

NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WEST VIRGINIA

ELECTRONICS DIVISION TECHNICAL NOTE NO. 178

Title: 140-ft. Telescope Coaxial Cable Tests
Authors: G. Behrens, R. Hall, G. Liptak, M. McKinnon
Date: July 26, 1996

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140-ft. Telescope Coaxial Cable Tests

G. Behrens
R. Hall
G. Liptak
M. McKinnon

July 26, 1996

Table of Contents

140-ft. Telescope Coaxial Cable Tests	3
Fig 1. Single Frequency Insertion Loss Measurement Setup	4
Fig 2. Swept Frequency Return Loss Measurements	5
Fig 3. Swept Frequency Insertion Loss Measurements	6
Fig 4. Time Domain Reflectometer Measurements	7
Fig 5A. Measured Insertion Loss of 7/8 in. Spiroline Cable at 140-ft., Cable 1	8
Figure 5B. Measured Insertion Loss of 7/8 in. Spiroline Cable at 140-ft., Cable 2	9
Figure 5C. Measured Insertion Loss of 7/8 in. Spiroline Cable at 140-ft., Cable 3	10
Figure 5D. Measured Insertion Loss of 7/8 in. Spiroline Cable at 140-ft., Cable 5	11
Figure 6A. Swept Frequency Insertion Loss Measurements, Cable 1 to 2, 7/8 in. Spiroline	12
Figure 6B. Swept Frequency Insertion Loss Measurements, Cable 1 to 3, 7/8 in. Spiroline	13
Figure 6C. Swept Frequency Insertion Loss Measurements, Cable 1 to 4, 7/8 in. Spiroline	14
Figure 6D. Swept Frequency Insertion Loss Measurements, Cable 1 to 5, 7/8 in. Spiroline	15
Figure 6E. Swept Frequency Insertion Loss Measurements, Cable 9 to 10, 1-5/8 in. Spiroline	16
Figure 6F. Swept Frequency Insertion Loss Measurements, Cable 11 to 12, 1-5/8 in. Spiroline	17
Figure 6G. Swept Frequency Insertion Loss Measurements, Cable 13 to 14, RG-9	18
Figure 6H. Swept Frequency Insertion Loss Measurements, Cable 13 to 15, RG-9	19
Figure 6I. Swept Frequency Insertion Loss Measurements, Cable 13 to 16, RG-9	20
Figure 6J. Reference - Jumper Cable used at Prime Focus	21
Figure 7A. Swept Frequency Return Loss Measurements, Cable 1, 7/8 in. Spiroline	22
Figure 7B. Swept Frequency Return Loss Measurements, Cable 2, 7/8 in. Spiroline	23
Figure 7C. Swept Frequency Return Loss Measurements, Cable 3, 7/8 in. Spiroline	24
Figure 7D. Swept Frequency Return Loss Measurements, Cable 4, 7/8 in. Spiroline	25
Figure 7E. Swept Frequency Return Loss Measurements, Cable 5, 7/8 in. Spiroline	26
Figure 7F. Swept Frequency Return Loss Measurements, Cable 9, 1-5/8 in. Spiroline	27
Figure 7G. Swept Frequency. Return Loss Measurements, Cable 9, 1-5/8 in. Spiroline	28
Figure 7H. Swept Frequency Return Loss Measurements, Cable 10, 1-5/8 in. Spiroline	29
Figure 7I. Swept Frequency Return Loss Measurements, Cable 10, 1-5/8 in. Spiroline	30
Figure 7J. Swept Frequency Return Loss Measurements, Cable 11, RG-9	31
Figure 7K. Swept Frequency Return Loss Measurements, Cable 12, RG-9	32
Figure 7L. Swept Frequency Return Loss Measurements, Cable 13, RG-9	33
Figure 7M. Swept Frequency Return Loss Measurements, Cable 14, RG-9	34
Figure 7N. Swept Frequency Return Loss Measurements, Cable 15, RG-9	35
Figure 7O. Swept Frequency Return Loss Measurements, Cable 16, RG-9	36
Figure 8A. Time Domain Reflectometer Measurements, Cable 1, 7/8 in. Spiroline	37
Figure 8B. Time Domain Reflectometer Measurements, Cable 2, 7/8 in. Spiroline	38
Figure 8C. Time Domain Reflectometer Measurements, Cable 3, 7/8 in. Spiroline	39
Figure 8D. Time Domain Reflectometer Measurements, Cable 4, 7/8 in. Spiroline	40
Figure 8E. Time Domain Reflectometer Measurements, Cable 5, 7/8 in. Spiroline	41
Figure 8F. Time Domain Reflectometer Measurements, Cable 9, 1-5/8 in. Spiroline	42
Figure 8G. Time Domain Reflectometer Measurements, Cable 10, 1-5/8 in. Spiroline	43
Figure 8H. Time Domain Reflectometer Measurements, Cable 11, RG-9	44
Figure 8I. Time Domain Reflectometer Measurements, Cable 12, RG-9	45
Figure 8J. Time Domain Reflectometer Measurements, Cable 13, RG-9	46
Figure 8K. Time Domain Reflectometer Measurements, Cable 14, RG-9	47
Figure 8L. Time Domain Reflectometer Measurements, Cable 15, RG-9	48
Figure 8M. Time Domain Reflectometer Measurements, Cable 16, RG-9	49
Figure 9. Spiroline Cable Attenuation	50
Figure 10. Coaxial Cable Attenuation	51
Figure 11. Reference Jumper RG-9	52
Table 1. Cable Routing and Identification	53

**140-ft. Telescope
Coaxial Cable Tests
of 12 June and 26 July 1996**

On 12 June 1996, and 26 July 1996, measurements were made on the various LO and IF coaxial cables that run from the control room to the focal point. The purpose of these measurements is to document the current performance of the cables, which can be used as a baseline when checking their performance in the future. The measurements were also made to determine if the losses are low enough to be used for the upcoming SETI project.

Four types of tests were made on the cables: (1) single frequency insertion loss (cables 1, 2, 3 and 5 only), (2) swept frequency insertion loss, (3) swept frequency return loss, and (4) time domain reflectometer tests. The setup for each of these tests is shown in Figures 1 through 4. In test 1 through 3, the frequency for all cables tested was varied or swept from 50 MHz to 1050 MHz. Additionally, for the 1-5/8 in. Spiroline cables, the frequency was swept from 1 GHz to 3 GHz in tests 2 and 3. A sweep time of 10 seconds was used in all swept frequency measurements.

The results of these tests are shown in figures 5 through 8, and indicate that the performance is close to that expected when using the manufacturer's data as shown in Figures 9 and 10. Table 1, 140-ft. Cable Routing, is included to provide routing information of the cables.

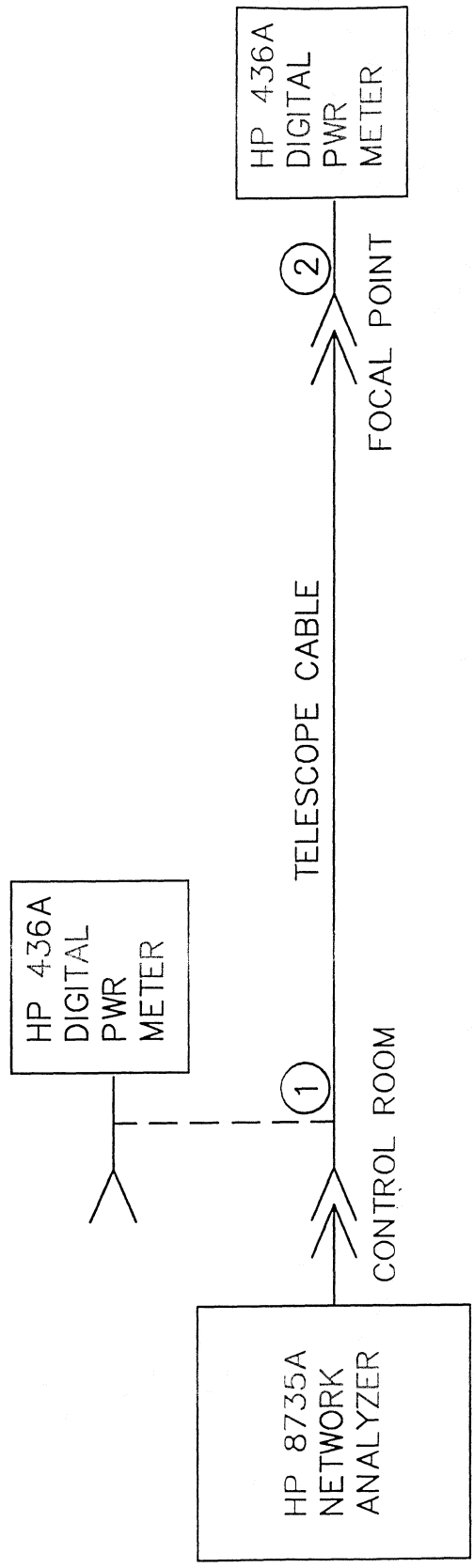


FIGURE 1. SINGLE FREQUENCY INSERTION LOSS MEASUREMENT SET UP

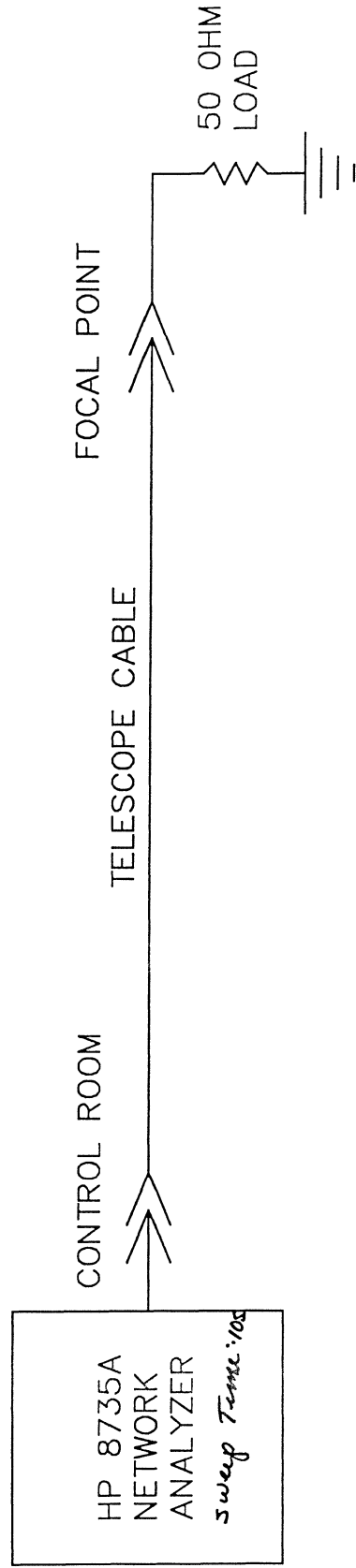
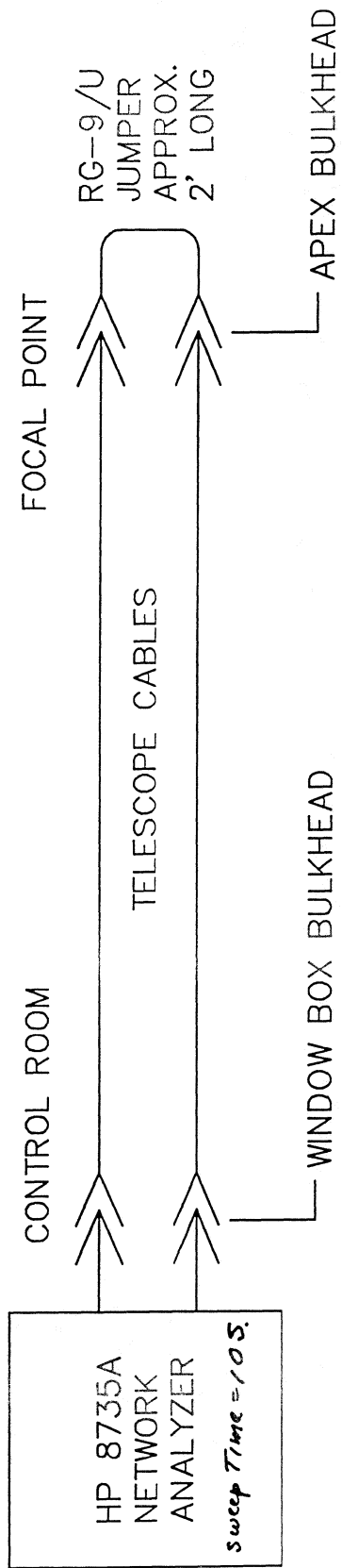
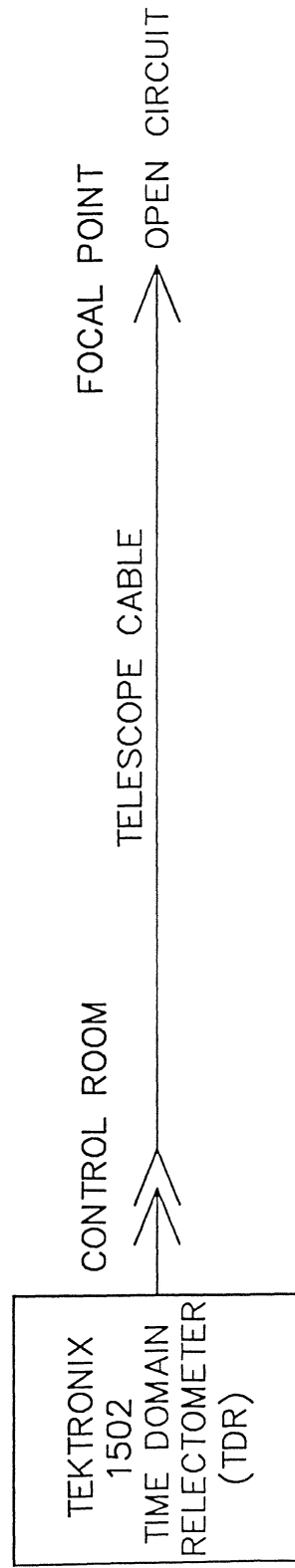


FIGURE 2. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS



12 JUNE 1996

FIGURE 3. SWEEP FREQUENCY INSERTION LOSS MEASUREMENTS



12 JUNE 1996

FIGURE 4. TIME DOMAIN REFLECTOMETER MEASUREMENTS

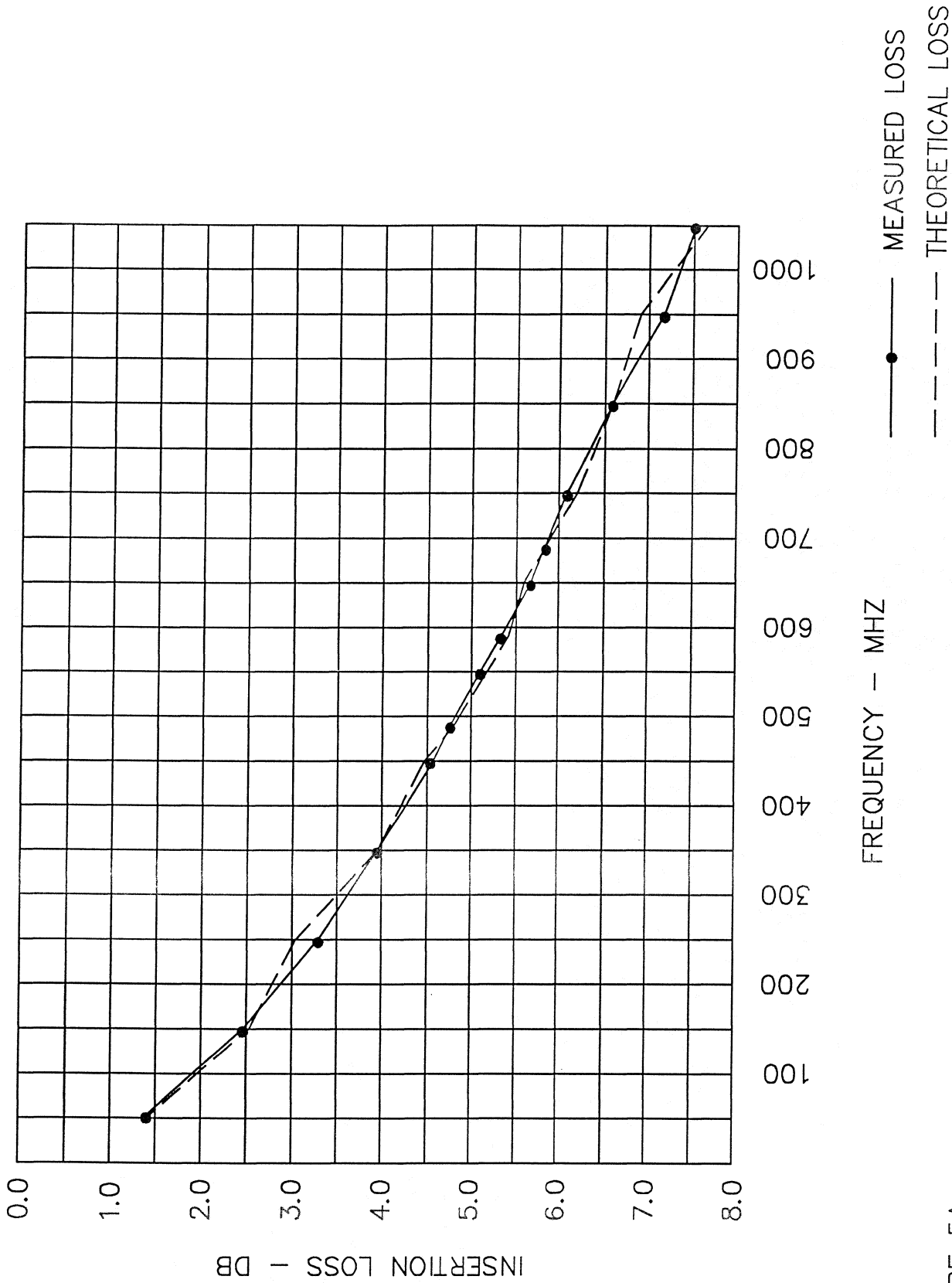


FIGURE 5A.
 MEASURED INSERTION LOSS OF 7/8 IN. SPIROLINE CABLE AT 140 FT. TELESCOPE, CABLE #1

6/05/96

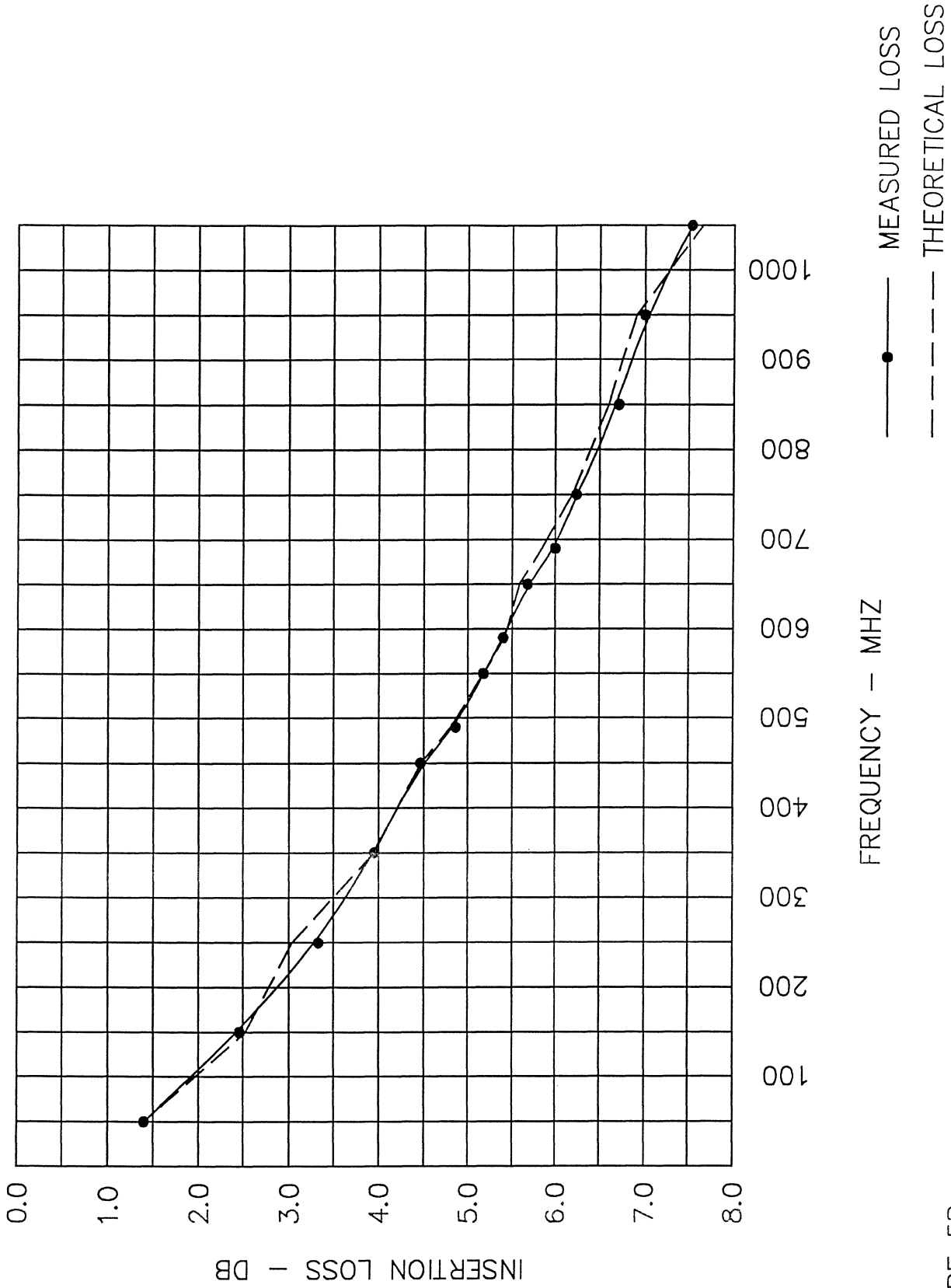


FIGURE 5B.
 MEASURED INSERTION LOSS OF 7/8 IN. SPIROLINE CABLE AT 140 FT. TELESCOPE, CABLE #2

6/05/96

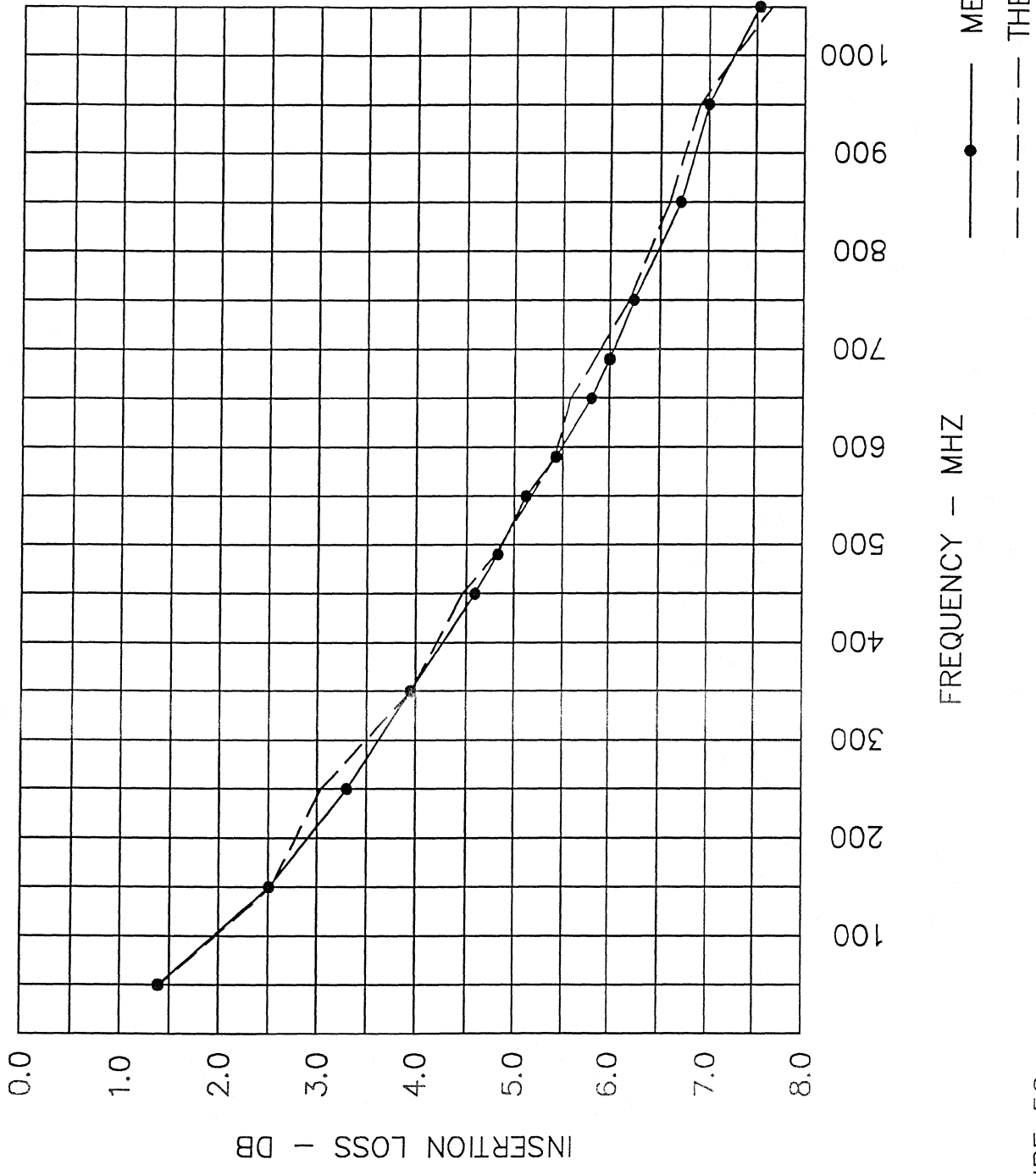


FIGURE 5C.
 MEASURED INSERTION LOSS OF 7/8 IN. SPIROLINE CABLE AT 140 FT. TELESCOPE, CABLE #3

6/05/96

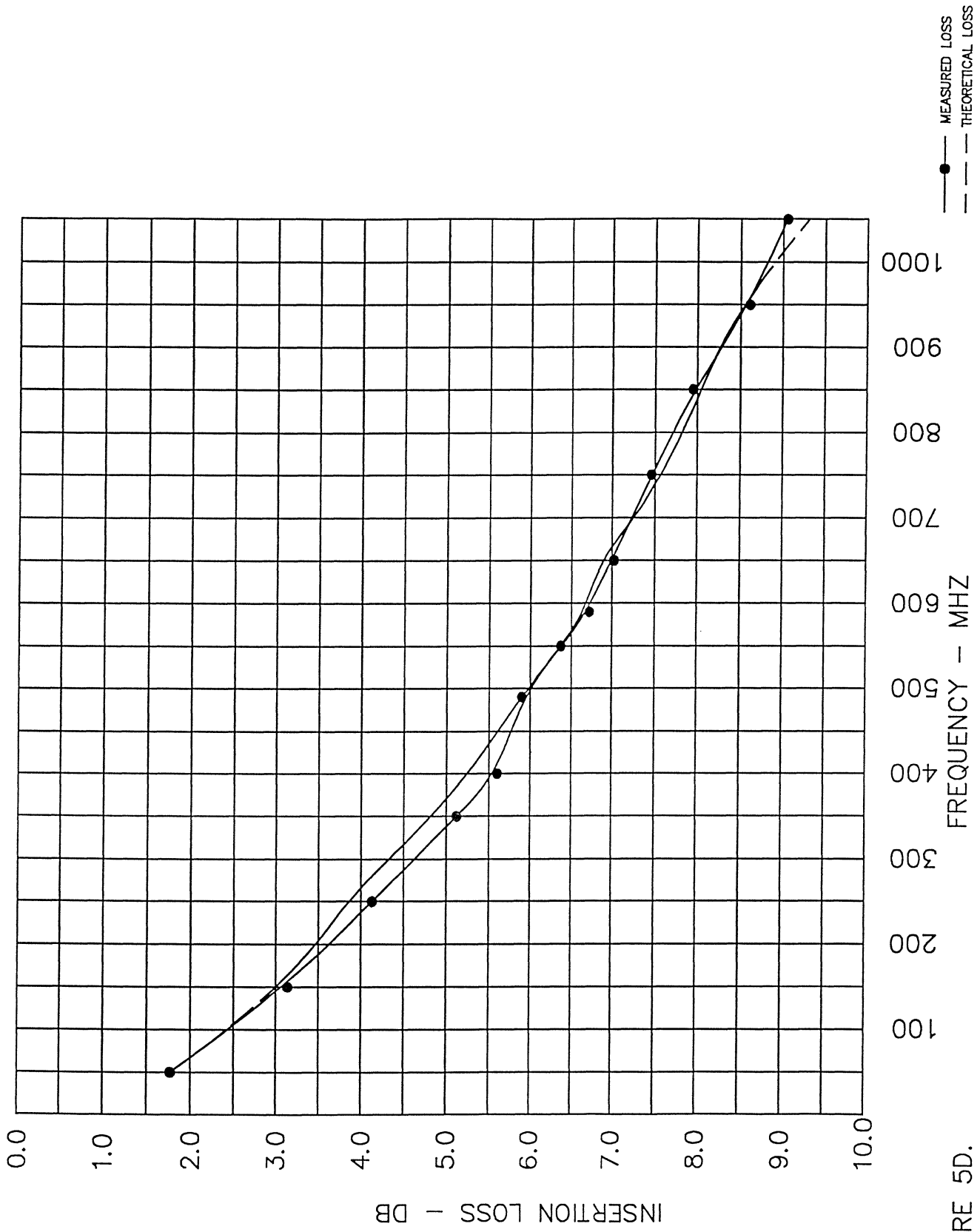


FIGURE 5D.
 MEASURED INSERTION LOSS OF 7/8 IN. SPIROLINE CABLE AT 140 FT. TELESCOPE, CABLE #5

6/05/96

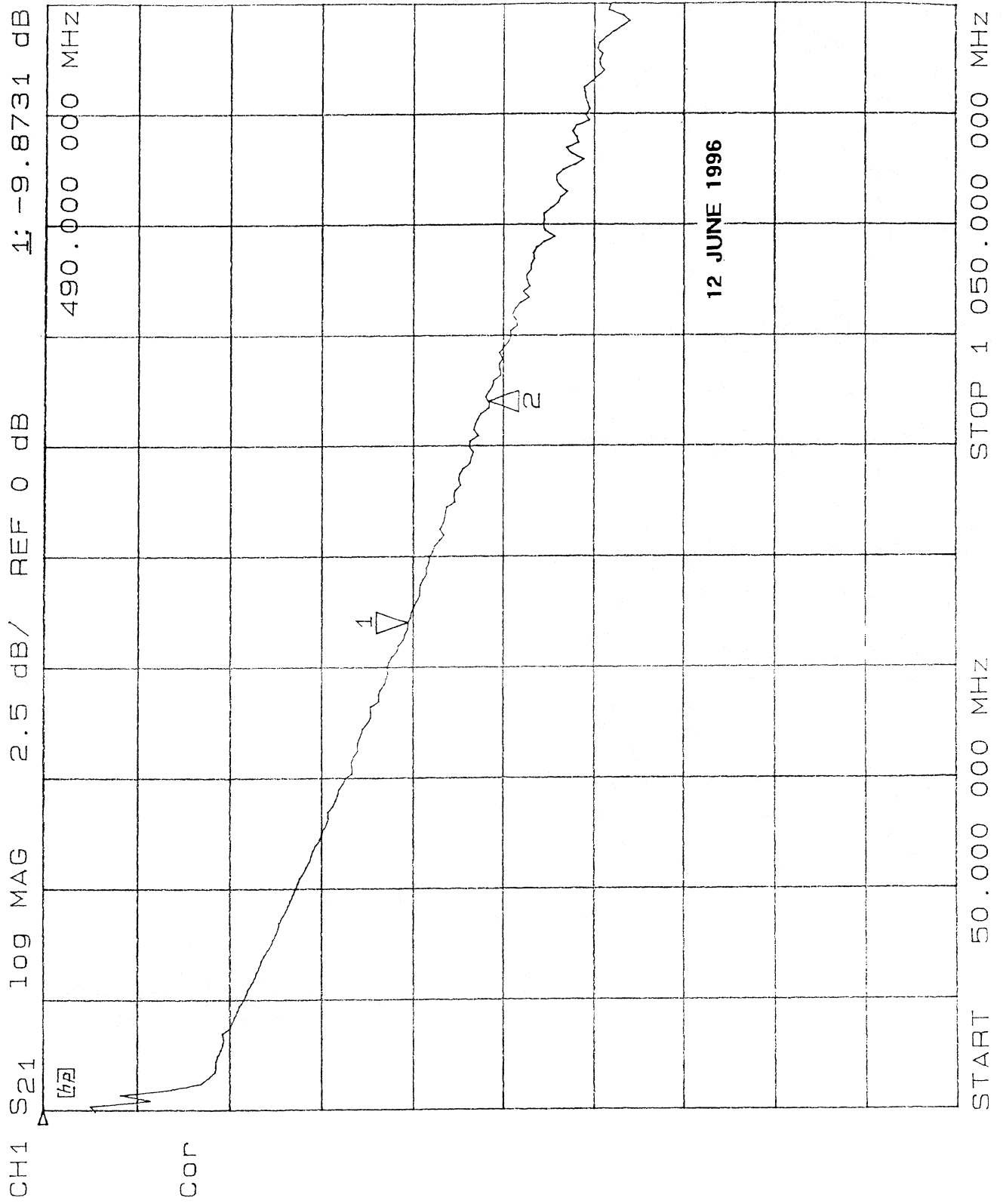


FIGURE 6A. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 2, 7/8 IN. SPIROLINE

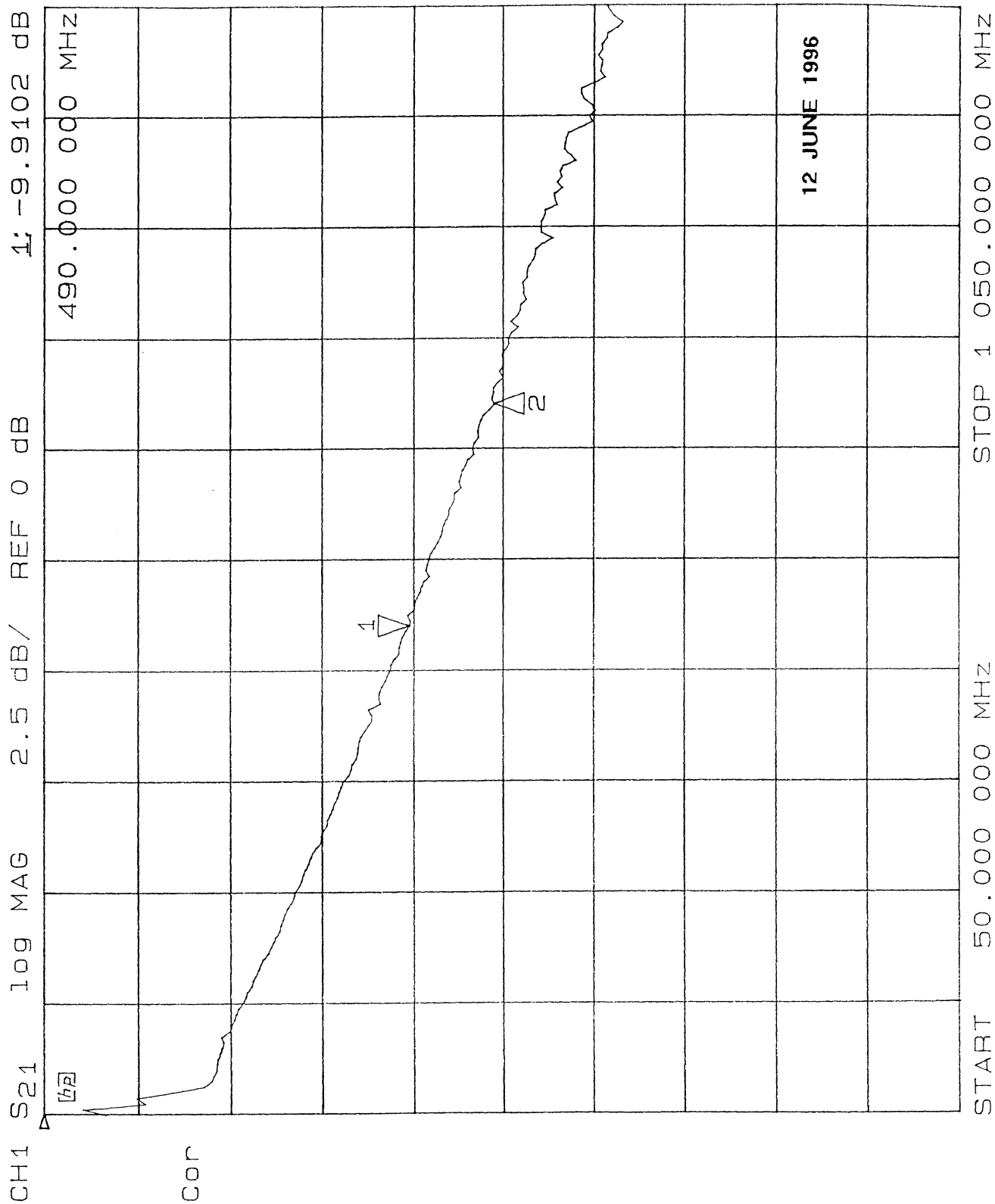


FIGURE 6B. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 3. 7/8 IN COAXIAL

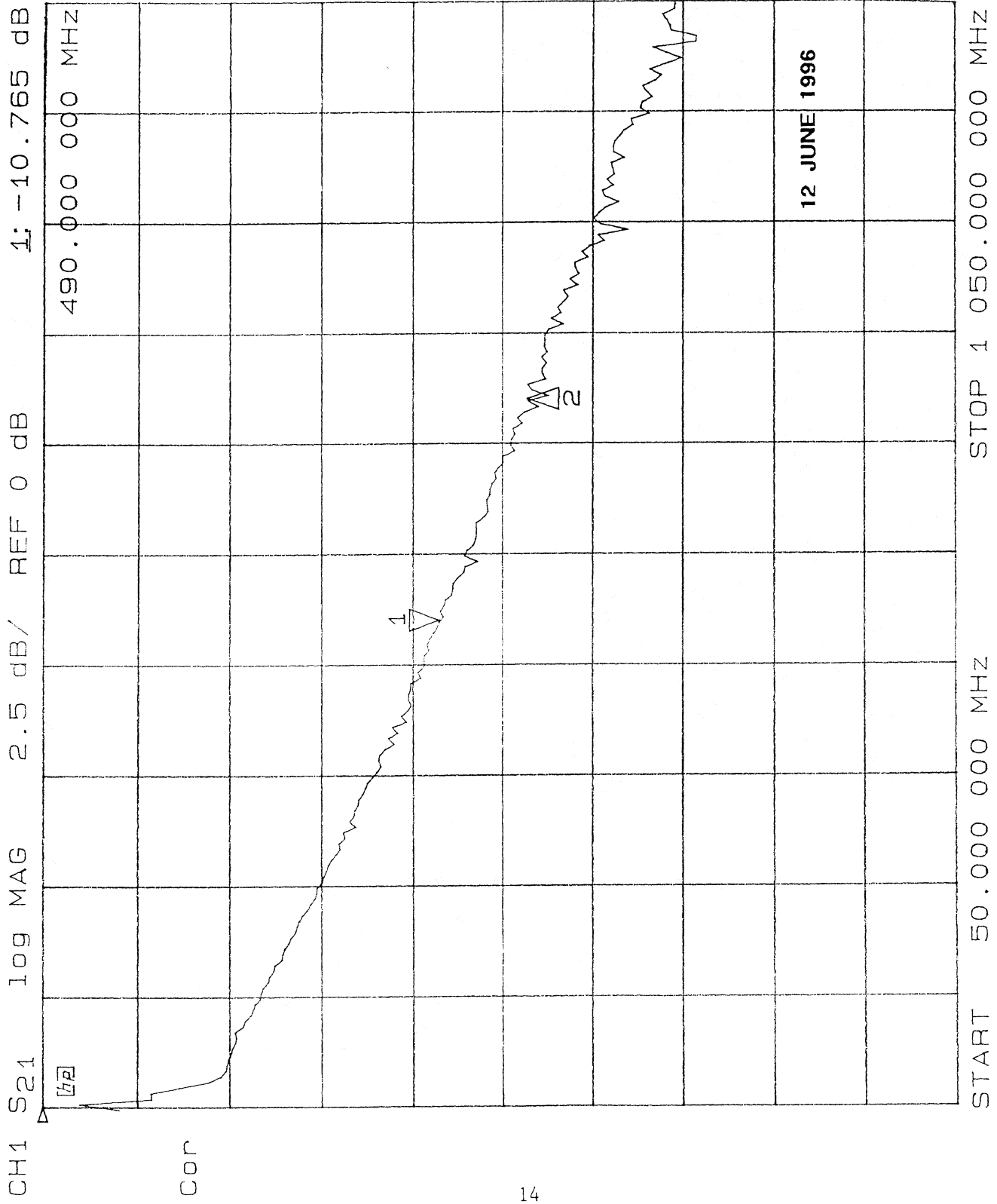


FIGURE 6C. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 4, 7/8 IN. SPIROLINE

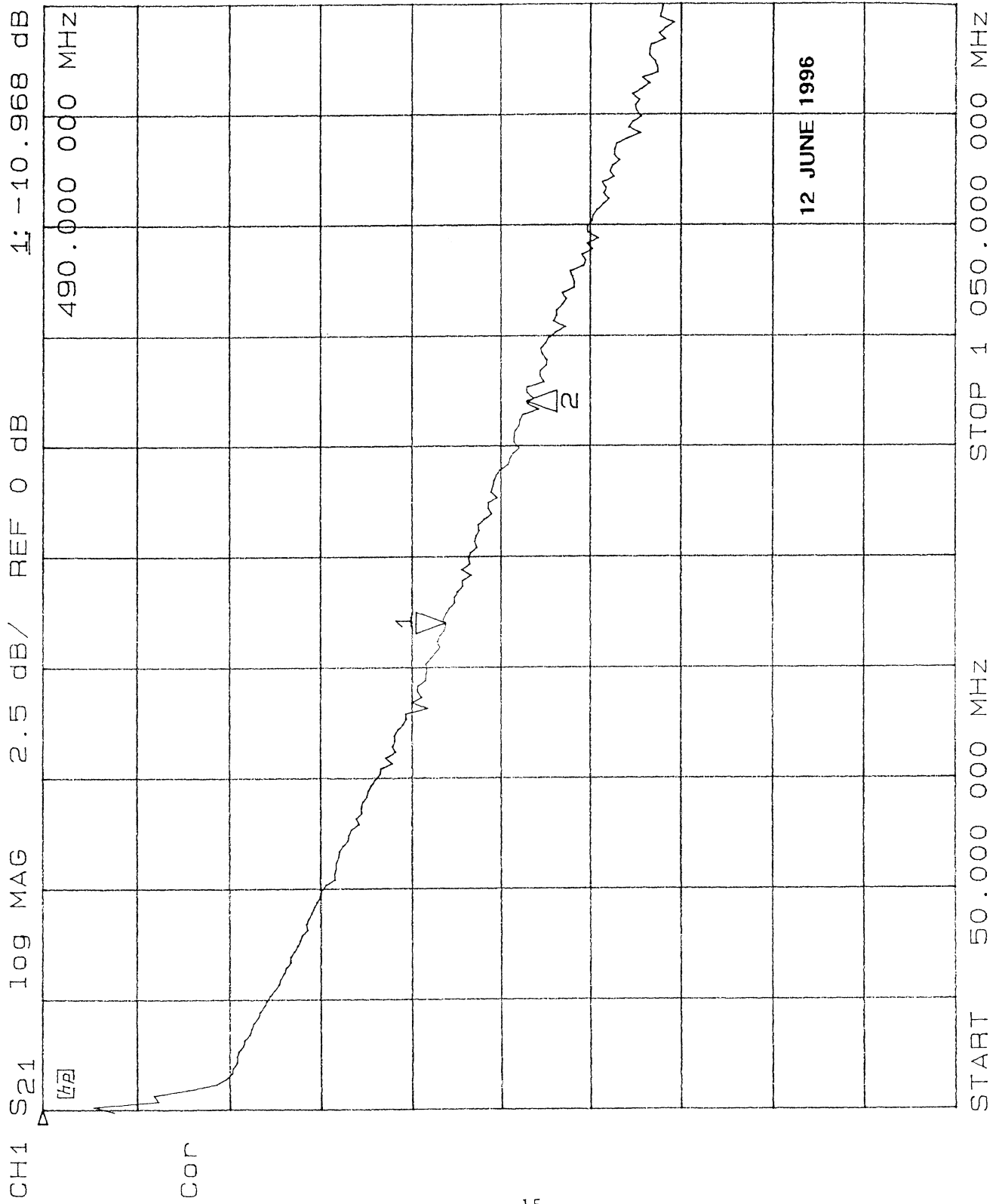


FIGURE 6D. SWEEP FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 5, 7/8 IN. SPIROLINE

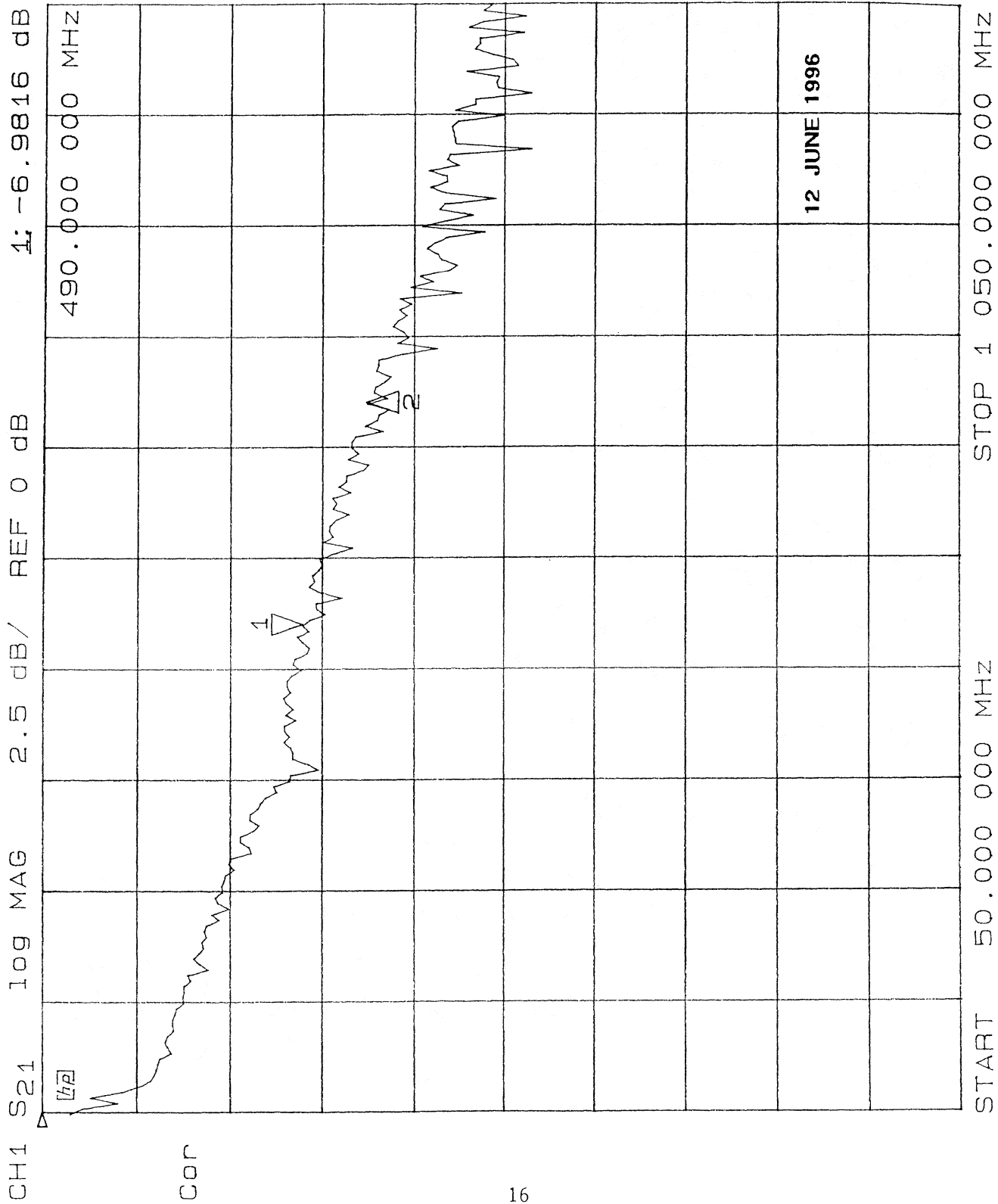
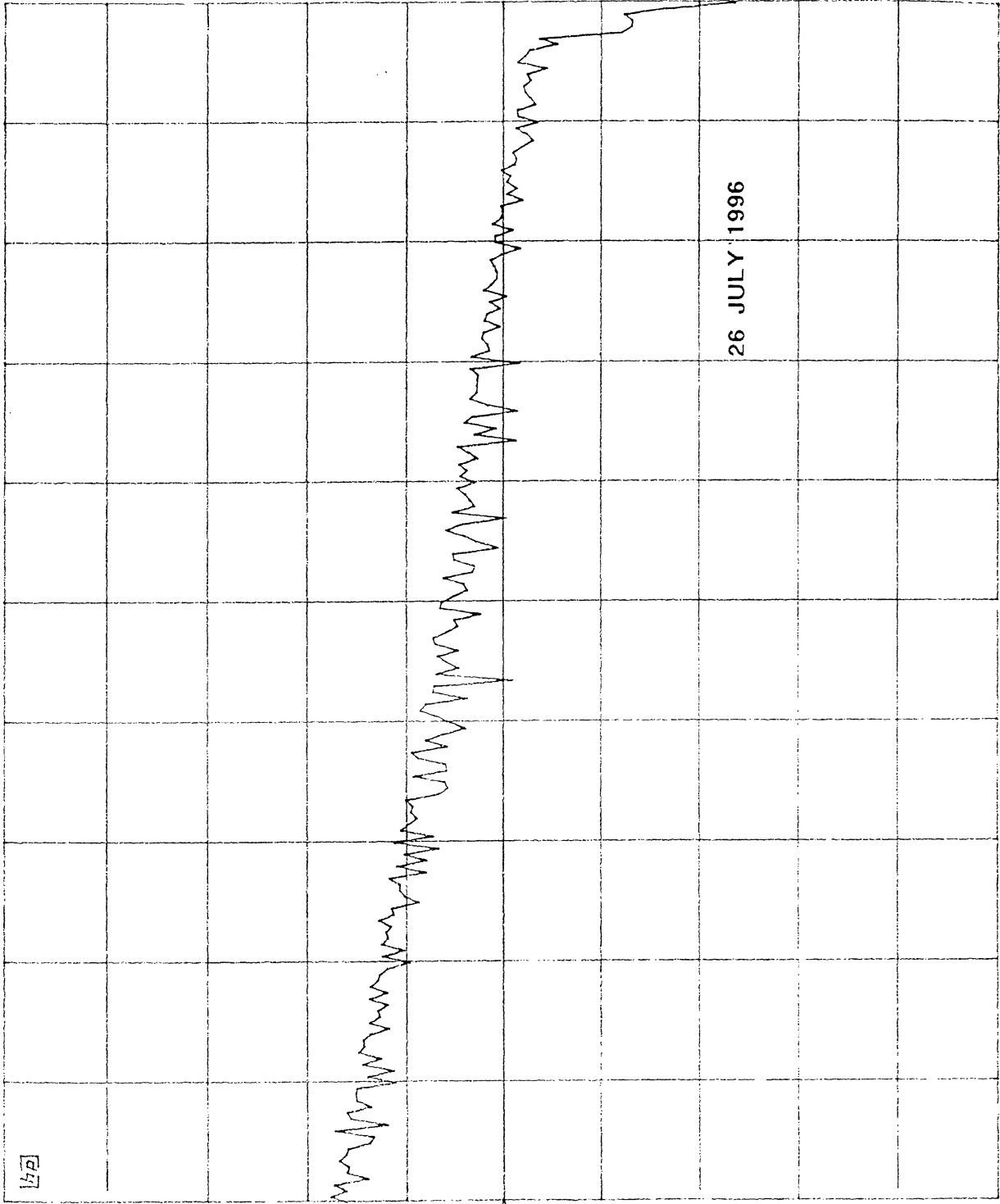


FIGURE 6E. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 9 TO 10 1-5/8 IN. SPIROLINE

CHI S21 109 MAG 5 dB/ REF -20 dB



START 1 000.000 000 MHZ STOP 3 000.000 000 MHZ

FIGURE 6F. SWEEP FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 9 TO 10 1-5/8 IN. SPIROLINE

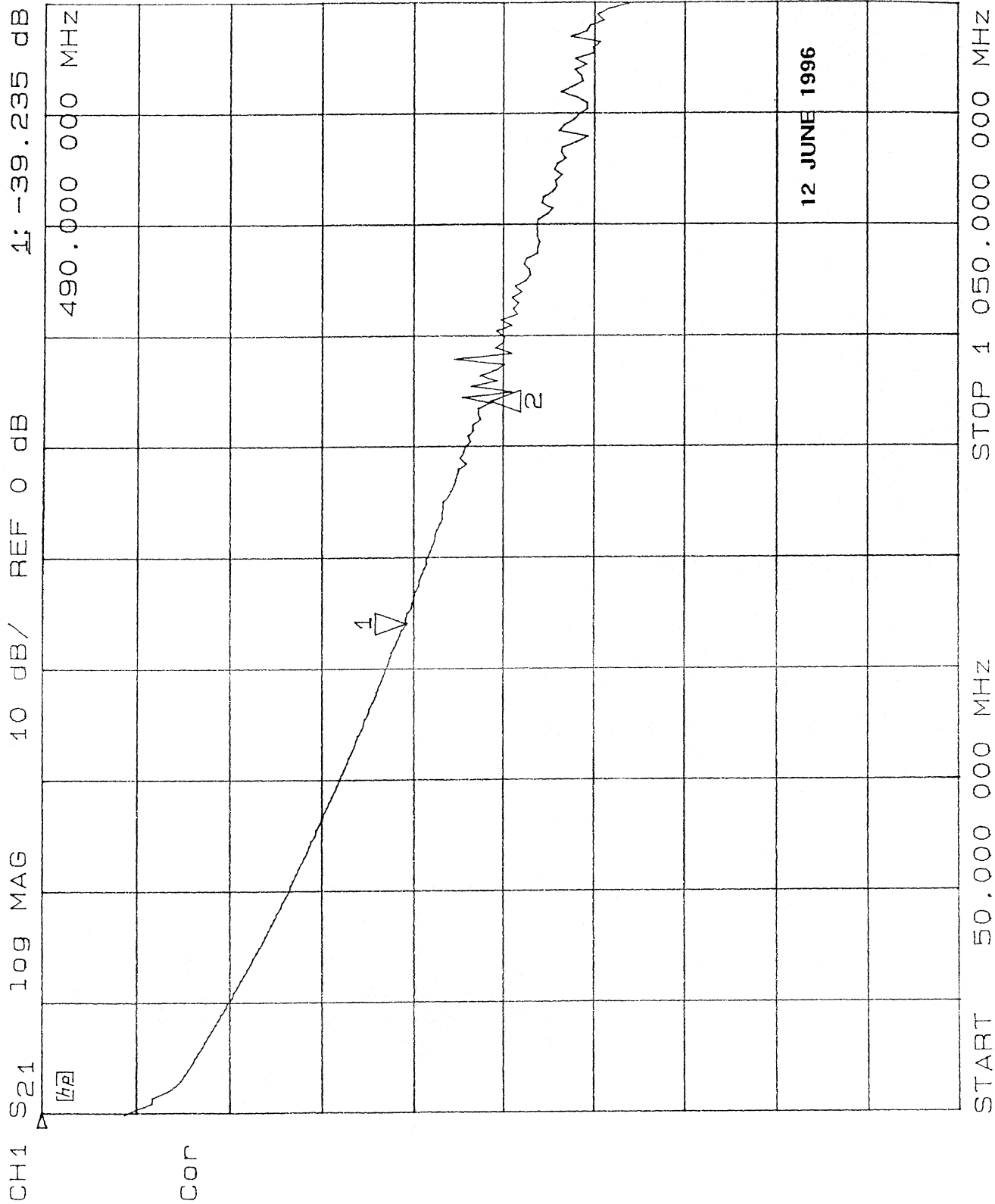


FIGURE 6G. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 14, RG-9

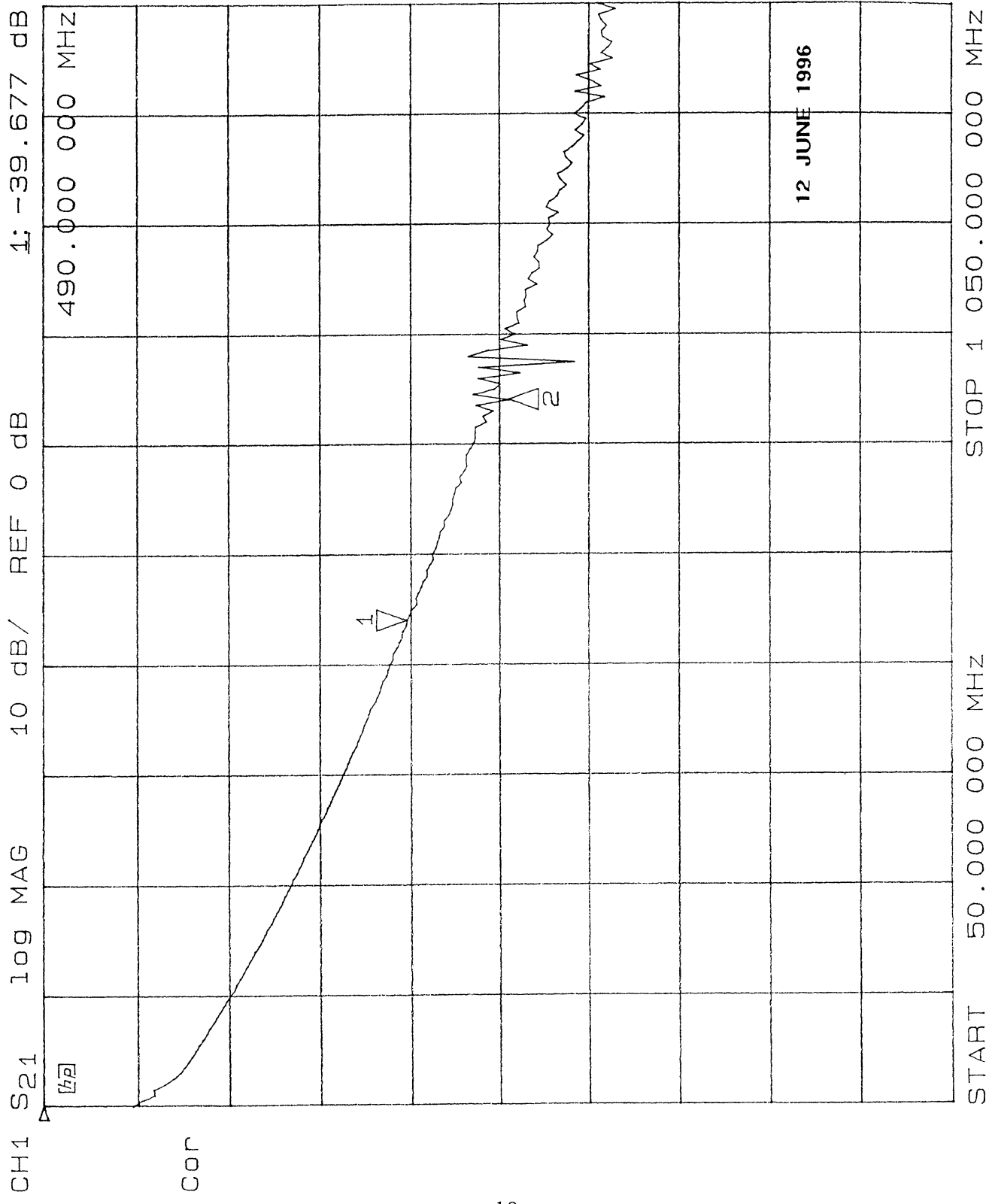


FIGURE 6H. SWEEP FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 15, RG-9

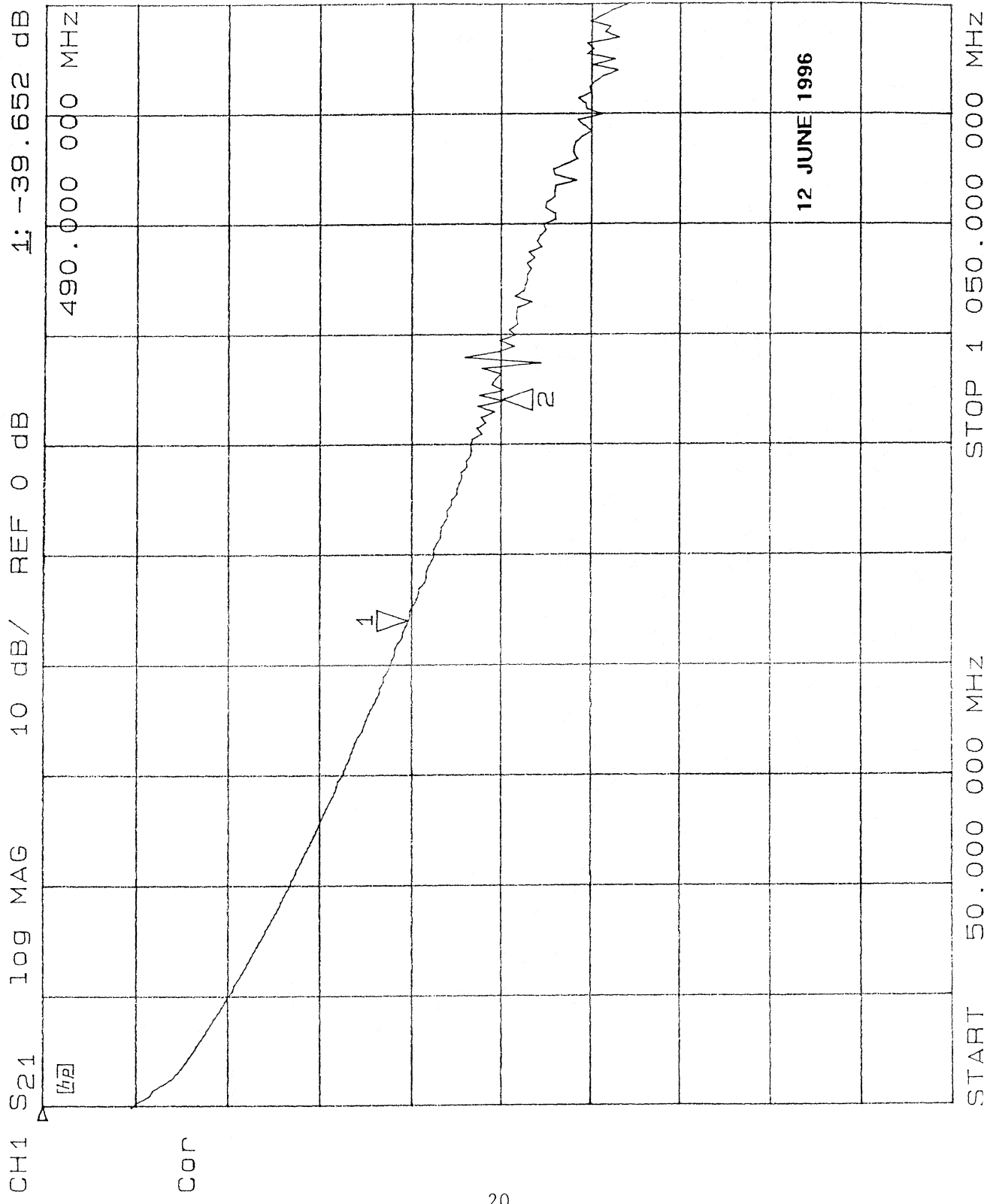


FIGURE 61. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 16, RG-9

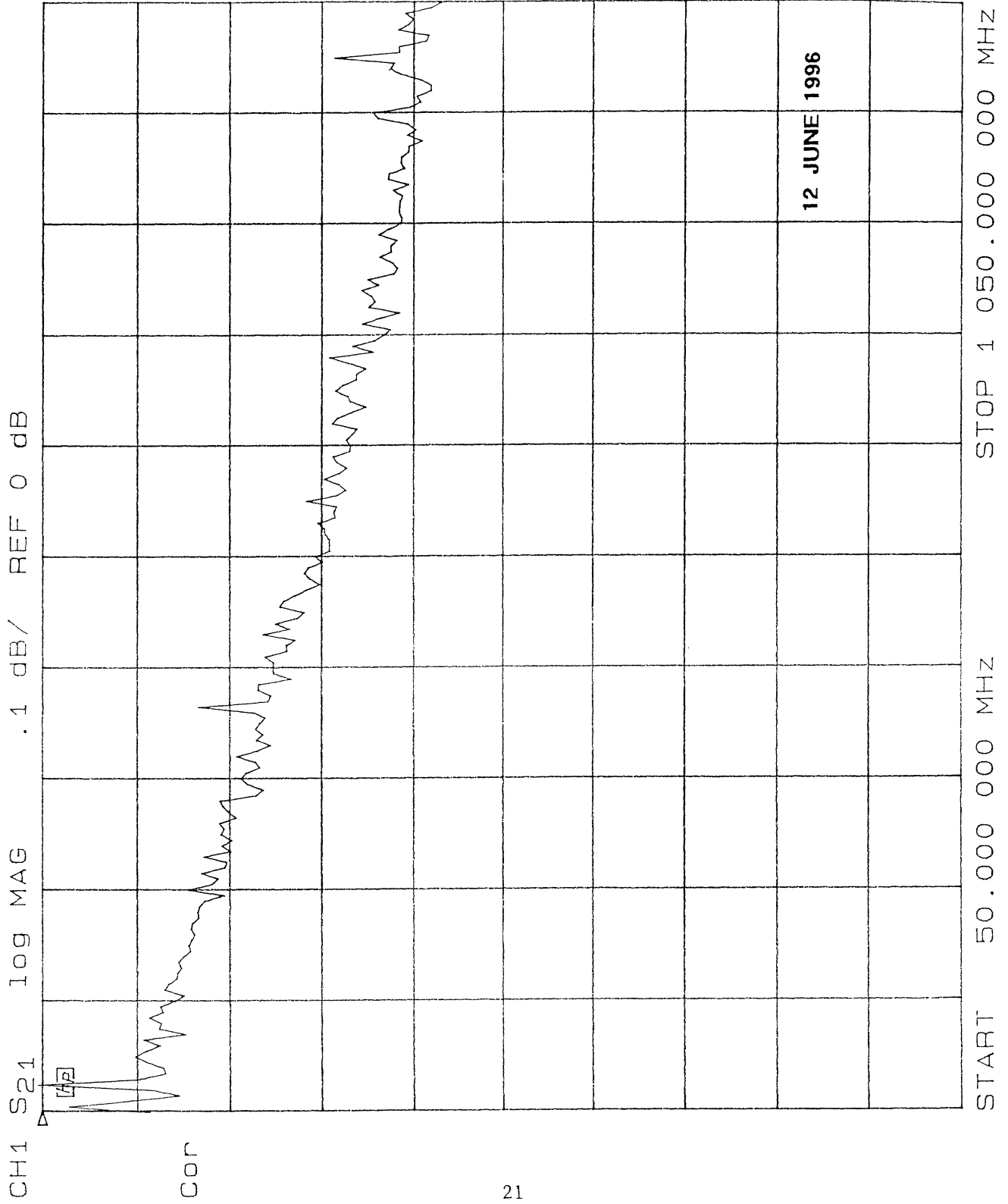


FIGURE 6J. REFERENCE - JUMPER CABLE USED AT PRIME FOCUS

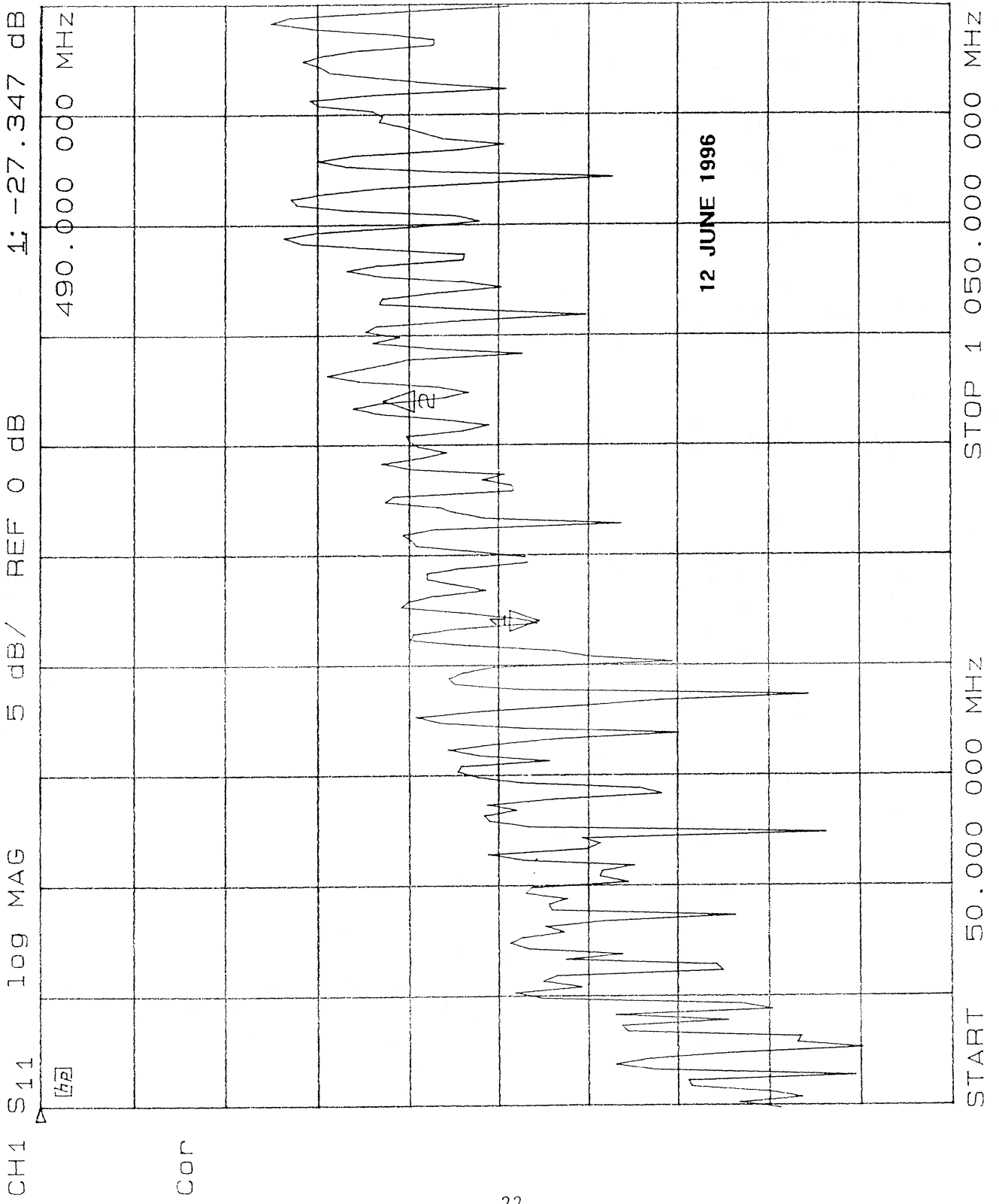


FIGURE 7A. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #1, 7/8 IN. SPIROLINE

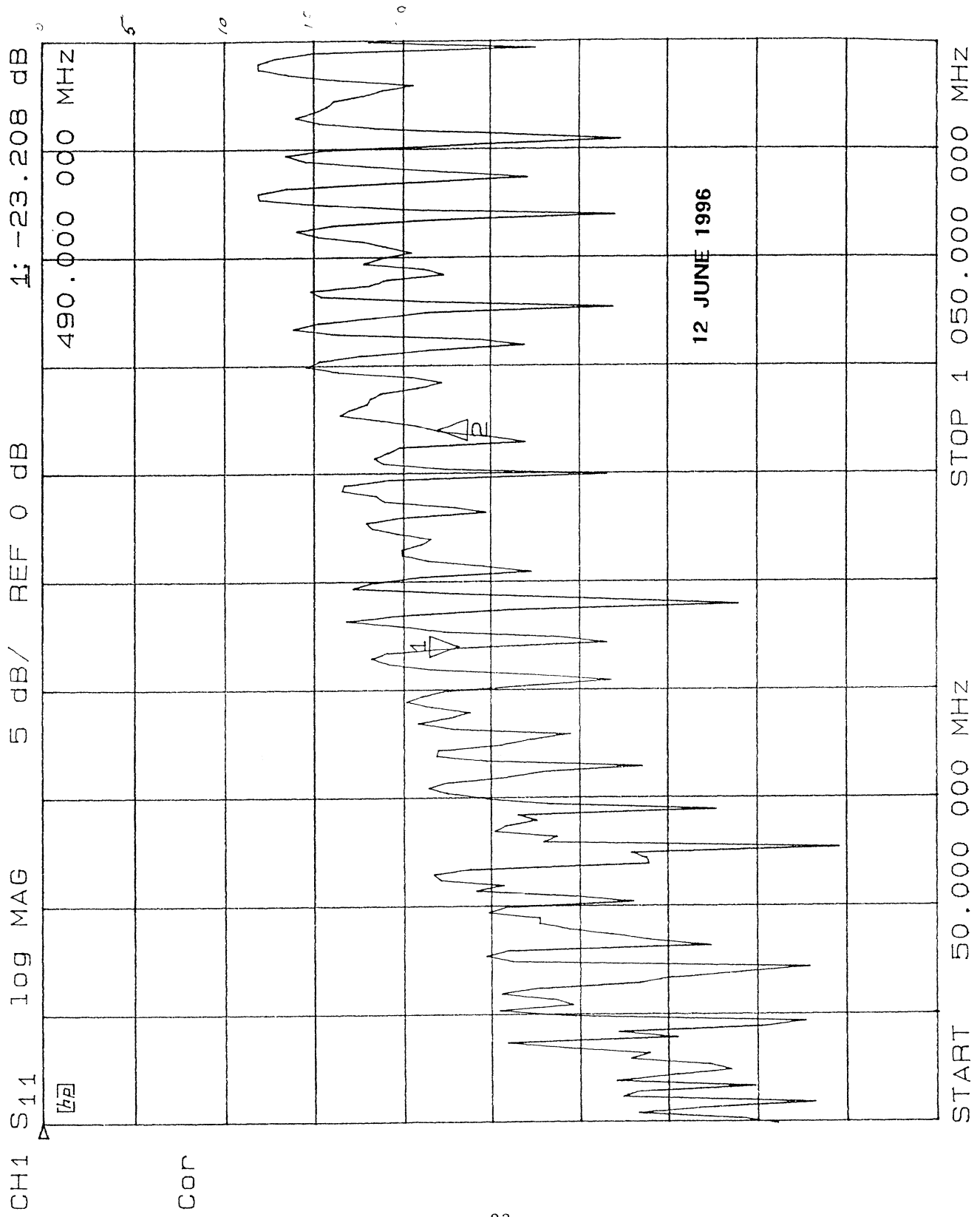
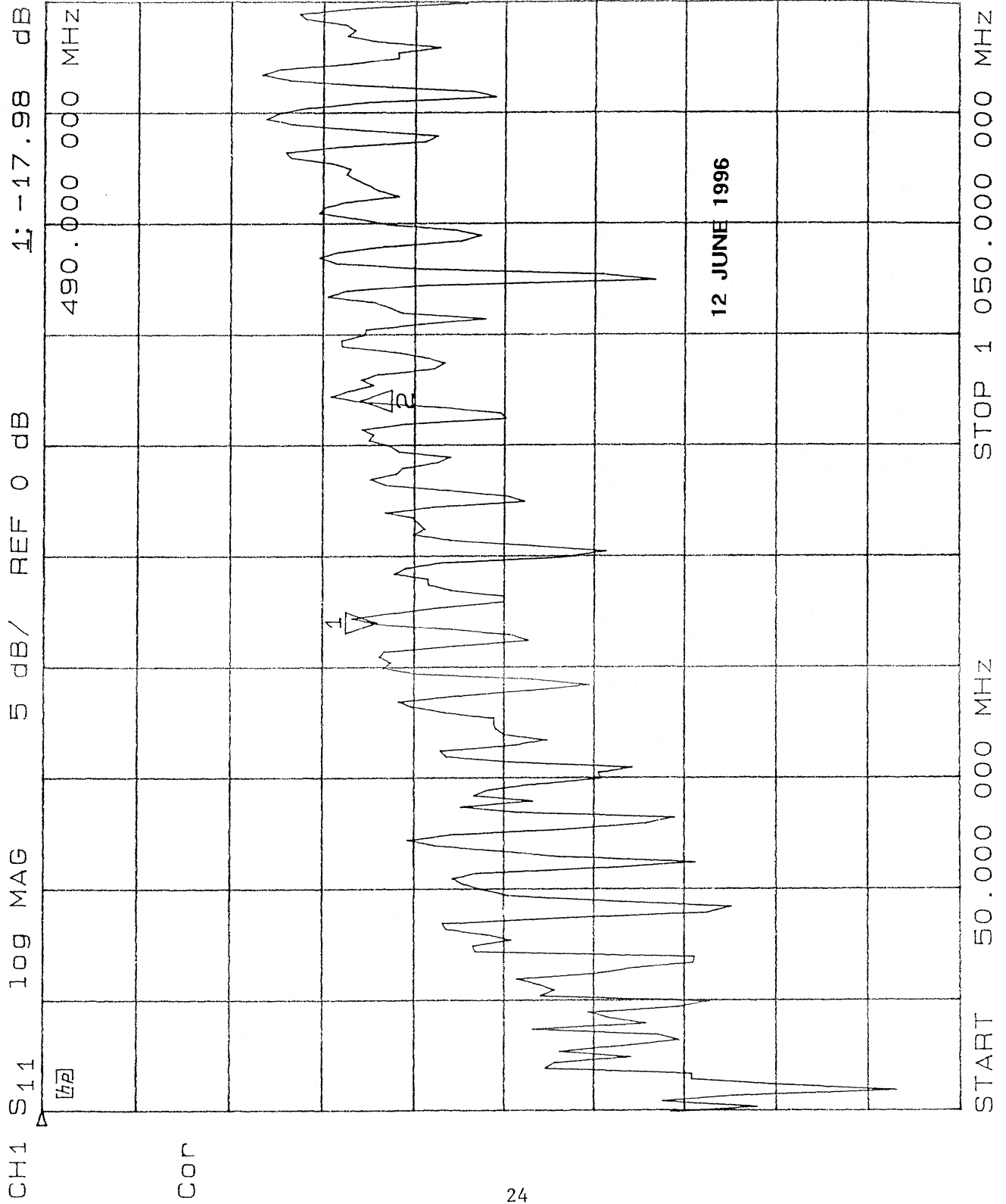


FIGURE 7B SWEEP FREQUENCY RETURN LOSS MEASUREMENTS CARFAC 1000



Cor

FIGURE 7C SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #3, 7/8 IN. SPIROLINE

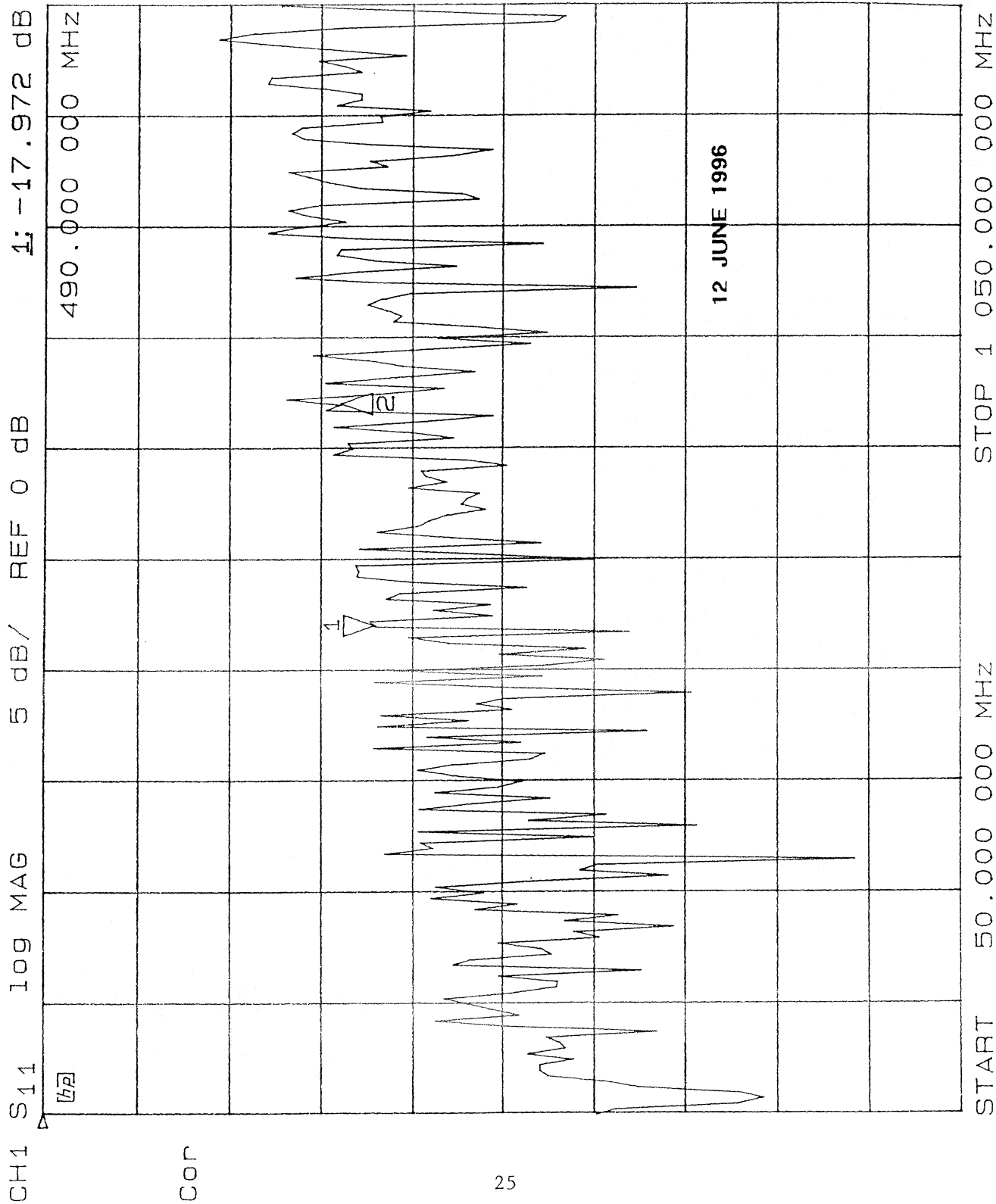


FIGURE 7D SWEEP FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #4, 7/8 IN. SPIROLINE

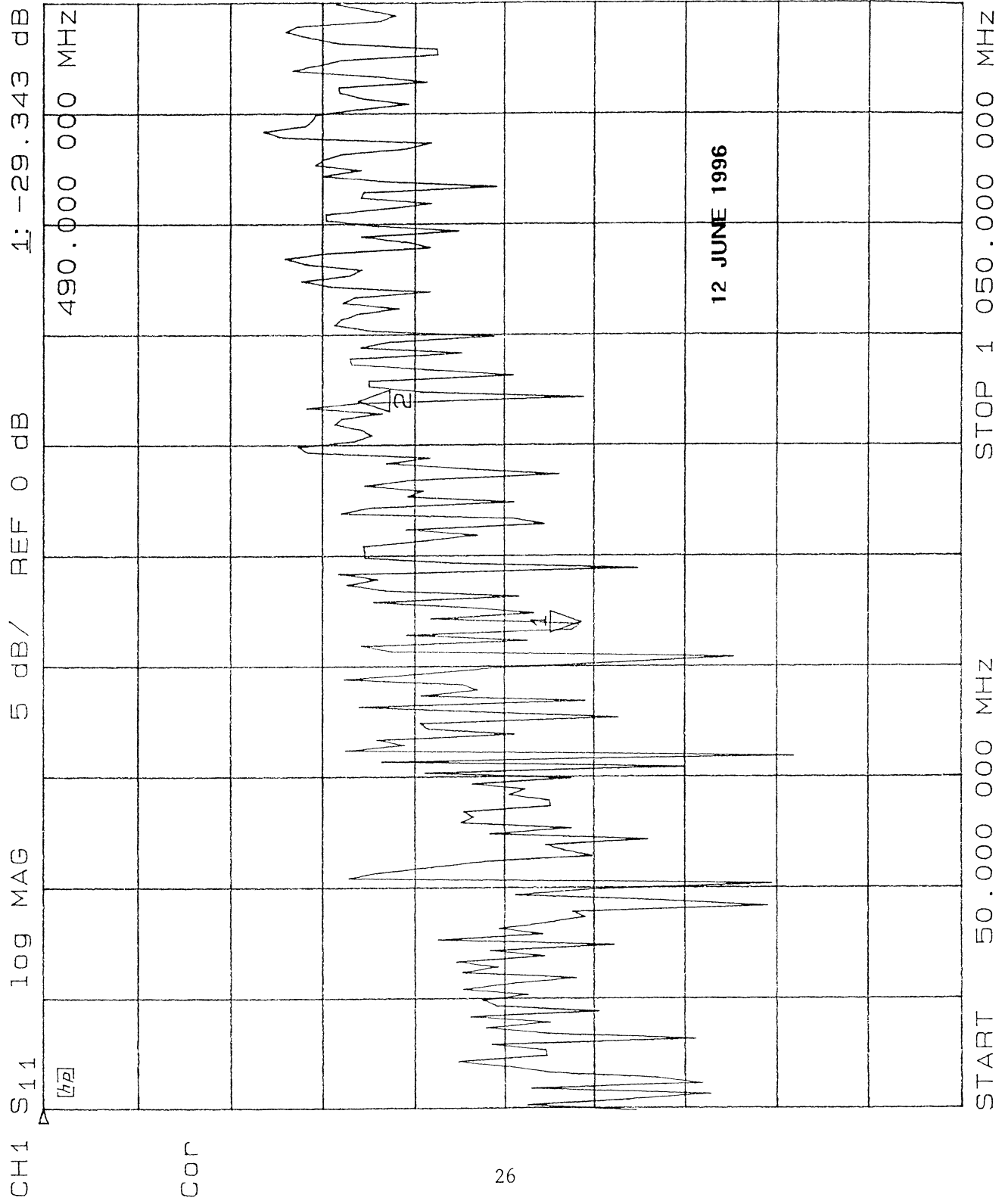


FIGURE 7E. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #5, 7/8 IN. SPIROLINE

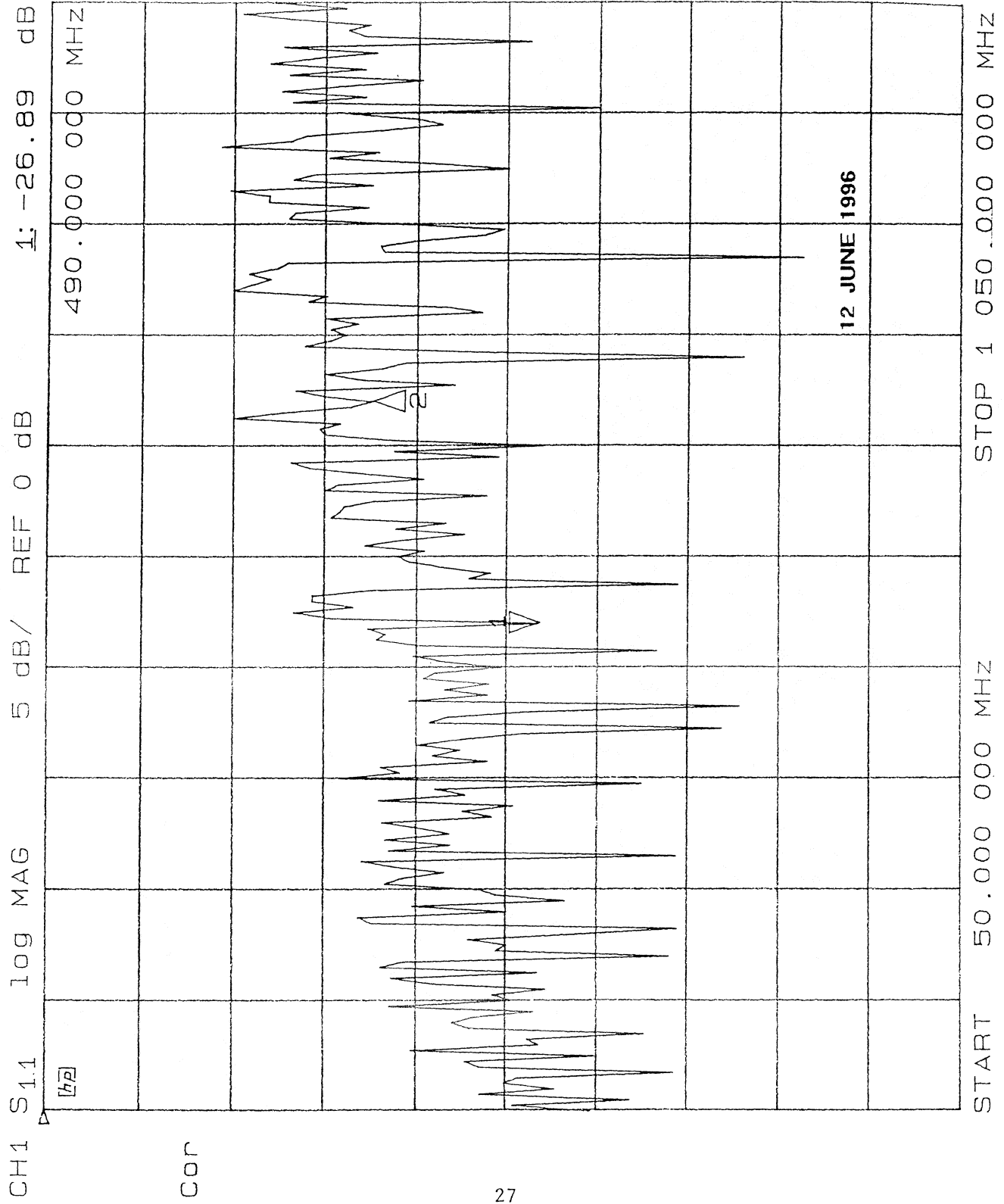


FIGURE 7F. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE 9, 1-5/8 IN. SPIROLINE

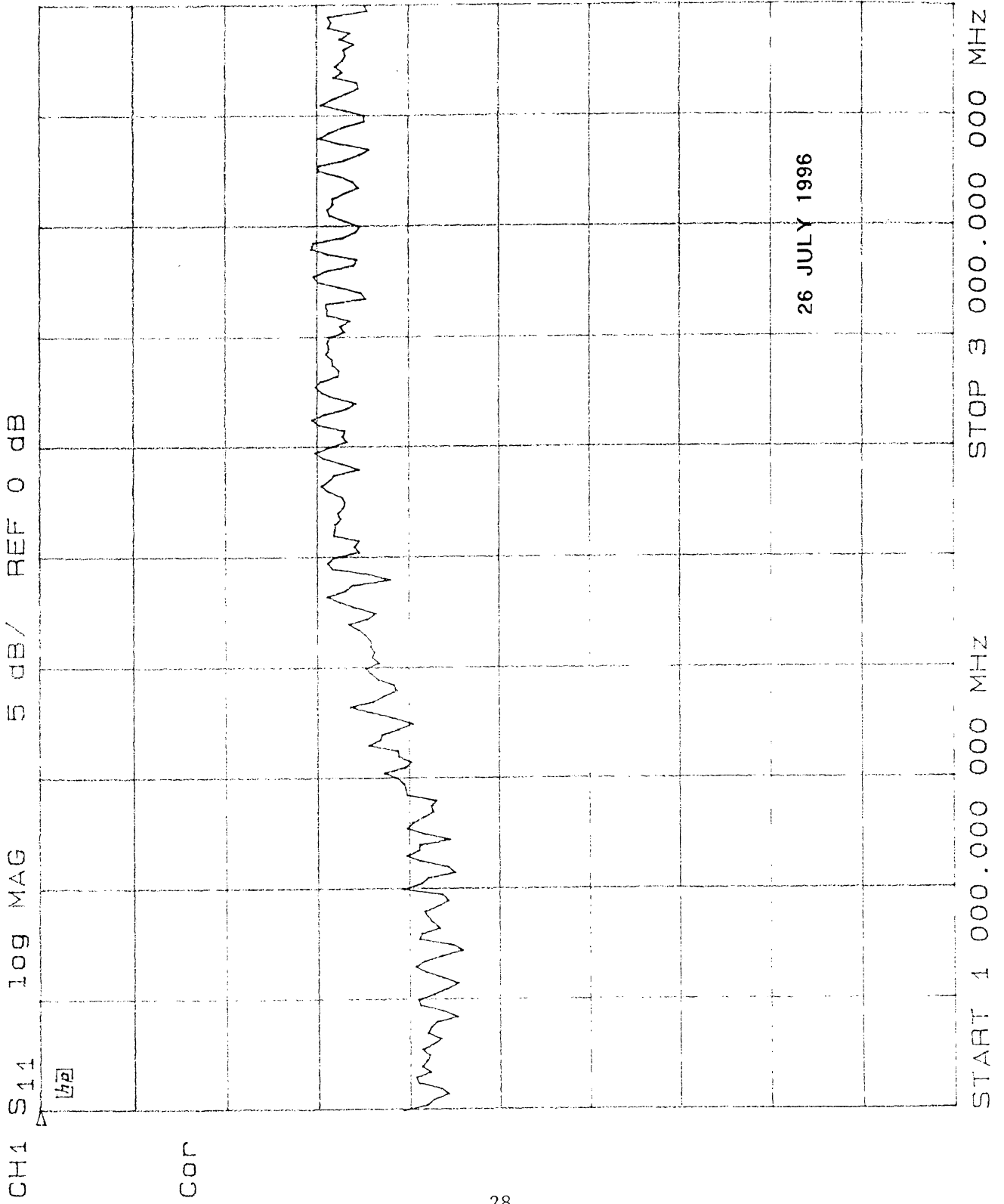


FIGURE 7G. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #9, 1-5/8 IN. SPIROLINE

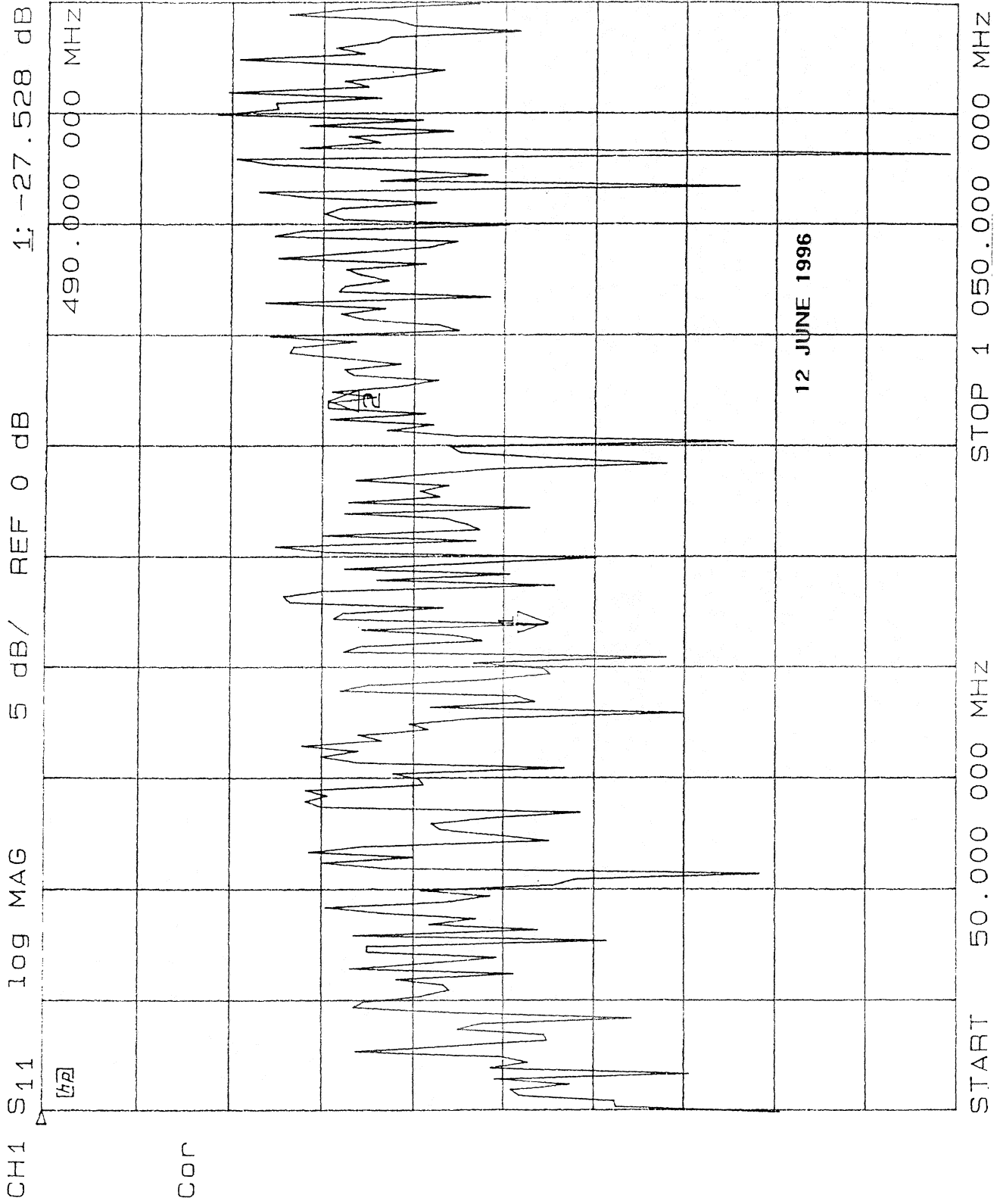


FIGURE 7H. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

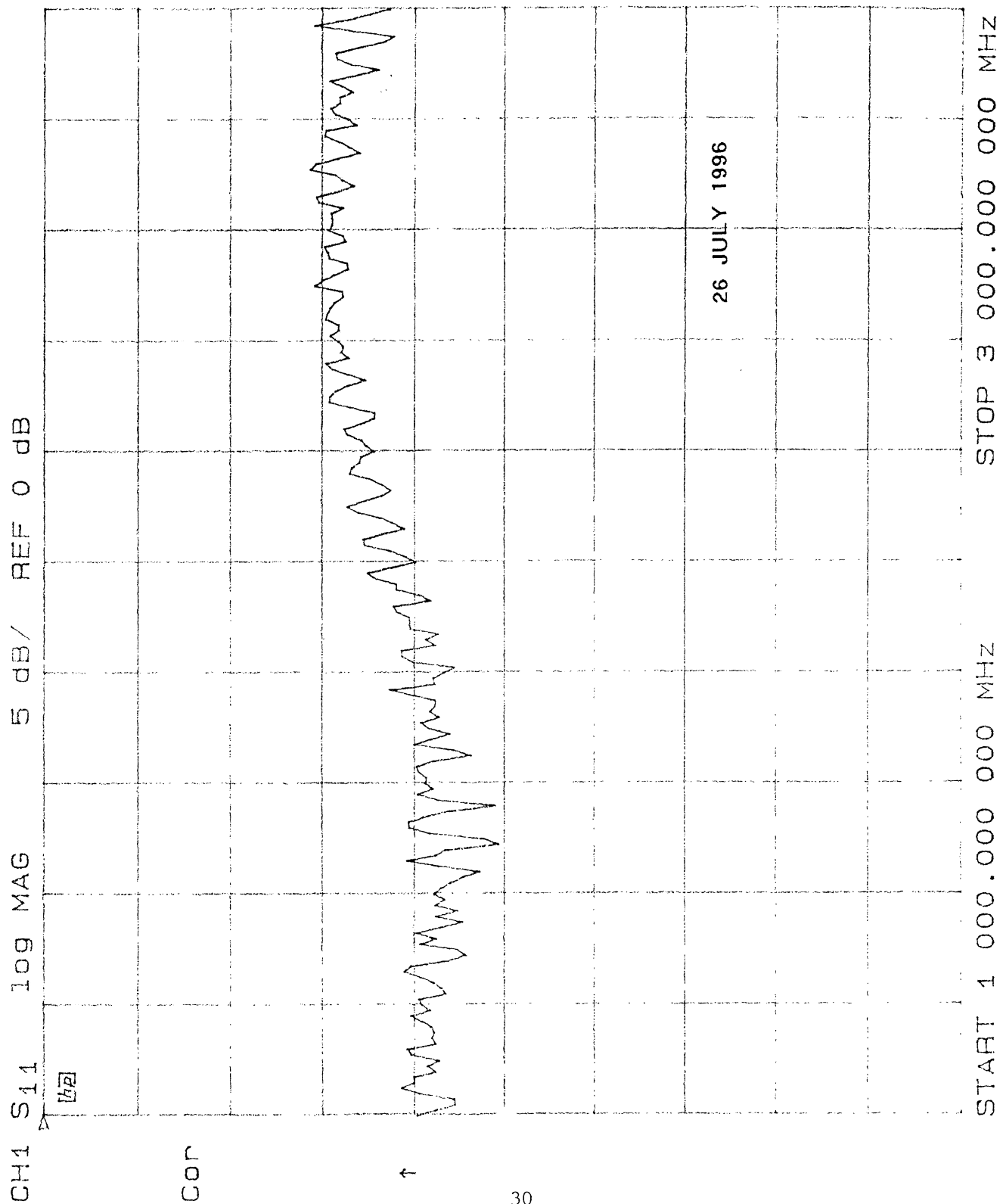


FIGURE 71. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

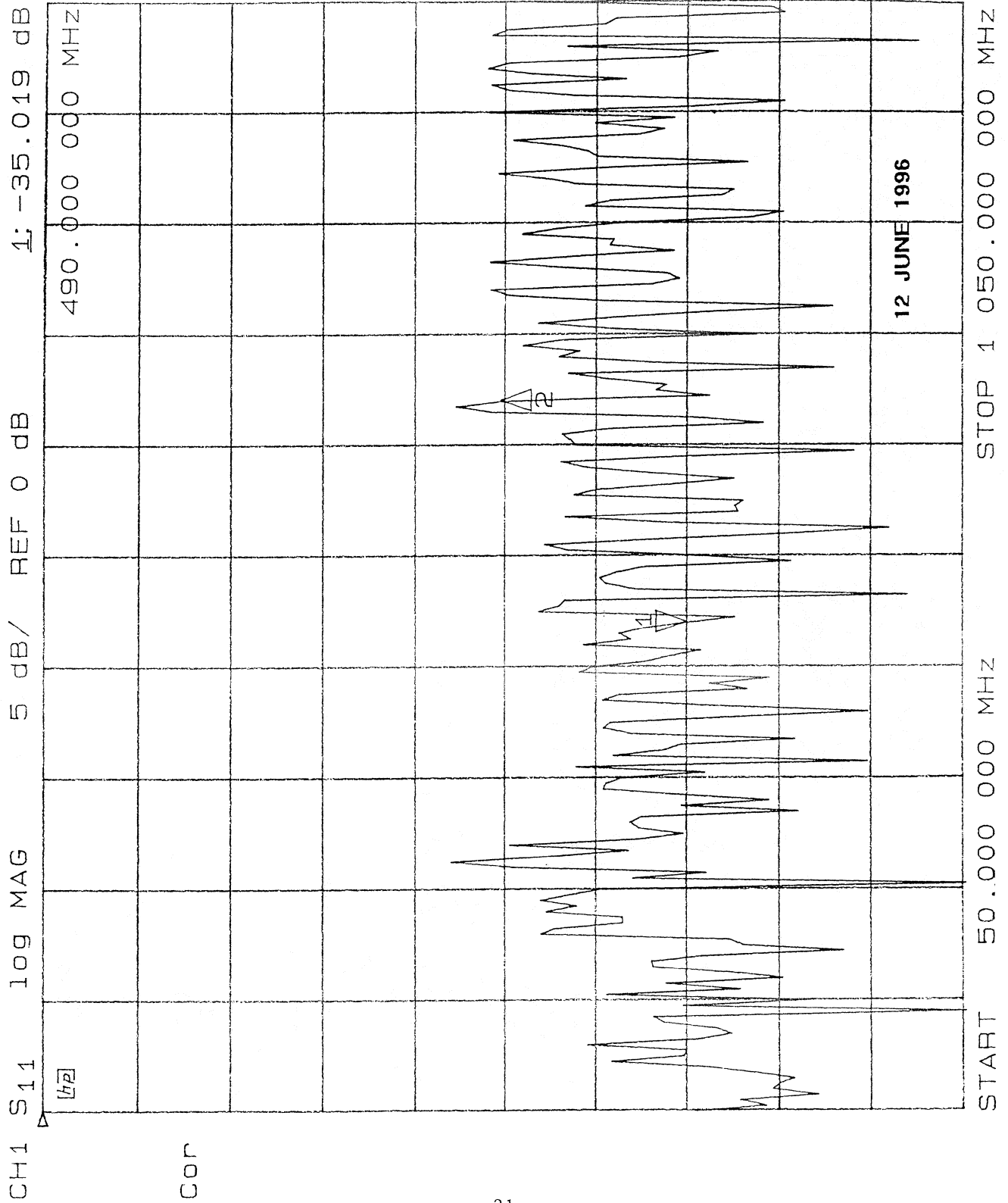


FIGURE 7J. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #11, RG-9

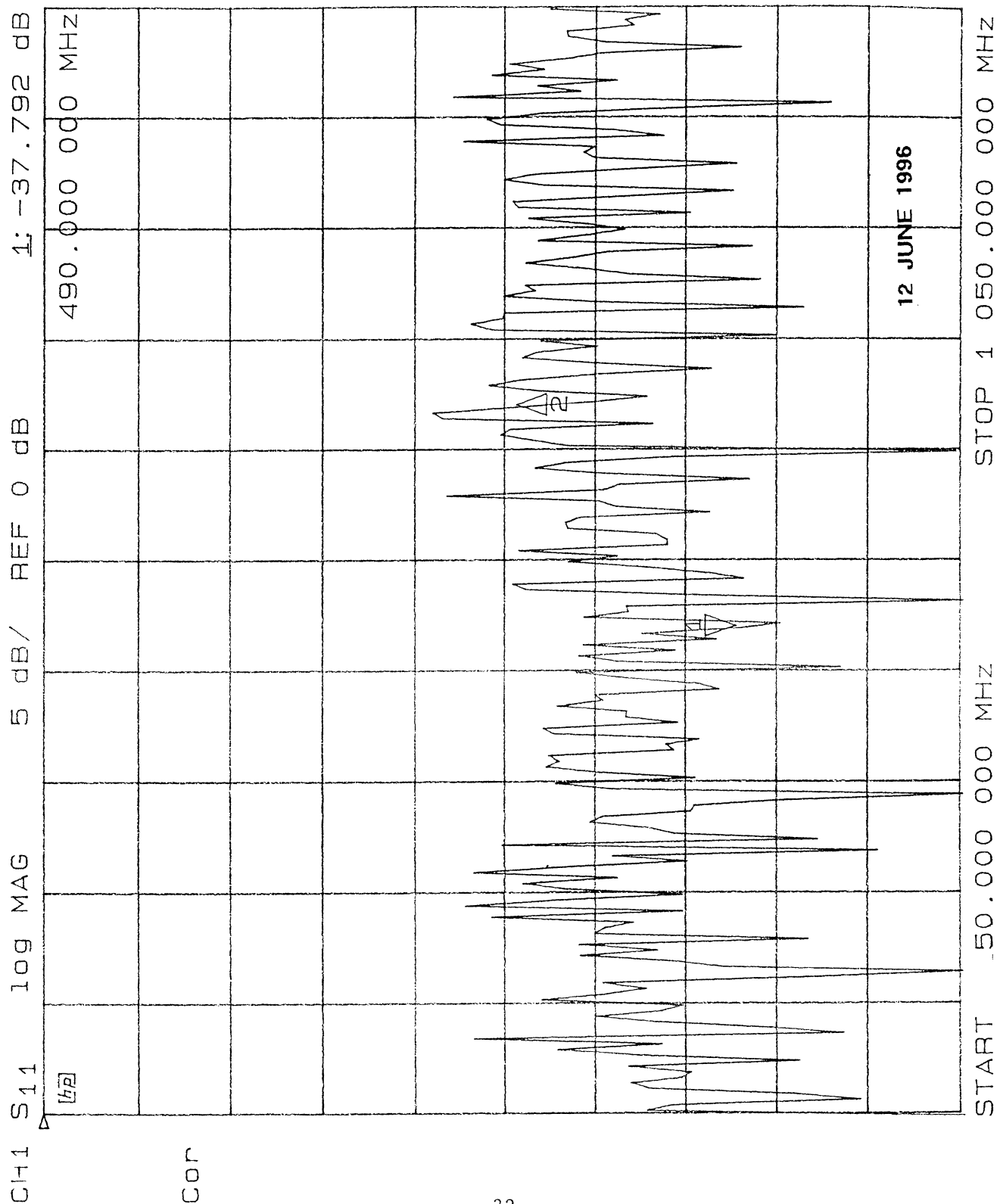


FIGURE 7K. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #12, RG-9

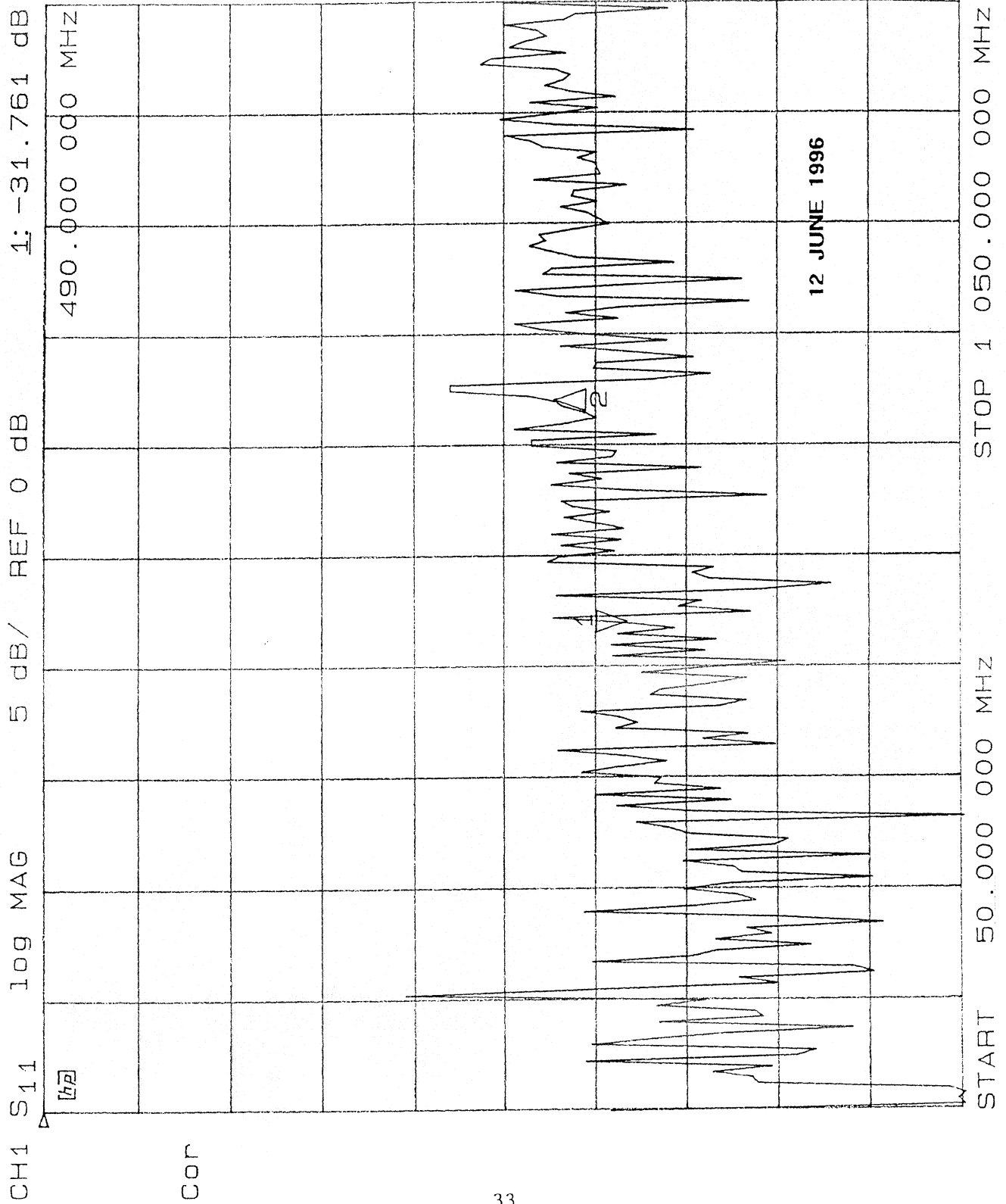


FIGURE 7L. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #13, RG-9

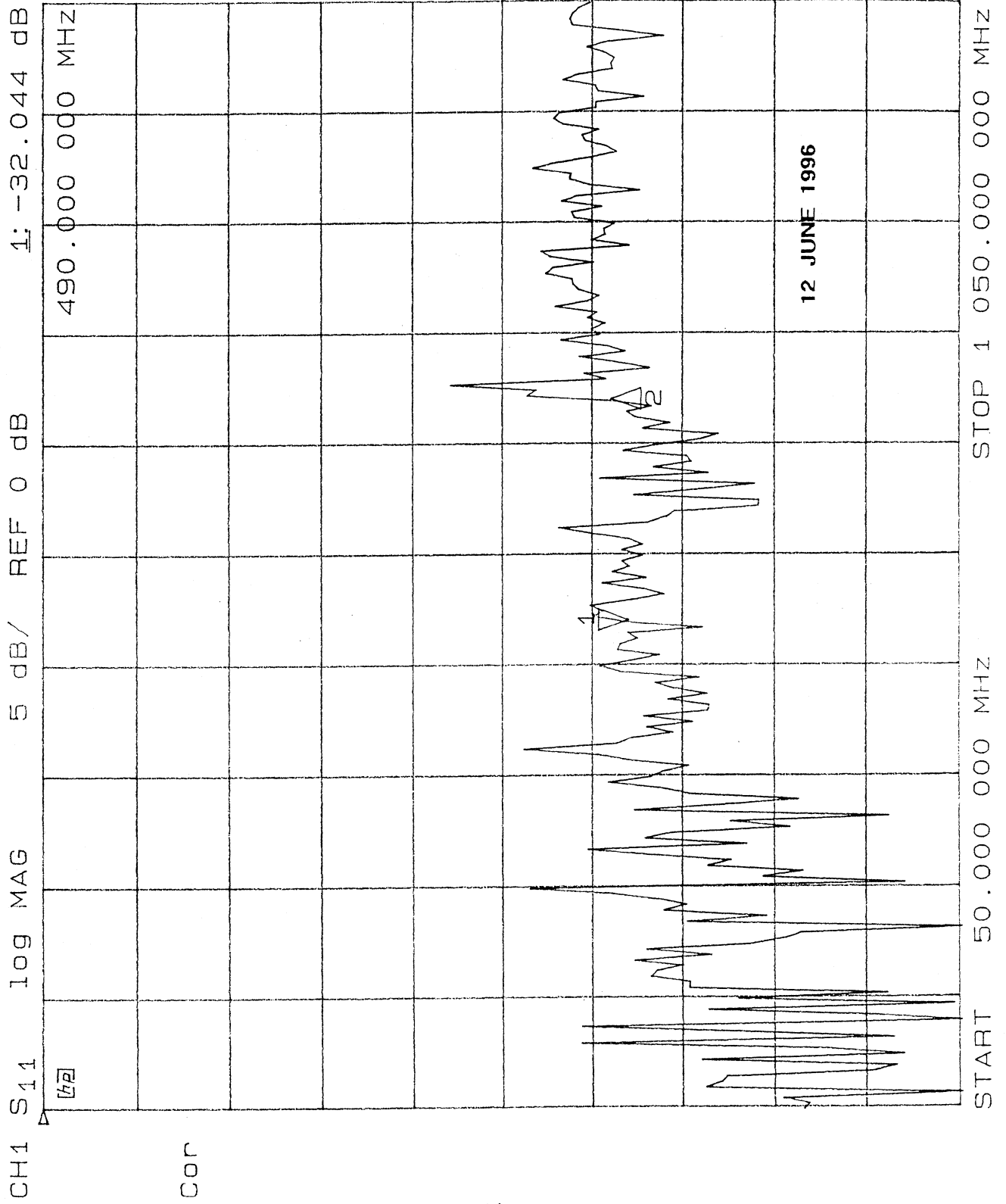


FIGURE 7M. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #14, RG-9

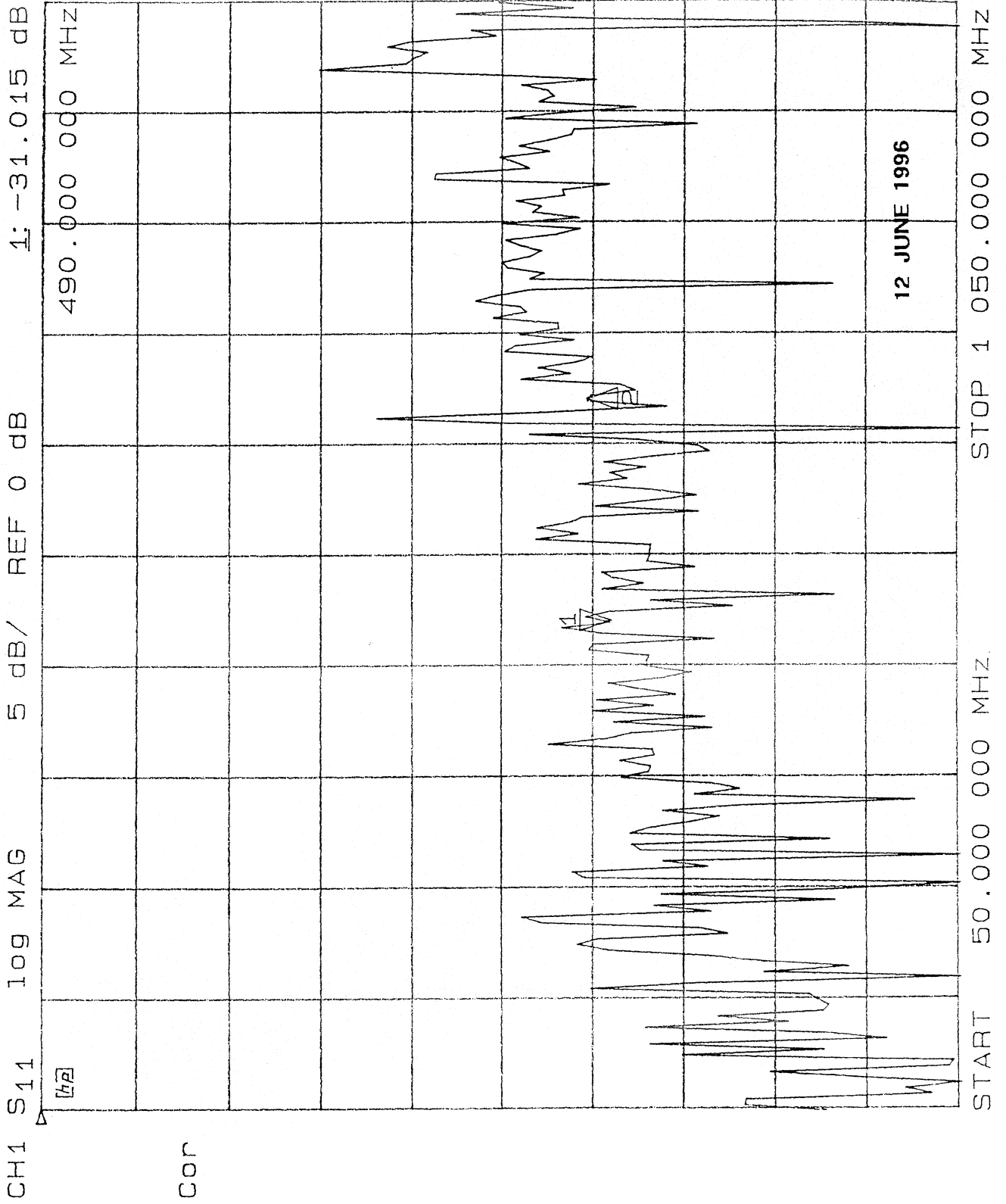


FIGURE 7N. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #15, RG-9

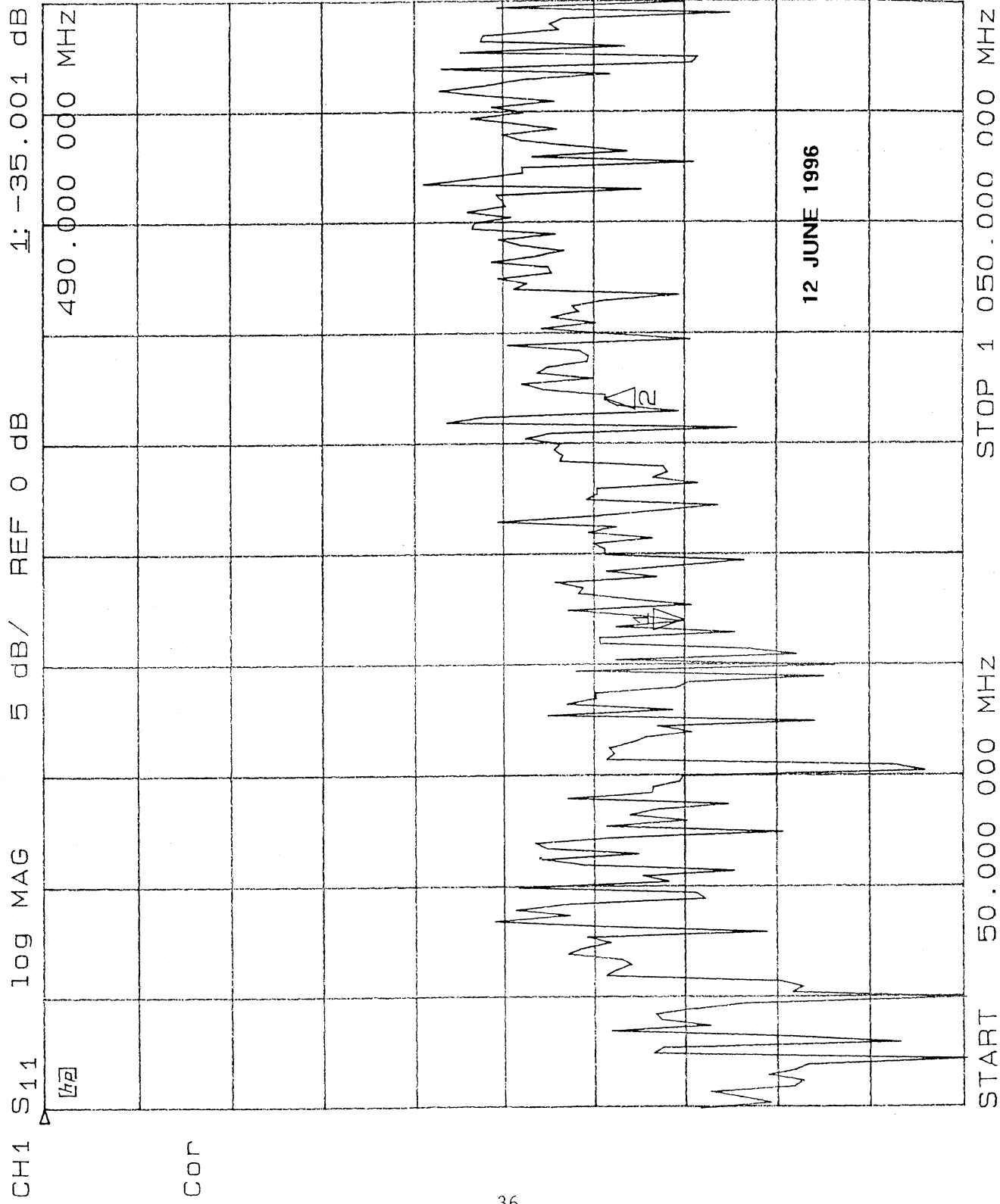


FIGURE 70. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #16, RG-9

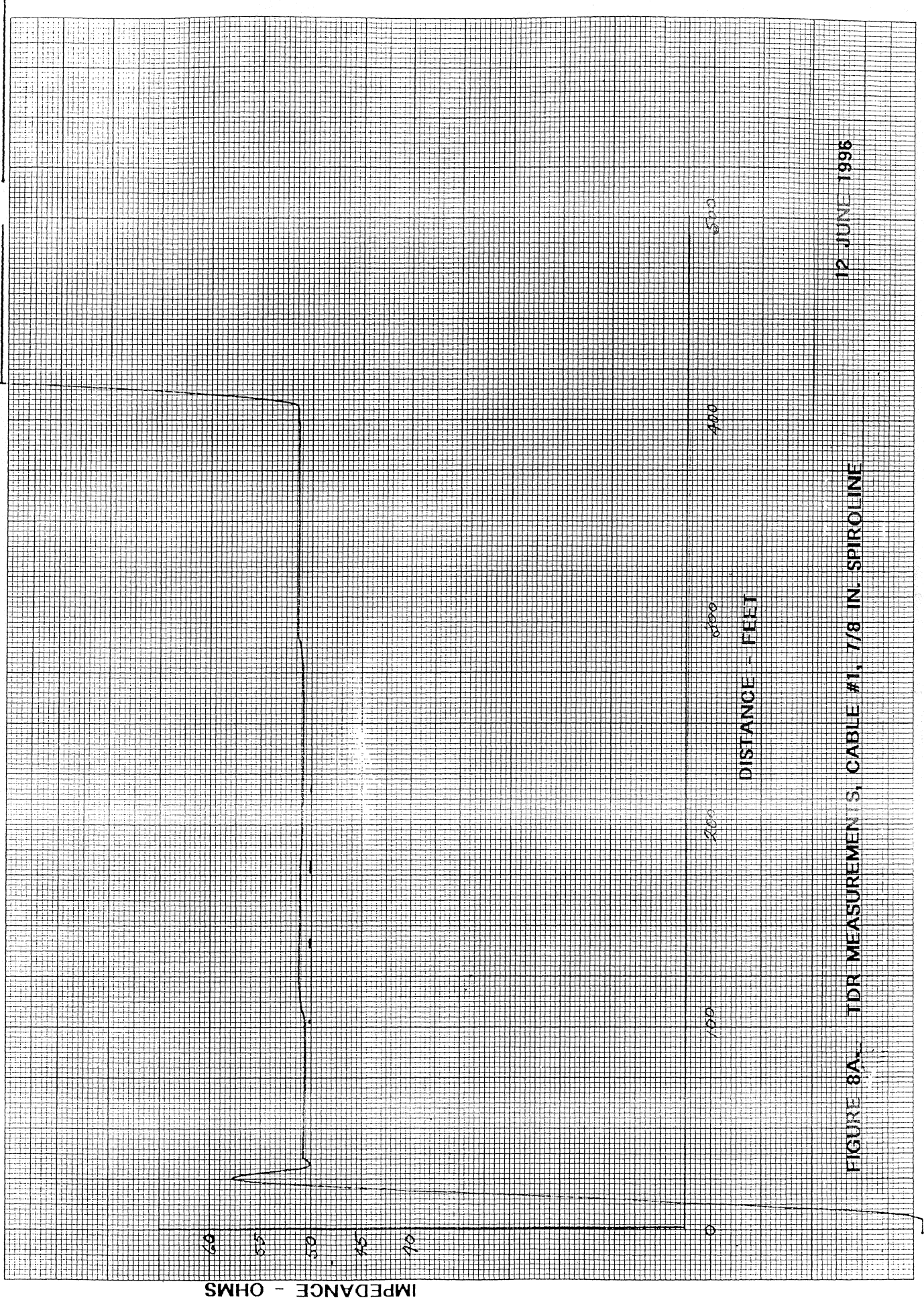


FIGURE 8A TDR MEASUREMENTS, CABLE #1, 7/8 IN. SPIROLINE

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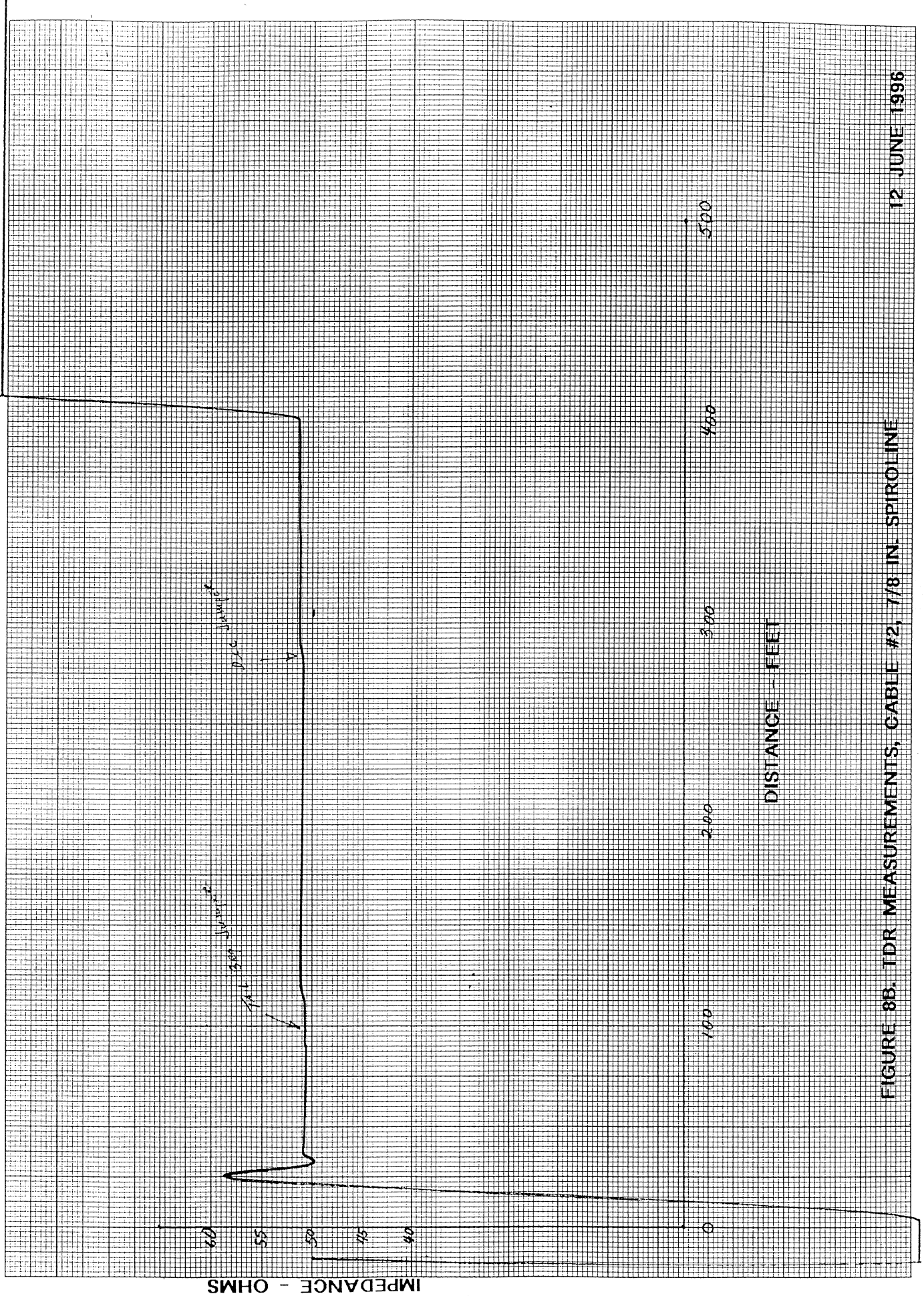


FIGURE 8B. TDR MEASUREMENTS, CABLE #2, 7/8 IN. SPIROLINE

12 JUNE 1995

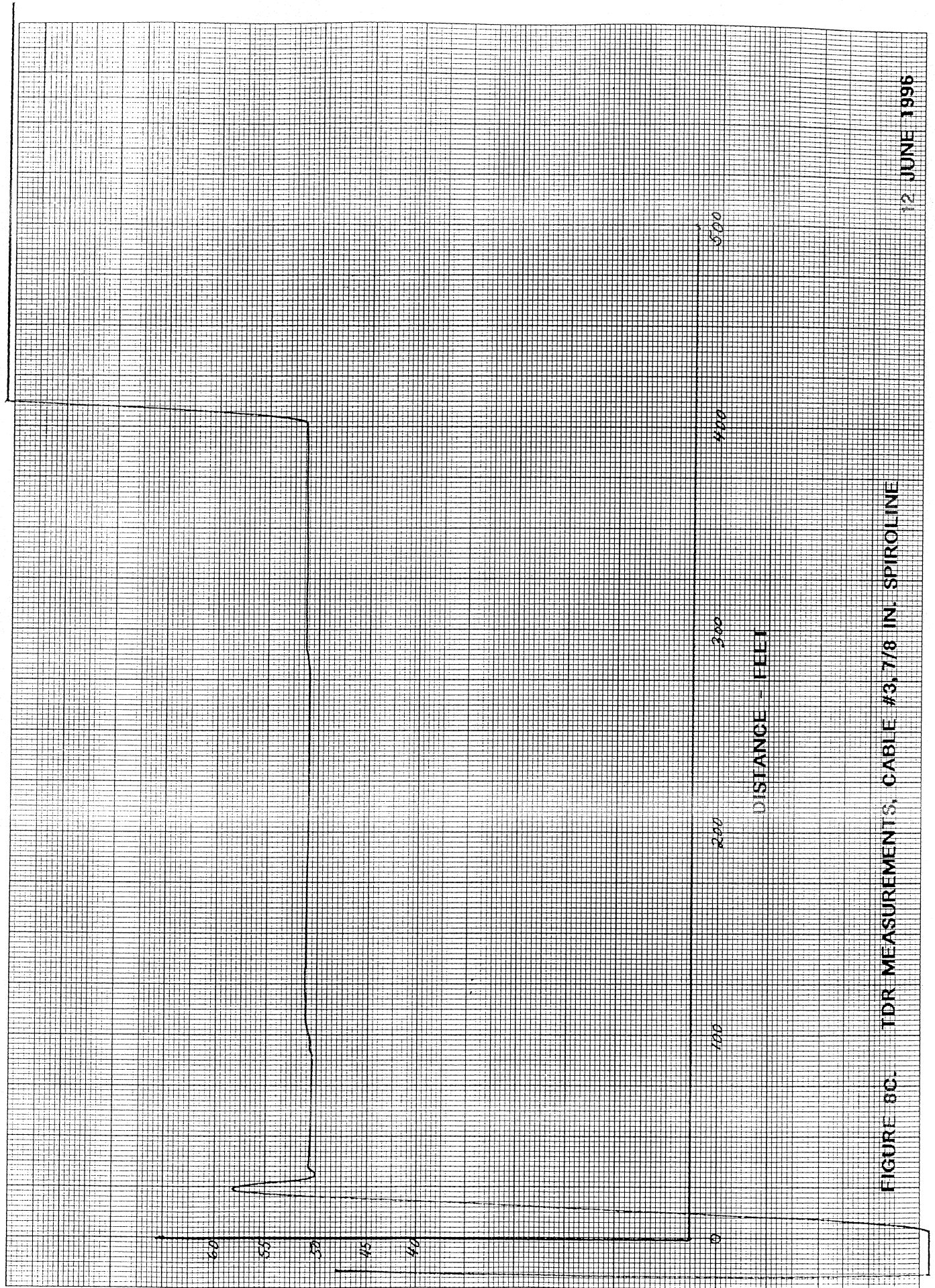


FIGURE 80. TDR MEASUREMENTS, CABLE #3, 7/8 IN. SPIROLINE

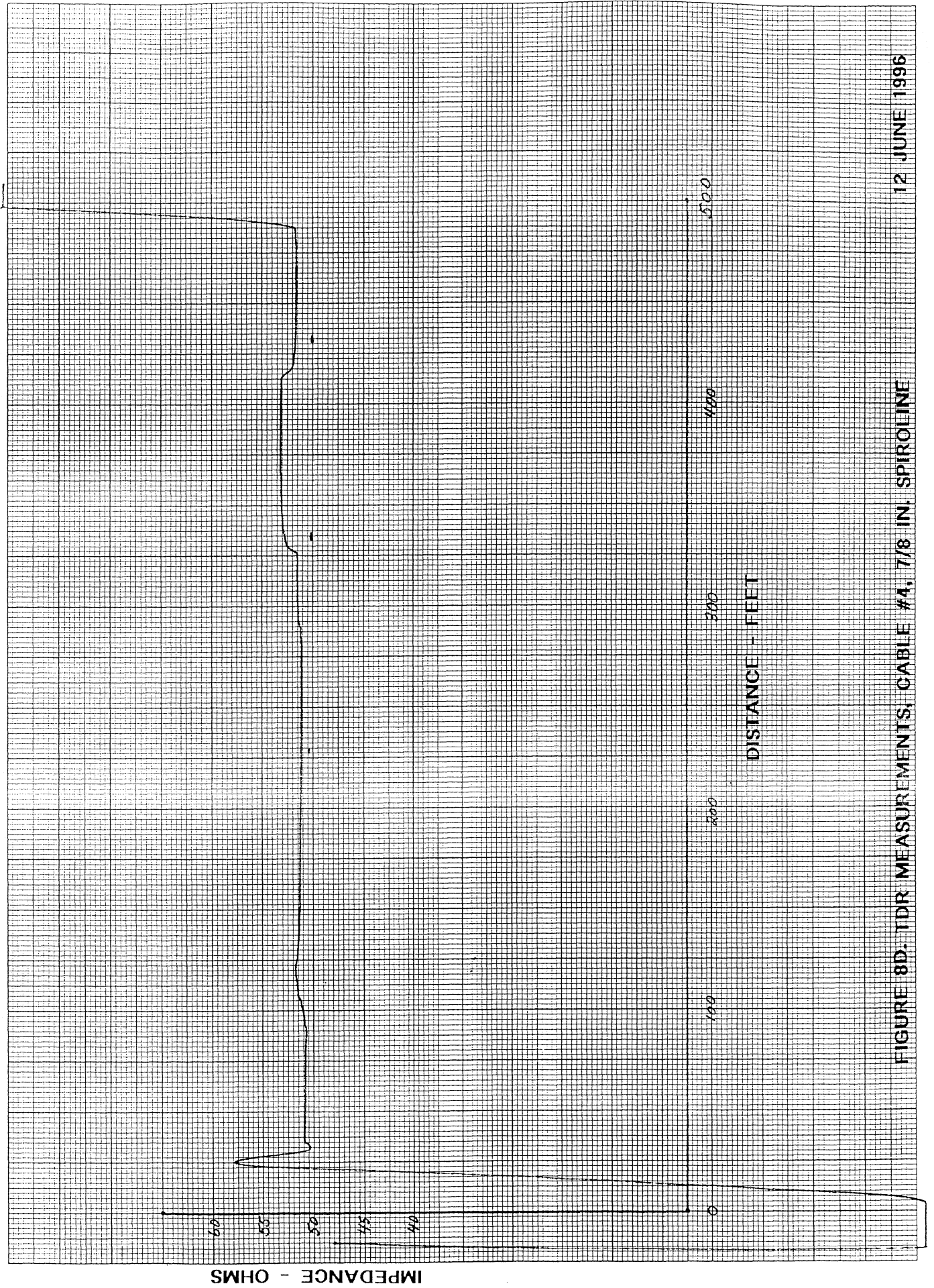
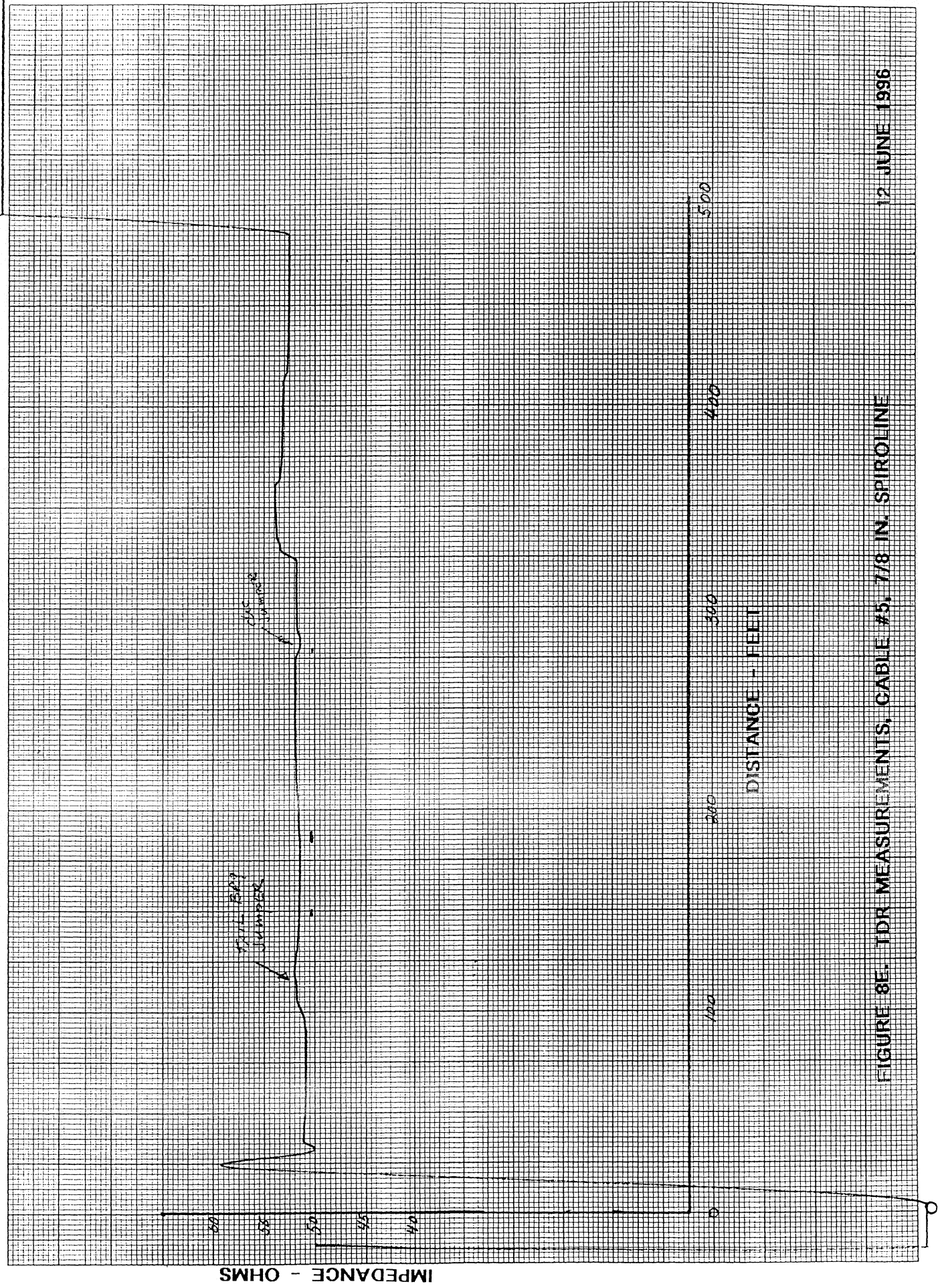


FIGURE 8D. TDR MEASUREMENTS, CABLE #4, 7/8 IN. SPIROLINE

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FIGURE 8E. TDR MEASUREMENTS, CABLE #5, 7/8 IN. SPIROLINE

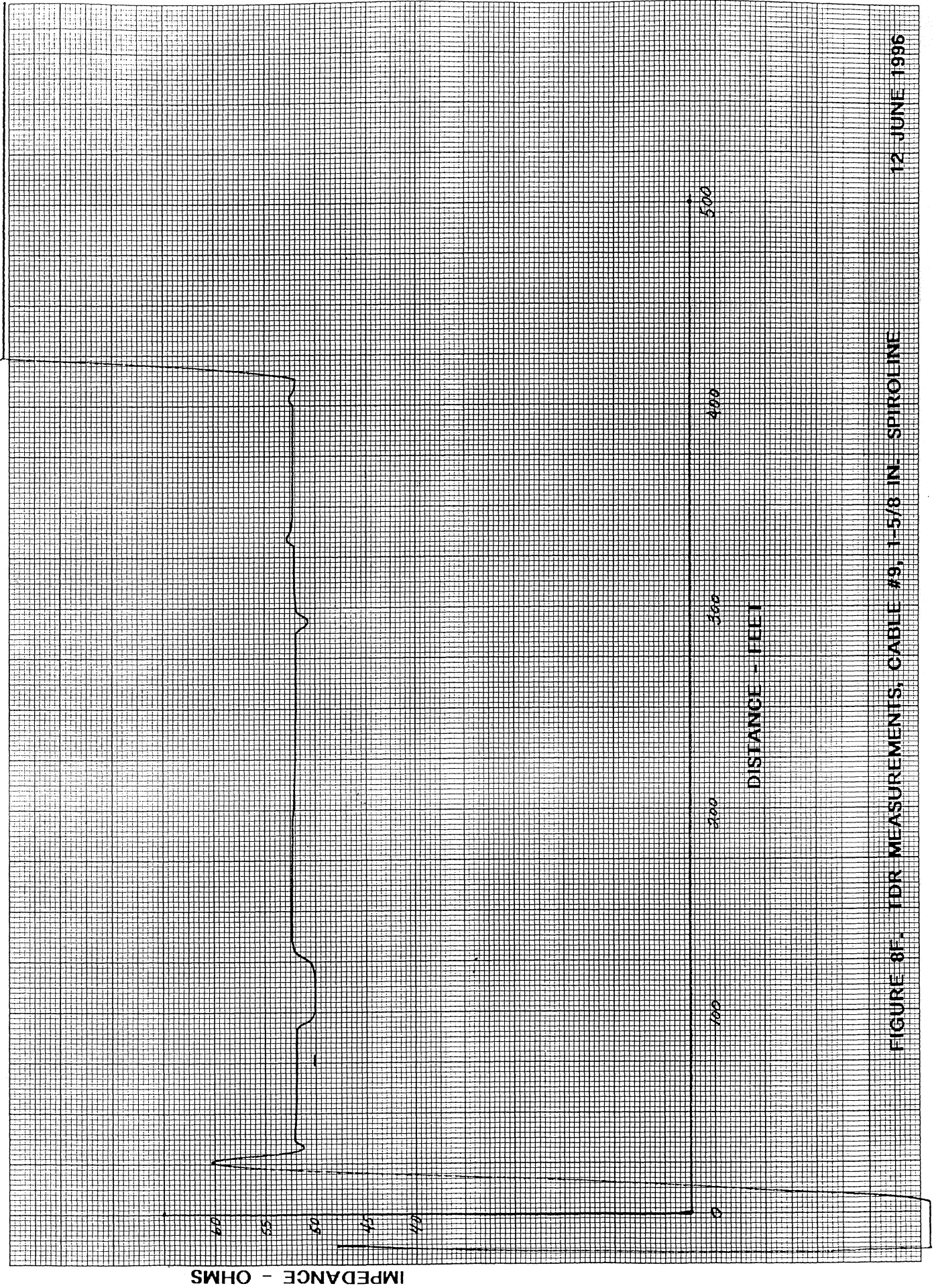


FIGURE 8F. TDR MEASUREMENTS, CABLE #9, 1-5/8 IN. SPIROLINE

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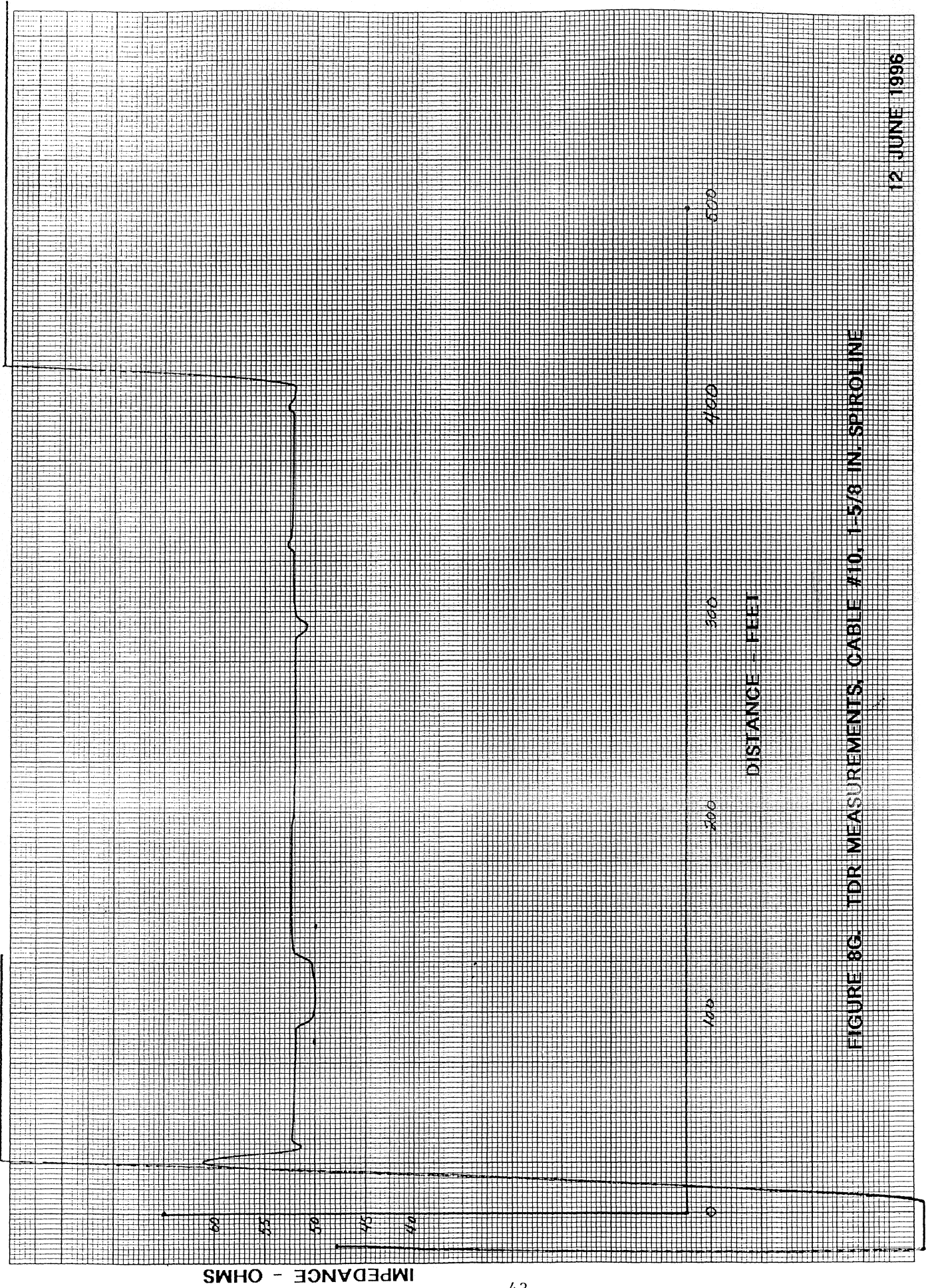


FIGURE 8G. TDR MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

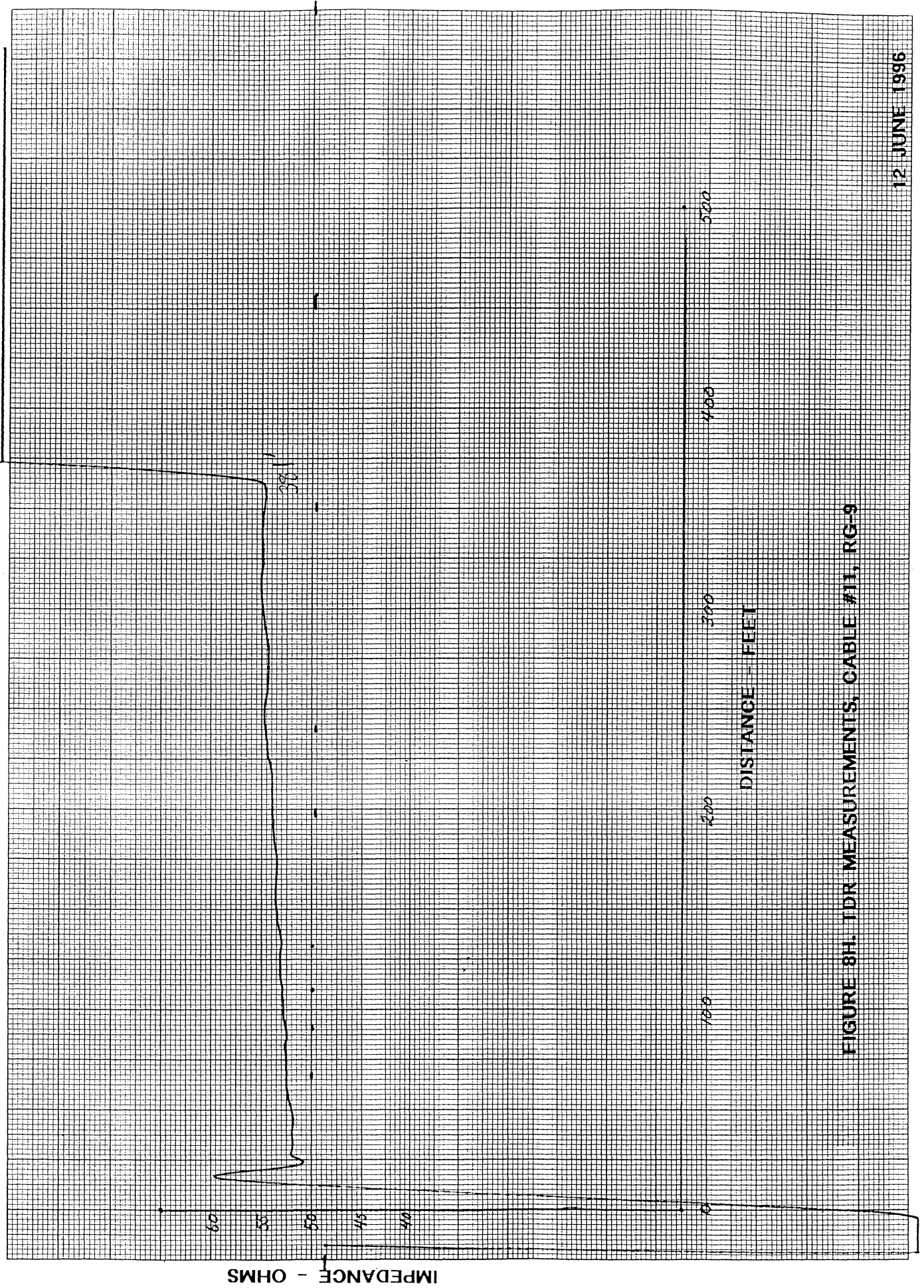


FIGURE 8H. TDR MEASUREMENTS, CABLE #11, RG-9

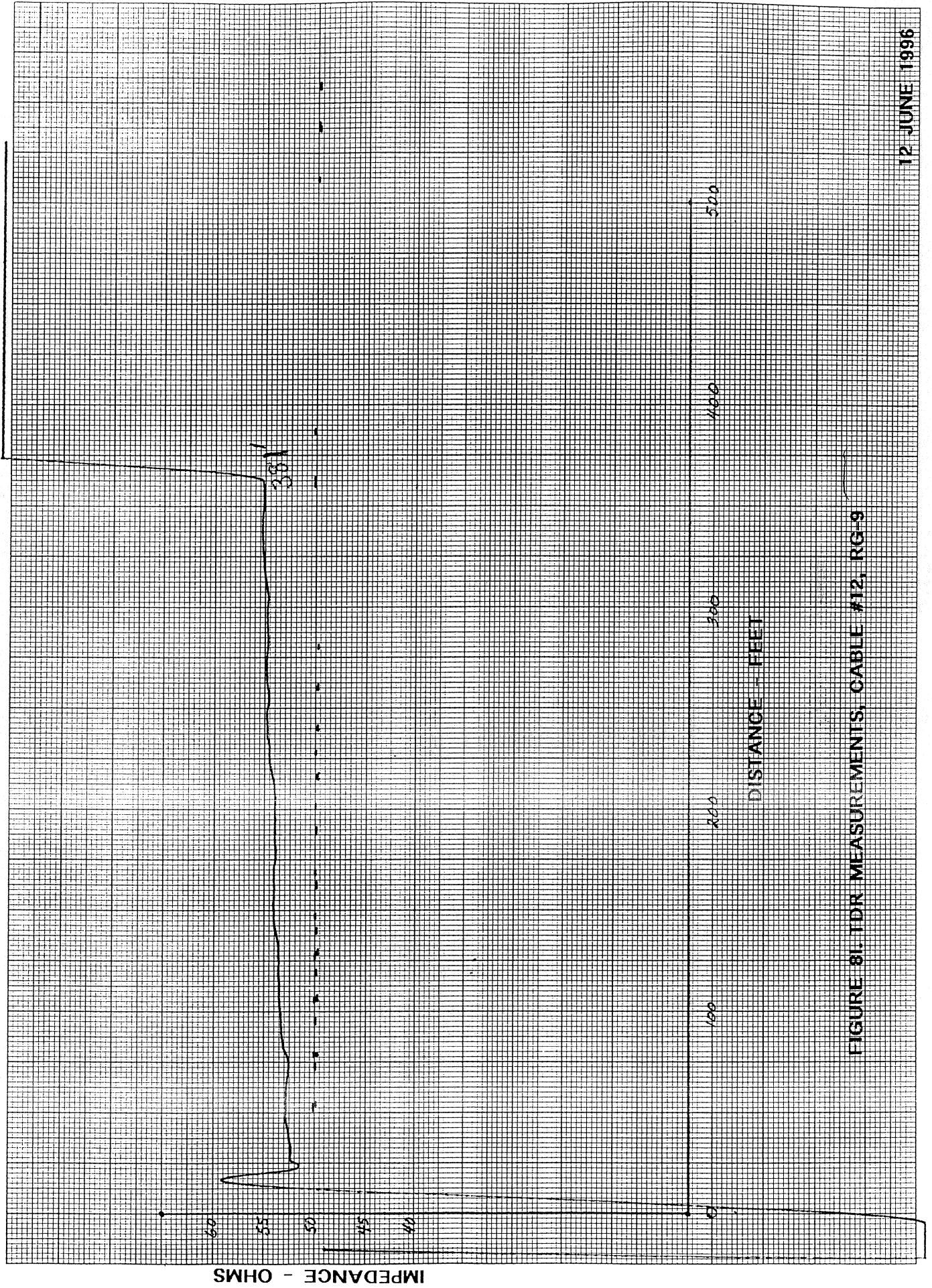


FIGURE 81. TDR MEASUREMENTS, CABLE #12, RG-9

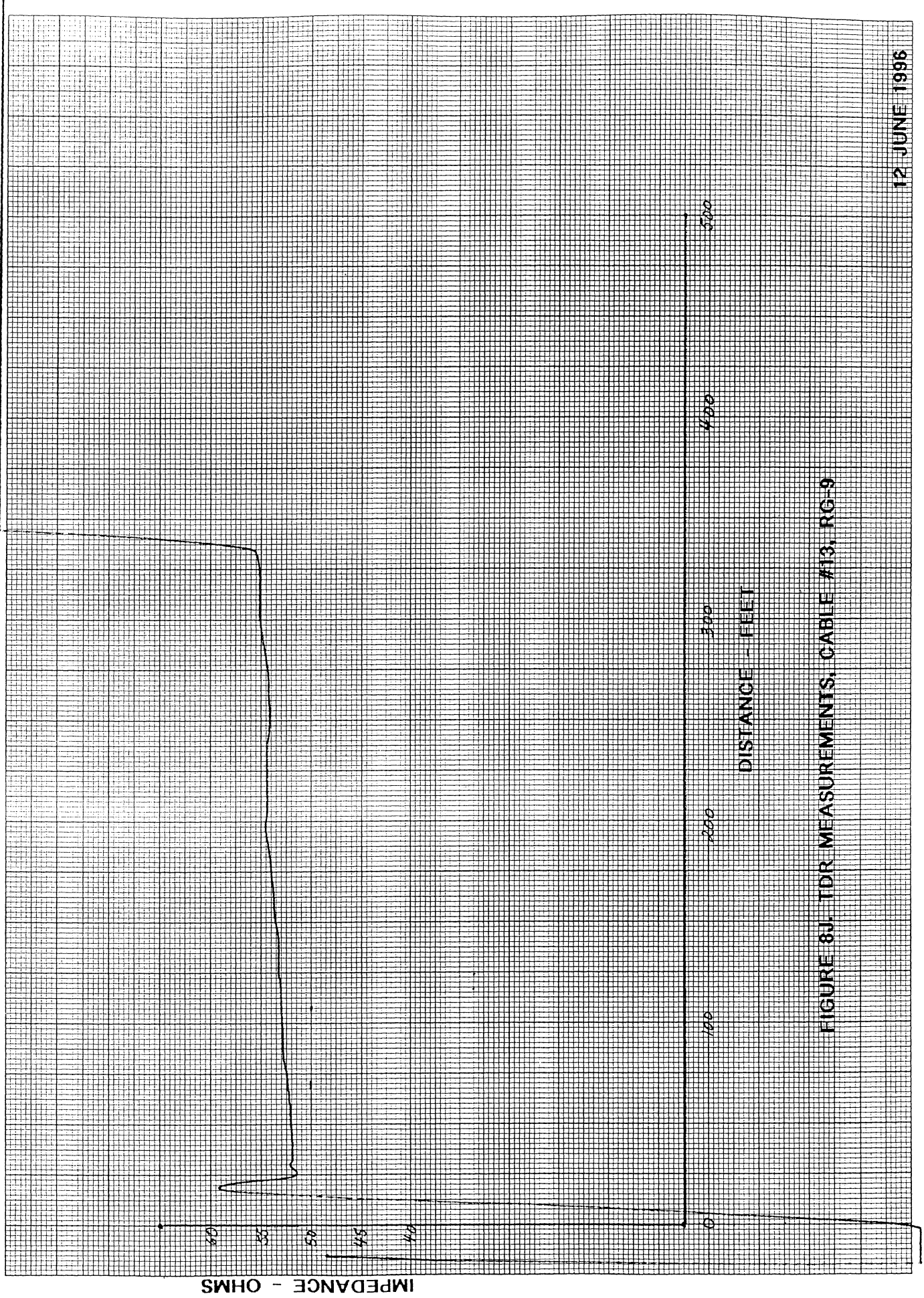


FIGURE 8J. TDR MEASUREMENTS, CABLE #13, RG-9

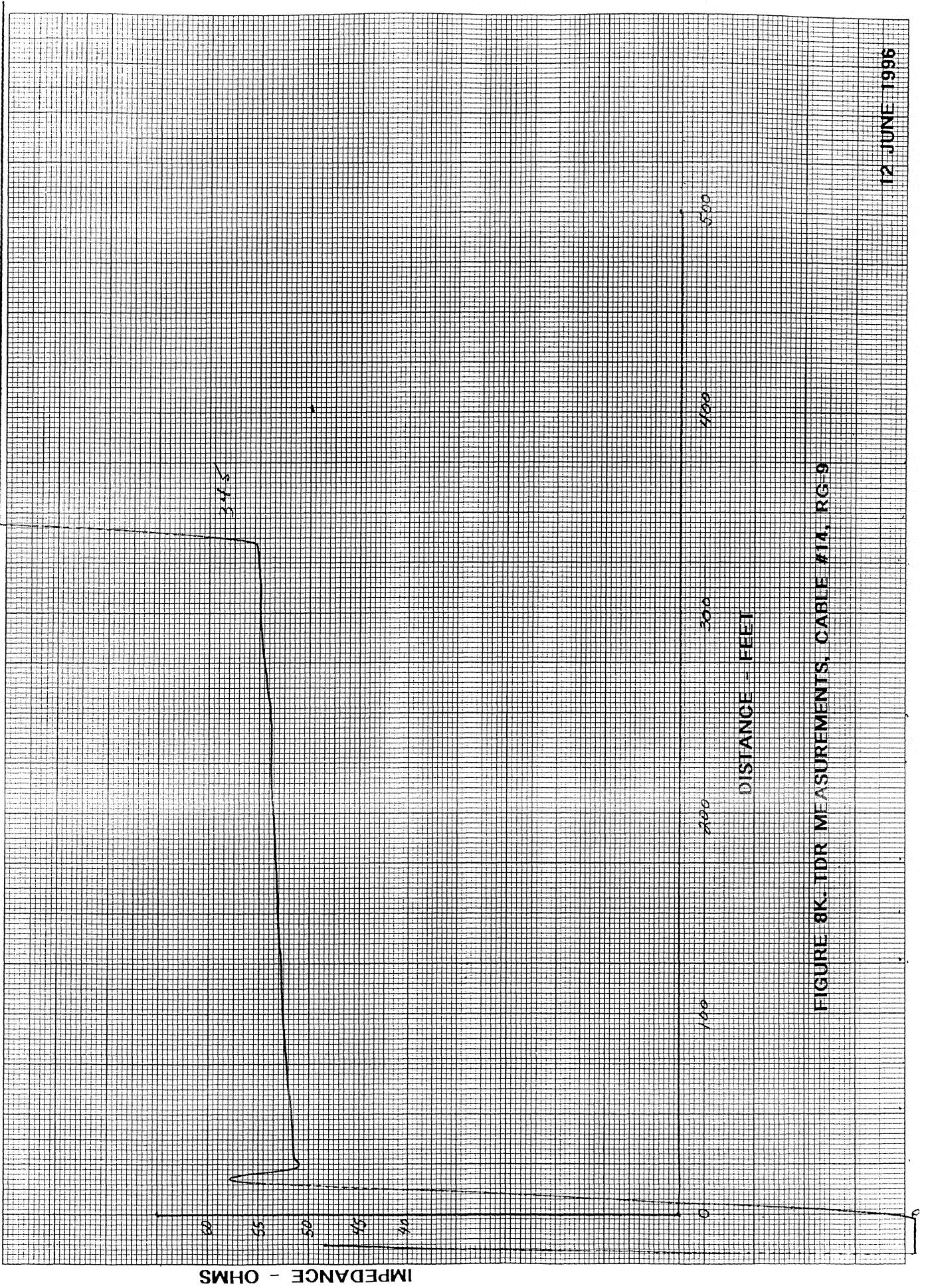


FIGURE 8K. TDR MEASUREMENTS, CABLE #14, RG-9

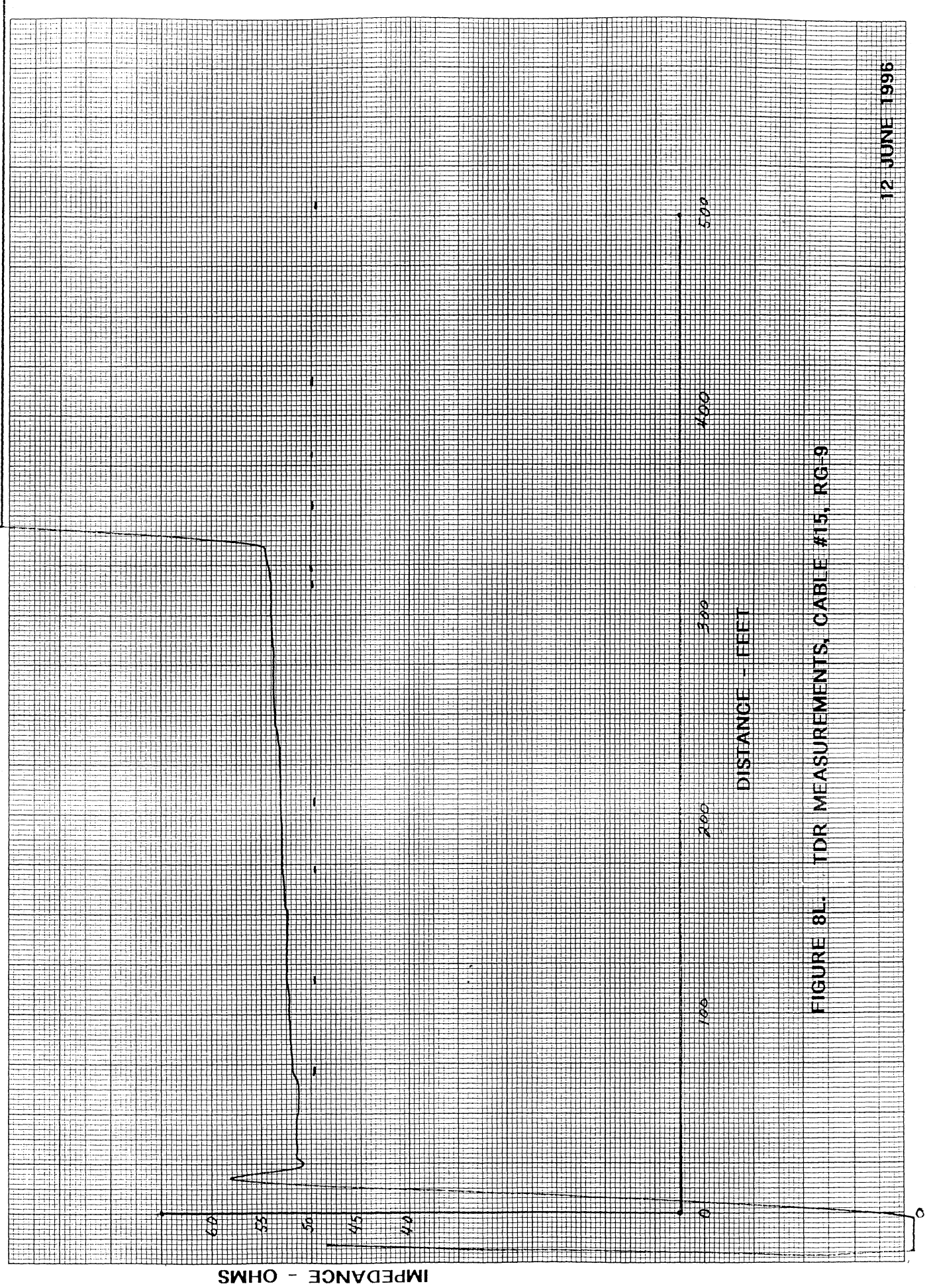


FIGURE 8L. TDR MEASUREMENTS, CABLE #15, RG-9

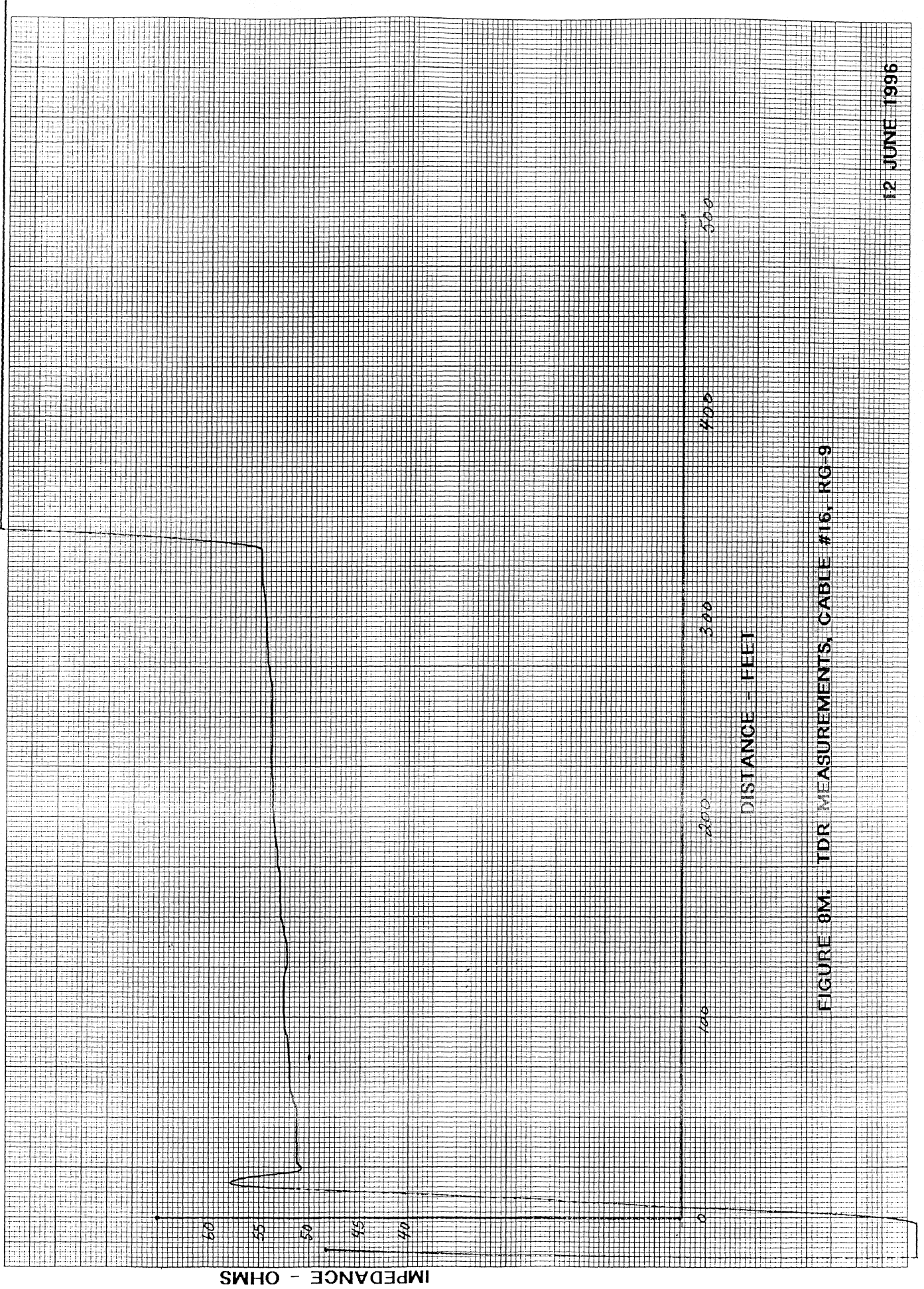


FIGURE 8M. TDR MEASUREMENTS, CABLE #16, RG-9

50 OHM SPIR-O-LINE COAXIAL CABLE VSWR 1.1:1.0

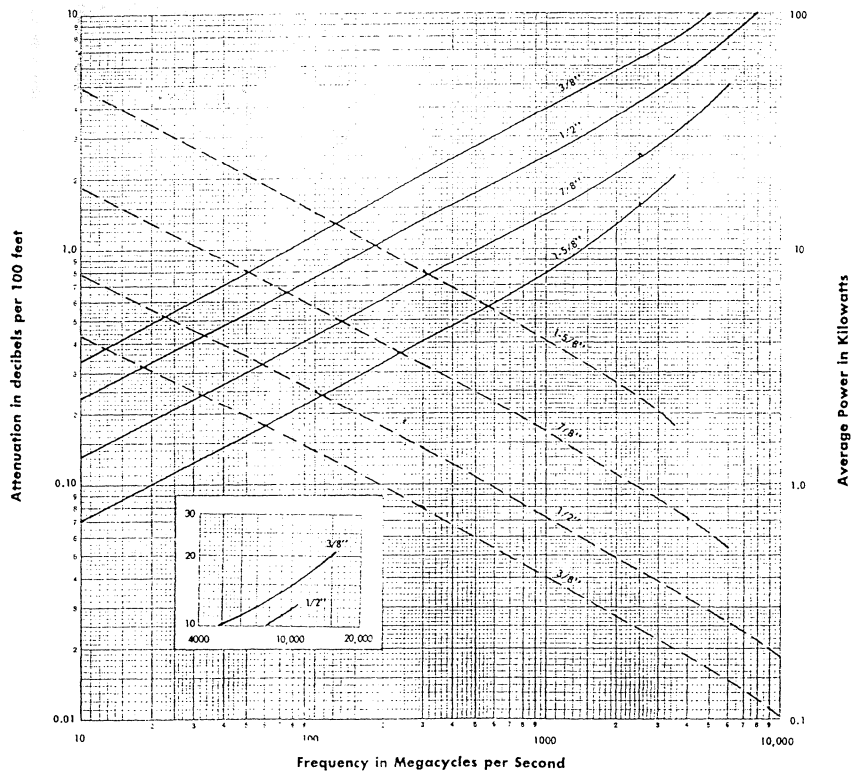
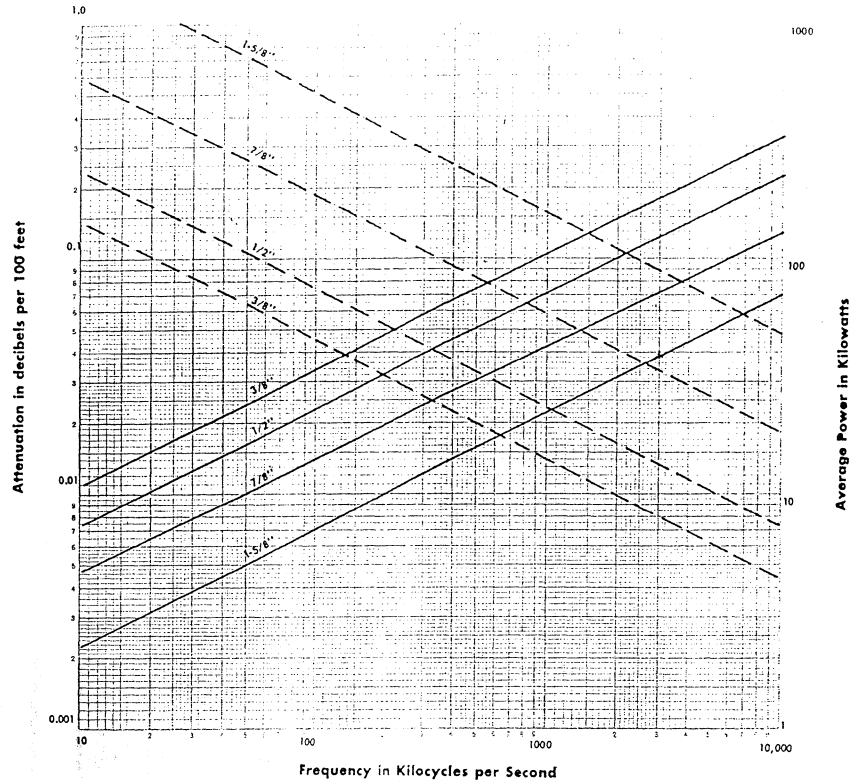


FIGURE 9. SPIROLINE CABLE ATTENUATION

— Attenuation vs Frequency
- - - Average Power Ratings

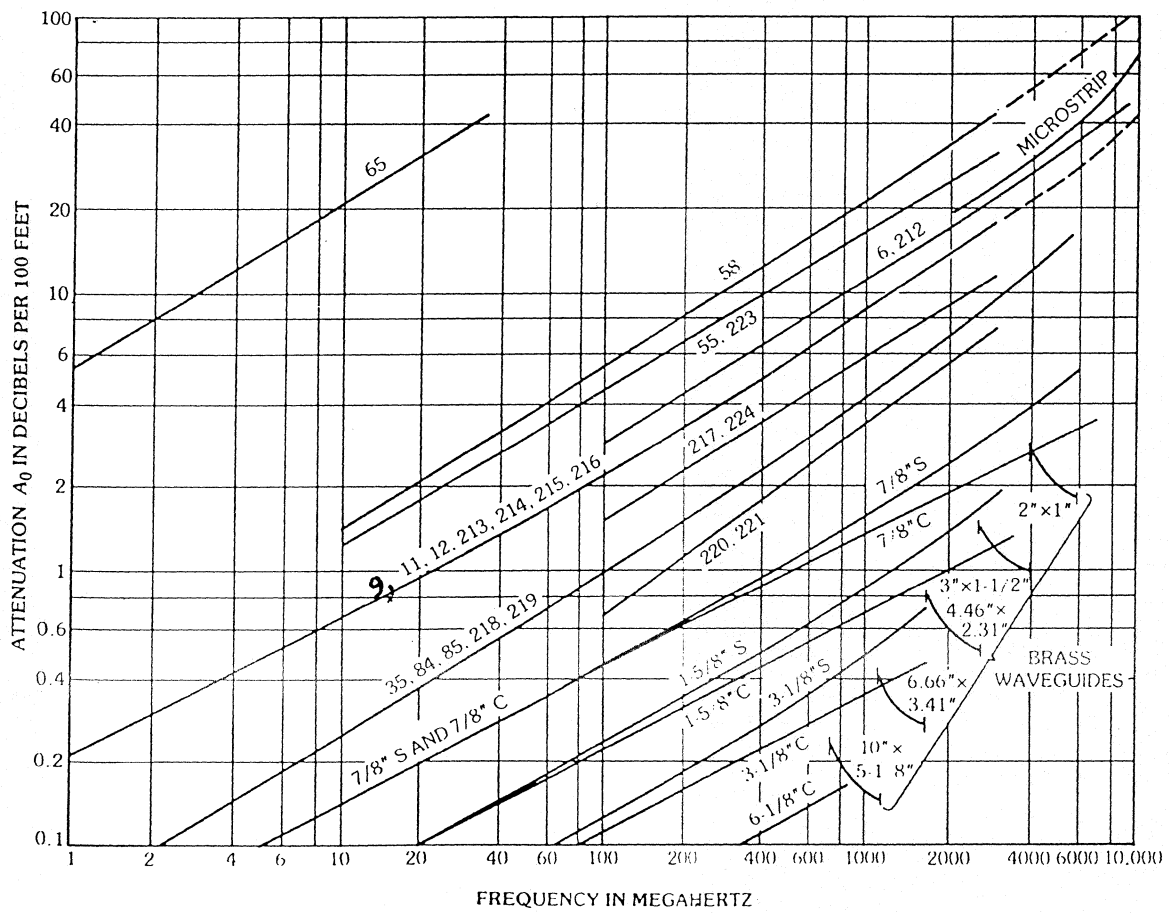


FIGURE 10. COAXIAL CABLE ATTENUATION,
 REFERENCE DATA FOR ENGINEERS:
 RADIO, ELECTRONICS, COMPUTER,
 AND COMMUNICATIONS, EDWARD JORDON
 P. 29-27

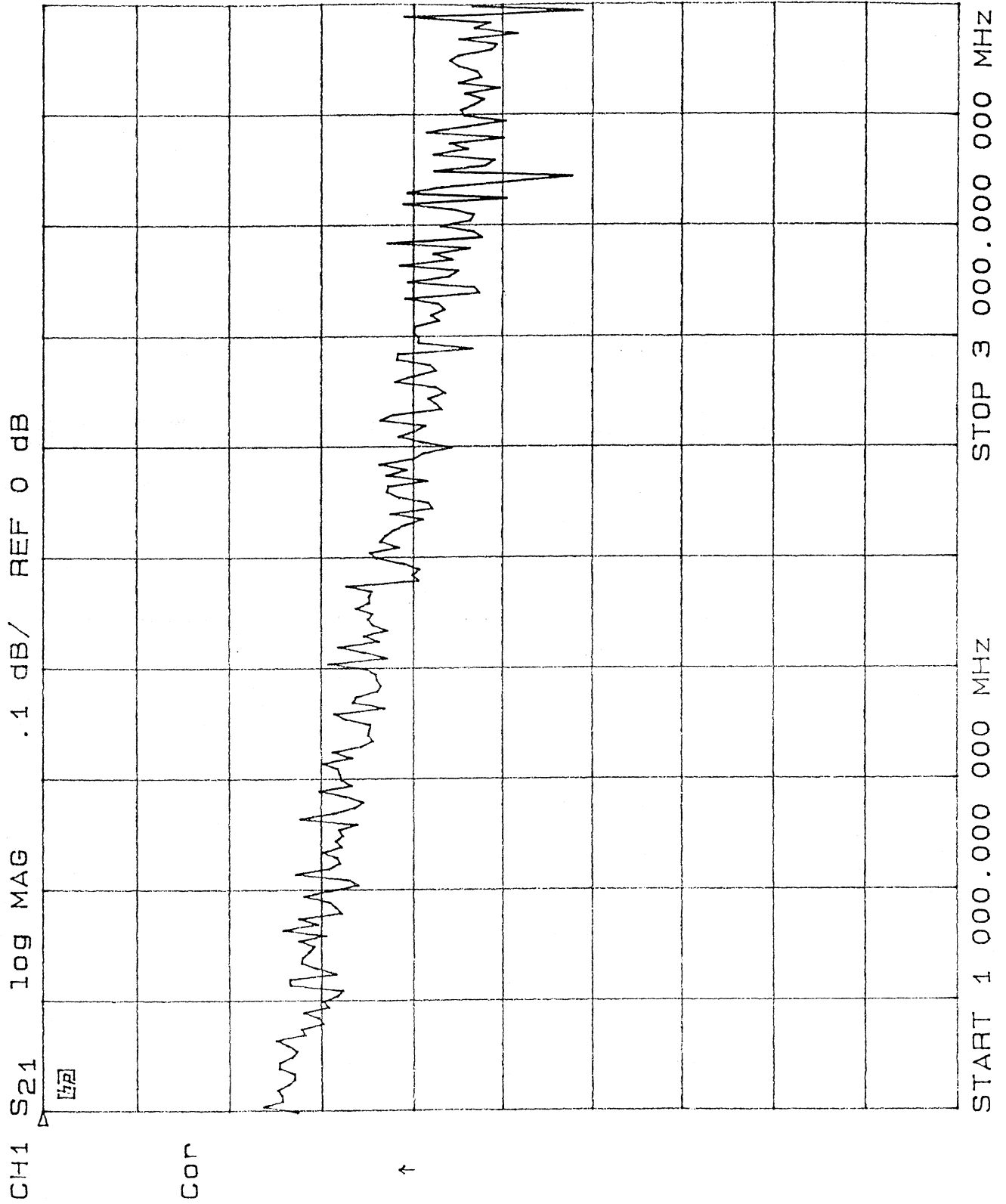


FIGURE 11. REFERENCE JUMPER RG-9 \approx 2 FEET LONG FOR CONNECTING CABLES #9 AND #10 TOGETHER

140' CABLE ROUTING											LEGEND				
JUL 95	FILE CABLE1.WK1					CHART1					Path = -> Termination =				
CABLE #	FUNCTION	TYPE	ORIGIN	TAIL JUMP	HUB	EAST YOKE	WEST YOKE	DEC JUMP	TRAY	VERTEX BULKHD	CASS	SKIN	LEG	APE	
01	PRIME FOCUS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW			->	SW		
02	PRIME FOCUS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW			->	SW		
03	PRIME FOCUS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW			->	SW		
04	CASS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW	SW					
04A	CASS RF/IF	7/8 SF	VERTEX						SW	SW	->	->	SW		
05	CASS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW	SW					
05A	CASS RF/IF	7/8 SF	VERTEX						SW	SW	->	->	SW		
06	CASS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW	SW					
07	CASS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW	SW					
08	CASS RF/IF	7/8 SF	WIND.BX	->	->		->	->	SW	SW					
09	PRIME FOCUS LO	1-5/8 SF	WIND.BX	->	->		->	->	NW			->	NW		
10	PRIME FOCUS LO	1-5/8 SF	WIND.BX	->	->		->	->	NW			->	NW		
11	PRIME FOCUS IF(LINE)	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
12	PRIME FOCUS IF(LINE)	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
13	PRIME FOCUS IF	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
14	PRIME FOCUS IF	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
15	PRIME FOCUS IF	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
16	PRIME FOCUS IF	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
17	CASS IF(LINE)	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
18	CASS IF(LINE)	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
19	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
20	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
21	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
22	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
23	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
24	CASS IF	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
25	CASS HIGH VOLTAGE	RG9B/U	WIND.BX	->	->		->	->	SW	SW					
26	PRIME FOCUS HIGH VOLT	RG9B/U	WIND.BX	->	->		->	->	NW			->	NW		
27	CASS RX CONTROL/MON.	30C/#16	WIND.BX	->	->	->			NE	NE					
28	CASS RX CONTROL/MON.	30C/#16	WIND.BX	->	->	->			NE	NE					
28A	P.F. RX CONTROL/MON.	30C/#16	VERTEX						NE	NE	->	->	NE		
29	CASS RX CONTROL/MON.	30C/#16	WIND.BX	->	->	->			NE	NE					
29A	P.F. RX CONTROL/MON.	30C/#16	VERTEX						NE	NE	->	->	NE		
30	NUTATOR TILT CONTROL	30C/#16	WIND.BX	->	->	->			NE	NE	->	->	NE		
30A	P.F. RX CONTROL/MON.	30C/#16	VERTEX						NE	NE	->	->	NE		
31	CASS AIR COND.CONTROL	30C/#16	CNTRL.RM												
31A	CASS AIR COND.CONTROL	30C/#16	CHILLER				->		NW	NW					
32	FOC/POL TACH&BRAKE	30C/#16	CNTRL.RM	->	->		->		SW			->	SW		
33	NUT.HYD.MONITOR	30C/#16	CNTRL.RM	->	->										
34	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			SE	SE					
34A	RX CONTROL/MONITOR	15P/#16	VERTEX						SE	SE	->	->	SE		
35	Removed 7-11-95	15P/#16	WIND.BX	->	->	->			SE	SE					
35A	Removed 7-11-95	15P/#16	VERTEX						SE	SE	->	->	SE		
36	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			SE	SE					
36A	RX CONTROL/MONITOR	15P/#16	VERTEX						SE	SE	->	->	SE		
37	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			SE	SE					
38	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			SE	SE					
39	NUTATOR CONTROL	15P/#16	CNTRL.RM	->	->	->			SE	SE					
39A	NUTATOR CONTROL	15P/#16	VERTEX	->	->	->			SE	SE	->	->	SE		
40	Eliminated 7-11-95	8C/#16	CNTRL.RM	->	->	->			NE	NE					
40A	Eliminated 7-11-95	8C/#16	VERTEX						NE	NE	->	->	NE		
41	Eliminated 7-11-95	8C/#16	CNTRL.RM	->	->	->			NE	NE					
41A	Eliminated 7-11-95	8C/#16	VERTEX						NE	NE	->	->	NE		
42	DC TEMP CONTROL	4C/#8	CNTRL.RM	->	->	->			SE	SE					
42A	DC TEMP CONTROL	4C/#8	VERTEX						SE	SE	->	->	SE		
43	DC TEMP CONTROL	4C/#8	CNTRL.RM	->	->	->			SE			->	SE		

TABLE 1. CABLE ROUTING AND IDENTIFICATION

CABLE #	FUNCTION	TYPE	ORIGIN	TAIL	HUB	EAST YOE	WEST YOE	DEC JUMP	TRAY	VERTICAL BULKHD				
44	DC TEMP CONTROL	4C/#8	CNTRLRM	->	->	->			SE					SE
45	REGULATED AC PRIME FOC	4C/#8	CNTRLRM	->	->	->			SE					SE
46	REGULATED AC CASS	4C/#8	CNTRLRM	->	->	->			SE	SE				SE
46A	REGULATED AC PRIME FOC	4C/#8	VERTEX						SE	SE	->	->		SE
47	REGULATED AC CASS	4C/#8	CNTRLRM	->	->	->			SE	SE				
48	UN-REG. AC CASS	4C/#8	YOKE				->		NW	NW				
49	FOC/POL DRIVE MOTORS	4C/#8	CNTRLRM	->	->	->			SE			->		SE
50	AC 440V NUTATOR	4C/#6	YOKE											
51	CASS HOUSE HEATERS	4C/#6	YOKE				->		NW	NW				
52	VERTEX WINCH MOTOR	4C/#10	YOKE				->		NW			->		NW
53	440V 3PH FEEDER	4C/#1-0	PUMP ROOM	->	->									
54	P.F. HE REFRIG. AC	3C/#14	TAIL BRNG	->	->		->		SW			->		SW
55	P.F. HE REFRIG. AC	3C/#14	TAIL BRNG	->	->		->		NW	NW		->		NW
56	CASS AIR COND. CONTROL	7P/#16	CNTRLRM	->	->		->		NW	NW				
57	MISC. CASS CONTROL	7P/#16	CNTRLRM	->	->		->		NW	NW				
58	FOC/POL ENCODER	7P/#16	CNTRLRM	->	->		->		SW			->		SW
59	FOC/POL CONTROL	7P/#16	CNTRLRM	->	->		->		SW			->		SW
60	CASS B RX CONTROL/MON.	30C/#16	CNTRLRM	->	->		->		NE	NE				
61	CASS B RX CONTROL/MON.	30C/#16	CNTRLRM	->	->		->		NE	NE				
62	CASS B RX CONTROL/MON.	15P/#18	CNTRLRM	->	->		->		NE	NE				
63	P.F. RX CONTROL/MON.	30C/#16	CNTRLRM	->	->	->			SE					SE
64	P.F. RX CONTROL/MON.	30C/#16	CNTRLRM	->	->	->			SE					SE
65	P.F. RX CONTROL/MON.	15P/#18	CNTRLRM	->	->	->			SE					SE
M55	POLR. SERVO	3C/#16	TB105A											
M56	POLR. TRANSDUCER	4C/#16	TB105A											
M57	DEC. SERVO	3C/#16	TB105A											
M58	DEC. TRANSDUCER	4C/#16	TB105A											