	MAGNITUDE:	-15.8195	Phase:	+63.24
Frequency:	1.645000000	MAGNITUDE:	-15.8150	Phase:	+63.25

FILE NAME: PLT2_20RAC
FILE TITLE: REFL-3 42vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-14.8154	Phase:	+93.98
Frequency:	1.539250000	MAGNITUDE:	-14.8059	Phase:	+93.99
Frequency:	1.543500000	MAGNITUDE:	-14.7946	Phase:	+94.00
Frequency:	1.636500000	MAGNITUDE:	-14.5474	Phase:	+93.95
Frequency:	1.640750000	MAGNITUDE:	-14.5379	Phase:	+93.94
Frequency:	1.645000000	MAGNITUDE:	-14.5283	Phase:	+93.94

FILE NAME: PLT2_30RAC
FILE TITLE: REFL-3 42vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-14.4189	Phase:	+86.39
Frequency:	1.539250000	MAGNITUDE:	-14.4011	Phase:	+86.37
Frequency:	1.543500000	MAGNITUDE:	-14.3863	Phase:	+86.37
Frequency:	1.636500000	MAGNITUDE:	-14.0591	Phase:	+86.49
Frequency:	1.640750000	MAGNITUDE:	-14.0431	Phase:	+86.51
Frequency:	1.645000000	MAGNITUDE:	-14.0298	Phase:	+86.53

FILE NAME: PLT2_40RAC
FILE TITLE: REFL-3 42vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-13.4482	Phase:	+69.80
Frequency:	1.539250000	MAGNITUDE:	-13.4387	Phase:	+69.91
Frequency:	1.543500000	MAGNITUDE:	-13.4326	Phase:	+70.04
Frequency:	1.636500000	MAGNITUDE:	-13.5493	Phase:	+71.21
Frequency:	1.640750000	MAGNITUDE:	-13.5577	Phase:	+71.17
Frequency:	1.645000000	MAGNITUDE:	-13.5669	Phase:	+71.13

FILE NAME: PLT2_50RAC
FILE TITLE: REFL-3 42vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-11.0977	Phase:	+64.74
Frequency:	1.539250000	MAGNITUDE:	-11.1051	Phase:	+64.75
Frequency:	1.543500000	MAGNITUDE:	-11.1119	Phase:	+64.75
Frequency:	1.636500000	MAGNITUDE:	-11.2735	Phase:	+63.51
Frequency:	1.640750000	MAGNITUDE:	-11.2782	Phase:	+63.43
Frequency:	1.645000000	MAGNITUDE:	-11.2833	Phase:	+63.35

FILE NAME: PLT2_60RAC
FILE TITLE: REFL-3 42vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-8.8818	Phase:	+64.10
Frequency:	1.539250000	MAGNITUDE:	-8.8864	Phase:	+63.7[illegible]
Frequency:	1.543500000	MAGNITUDE:	-8.8900	Phase:	+63.4[illegible]
Frequency:	1.636500000	MAGNITUDE:	-8.6555	Phase:	+57.33
Frequency:	1.640750000	MAGNITUDE:	-8.6340	Phase:	+57.[illegible]
Frequency:	1.645000000	MAGNITUDE:	-8.6133	Phase:	+57.33

FILE NAME: PLT2_70RAC
FILE TITLE: REFL-3 42vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-4.2988	Phase:	+89.[illegible]
Frequency:	1.539250000	MAGNITUDE:	-4.3910	Phase:	+88.33
Frequency:	1.543500000	MAGNITUDE:	-4.4792	Phase:	+88.[illegible]
Frequency:	1.636500000	MAGNITUDE:	-5.9541	Phase:	+75.[illegible]
Frequency:	1.640750000	MAGNITUDE:	-5.9933	Phase:	+75.[illegible]
Frequency:	1.645000000	MAGNITUDE:	-6.0259	Phase:	+74.3[illegible]

FILE NAME: PLT2_10RBC
FILE TITLE: REFL-3 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-15.3523	Phase:	+70.62
Frequency:	1.539250000	MAGNITUDE:	-15.3448	Phase:	+70.56
Frequency:	1.543500000	MAGNITUDE:	-15.3339	Phase:	+70.48
Frequency:	1.636500000	MAGNITUDE:	-15.3434	Phase:	+68.85
Frequency:	1.640750000	MAGNITUDE:	-15.3365	Phase:	+68.77
Frequency:	1.645000000	MAGNITUDE:	-15.3286	Phase:	+68.69

FILE NAME: PLT2_20RBC
FILE TITLE: REFL-3 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-15.1362	Phase:	+93.01
Frequency:	1.539250000	MAGNITUDE:	-15.1213	Phase:	+92.98
Frequency:	1.543500000	MAGNITUDE:	-15.1040	Phase:	+92.95
Frequency:	1.636500000	MAGNITUDE:	-14.7494	Phase:	+91.91
Frequency:	1.640750000	MAGNITUDE:	-14.7367	Phase:	+91.84
Frequency:	1.645000000	MAGNITUDE:	-14.7246	Phase:	+91.79

FILE NAME: PLT2_30RBC
FILE TITLE: REFL-3 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-14.5200	Phase:	+77.37
Frequency:	1.539250000	MAGNITUDE:	-14.5072	Phase:	+77.30
Frequency:	1.543500000	MAGNITUDE:	-14.4940	Phase:	+77.24
Frequency:	1.636500000	MAGNITUDE:	-14.2653	Phase:	+76.16
Frequency:	1.640750000	MAGNITUDE:	-14.2564	Phase:	+76.12
Frequency:	1.645000000	MAGNITUDE:	-14.2480	Phase:	+76.08

FILE NAME: PLT2_40RBC
FILE TITLE: REFL-3 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-12.7656	Phase:	+71.79
Frequency:	1.539250000	MAGNITUDE:	-12.7486	Phase:	+71.84
Frequency:	1.543500000	MAGNITUDE:	-12.7357	Phase:	+71.90
Frequency:	1.636500000	MAGNITUDE:	-12.7243	Phase:	+71.69
Frequency:	1.640750000	MAGNITUDE:	-12.7291	Phase:	+71.59
Frequency:	1.645000000	MAGNITUDE:	-12.7353	Phase:	+71.50

FILE NAME: PLT2_50RBC
FILE TITLE: REFL-3 48vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-13.3442	Phase:	+78.15
Frequency:	1.539250000	MAGNITUDE:	-13.3475	Phase:	+78.14
Frequency:	1.543500000	MAGNITUDE:	-13.3468	Phase:	+78.12
Frequency:	1.636500000	MAGNITUDE:	-13.3408	Phase:	+76.13
Frequency:	1.640750000	MAGNITUDE:	-13.3429	Phase:	+76.02
Frequency:	1.645000000	MAGNITUDE:	-13.3433	Phase:	+75.97

FILE NAME: PLT2_60RBC
FILE TITLE: REFL-3 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-9.4175	Phase:	+80.20
Frequency:	1.539250000	MAGNITUDE:	-9.4241	Phase:	+79.92
Frequency:	1.543500000	MAGNITUDE:	-9.4311	Phase:	+79.63
Frequency:	1.636500000	MAGNITUDE:	-9.1800	Phase:	+73.22
Frequency:	1.640750000	MAGNITUDE:	-9.1546	Phase:	+72.96
Frequency:	1.645000000	MAGNITUDE:	-9.1284	Phase:	+72.70

FILE NAME: PLT2_70RBC
FILE TITLE: REFL-3 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-4.0811	Phase:	+99.43
Frequency:	1.539250000	MAGNITUDE:	-4.1825	Phase:	+98.97
Frequency:	1.543500000	MAGNITUDE:	-4.2804	Phase:	+98.47
Frequency:	1.636500000	MAGNITUDE:	-6.0105	Phase:	+85.02
Frequency:	1.640750000	MAGNITUDE:	-6.0614	Phase:	+84.35
Frequency:	1.645000000	MAGNITUDE:	-6.1052	Phase:	+83.68

FILE NAME: PLT2_0T1A
FILE TITLE: TRANS1-3 42vert 0deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.3129	Phase:	-11.50
Frequency:	1.539250000	MAGNITUDE:	-.3122	Phase:	-11.51
Frequency:	1.543500000	MAGNITUDE:	-.3107	Phase:	-11.51
Frequency:	1.636500000	MAGNITUDE:	-.2743	Phase:	-11.90
Frequency:	1.640750000	MAGNITUDE:	-.2737	Phase:	-11.93
Frequency:	1.645000000	MAGNITUDE:	-.2729	Phase:	-11.95

FILE NAME: PLT2_10T1A
FILE TITLE: TRANS1-3 42vert 10deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.3521	Phase:	-10.49
Frequency:	1.539250000	MAGNITUDE:	-.3488	Phase:	-10.49
Frequency:	1.543500000	MAGNITUDE:	-.3446	Phase:	-10.50
Frequency:	1.636500000	MAGNITUDE:	-.2409	Phase:	-10.93
Frequency:	1.640750000	MAGNITUDE:	-.2368	Phase:	-10.97
Frequency:	1.645000000	MAGNITUDE:	-.2327	Phase:	-11.00

FILE NAME: PLT2_20T1A
FILE TITLE: TRANS1-3 42vert 20deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.5144	Phase:	-11.22
Frequency:	1.539250000	MAGNITUDE:	-.5107	Phase:	-11.21
Frequency:	1.543500000	MAGNITUDE:	-.5080	Phase:	-11.21
Frequency:	1.636500000	MAGNITUDE:	-.4320	Phase:	-11.40
Frequency:	1.640750000	MAGNITUDE:	-.4291	Phase:	-11.43
Frequency:	1.645000000	MAGNITUDE:	-.4252	Phase:	-11.45

FILE NAME: PLT2_30T1A
FILE TITLE: TRANS1-3 42vert 30deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.6571	Phase:	-14.22
Frequency:	1.539250000	MAGNITUDE:	-.6565	Phase:	-14.21
Frequency:	1.543500000	MAGNITUDE:	-.6567	Phase:	-14.20
Frequency:	1.636500000	MAGNITUDE:	-.6201	Phase:	-14.38
Frequency:	1.640750000	MAGNITUDE:	-.6200	Phase:	-14.41
Frequency:	1.645000000	MAGNITUDE:	-.6185	Phase:	-14.44

FILE NAME: PLT2_40T1A
FILE TITLE: TRANS1-3 42vert 40deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.5240	Phase:	-16.96
Frequency:	1.539250000	MAGNITUDE:	-.5246	Phase:	-16.97
Frequency:	1.543500000	MAGNITUDE:	-.5265	Phase:	-16.99
Frequency:	1.636500000	MAGNITUDE:	-.5464	Phase:	-17.65
Frequency:	1.640750000	MAGNITUDE:	-.5494	Phase:	-17.70
Frequency:	1.645000000	MAGNITUDE:	-.5513	Phase:	-17.74

FILE NAME: PLT2_50T1A
FILE TITLE: TRANS1-3 42vert 50deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1362	Phase:	-20.14
Frequency:	1.539250000	MAGNITUDE:	-.1378	Phase:	-20.17
Frequency:	1.543500000	MAGNITUDE:	-.1391	Phase:	-20.20
Frequency:	1.636500000	MAGNITUDE:	-.1493	Phase:	-21.25
Frequency:	1.640750000	MAGNITUDE:	-.1511	Phase:	-21.32
Frequency:	1.645000000	MAGNITUDE:	-.1527	Phase:	-21.38

FILE NAME: PLT2_60T1A
FILE TITLE: TRANS1-3 42vert 60deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0762	Phase:	-21.83
Frequency:	1.539250000	MAGNITUDE:	+.0752	Phase:	-21.87
Frequency:	1.543500000	MAGNITUDE:	+.0728	Phase:	-21.91
Frequency:	1.636500000	MAGNITUDE:	+.0779	Phase:	-22.91
Frequency:	1.640750000	MAGNITUDE:	+.0791	Phase:	-22.98
Frequency:	1.645000000	MAGNITUDE:	+.0799	Phase:	-23.05

FILE NAME: PLT2_70T1A
FILE TITLE: TRANS1-3 42vert 70deg V-POL (repeat)

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0483	Phase:	-24.24
Frequency:	1.539250000	MAGNITUDE:	+.0448	Phase:	-24.27
Frequency:	1.543500000	MAGNITUDE:	+.0429	Phase:	-24.31
Frequency:	1.636500000	MAGNITUDE:	+.0376	Phase:	-25.36
Frequency:	1.640750000	MAGNITUDE:	+.0377	Phase:	-25.43
Frequency:	1.645000000	MAGNITUDE:	+.0398	Phase:	-25.49

FILE NAME: PLT2_0T1B
FILE TITLE: TRANS1-3 48vert 0deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.3331	Phase:	-9.33
Frequency:	1.539250000	MAGNITUDE:	-.3284	Phase:	-9.35
Frequency:	1.543500000	MAGNITUDE:	-.3241	Phase:	-9.36
Frequency:	1.636500000	MAGNITUDE:	-.2174	Phase:	-9.82
Frequency:	1.640750000	MAGNITUDE:	-.2124	Phase:	-9.86
Frequency:	1.645000000	MAGNITUDE:	-.2082	Phase:	-9.89

FILE NAME: PLT2_10T1B
FILE TITLE: TRANS1-3 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.3750	Phase:	-9.01
Frequency:	1.539250000	MAGNITUDE:	-.3696	Phase:	-9.03
Frequency:	1.543500000	MAGNITUDE:	-.3624	Phase:	-9.04
Frequency:	1.636500000	MAGNITUDE:	-.2252	Phase:	-9.57
Frequency:	1.640750000	MAGNITUDE:	-.2203	Phase:	-9.60
Frequency:	1.645000000	MAGNITUDE:	-.2155	Phase:	-9.64

FILE NAME: PLT2_20T1B
FILE TITLE: TRANS1-3 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.5799	Phase:	-9.79
Frequency:	1.539250000	MAGNITUDE:	-.5745	Phase:	-9.78
Frequency:	1.543500000	MAGNITUDE:	-.5683	Phase:	-9.77
Frequency:	1.636500000	MAGNITUDE:	-.4238	Phase:	-9.92
Frequency:	1.640750000	MAGNITUDE:	-.4182	Phase:	-9.95
Frequency:	1.645000000	MAGNITUDE:	-.4136	Phase:	-9.97

FILE NAME: PLT2_30T1B
FILE TITLE: TRANS1-3 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.8147	Phase:	-12.34
Frequency:	1.539250000	MAGNITUDE:	-.8132	Phase:	-12.31
Frequency:	1.543500000	MAGNITUDE:	-.8095	Phase:	-12.28
Frequency:	1.636500000	MAGNITUDE:	-.7161	Phase:	-12.03
Frequency:	1.640750000	MAGNITUDE:	-.7114	Phase:	-12.03
Frequency:	1.645000000	MAGNITUDE:	-.7083	Phase:	-12.04

FILE NAME: PLT2_40T1B
FILE TITLE: TRANS1-3 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.8368	Phase:	-16.52
Frequency:	1.539250000	MAGNITUDE:	-.8380	Phase:	-16.49
Frequency:	1.543500000	MAGNITUDE:	-.8390	Phase:	-16.46
Frequency:	1.636500000	MAGNITUDE:	-.8385	Phase:	-16.38
Frequency:	1.640750000	MAGNITUDE:	-.8395	Phase:	-16.36
Frequency:	1.645000000	MAGNITUDE:	-.8403	Phase:	-16.37

FILE NAME: PLT2_50T1B
FILE TITLE: TRANS1-3 48vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.5742	Phase:	-20.90
Frequency:	1.539250000	MAGNITUDE:	-.5803	Phase:	-20.90
Frequency:	1.543500000	MAGNITUDE:	-.5848	Phase:	-20.91
Frequency:	1.636500000	MAGNITUDE:	-.6727	Phase:	-21.21
Frequency:	1.640750000	MAGNITUDE:	-.6769	Phase:	-21.22
Frequency:	1.645000000	MAGNITUDE:	-.6820	Phase:	-21.24

FILE NAME: PLT2_60T1B
FILE TITLE: TRANS1-3 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0088	Phase:	-25.53
Frequency:	1.539250000	MAGNITUDE:	-.0158	Phase:	-25.57
Frequency:	1.543500000	MAGNITUDE:	-.0213	Phase:	-25.62
Frequency:	1.636500000	MAGNITUDE:	-.1285	Phase:	-26.67
Frequency:	1.640750000	MAGNITUDE:	-.1332	Phase:	-26.72
Frequency:	1.645000000	MAGNITUDE:	-.1395	Phase:	-26.78

FILE NAME: PLT2_70T1B
FILE TITLE: TRANS1-3 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.2519	Phase:	-30.95
Frequency:	1.539250000	MAGNITUDE:	+.2432	Phase:	-31.00
Frequency:	1.543500000	MAGNITUDE:	+.2350	Phase:	-31.05
Frequency:	1.636500000	MAGNITUDE:	+.0926	Phase:	-32.17
Frequency:	1.640750000	MAGNITUDE:	+.0873	Phase:	-32.22
Frequency:	1.645000000	MAGNITUDE:	+.0804	Phase:	-32.28

FILE NAME: PT1_10AT2C
FILE TITLE: TRANS2-1 42vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1387	Phase:	-13.62
Frequency:	1.539250000	MAGNITUDE:	-.1377	Phase:	-13.69
Frequency:	1.543500000	MAGNITUDE:	-.1365	Phase:	-13.76
Frequency:	1.636500000	MAGNITUDE:	-.1298	Phase:	-15.41
Frequency:	1.640750000	MAGNITUDE:	-.1303	Phase:	-15.49
Frequency:	1.645000000	MAGNITUDE:	-.1307	Phase:	-15.56

FILE NAME: PT1_20AT2C
FILE TITLE: TRANS2-1 42vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1411	Phase:	-4.86
Frequency:	1.539250000	MAGNITUDE:	-.1402	Phase:	-4.92
Frequency:	1.543500000	MAGNITUDE:	-.1394	Phase:	-4.97
Frequency:	1.636500000	MAGNITUDE:	-.1276	Phase:	-6.29
Frequency:	1.640750000	MAGNITUDE:	-.1275	Phase:	-6.36
Frequency:	1.645000000	MAGNITUDE:	-.1275	Phase:	-6.42

FILE NAME: PT1_30AT2C
FILE TITLE: TRANS2-1 42vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1958	Phase:	-4.99
Frequency:	1.539250000	MAGNITUDE:	-.1942	Phase:	-5.03
Frequency:	1.543500000	MAGNITUDE:	-.1924	Phase:	-5.07
Frequency:	1.636500000	MAGNITUDE:	-.1531	Phase:	-6.27
Frequency:	1.640750000	MAGNITUDE:	-.1511	Phase:	-6.33
Frequency:	1.645000000	MAGNITUDE:	-.1490	Phase:	-6.40

FILE NAME: PT1_40AT2C
FILE TITLE: TRANS2-1 42vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1926	Phase:	-13.27
Frequency:	1.539250000	MAGNITUDE:	-.1903	Phase:	-13.35
Frequency:	1.543500000	MAGNITUDE:	-.1878	Phase:	-13.42
Frequency:	1.636500000	MAGNITUDE:	-.1346	Phase:	-14.72
Frequency:	1.640750000	MAGNITUDE:	-.1333	Phase:	-14.76
Frequency:	1.645000000	MAGNITUDE:	-.1326	Phase:	-14.80

FILE NAME: PT1_50AT2C
FILE TITLE: TRANS2-1 42vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0132	Phase:	-12.84
Frequency:	1.539250000	MAGNITUDE:	+.0174	Phase:	-12.98
Frequency:	1.543500000	MAGNITUDE:	+.0216	Phase:	-13.91
Frequency:	1.636500000	MAGNITUDE:	+.0795	Phase:	-13.57
Frequency:	1.640750000	MAGNITUDE:	+.0800	Phase:	-13.61
Frequency:	1.645000000	MAGNITUDE:	+.0805	Phase:	-13.64

FILE NAME: PT1_60AT2C
FILE TITLE: TRANS2-1 42vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0421	Phase:	-16.06
Frequency:	1.539250000	MAGNITUDE:	+.0481	Phase:	-16.10
Frequency:	1.543500000	MAGNITUDE:	+.0544	Phase:	-16.14
Frequency:	1.636500000	MAGNITUDE:	+.1499	Phase:	-16.38
Frequency:	1.640750000	MAGNITUDE:	+.1517	Phase:	-16.38
Frequency:	1.645000000	MAGNITUDE:	+.1535	Phase:	-16.38

FILE NAME: PT1_70AT2C
FILE TITLE: TRANS2-1 42vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0432	Phase:	-28.61
Frequency:	1.539250000	MAGNITUDE:	+.0524	Phase:	-28.68
Frequency:	1.543500000	MAGNITUDE:	+.0623	Phase:	-28.74
Frequency:	1.636500000	MAGNITUDE:	+.2736	Phase:	-30.08
Frequency:	1.640750000	MAGNITUDE:	+.2880	Phase:	-30.13
Frequency:	1.645000000	MAGNITUDE:	+.2975	Phase:	-30.18

FILE NAME: PT1_10BT2C
FILE TITLE: TRANS2-1 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0218	Phase:	-6.76
Frequency:	1.539250000	MAGNITUDE:	-.0205	Phase:	-6.82
Frequency:	1.543500000	MAGNITUDE:	-.0195	Phase:	-6.88
Frequency:	1.636500000	MAGNITUDE:	-.0017	Phase:	-8.26
Frequency:	1.640750000	MAGNITUDE:	-.0014	Phase:	-8.33
Frequency:	1.645000000	MAGNITUDE:	-.0011	Phase:	-8.39

FILE NAME: PT1_20BT2C
FILE TITLE: TRANS2-1 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0769	Phase:	-11.09
Frequency:	1.539250000	MAGNITUDE:	-.0760	Phase:	-11.15
Frequency:	1.543500000	MAGNITUDE:	-.0748	Phase:	-11.21
Frequency:	1.636500000	MAGNITUDE:	-.0534	Phase:	-12.53
Frequency:	1.640750000	MAGNITUDE:	-.0527	Phase:	-12.59
Frequency:	1.645000000	MAGNITUDE:	-.0520	Phase:	-12.65

FILE NAME: PT1_30BT2C
FILE TITLE: TRANS2-1 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1692	Phase:	-16.35
Frequency:	1.539250000	MAGNITUDE:	-.1693	Phase:	-16.41
Frequency:	1.543500000	MAGNITUDE:	-.1692	Phase:	-16.47
Frequency:	1.636500000	MAGNITUDE:	-.1667	Phase:	-18.01
Frequency:	1.640750000	MAGNITUDE:	-.1662	Phase:	-18.08
Frequency:	1.645000000	MAGNITUDE:	-.1656	Phase:	-18.16

FILE NAME: PT1_40BT2C
FILE TITLE: TRANS2-1 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.0253	Phase:	-17.48
Frequency:	1.539250000	MAGNITUDE:	-.0244	Phase:	-17.55
Frequency:	1.543500000	MAGNITUDE:	-.0237	Phase:	-17.62
Frequency:	1.636500000	MAGNITUDE:	-.0063	Phase:	-18.96
Frequency:	1.640750000	MAGNITUDE:	-.0064	Phase:	-19.00
Frequency:	1.645000000	MAGNITUDE:	-.0068	Phase:	-19.05

FILE NAME: PT1_50BT2C
FILE TITLE: TRANS2-1 48vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0428	Phase:	-16.17
Frequency:	1.539250000	MAGNITUDE:	+.0462	Phase:	-16.21
Frequency:	1.543500000	MAGNITUDE:	+.0499	Phase:	-16.25
Frequency:	1.636500000	MAGNITUDE:	+.0837	Phase:	-16.31
Frequency:	1.640750000	MAGNITUDE:	+.0827	Phase:	-16.35
Frequency:	1.645000000	MAGNITUDE:	+.0818	Phase:	-16.38

FILE NAME: PT1_60BT2C
FILE TITLE: TRANS2-1 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.2041	Phase:	-17.82
Frequency:	1.539250000	MAGNITUDE:	+.2103	Phase:	-17.86
Frequency:	1.543500000	MAGNITUDE:	+.2166	Phase:	-17.89
Frequency:	1.636500000	MAGNITUDE:	+.3147	Phase:	-18.22
Frequency:	1.640750000	MAGNITUDE:	+.3166	Phase:	-18.23
Frequency:	1.645000000	MAGNITUDE:	+.3184	Phase:	-18.25

FILE NAME: PT1_70BT2C
FILE TITLE: TRANS2-1 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0947	Phase:	-27.39
Frequency:	1.539250000	MAGNITUDE:	+.1039	Phase:	-27.47
Frequency:	1.543500000	MAGNITUDE:	+.1138	Phase:	-27.55
Frequency:	1.636500000	MAGNITUDE:	+.3181	Phase:	-29.25
Frequency:	1.640750000	MAGNITUDE:	+.3263	Phase:	-29.31
Frequency:	1.645000000	MAGNITUDE:	+.3343	Phase:	-29.38

FILE NAME: PT2_10AT2C
FILE TITLE: TRANS2-3 42vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.5143	Phase:	-11.23
Frequency:	1.539250000	MAGNITUDE:	-.5147	Phase:	-11.29
Frequency:	1.543500000	MAGNITUDE:	-.5154	Phase:	-11.35
Frequency:	1.636500000	MAGNITUDE:	-.5287	Phase:	-12.70
Frequency:	1.640750000	MAGNITUDE:	-.5293	Phase:	-12.77
Frequency:	1.645000000	MAGNITUDE:	-.5298	Phase:	-12.83

FILE NAME: PT2_20AT2C
FILE TITLE: TRANS2-3 42vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1056	Phase:	-10.60
Frequency:	1.539250000	MAGNITUDE:	-.1053	Phase:	-10.66
Frequency:	1.543500000	MAGNITUDE:	-.1050	Phase:	-10.72
Frequency:	1.636500000	MAGNITUDE:	-.1053	Phase:	-12.17
Frequency:	1.640750000	MAGNITUDE:	-.1056	Phase:	-12.23
Frequency:	1.645000000	MAGNITUDE:	-.1059	Phase:	-12.30

FILE NAME: PT2_30AT2C
FILE TITLE: TRANS2-3 42vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.3326	Phase:	-6.85
Frequency:	1.539250000	MAGNITUDE:	-.3322	Phase:	-6.91
Frequency:	1.543500000	MAGNITUDE:	-.3320	Phase:	-6.96
Frequency:	1.636500000	MAGNITUDE:	-.3147	Phase:	-8.07
Frequency:	1.640750000	MAGNITUDE:	-.3133	Phase:	-8.13
Frequency:	1.645000000	MAGNITUDE:	-.3124	Phase:	-8.18

FILE NAME: PT2_40AT2C
FILE TITLE: TRANS2-3 42vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.4784	Phase:	-19.87
Frequency:	1.539250000	MAGNITUDE:	-.4774	Phase:	-19.93
Frequency:	1.543500000	MAGNITUDE:	-.4758	Phase:	-19.97
Frequency:	1.636500000	MAGNITUDE:	-.4635	Phase:	-20.55
Frequency:	1.640750000	MAGNITUDE:	-.4642	Phase:	-20.58
Frequency:	1.645000000	MAGNITUDE:	-.4648	Phase:	-20.61

FILE NAME: PT2_50AT2C
FILE TITLE: TRANS2-3 42vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.4916	Phase:	-24.27
Frequency:	1.539250000	MAGNITUDE:	-.4917	Phase:	-24.29
Frequency:	1.543500000	MAGNITUDE:	-.4920	Phase:	-24.31
Frequency:	1.636500000	MAGNITUDE:	-.5237	Phase:	-24.84
Frequency:	1.640750000	MAGNITUDE:	-.5245	Phase:	-24.89
Frequency:	1.645000000	MAGNITUDE:	-.5254	Phase:	-25.03

FILE NAME: PT2_60AT2C
FILE TITLE: TRANS2-3 42vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.4575	Phase:	-29.23
Frequency:	1.539250000	MAGNITUDE:	-.4653	Phase:	-29.25
Frequency:	1.543500000	MAGNITUDE:	-.4737	Phase:	-29.26
Frequency:	1.636500000	MAGNITUDE:	-.6292	Phase:	-30.30
Frequency:	1.640750000	MAGNITUDE:	-.6344	Phase:	-30.38
Frequency:	1.645000000	MAGNITUDE:	-.6397	Phase:	-30.45

FILE NAME: PT2_70AT2C
FILE TITLE: TRANS2-3 42vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.7989	Phase:	-36.03
Frequency:	1.539250000	MAGNITUDE:	+.7725	Phase:	-35.94
Frequency:	1.543500000	MAGNITUDE:	+.7457	Phase:	-35.87
Frequency:	1.636500000	MAGNITUDE:	+.1851	Phase:	-35.44
Frequency:	1.640750000	MAGNITUDE:	+.1623	Phase:	-35.47
Frequency:	1.645000000	MAGNITUDE:	+.1401	Phase:	-35.52

FILE NAME: PT2_10BT2C
FILE TITLE: TRANS2-3 48vert 10deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.2219	Phase:	-20.16
Frequency:	1.539250000	MAGNITUDE:	-.2218	Phase:	-20.27
Frequency:	1.543500000	MAGNITUDE:	-.2218	Phase:	-20.39
Frequency:	1.636500000	MAGNITUDE:	-.2175	Phase:	-22.82
Frequency:	1.640750000	MAGNITUDE:	-.2173	Phase:	-22.94
Frequency:	1.645000000	MAGNITUDE:	-.2169	Phase:	-23.05

FILE NAME: PT2_20BT2C
FILE TITLE: TRANS2-3 48vert 20deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0696	Phase:	-26.48
Frequency:	1.539250000	MAGNITUDE:	+.0696	Phase:	-26.57
Frequency:	1.543500000	MAGNITUDE:	+.0695	Phase:	-26.66
Frequency:	1.636500000	MAGNITUDE:	+.0602	Phase:	-28.67
Frequency:	1.640750000	MAGNITUDE:	+.0593	Phase:	-28.76
Frequency:	1.645000000	MAGNITUDE:	+.0588	Phase:	-28.85

FILE NAME: PT2_30BT2C
FILE TITLE: TRANS2-3 48vert 30deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	-.1221	Phase:	-26.17
Frequency:	1.539250000	MAGNITUDE:	-.1232	Phase:	-26.27
Frequency:	1.543500000	MAGNITUDE:	-.1242	Phase:	-26.37
Frequency:	1.636500000	MAGNITUDE:	-.1435	Phase:	-28.45
Frequency:	1.640750000	MAGNITUDE:	-.1447	Phase:	-28.55
Frequency:	1.645000000	MAGNITUDE:	-.1455	Phase:	-28.64

FILE NAME: PT2_40BT2C
FILE TITLE: TRANS2-3 48vert 40deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.1608	Phase:	-44.68
Frequency:	1.539250000	MAGNITUDE:	+.1620	Phase:	-44.80
Frequency:	1.543500000	MAGNITUDE:	+.1636	Phase:	-44.93
Frequency:	1.636500000	MAGNITUDE:	+.1590	Phase:	-47.29
Frequency:	1.640750000	MAGNITUDE:	+.1568	Phase:	-47.40
Frequency:	1.645000000	MAGNITUDE:	+.1547	Phase:	-47.51

FILE NAME: PT2_50BT2C
FILE TITLE: TRANS2-3 48vert 50deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0948	Phase:	-29.32
Frequency:	1.539250000	MAGNITUDE:	+.0954	Phase:	-29.39
Frequency:	1.543500000	MAGNITUDE:	+.0955	Phase:	-29.45
Frequency:	1.636500000	MAGNITUDE:	+.0430	Phase:	-31.01
Frequency:	1.640750000	MAGNITUDE:	+.0392	Phase:	-31.09
Frequency:	1.645000000	MAGNITUDE:	+.0359	Phase:	-31.16

FILE NAME: PT2_60BT2C
FILE TITLE: TRANS2-3 48vert 60deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.1816	Phase:	-29.60
Frequency:	1.539250000	MAGNITUDE:	+.1758	Phase:	-29.64
Frequency:	1.543500000	MAGNITUDE:	+.1697	Phase:	-29.69
Frequency:	1.636500000	MAGNITUDE:	+.0452	Phase:	-31.63
Frequency:	1.640750000	MAGNITUDE:	+.0402	Phase:	-31.75
Frequency:	1.645000000	MAGNITUDE:	+.0350	Phase:	-31.87

FILE NAME: PT2_70BT2C
FILE TITLE: TRANS2-3 48vert 70deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+1.2956	Phase:	-37.04
Frequency:	1.539250000	MAGNITUDE:	+1.2710	Phase:	-36.96
Frequency:	1.543500000	MAGNITUDE:	+1.2460	Phase:	-36.89
Frequency:	1.636500000	MAGNITUDE:	+.7077	Phase:	-36.31
Frequency:	1.640750000	MAGNITUDE:	+.6848	Phase:	-36.32
Frequency:	1.645000000	MAGNITUDE:	+.6623	Phase:	-36.35

FILE NAME: PLT1_T1DVP
FILE TITLE: TRANS1-1 DOT-DOT 42vert 0deg V-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0200	Phase:	-.09
Frequency:	1.539250000	MAGNITUDE:	+.0191	Phase:	-.09
Frequency:	1.543500000	MAGNITUDE:	+.0197	Phase:	-.10
Frequency:	1.636500000	MAGNITUDE:	+.0201	Phase:	-.18
Frequency:	1.640750000	MAGNITUDE:	+.0199	Phase:	-.19
Frequency:	1.645000000	MAGNITUDE:	+.0190	Phase:	-.19

FILE NAME: PLT1_T1DHP
FILE TITLE: TRANS1-1 DOT-DOT 42vert 0deg H-POL

	GHz		dB		deg
Frequency:	1.535000000	MAGNITUDE:	+.0027	Phase:	+.24
Frequency:	1.539250000	MAGNITUDE:	+.0027	Phase:	+.24
Frequency:	1.543500000	MAGNITUDE:	+.0034	Phase:	+.24
Frequency:	1.636500000	MAGNITUDE:	+.0047	Phase:	+.26
Frequency:	1.640750000	MAGNITUDE:	+.0044	Phase:	+.26
Frequency:	1.645000000	MAGNITUDE:	+.0048	Phase:	+.27

APPENDIX A

ANECHOIC CHAMBER

The Radiation Laboratory's anechoic chamber is a tapered design with overall dimensions 18 ft. wide x 60 ft. long x 18 ft. high.

The anechoic treatment consists of 72 inch deep pyramidal absorber on the target endwall of the chamber; 24 inch and 18 inch deep pyramidal absorbers, and 12 inch wedge absorber on the sidewalls, ceiling, and floor surfaces of the 18 ft. x 18 ft. x 22 ft. long test region; and, 18 inch deep pyramidal and 12 inch deep wedge absorbers on all surfaces of the tapered section. In addition, 140 sq. ft. of the test region floor surface is treated with 24 inch deep walkway absorber.

The test region quiet zone is a sphere, 6 ft. in diameter whose center was positioned on the chamber centerline, 13 feet from the target endwall surface.

Measured chamber reflectivity were specified not to exceed the following values within the quiet zone test region.

	REFLECTIVITY PERFORMANCE SPECIFICATION	
FREQUENCY	Backwall	Sidewall
100 MHz	-25 dB	-20 dB
300 MHz	-35 dB	-25 dB
1 GHz	-45 dB	-35 dB
26 GHz	-45 dB	-45 dB

The measured performance well exceeds the specification, except for 1 or 2 dB at isolated points. At 1 GHz the specified performance is exceeded by about 10 dB and at 26 GHz by about 25 to 35 dB.

Effect of Curvature on the Reflectivity of Panels

Assume a rectangular panel of size $a \times b$ is curved in two directions parallel to side a and side b, respectively, which is the case with provided samples. For normal plane wave incidence, it is found that the ratio of the magnitude of the backscattered far field of the curved panel, denoted by S, to that of a flat panel of same size, denoted by S^{fp}, is [1]

$$\frac{S}{S^{fp}} = \frac{1}{\gamma_1} |F(\gamma_1)| \cdot \frac{1}{\gamma_2} |F(\gamma_2)|$$

where

$$\gamma_1 = \frac{a}{2}\sqrt{\frac{k}{r_1}}, \quad \gamma_2 = \frac{b}{2}\sqrt{\frac{k}{r_2}}$$

In the above, k is the free-space wavenumber, r_1 and r_2 are the curvature radii of the panel along the side a and side b, and F denotes the well-known Fresnel integral defined by

$$F(\tau) = \int_0^\tau e^{iu^2} du$$

To give a quantitative idea on the effect of curvature in our panel measurements, we present a calculation here for the case of Panel-1. For Panel-1

$$a = 42\ in., \quad b = 48\ in.$$

$$r_1 = 622\ in., \quad r_2 = 780\ in.$$

[1] K. Sarabandi, T.B.A. Senior, and F.T. Ulaby, "Effect of curvature on the backscattering from leaves," to be published on the *Journal of Electromagnetic Waves and Applications.*

At $f = 1.650\ GHz$, $k = 0.8778/in.$ and hence

$$\gamma_1 = 0.7889\ , \quad \gamma_2 = 0.8051$$

The corresponding Fresnel integral values are

$$|F(\gamma_1)| = 0.7760\ , \quad |F(\gamma_2)| = 0.7875$$

which then give

$$\frac{S}{S^{fp}} = 0.8825$$

or

$$20log\left(\frac{S}{S^{fp}}\right) = -1.1\ dB$$

Thus, the curvature of the panel reduces the reflectivity in normal direction by 1.1 dB.

This computation shows that even a slight curvature can affect the specular return. In fact, in practice, the curvature effect can actually increase the return. This will occurr when the curvature is concave toward the transmitting/receiving antennas.

Appendix C. Transmissivity2 Data Processing.

This appendix presents the coherent approach for transmissivity calculations based on total reflectivity measurements of the dielectric panels backed by an aluminum plate.

Figure C shows ray traces for the dielectric sample in the front of the aluminum plate whose reflectivity is considered as $R_c = -1$. The assumptions which is used are :

1. the dielectric medium has an uniform dielectric constant
2. reflectivities of both surfaces of the sample are same.

For each ray trace, the reflectivity is as follows:

ray 1 : $R_1 = R$

ray 2 : $R_2 = T^2 R exp(-j2\beta d/cos\theta_2)$

ray 3 : $R_3 = T^4 R_c exp(-j2\beta_0 d_0/cos\theta_1) exp(-j2\beta d/cos\theta_2)$

ray 4 : $R_4 = T^4 R R_c^2 exp(-j4\beta_0 d_0/cos\theta_1) exp(-j2\beta d/cos\theta_2)$

ray 5 : $R_5 = T^6 R R_c^2 exp(-j4\beta_0 d_0/cos\theta_1) exp(-j4\beta d/cos\theta_2)$

where T and R are transmissivity and reflectivity at a surface of the sample respectively and β and β_0 denote the propagation constants of dielectric and air media respectively.

The total reflectivity including the reflected ray only once from the surface of the sample is the summation of the rays 1 through 5 neglecting rays on the order

of R^2. The reflectivity of the sample alone, R_s, is the sum of R_1 and R_2. The transmissivity of the sample, T_s, may be expressed as

$$T_s = T^2 exp(-j\beta d/cos\theta_2) \tag{1}$$

Therefore the total reflectivity of the sample in front of the aluminum, R_T, can be expressed in terms of R_s, R_c and T_s as

$$R_T = R_s + T_s^2 R_c(1 + R_c R_s) \tag{2}$$

with the assumption $\beta_0 d_0 << 1$.

It can be shown that the exact expression for R_T is given by

$$R_T = R_s + (T_s^2 R_c)/(1 - R_c R_s) \tag{3}$$

Therefore, with the measurements of R_T and the seperate measurements of R_s, the T_s can be calculated.

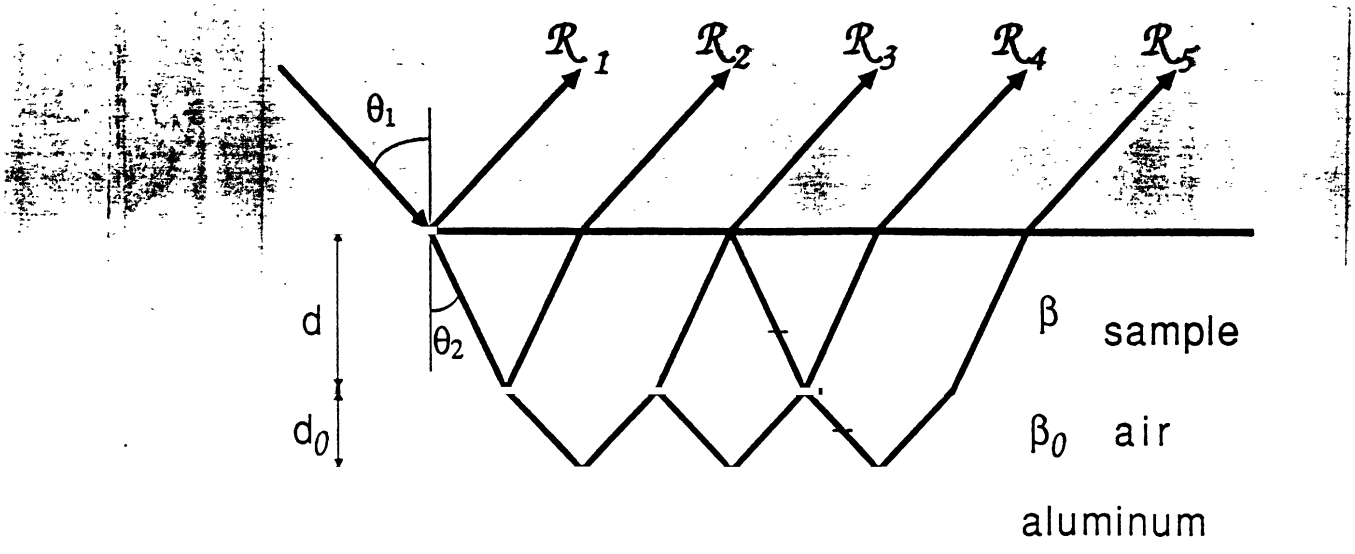


Fig. C. Rays with model.