

**NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WEST VIRGINIA**

ELECTRONICS DIVISION TECHNICAL NOTE NO. 178

Title: 140-ft. Telescope Coaxial Cable Tests

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Date: July 26, 1996

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140-ft. Telescope Coaxial Cable Tests

G. Behrens
R. Hall
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M. McKinnon

July 26, 1996

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**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.

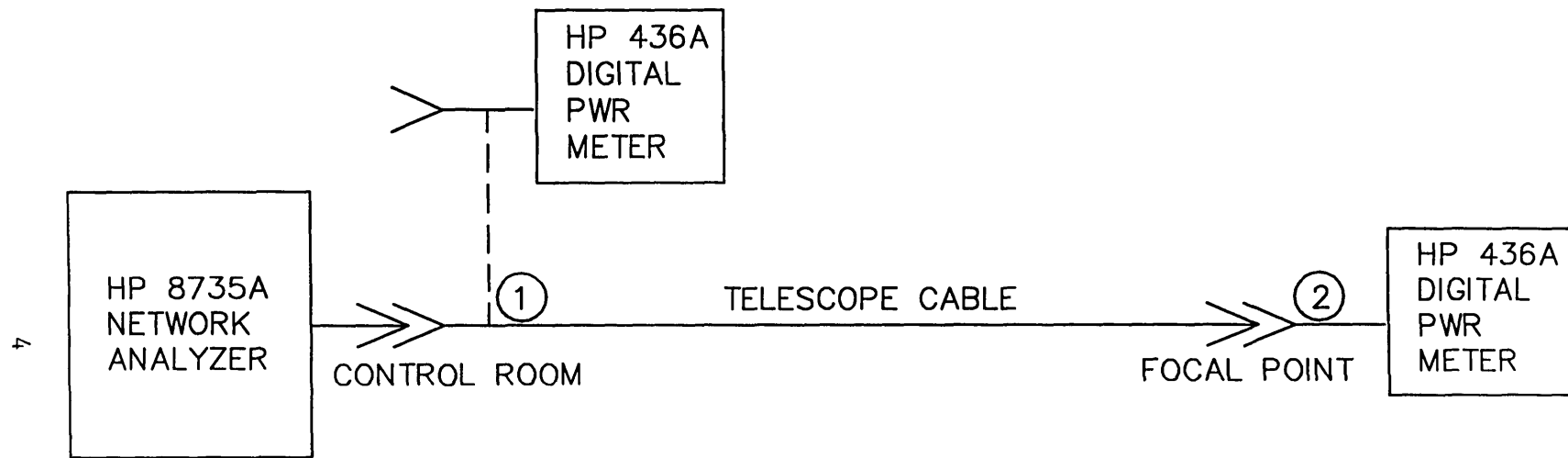


FIGURE 1. SINGLE FREQUENCY INSERTION LOSS MEASUREMENT SET UP

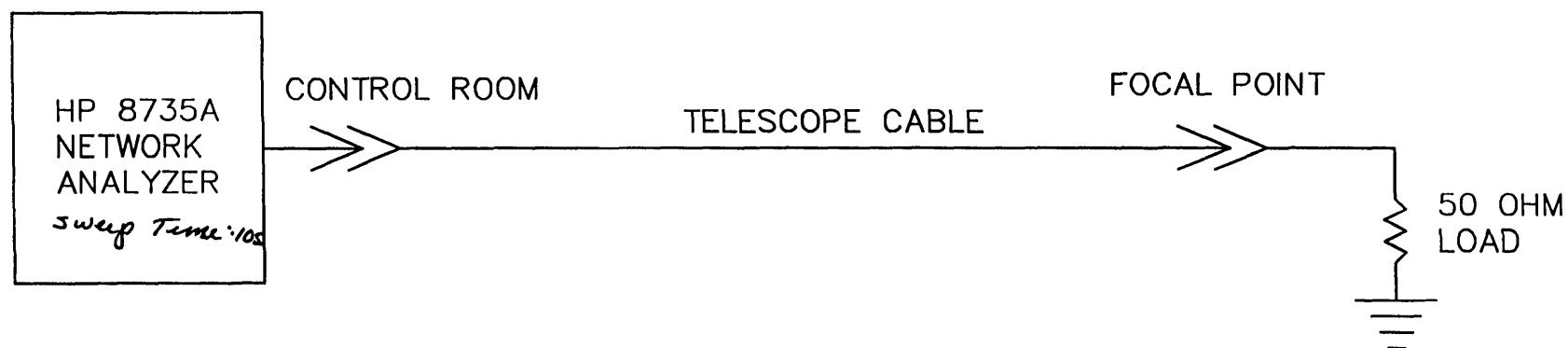
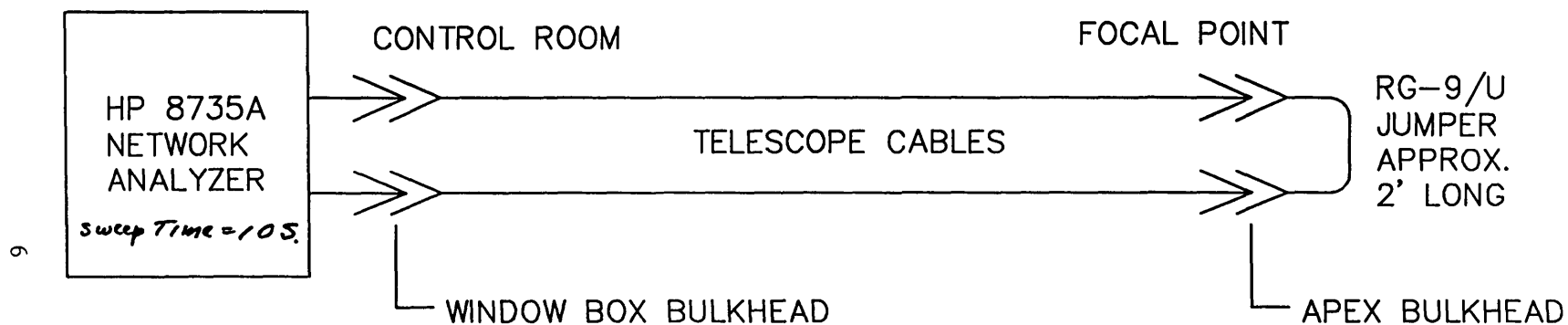
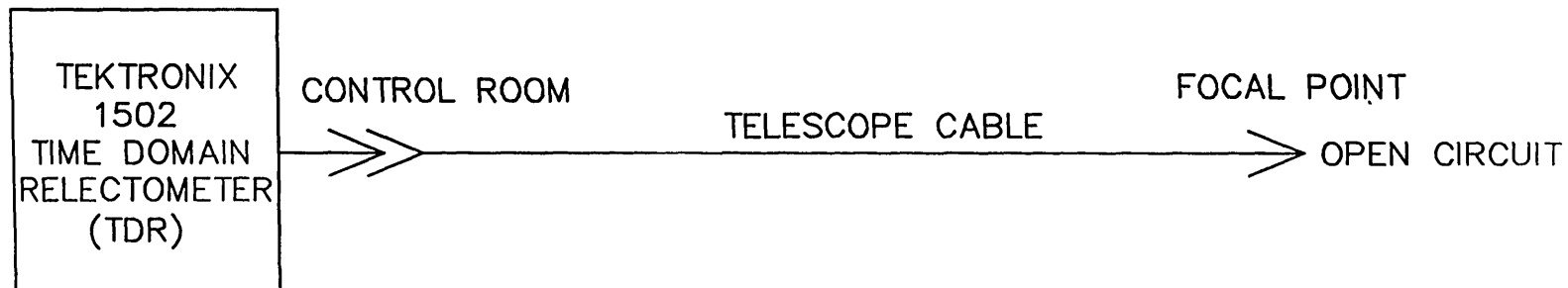


FIGURE 2. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS



12 JUNE 1996

FIGURE 3. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS



12 JUNE 1996

FIGURE 4. TIME DOMAIN REFLECTOMETER MEASUREMENTS

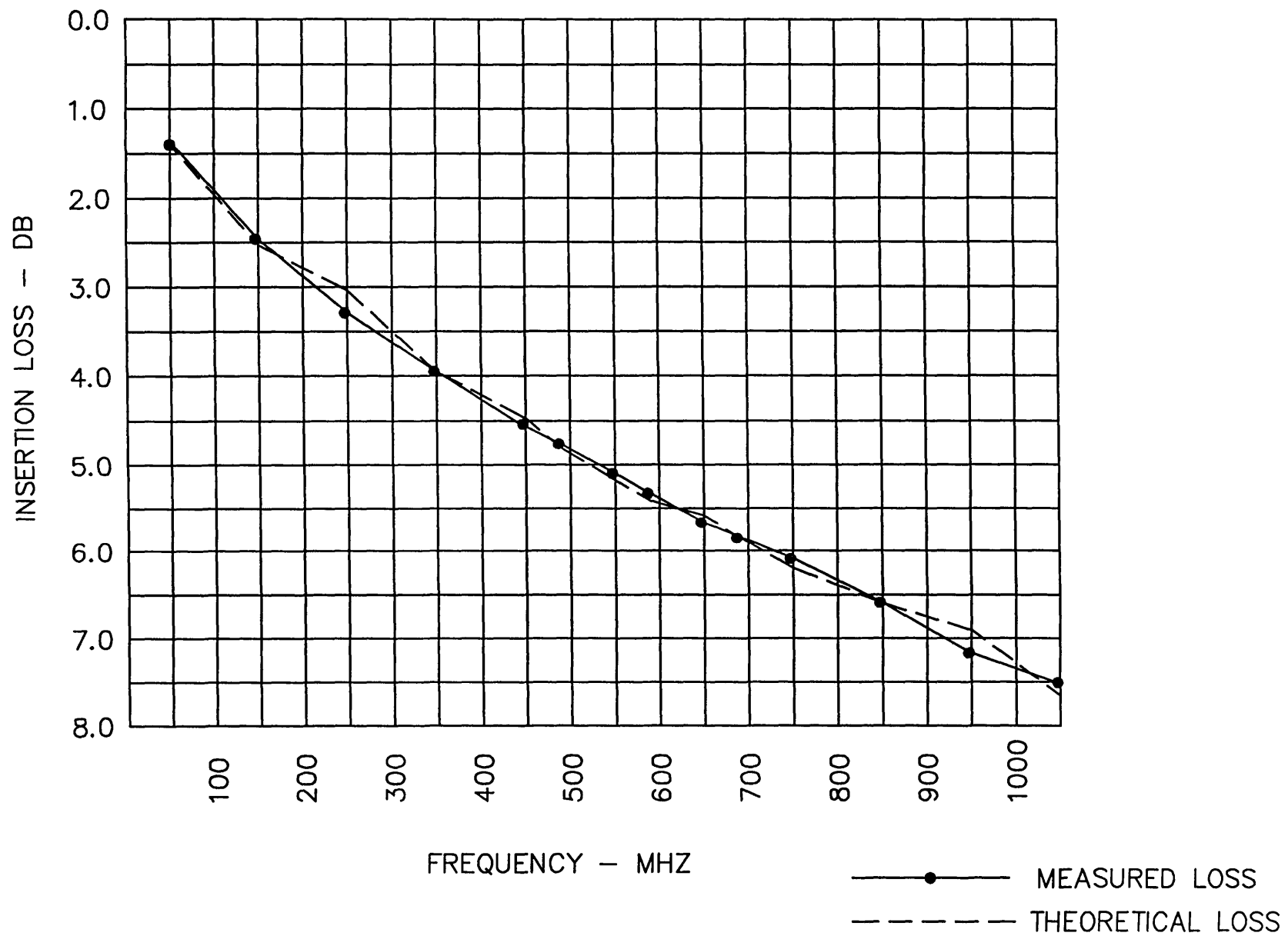


FIGURE 5A.

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

6/05/96

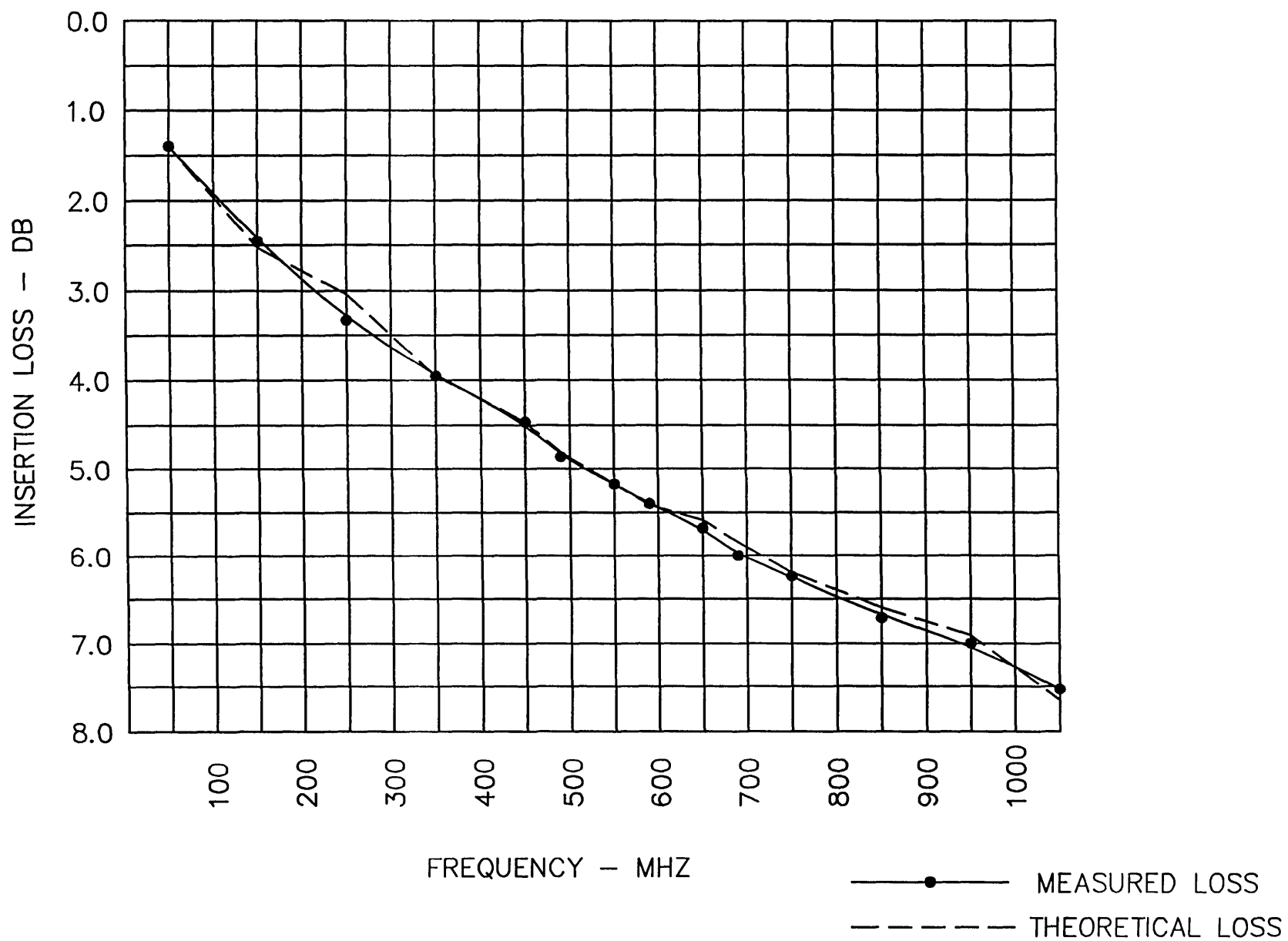


FIGURE 5B.

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

6/05/96

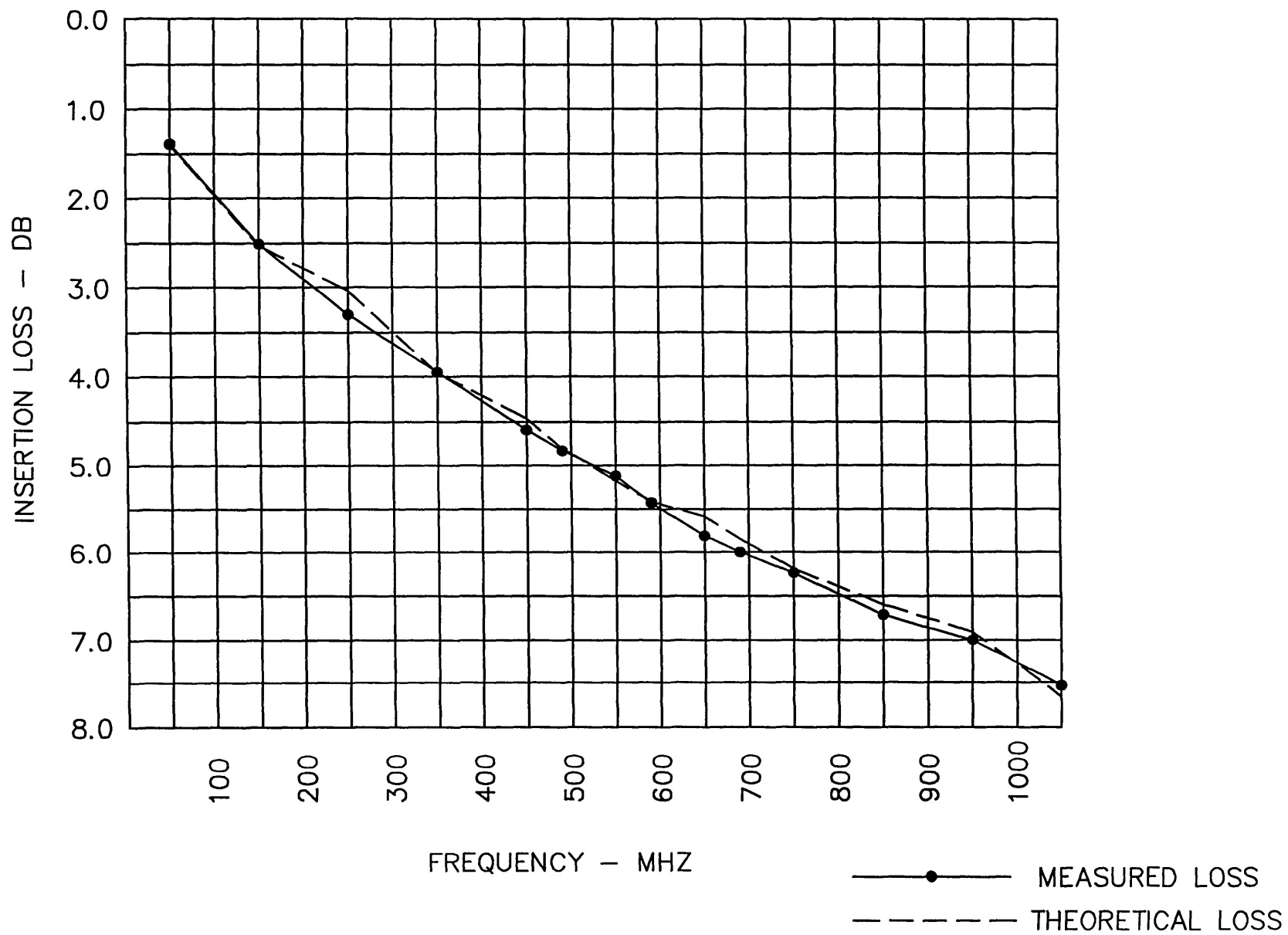


FIGURE 5C.

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

6/05/96

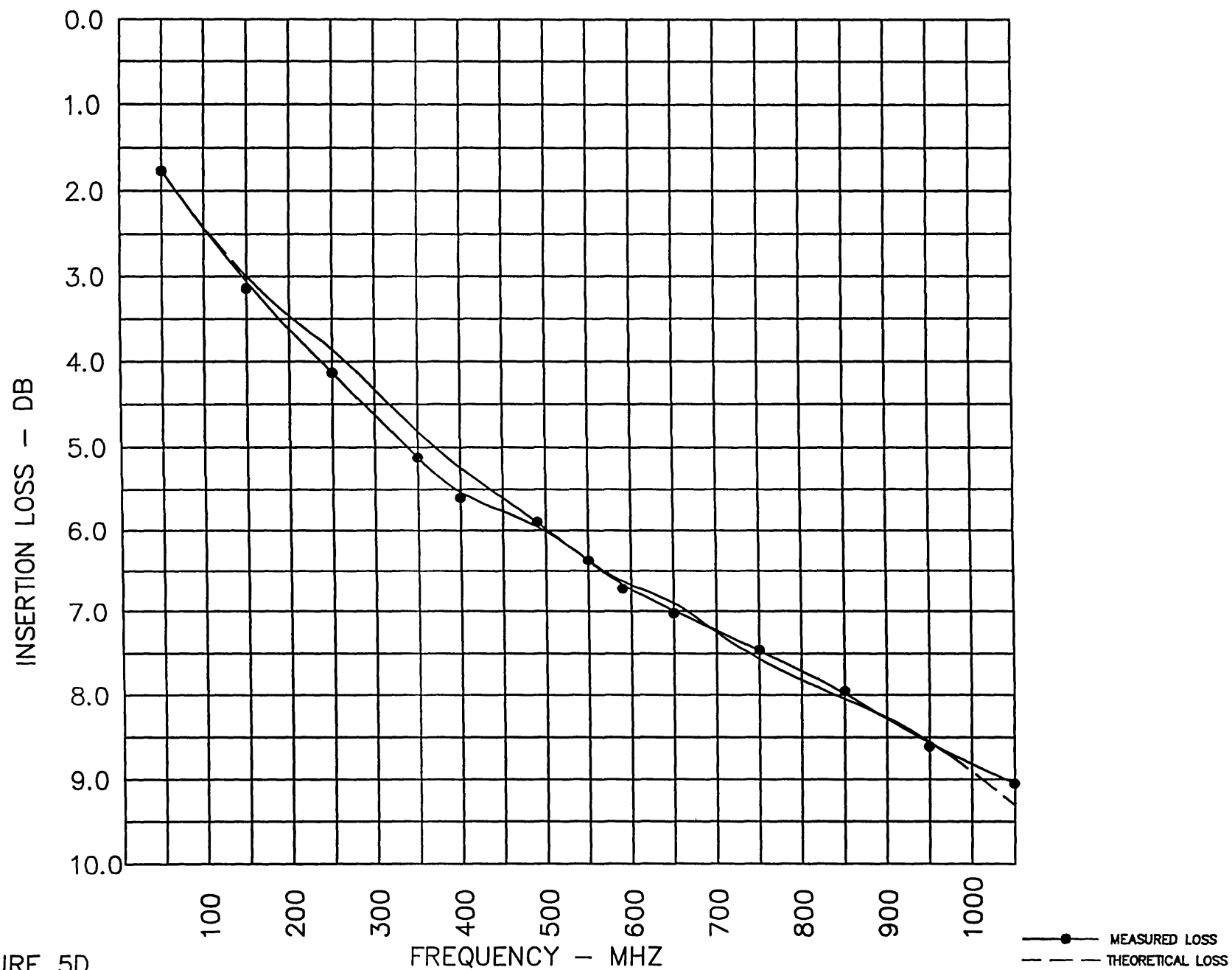


FIGURE 5D.

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

6/05/96

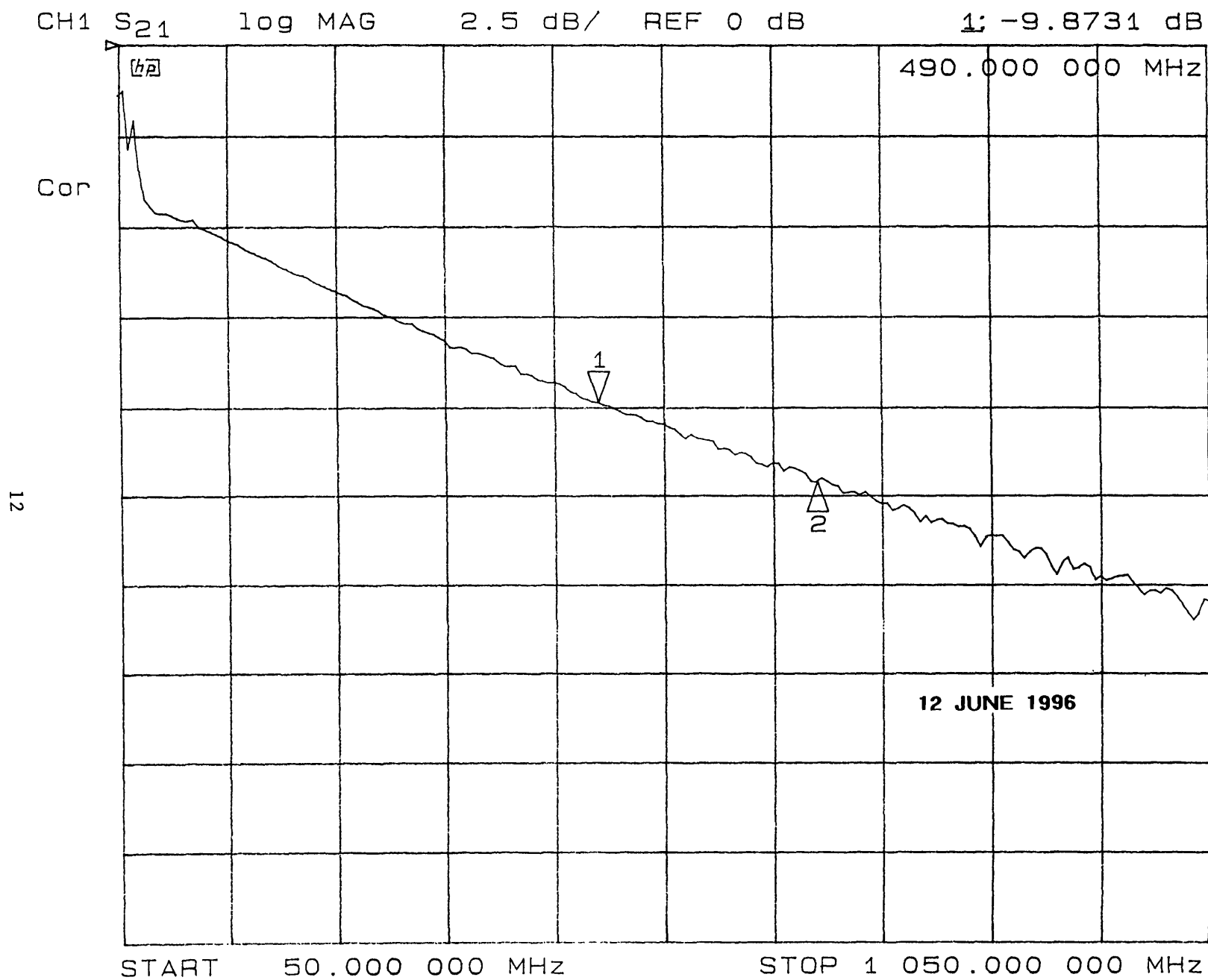


FIGURE 6A. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 2, 7/8 IN. SPIROLINE

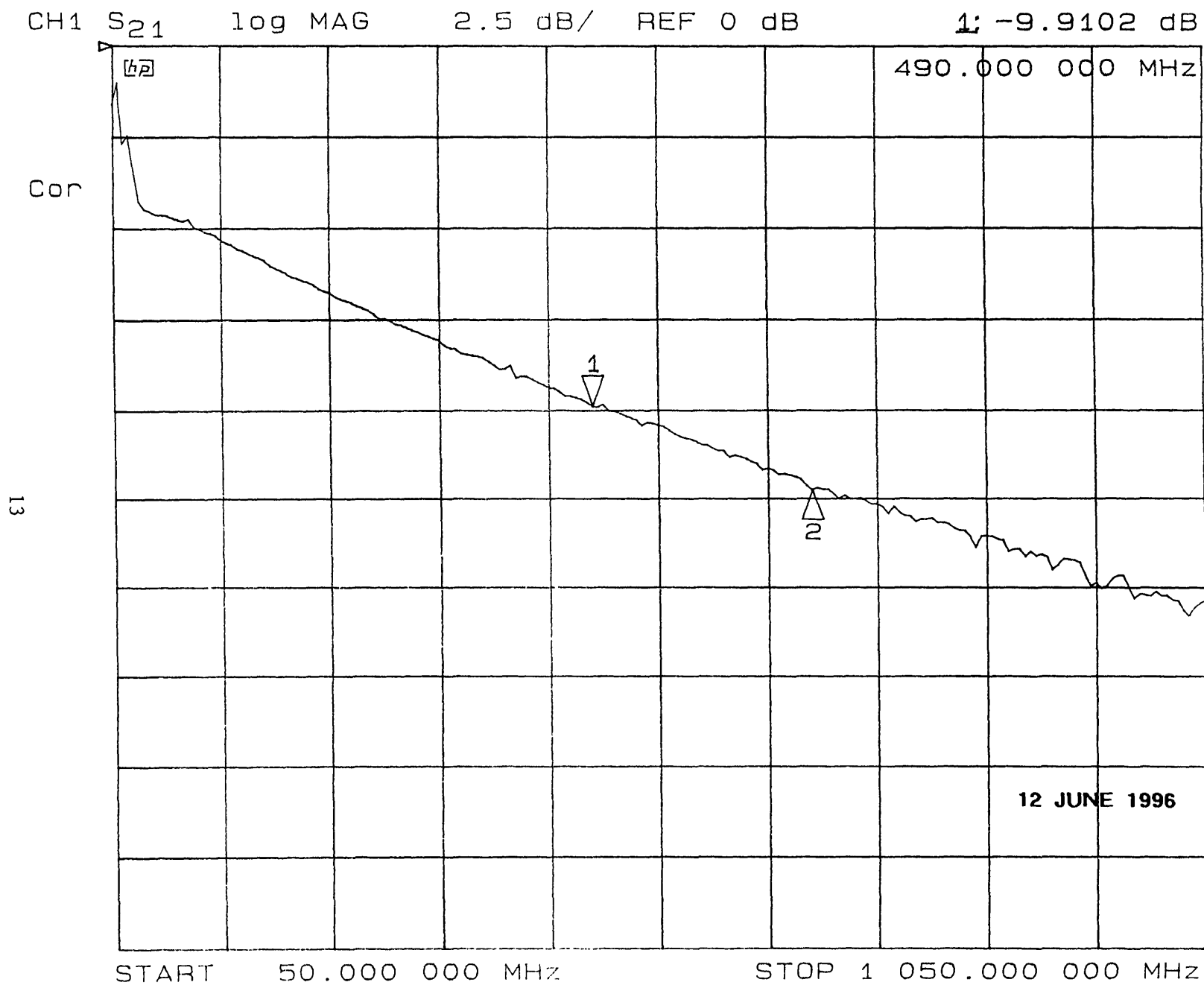


FIGURE 6B. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 3. 7/8 IN SPIRALINE

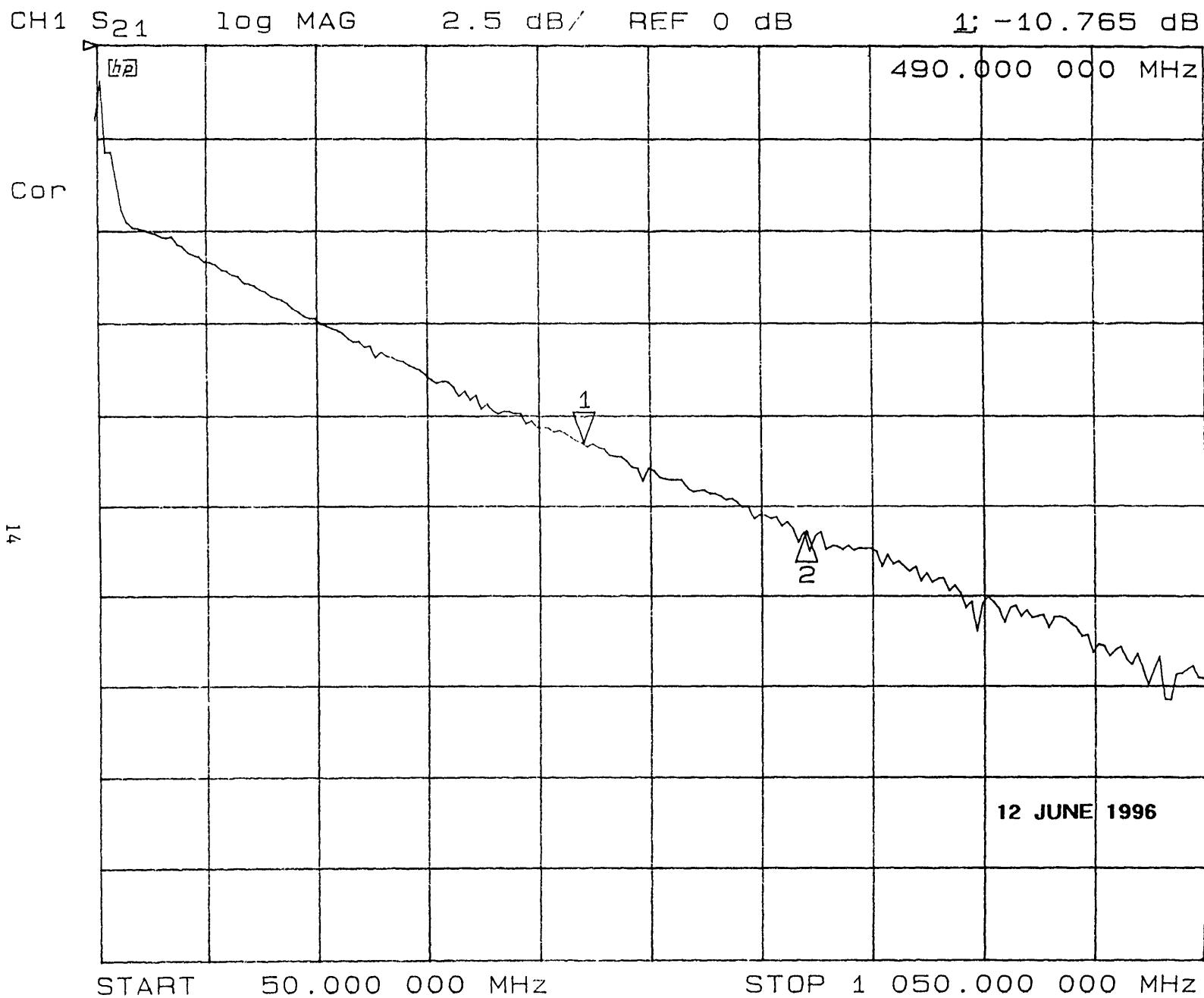


FIGURE 6C. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 4, 7/8 IN. SPIROLINE

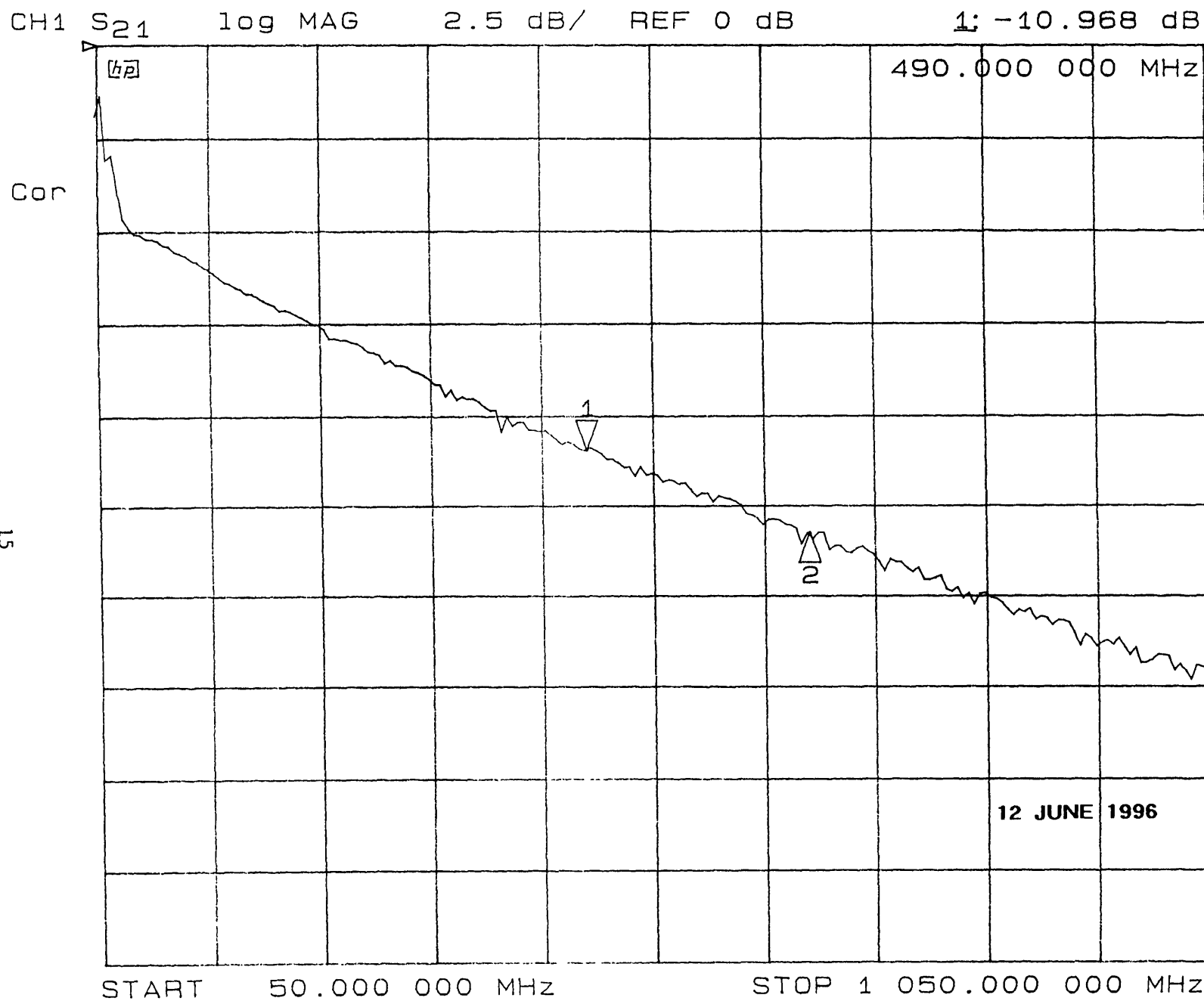


FIGURE 6D. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 1 TO 5, 7/8 IN. SPIROLINE

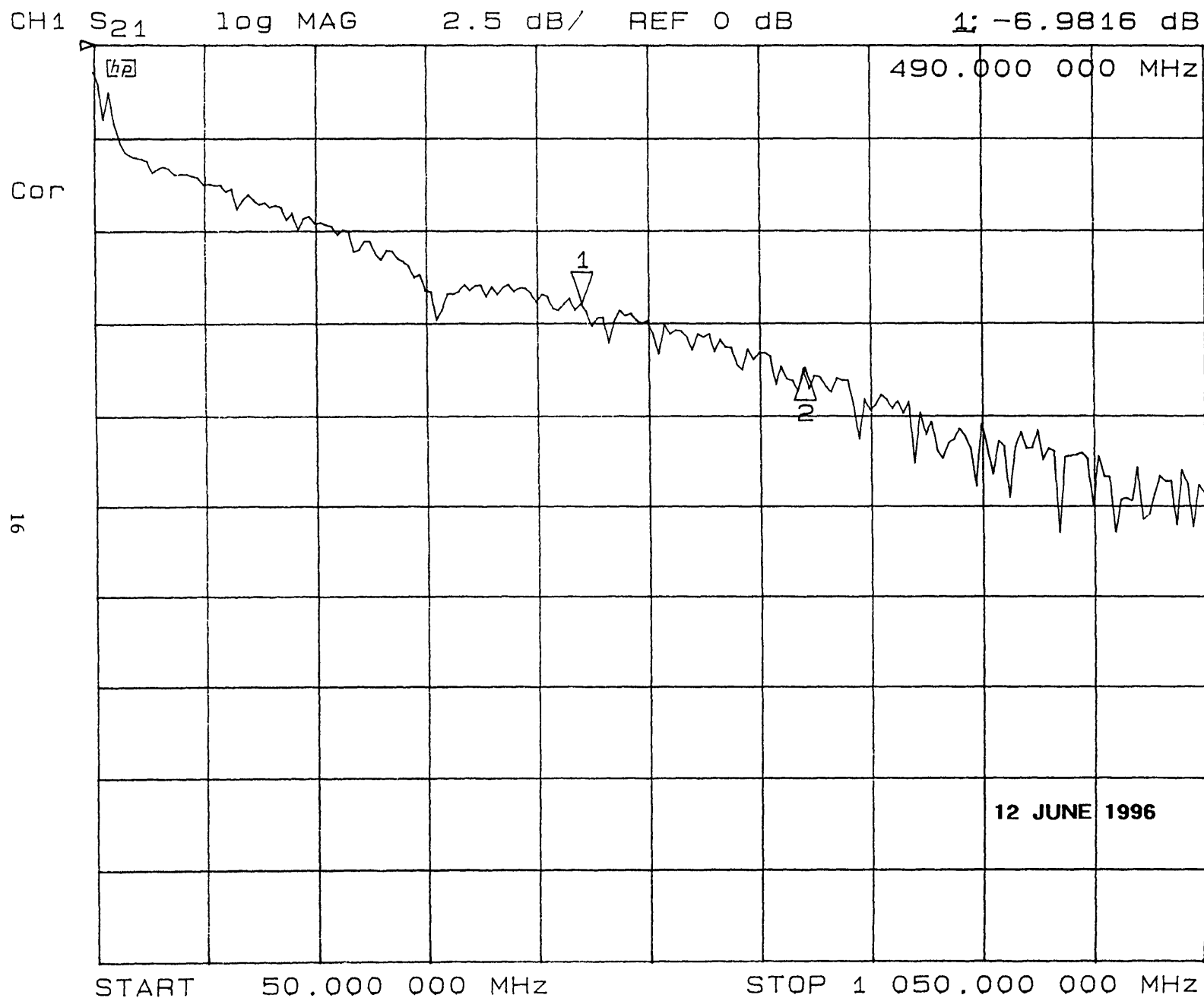


FIGURE 6E. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 9 TO 10 1-5/8 IN. SPIROLINE

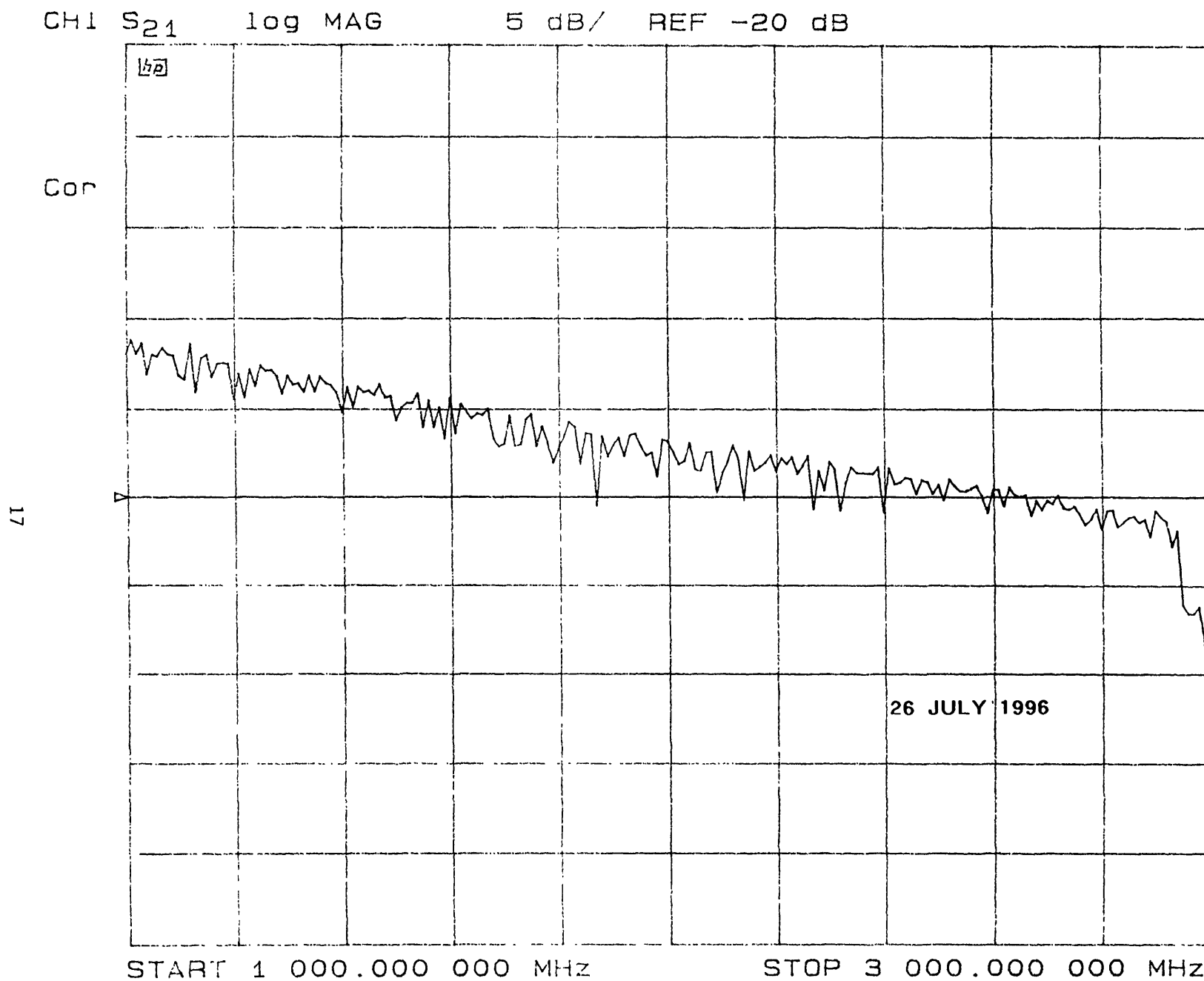


FIGURE 6F. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 9 TO 10 1-5/8 IN. SPIROLINE

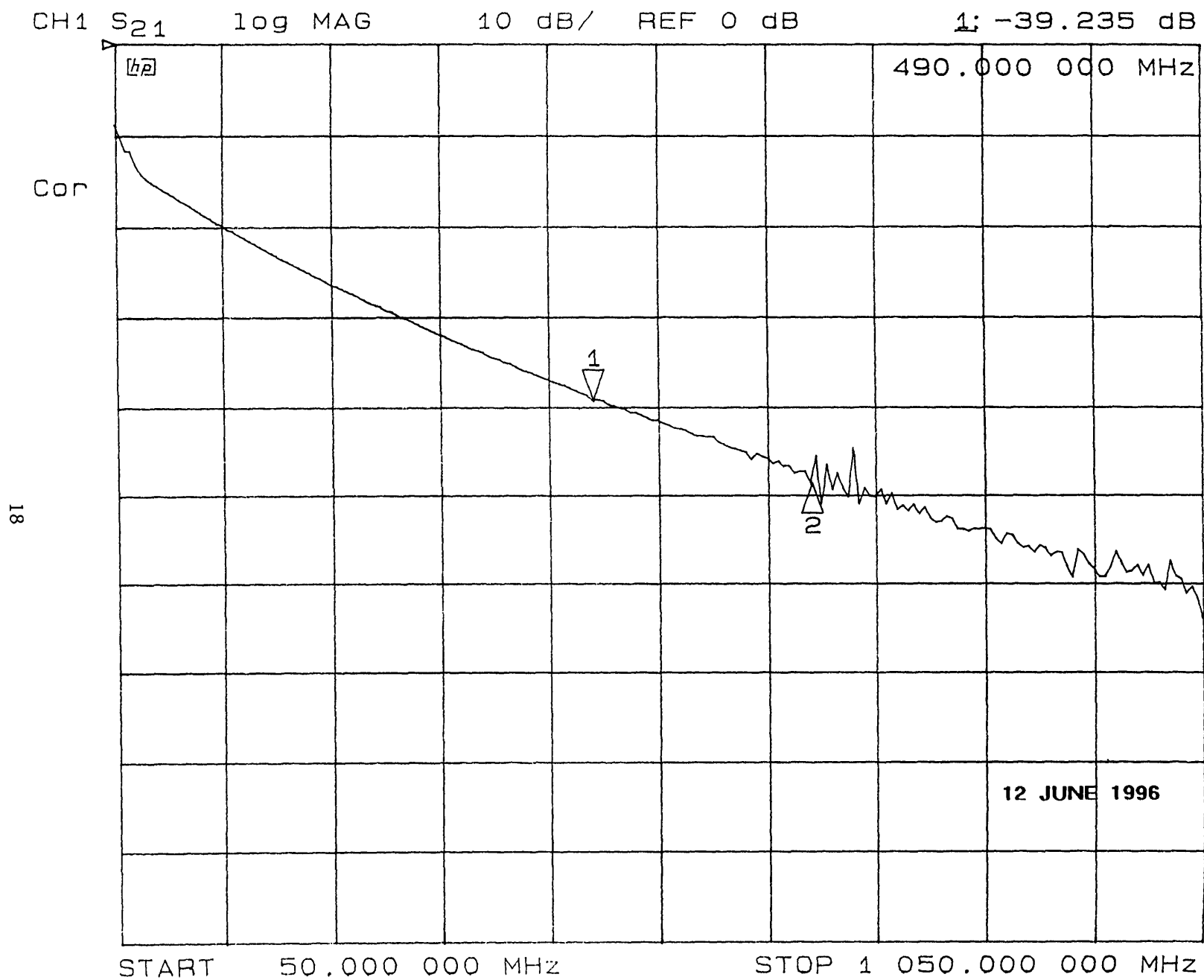


FIGURE 6G. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 14, RG-9

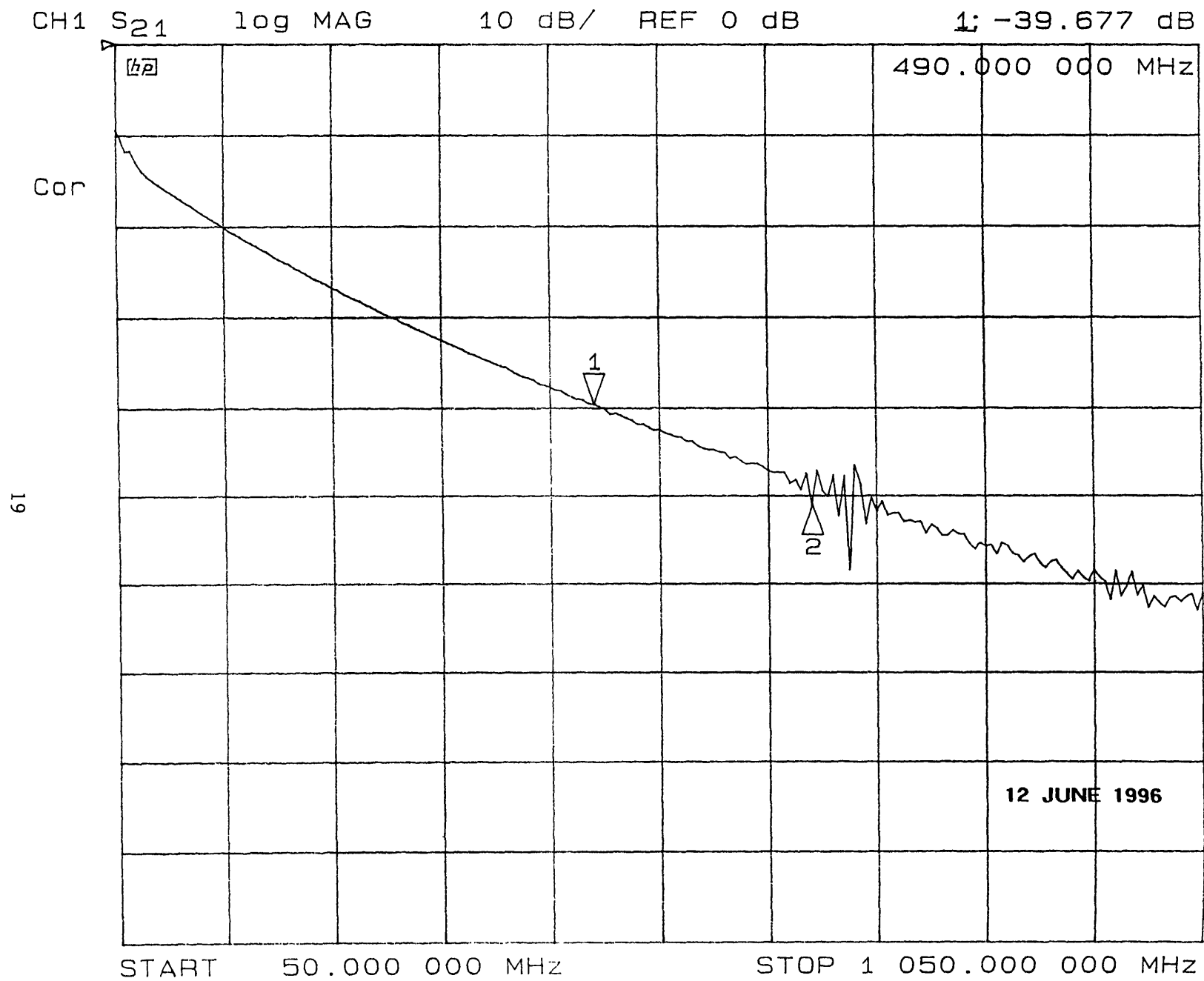


FIGURE 6H. SWEEPED FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 15, RG-9

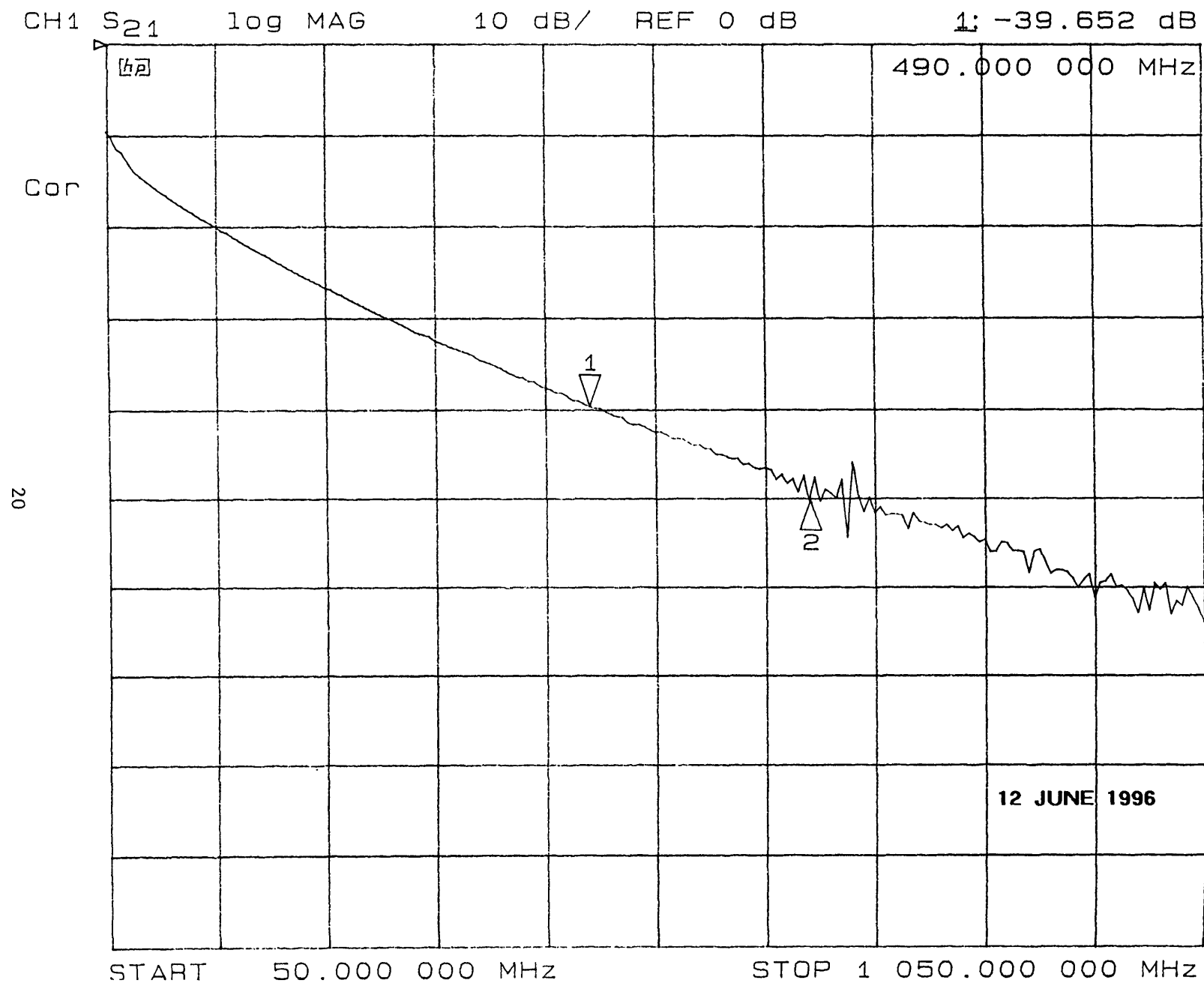


FIGURE 6I. SWEPT FREQUENCY INSERTION LOSS MEASUREMENTS, CABLE 13 TO 16, RG-9

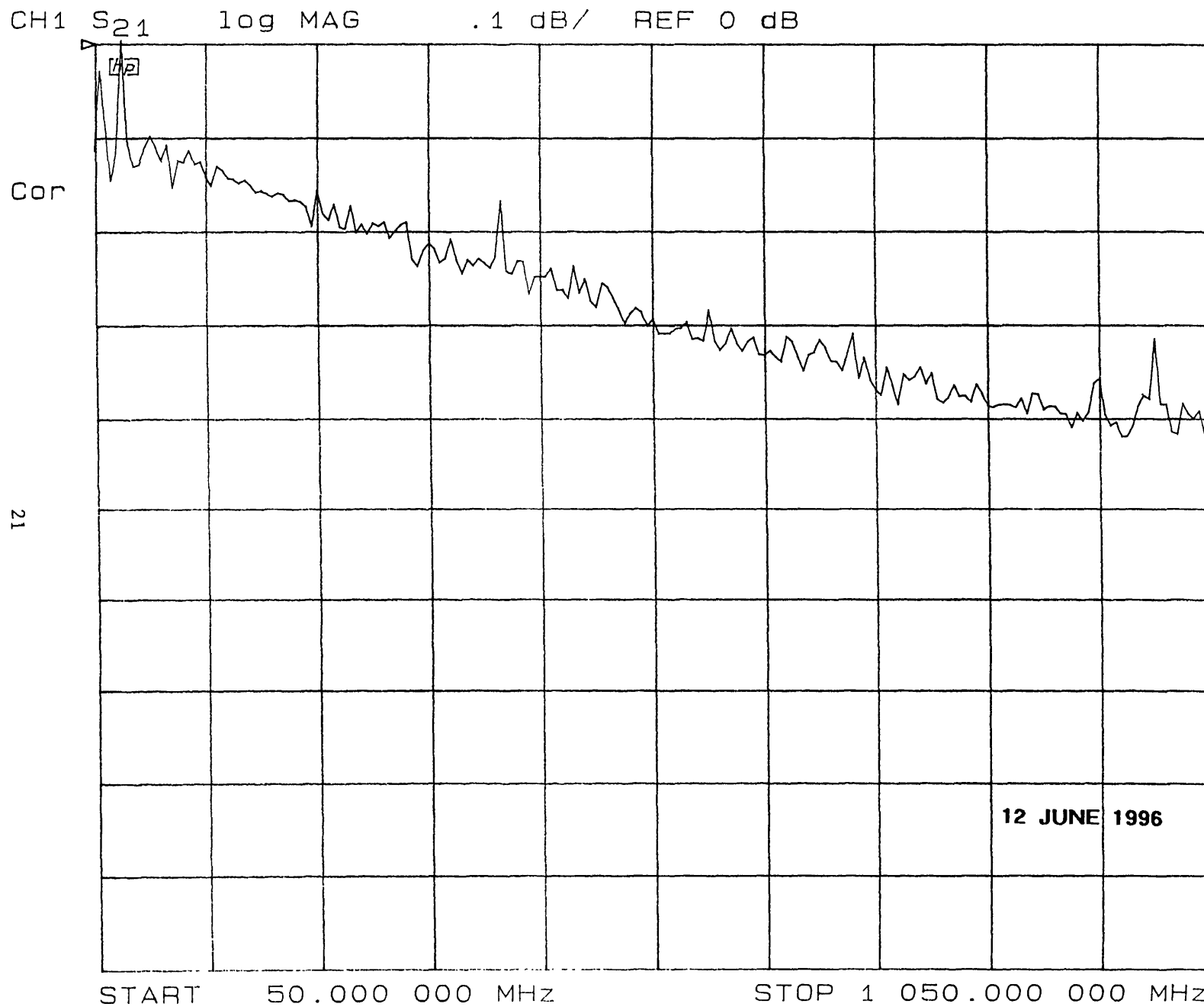


FIGURE 6J. REFERENCE - JUMPER CABLE USED AT PRIME FOCUS

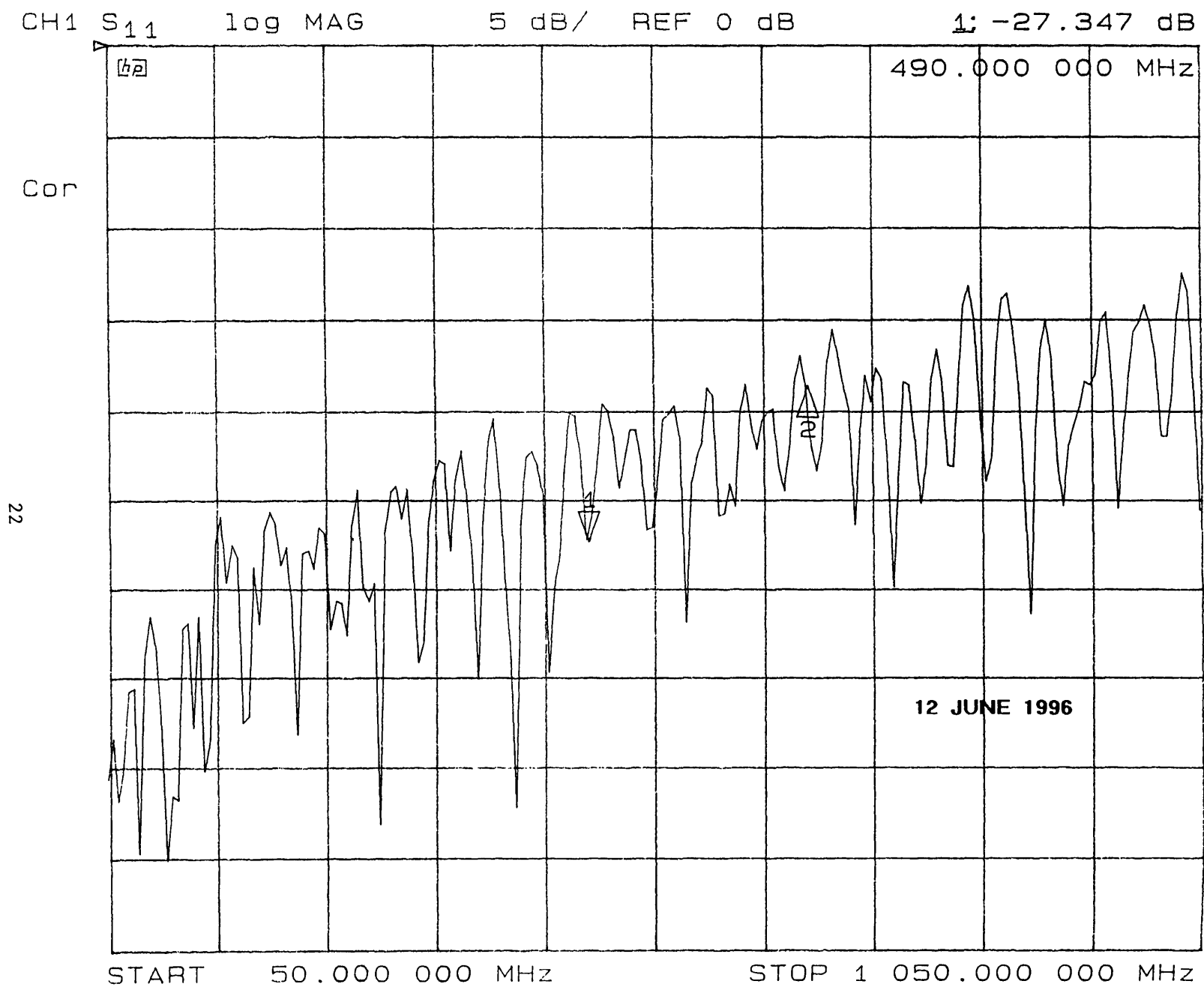


FIGURE 7A. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #1, 7/8 IN. SPIROLINE

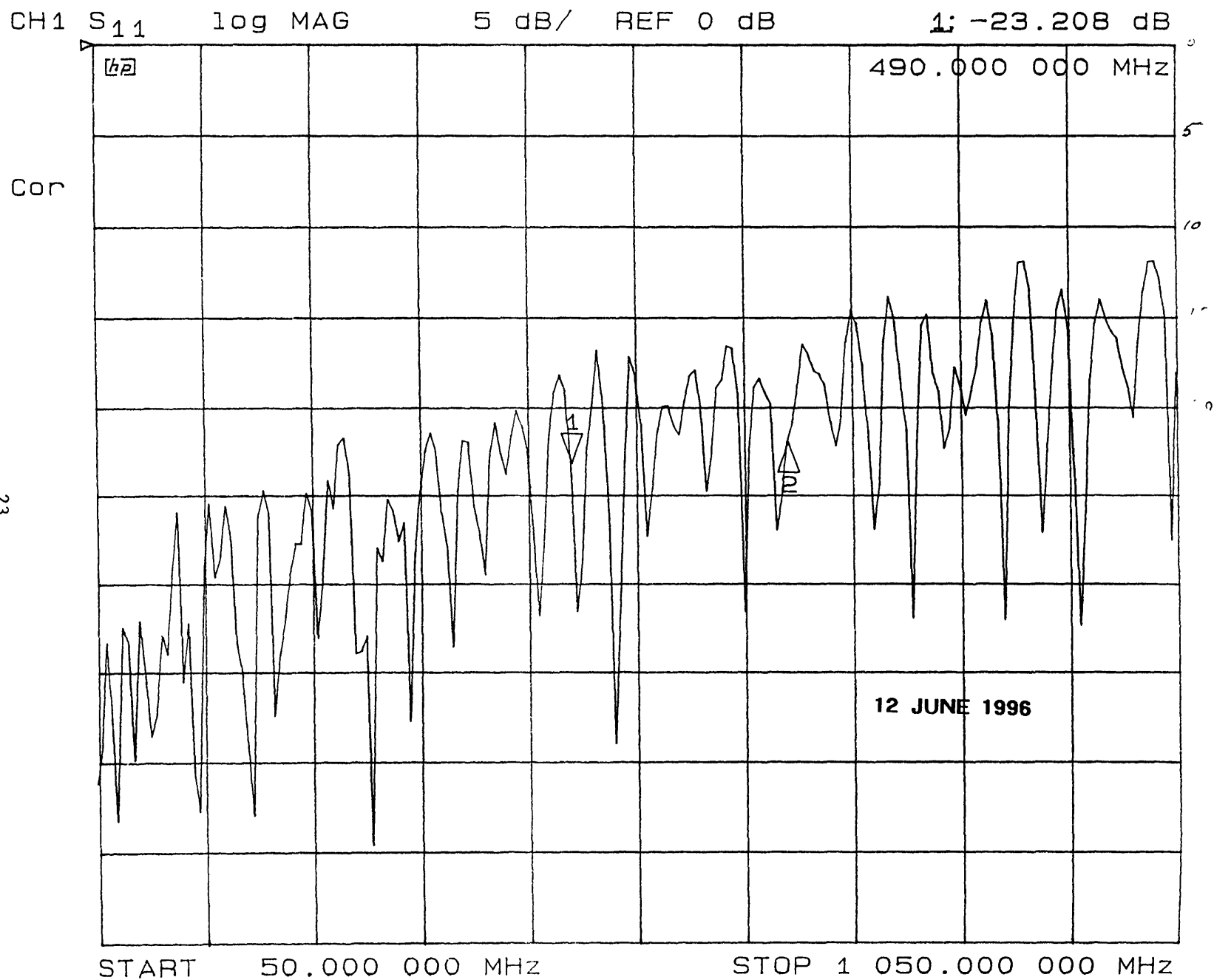


FIGURE 7B SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #2, 7/8 IN. SPIROLINE

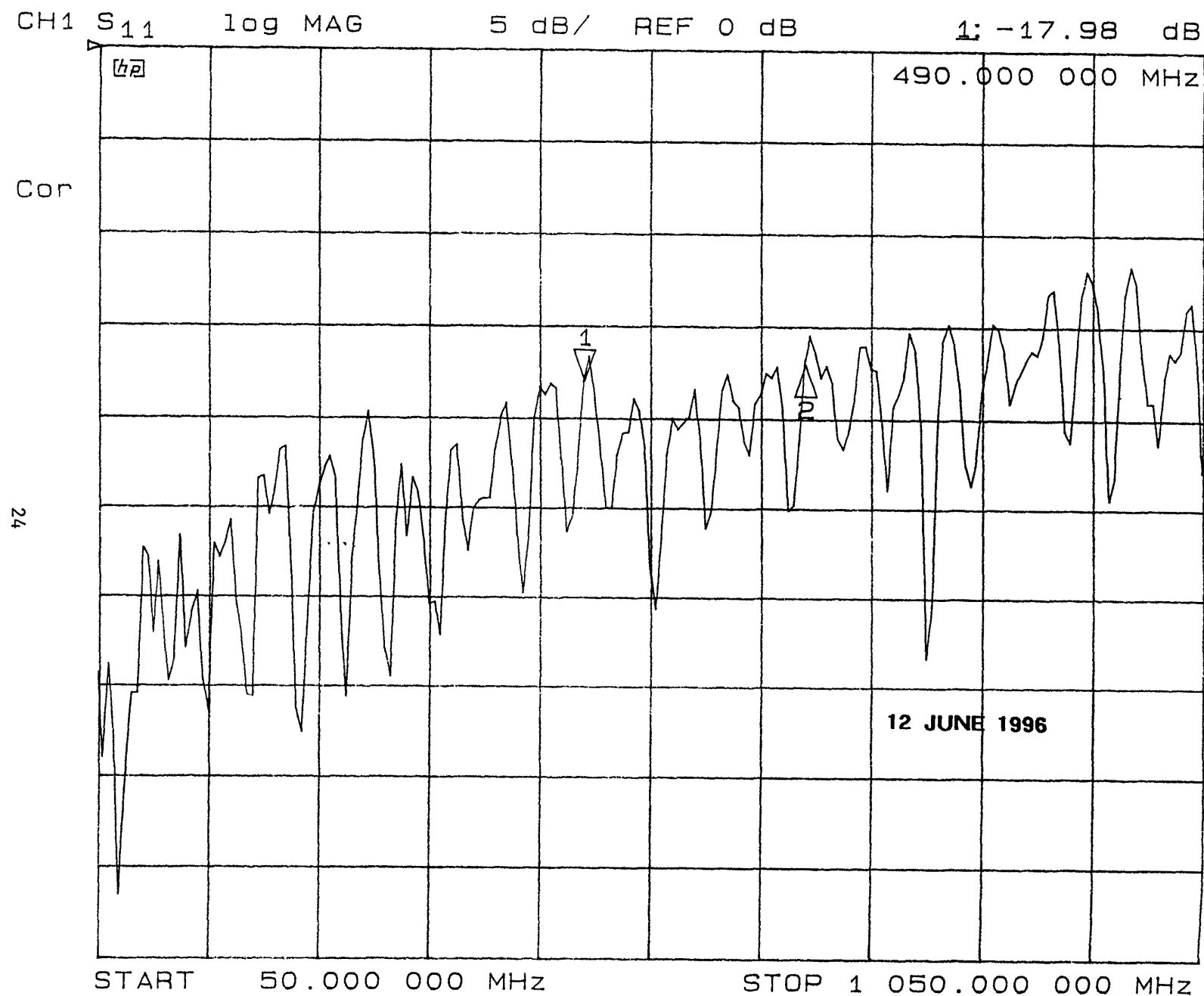


FIGURE 7C SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #3, 7/8 IN. SPIROLINE

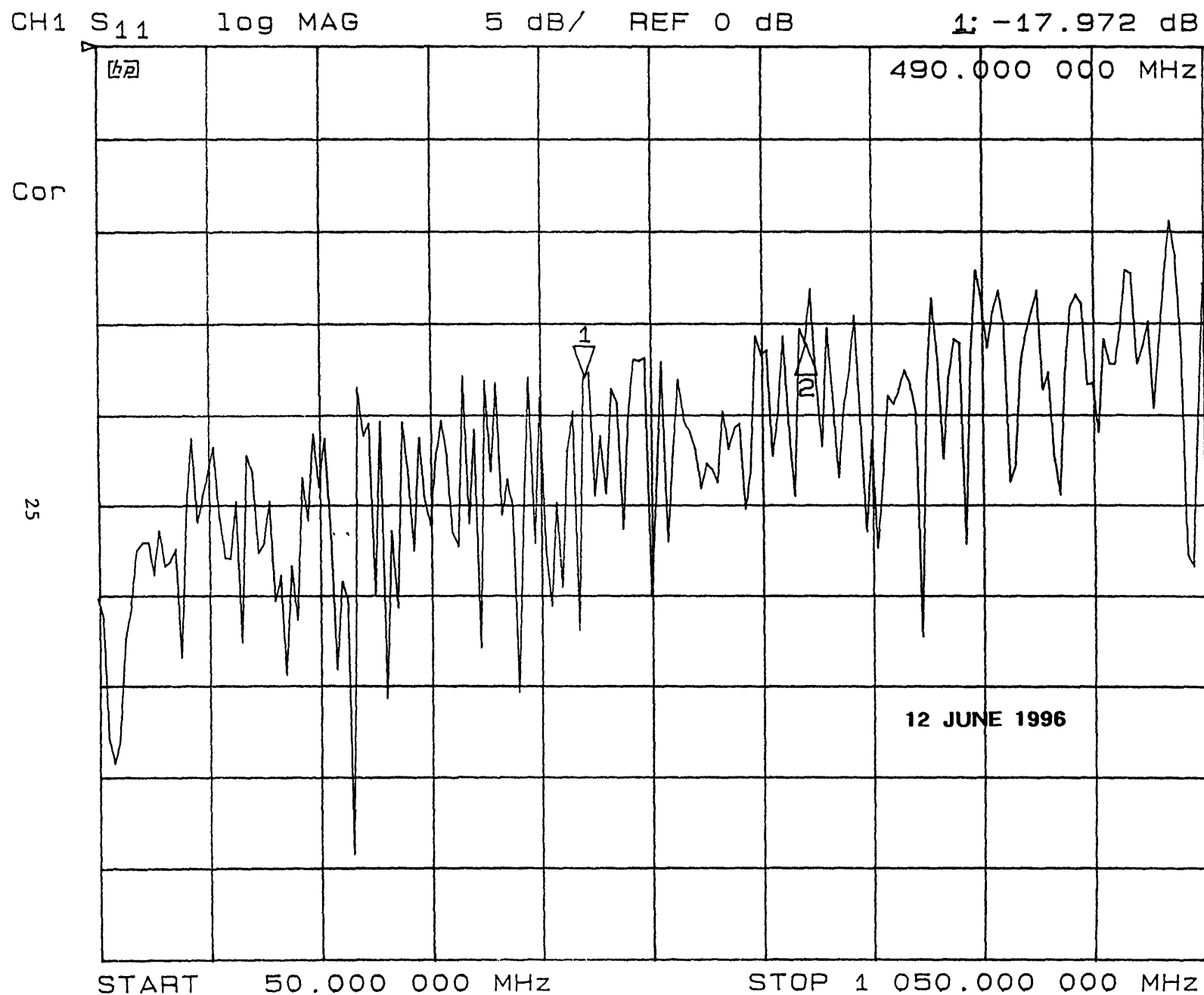


FIGURE 7D SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #4, 7/8 IN. SPIROLINE

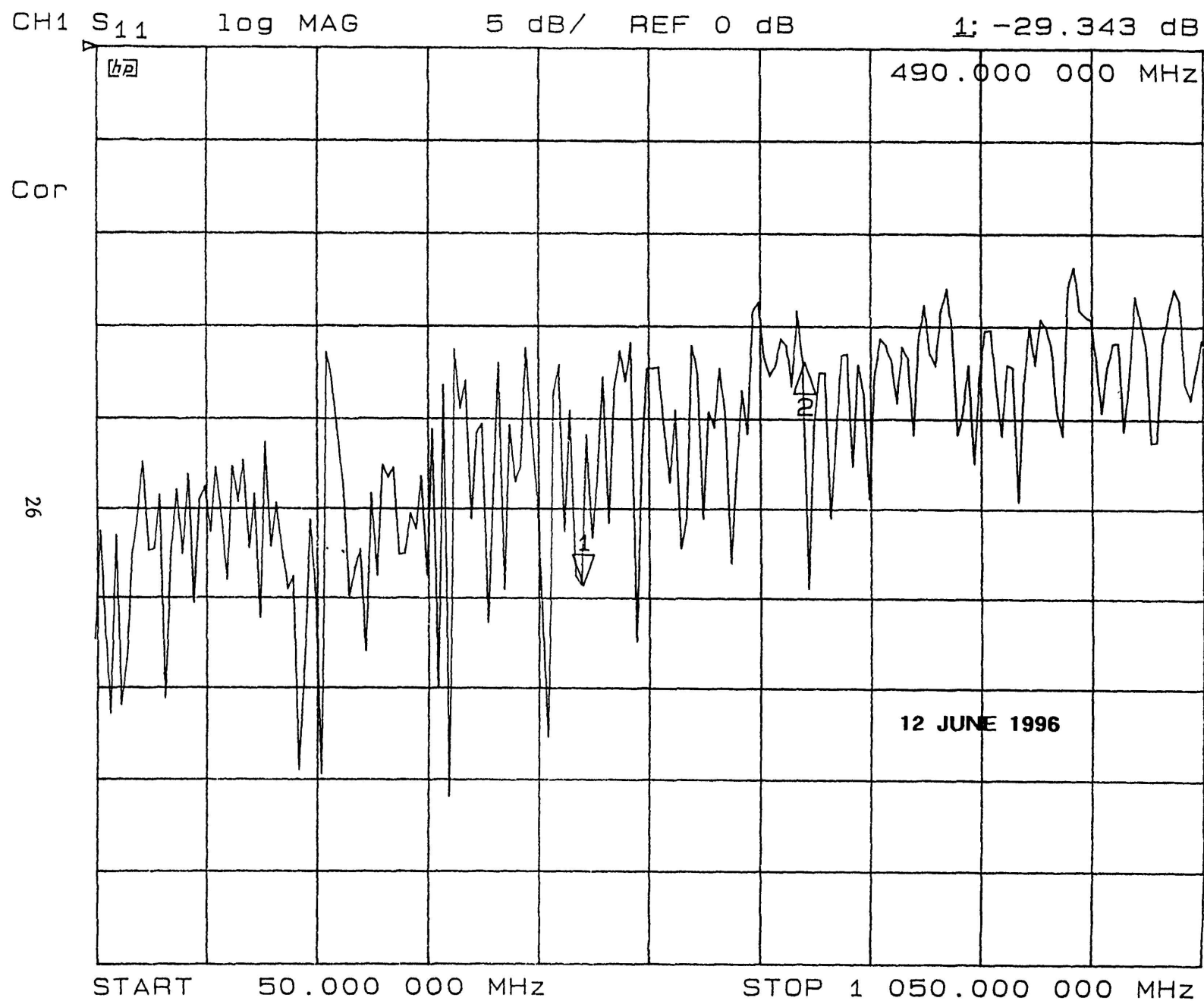


FIGURE 7E. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #5, 7/8 IN. SPIROLINE

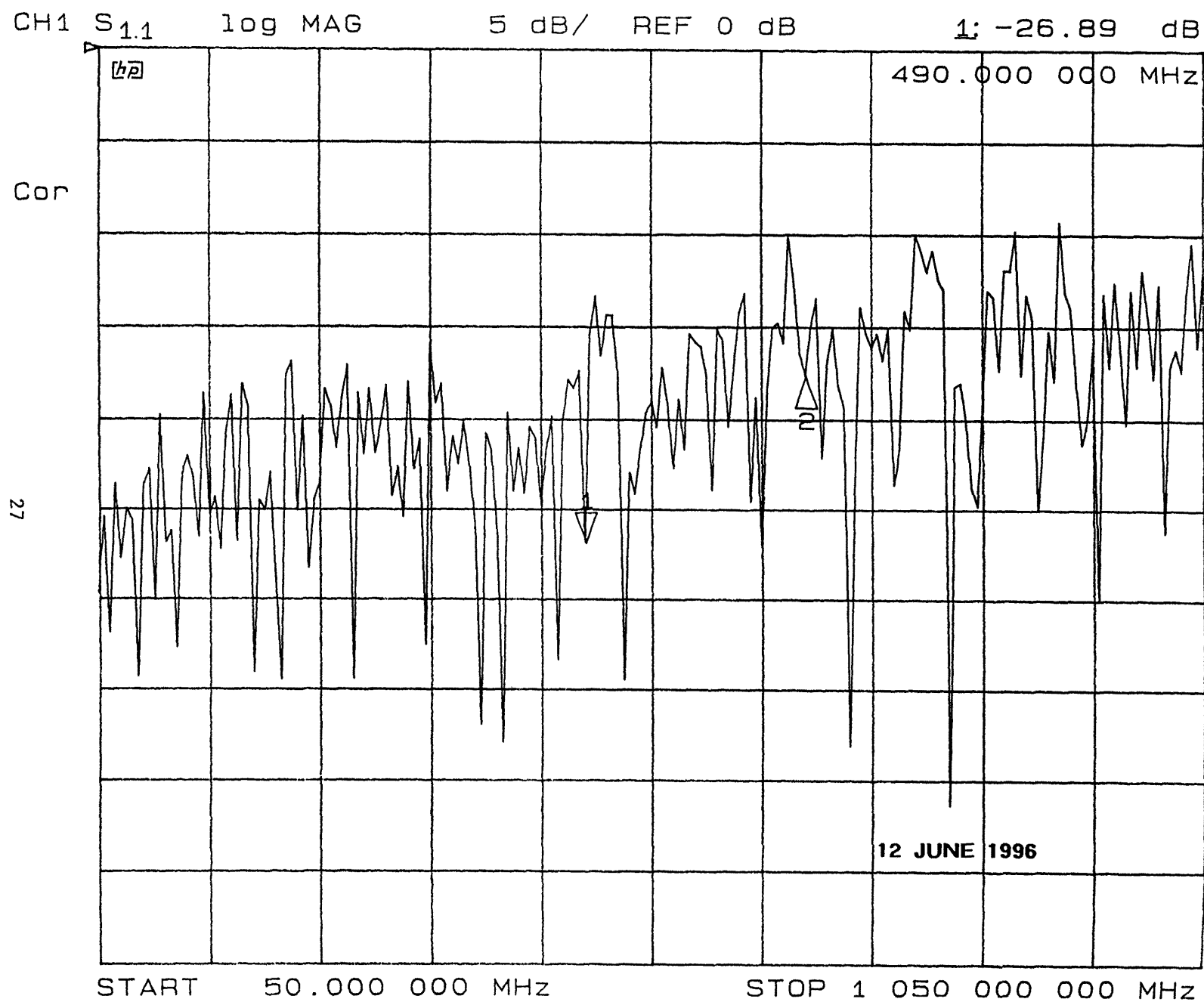


FIGURE 7F. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE 9, 1-5/8 IN. SPIROLINE

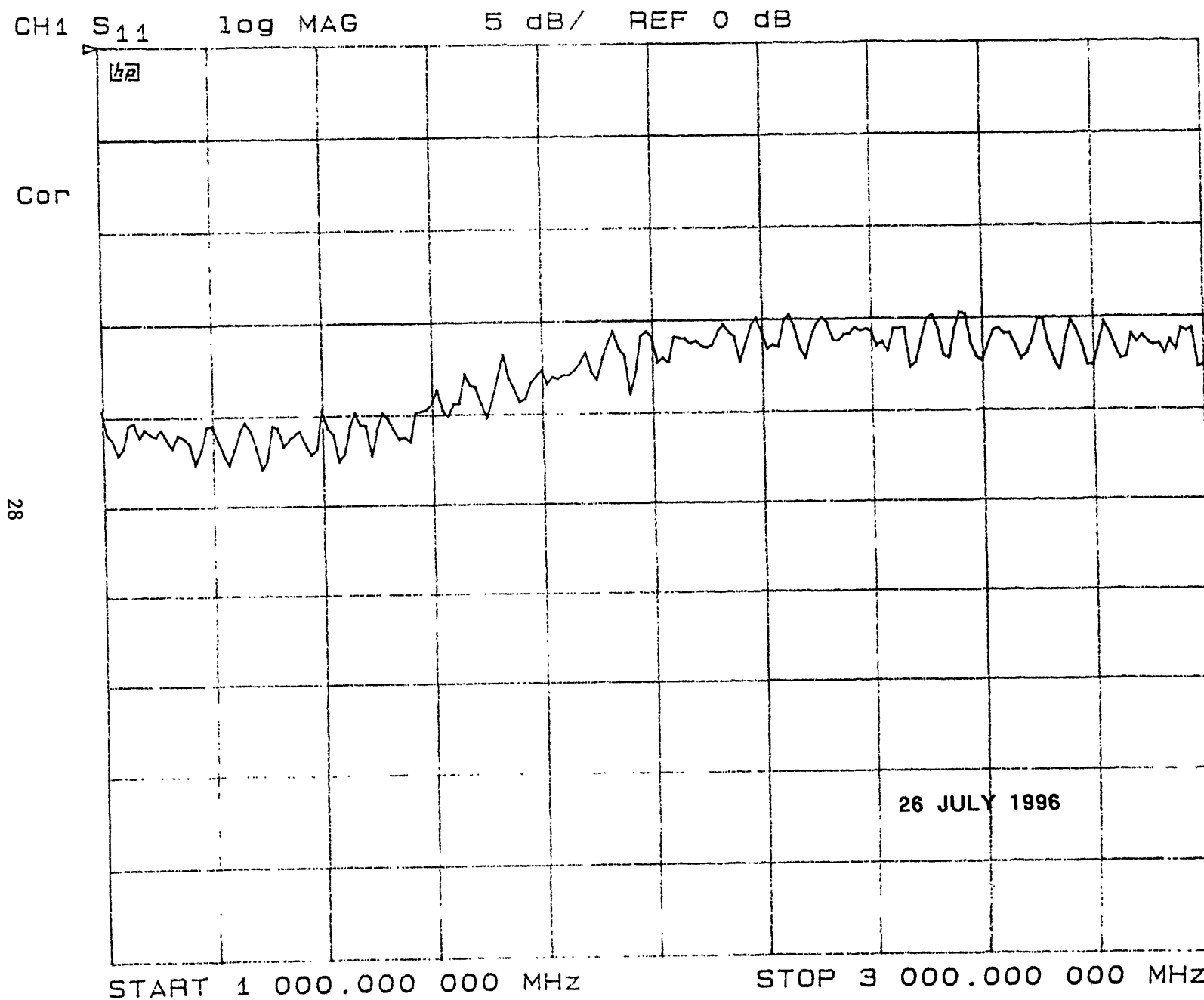


FIGURE 7G. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #9, 1-5/8 IN. SPIROLINE

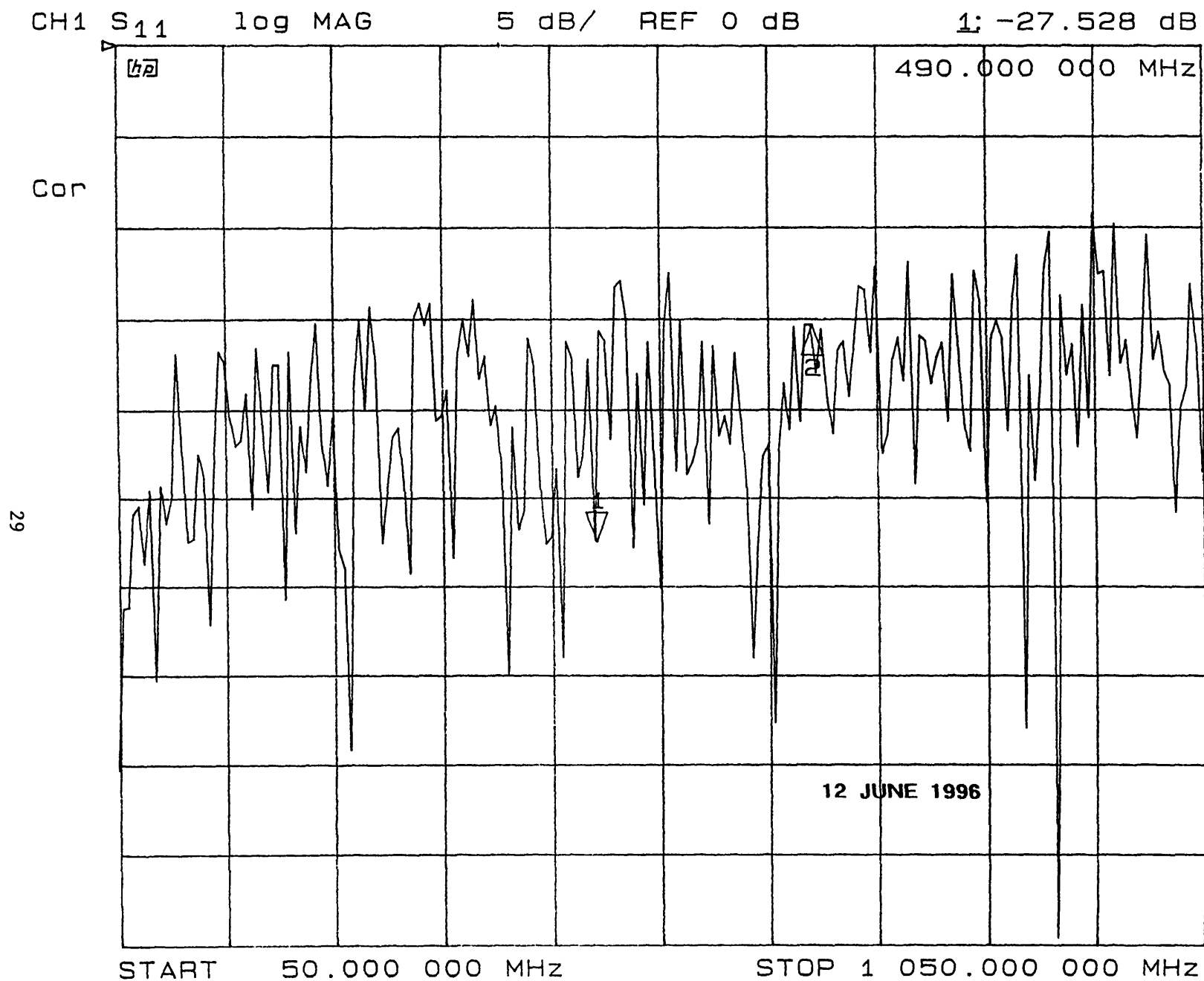


FIGURE 7H. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

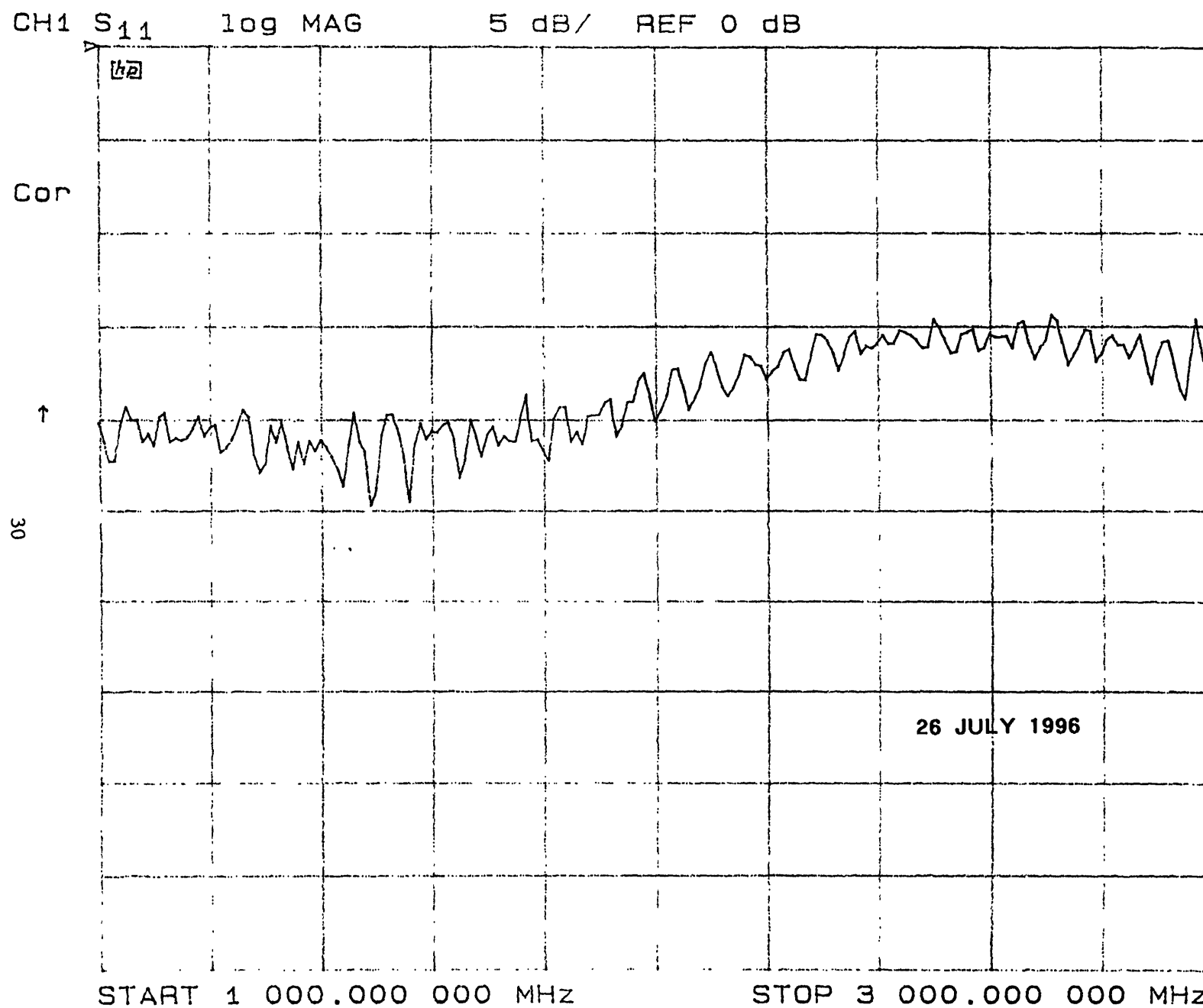


FIGURE 71. SWEEPED FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

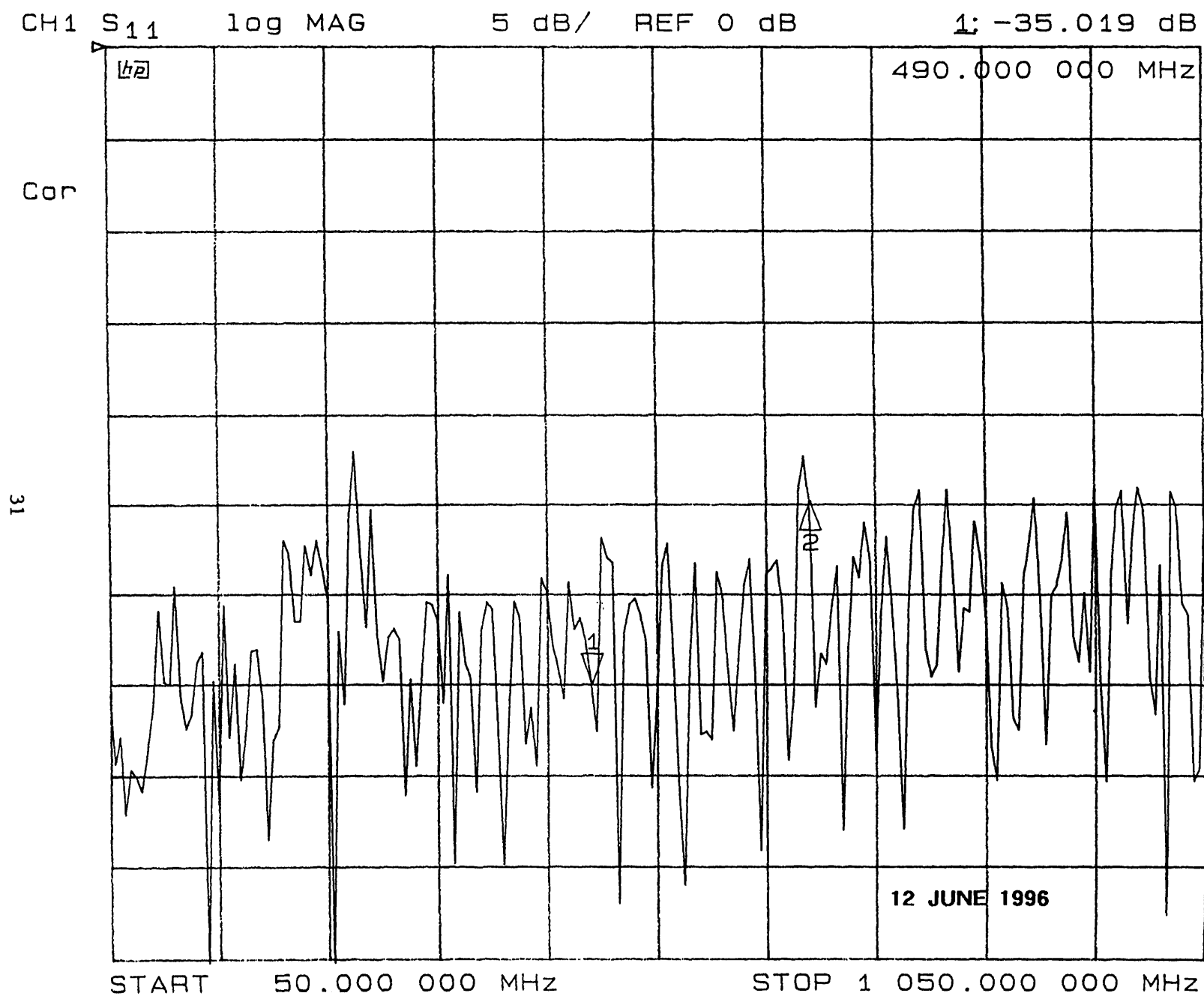


FIGURE 7J. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #11, RG-9

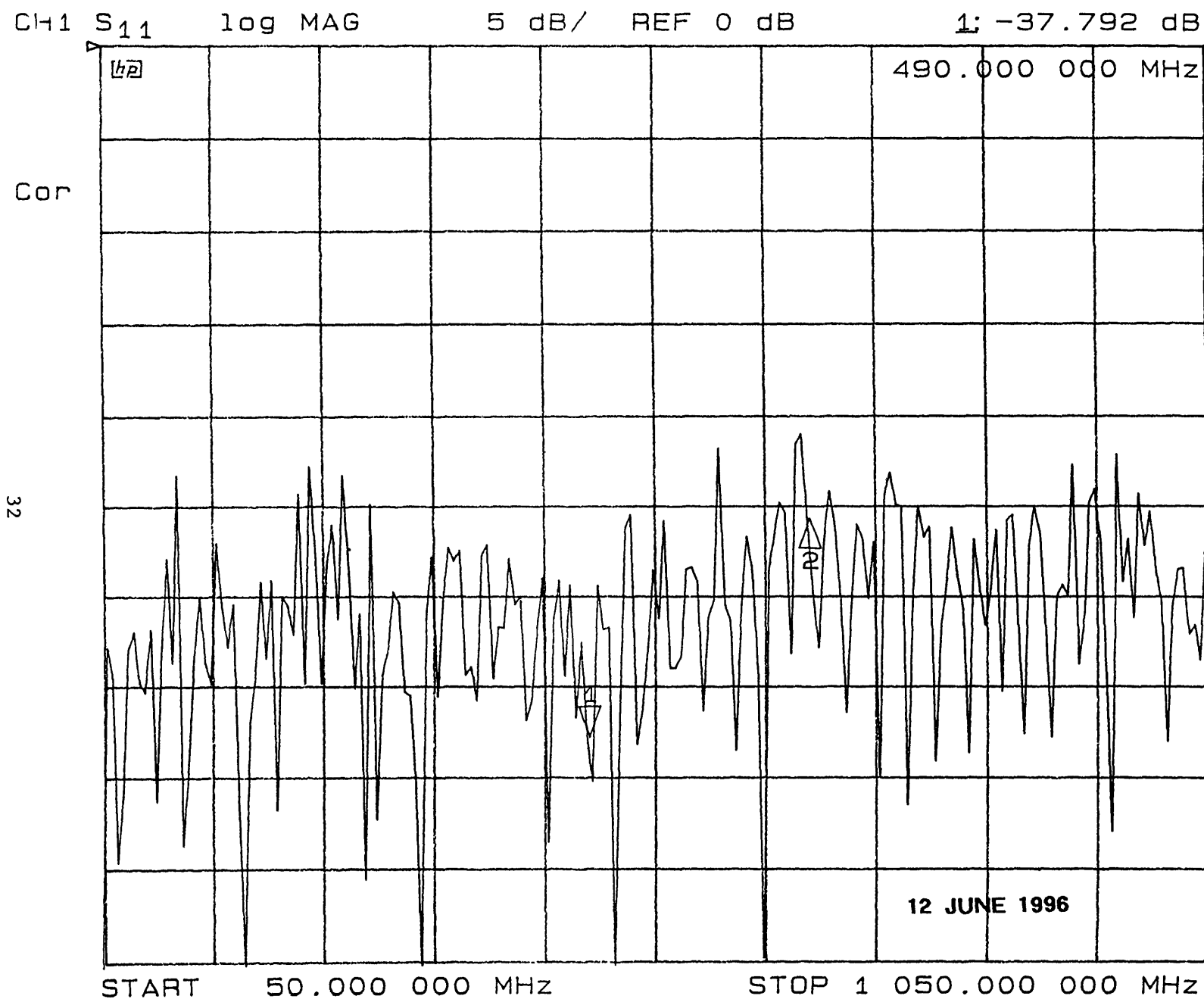


FIGURE 7K. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #12, RG-9

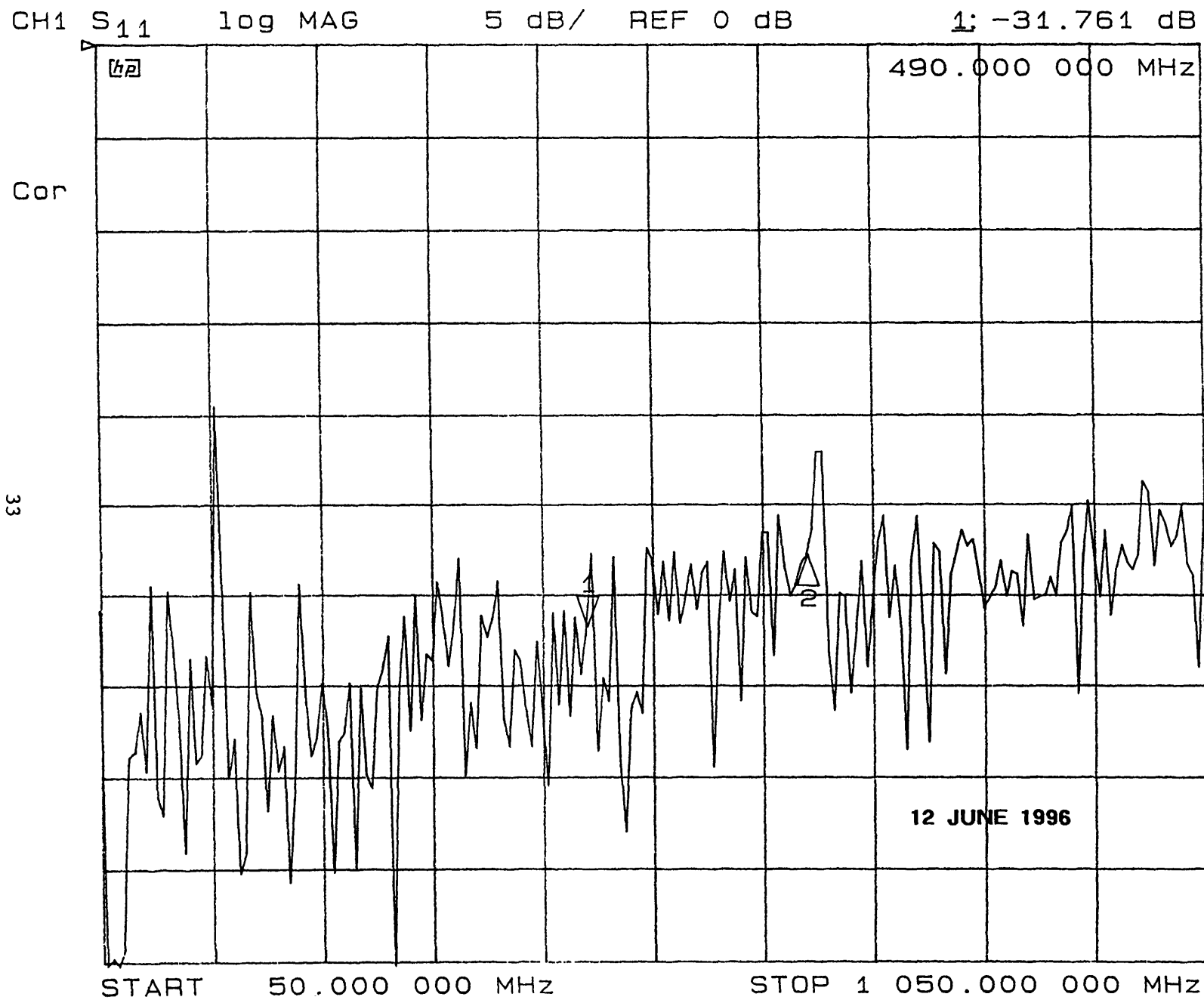


FIGURE 7L. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #13, RG-9

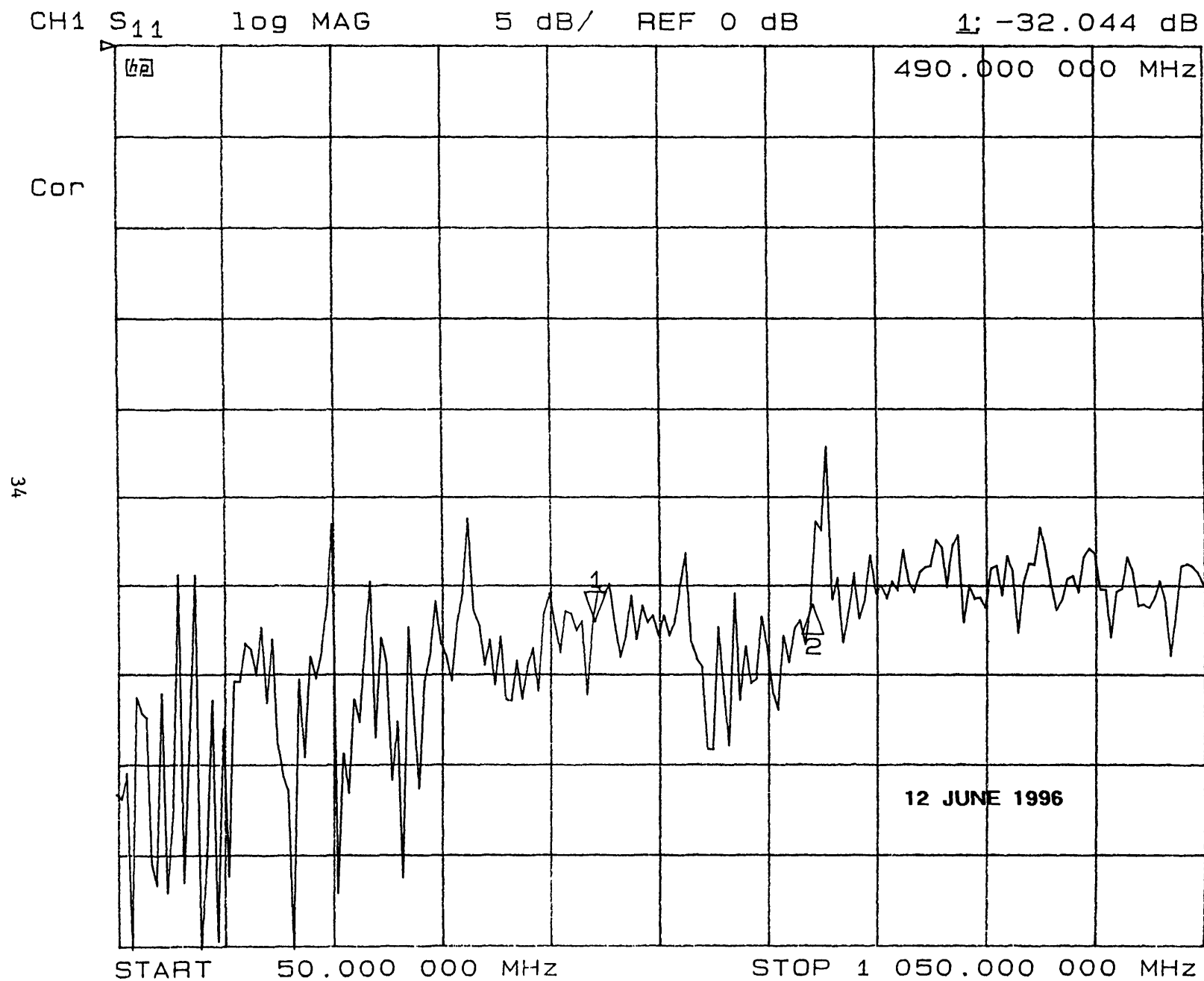


FIGURE 7M. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #14, RG-9

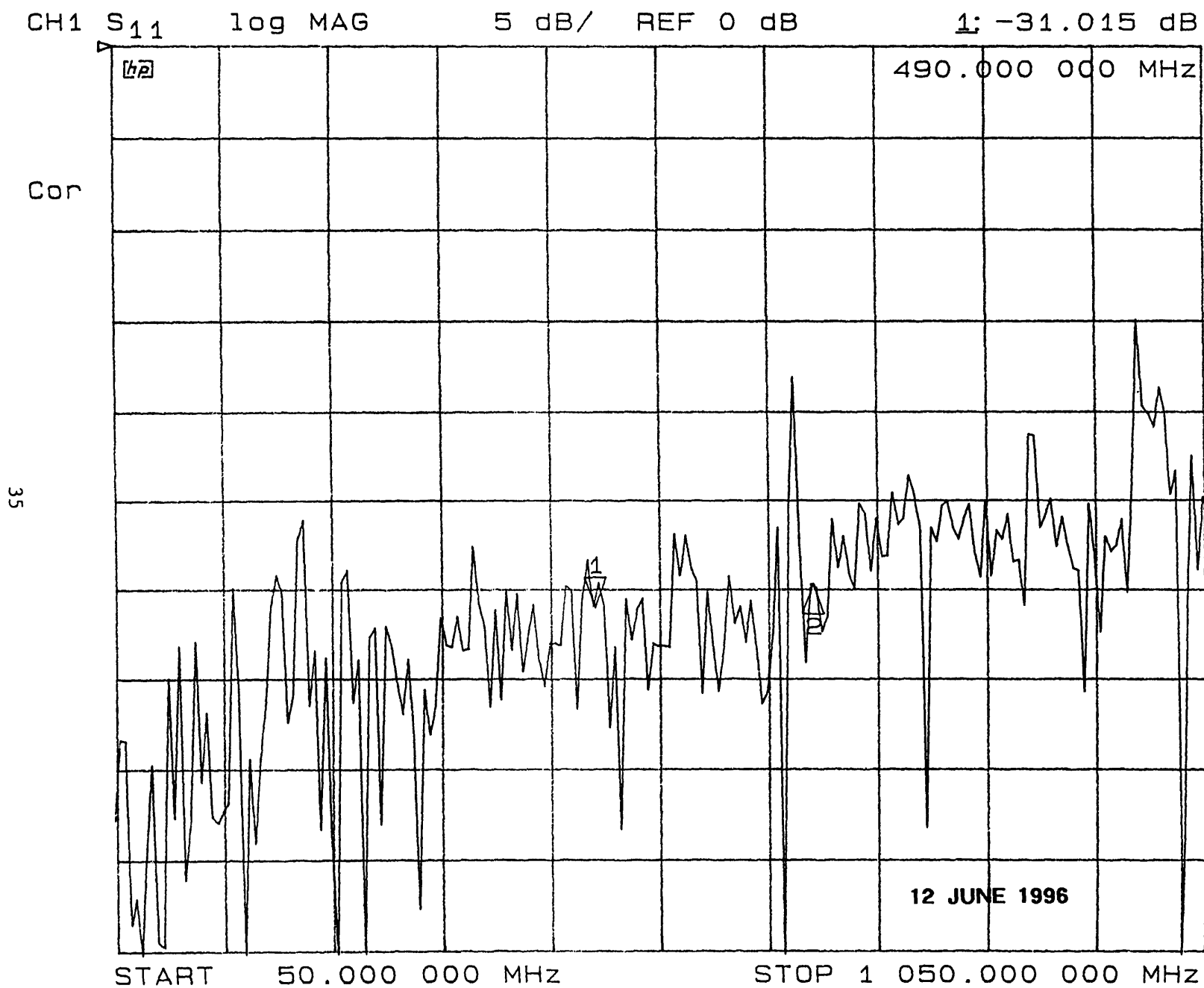


FIGURE 7N. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #15, RG-9

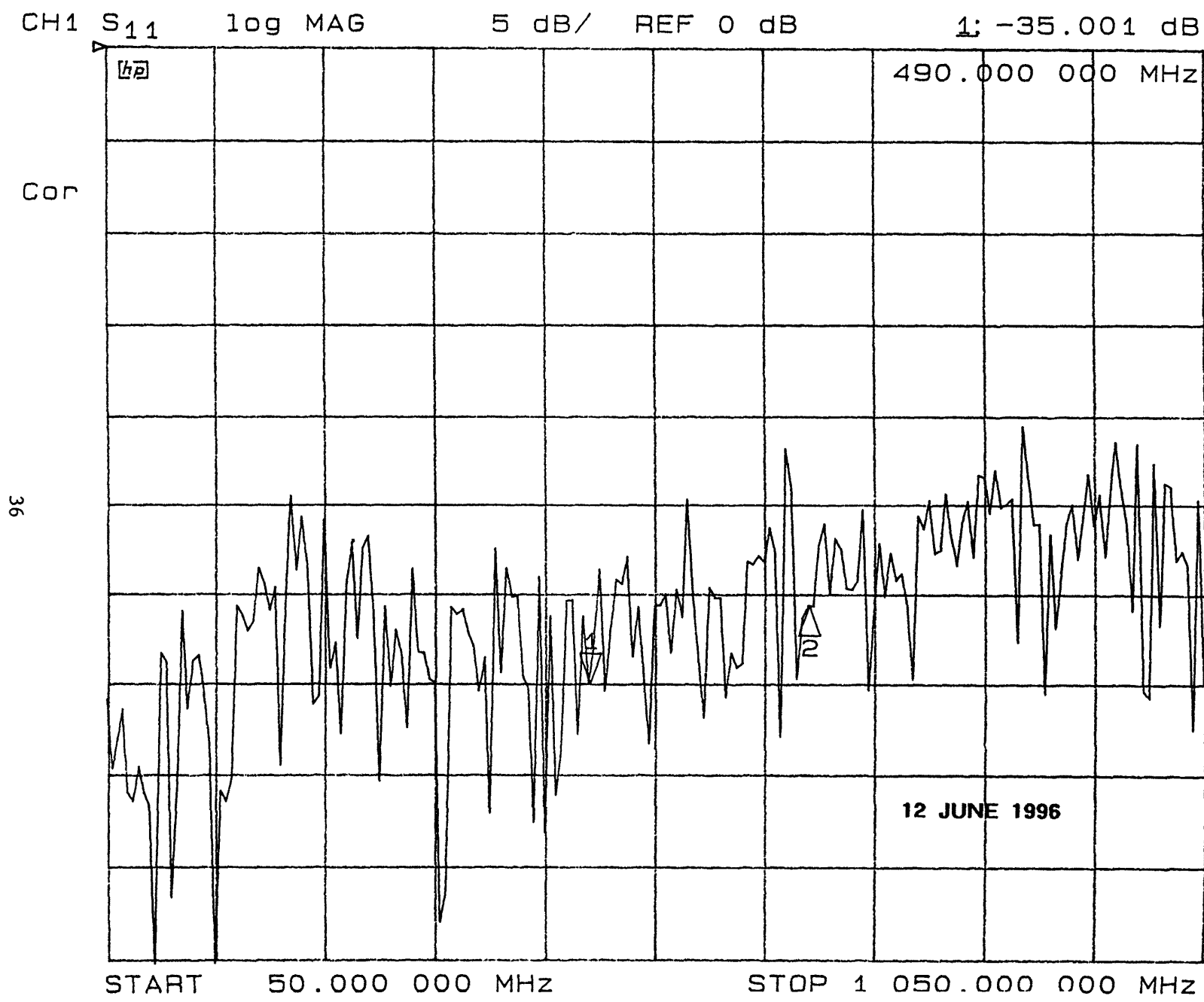


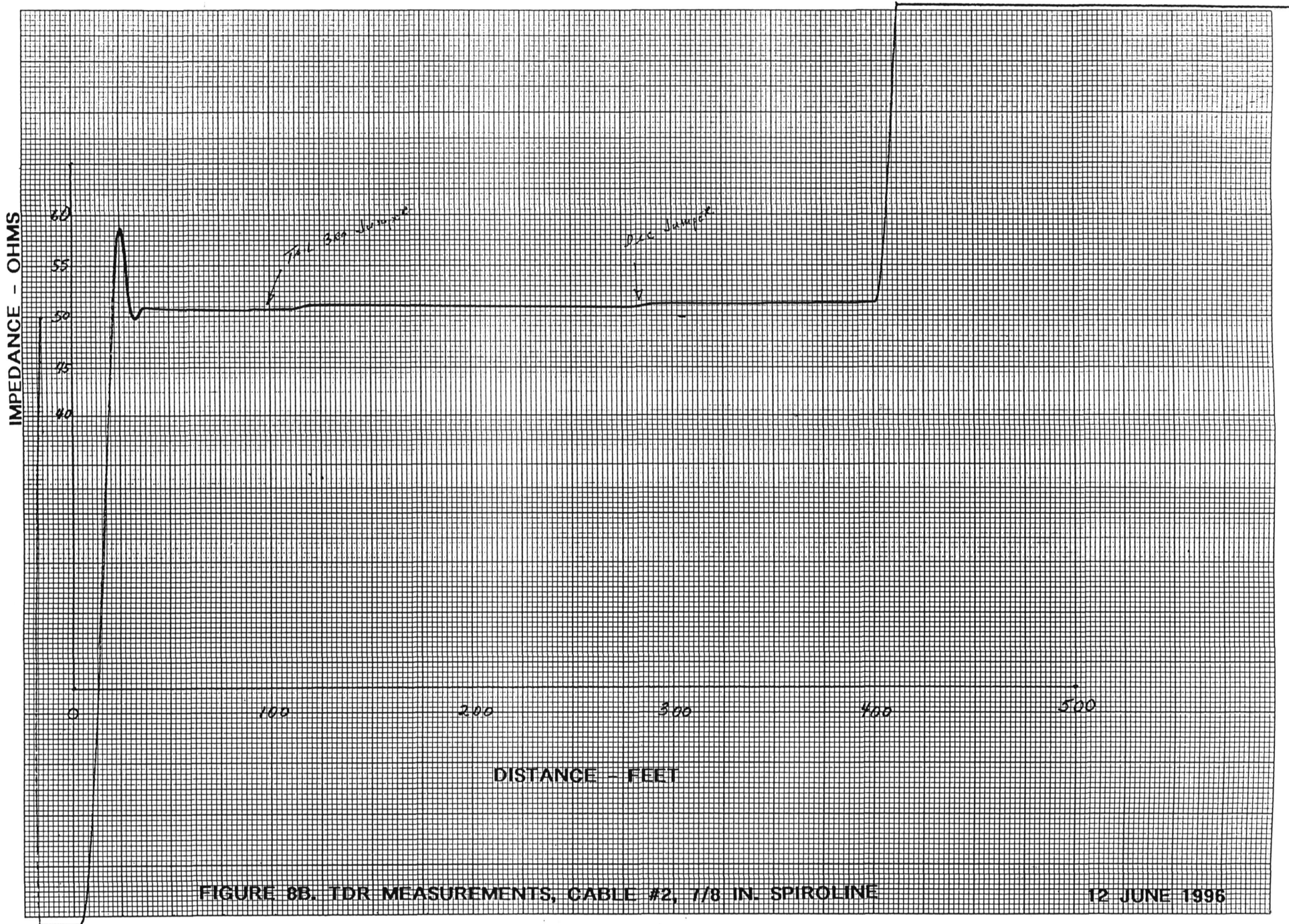
FIGURE 70. SWEPT FREQUENCY RETURN LOSS MEASUREMENTS, CABLE #16, RG-9

IMPEDANCE - OHMS

DISTANCE - FEET

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

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IMPEDANCE - OHMS

39

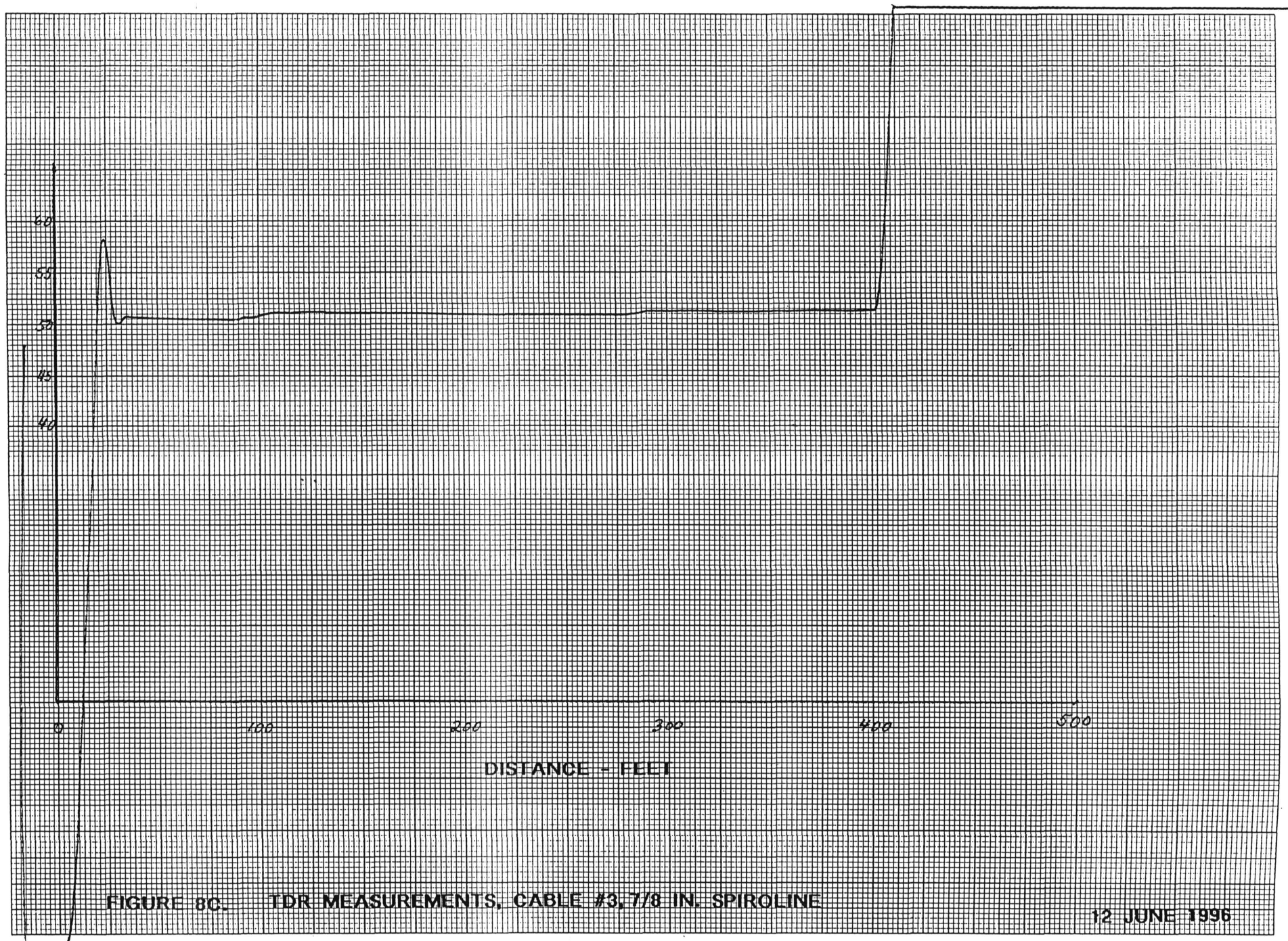
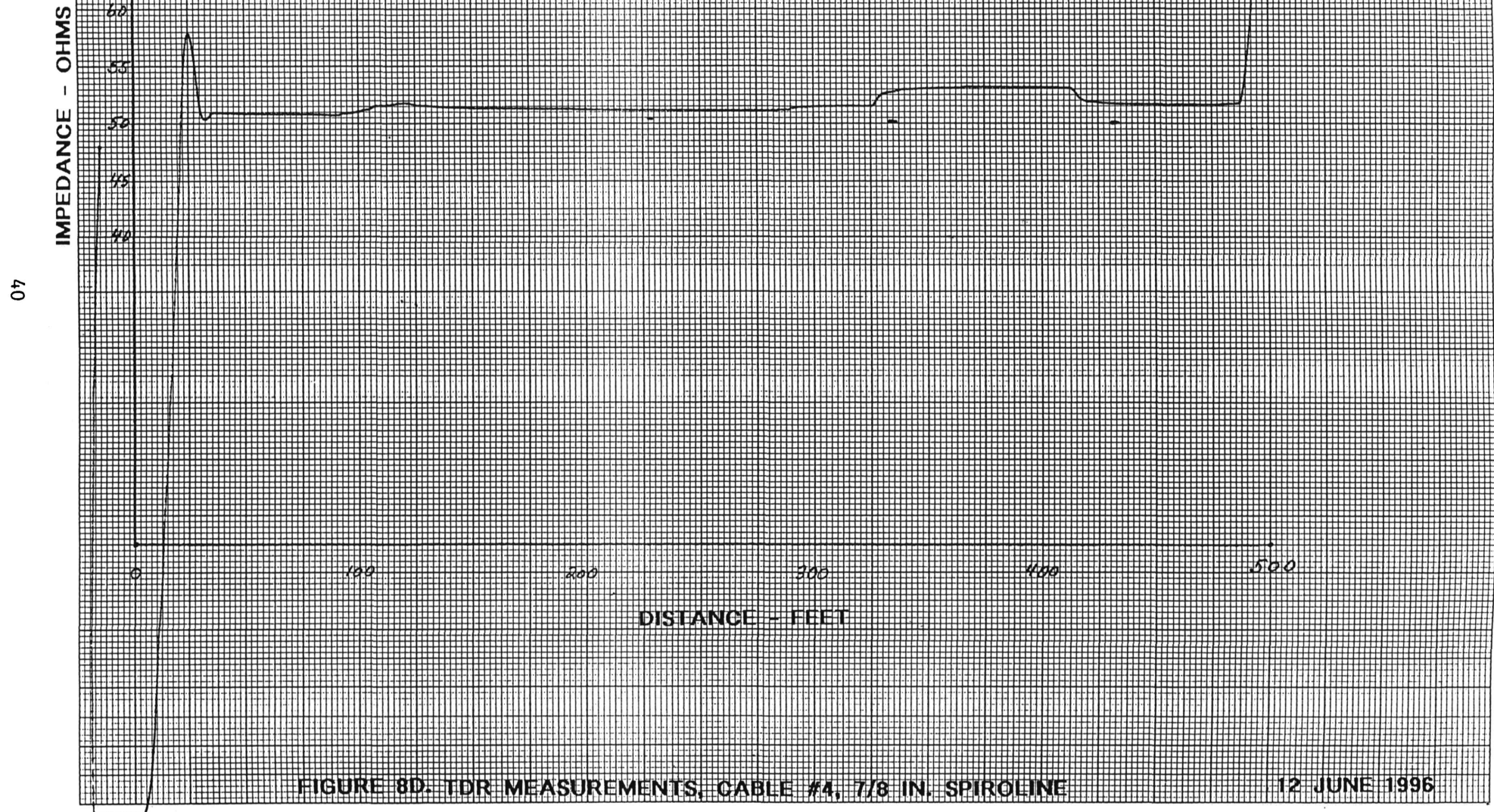
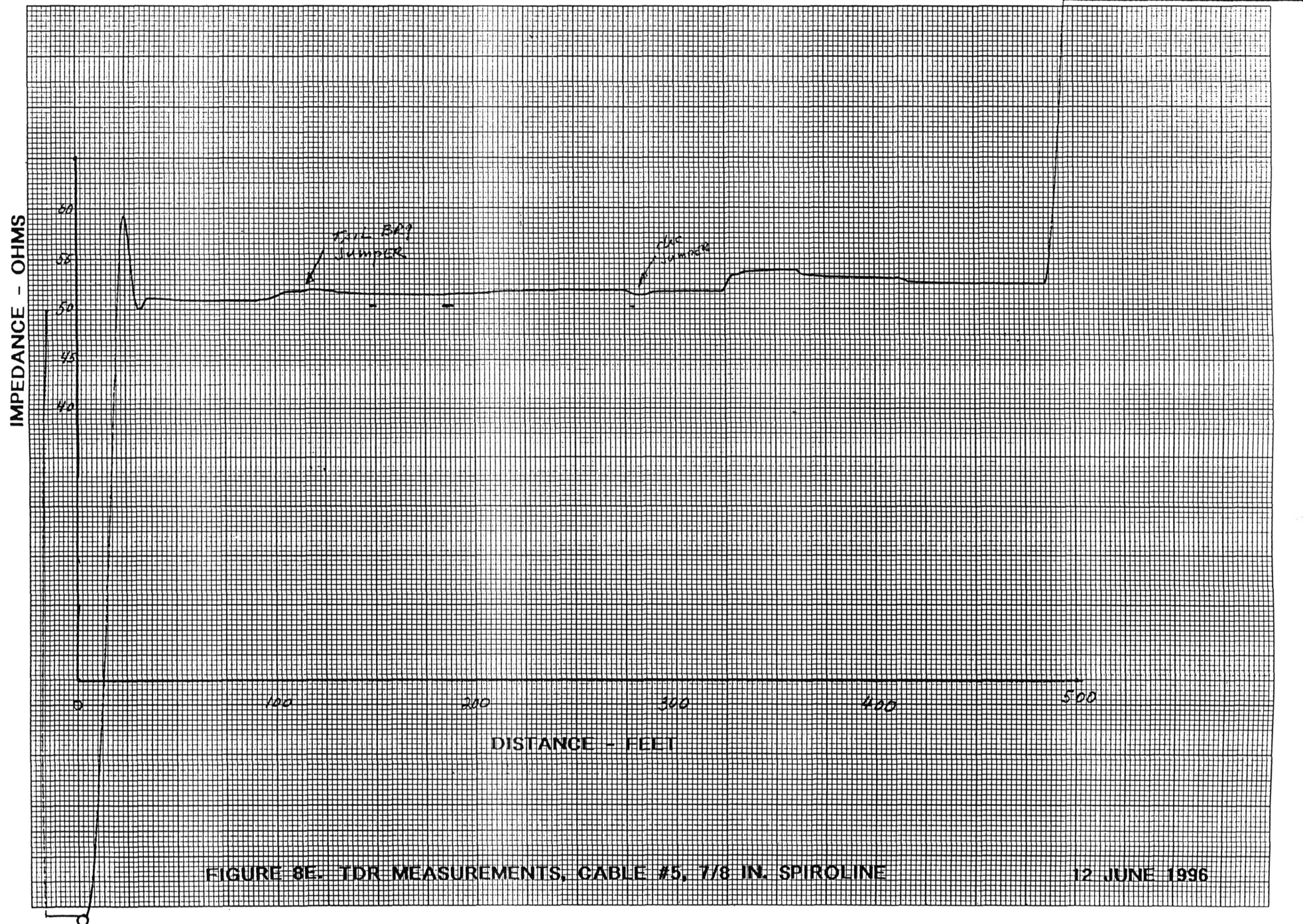
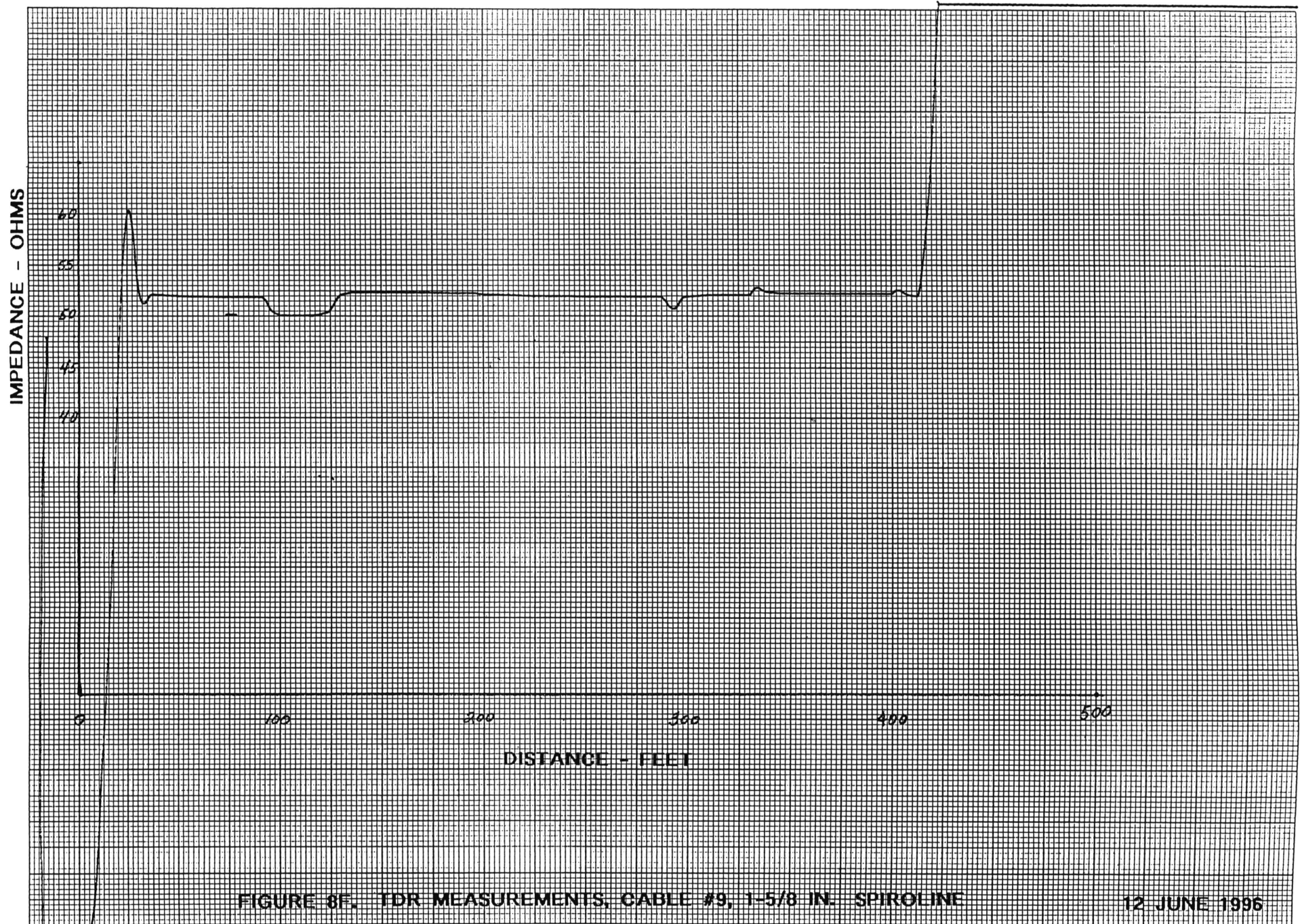


FIGURE 8C. TDR MEASUREMENTS, CABLE #3, 7/8 IN. SPIROLINE

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IMPEDANCE - OHMS

43

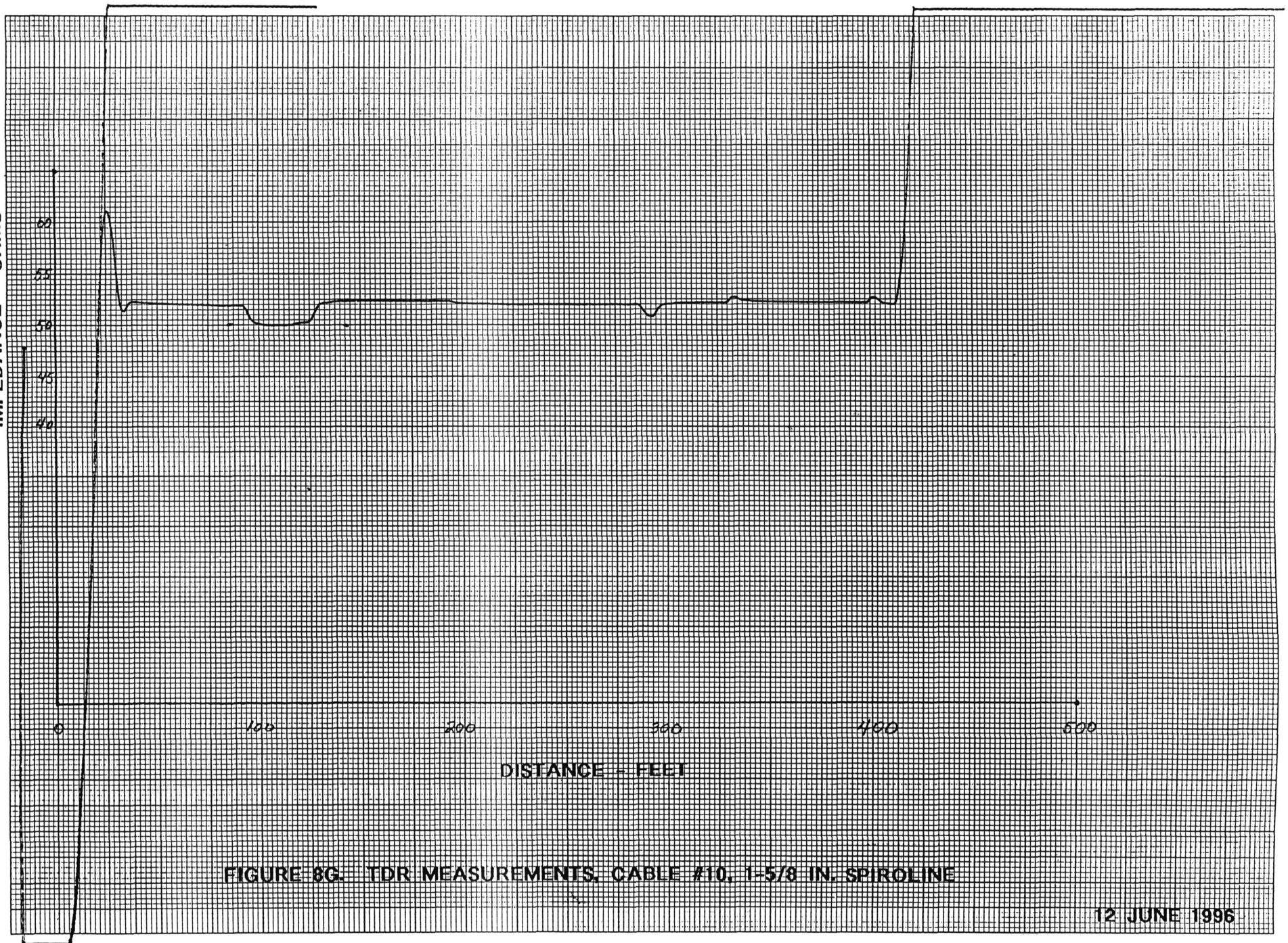


FIGURE 8G. TDR MEASUREMENTS, CABLE #10, 1-5/8 IN. SPIROLINE

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IMPEDANCE - OHMS

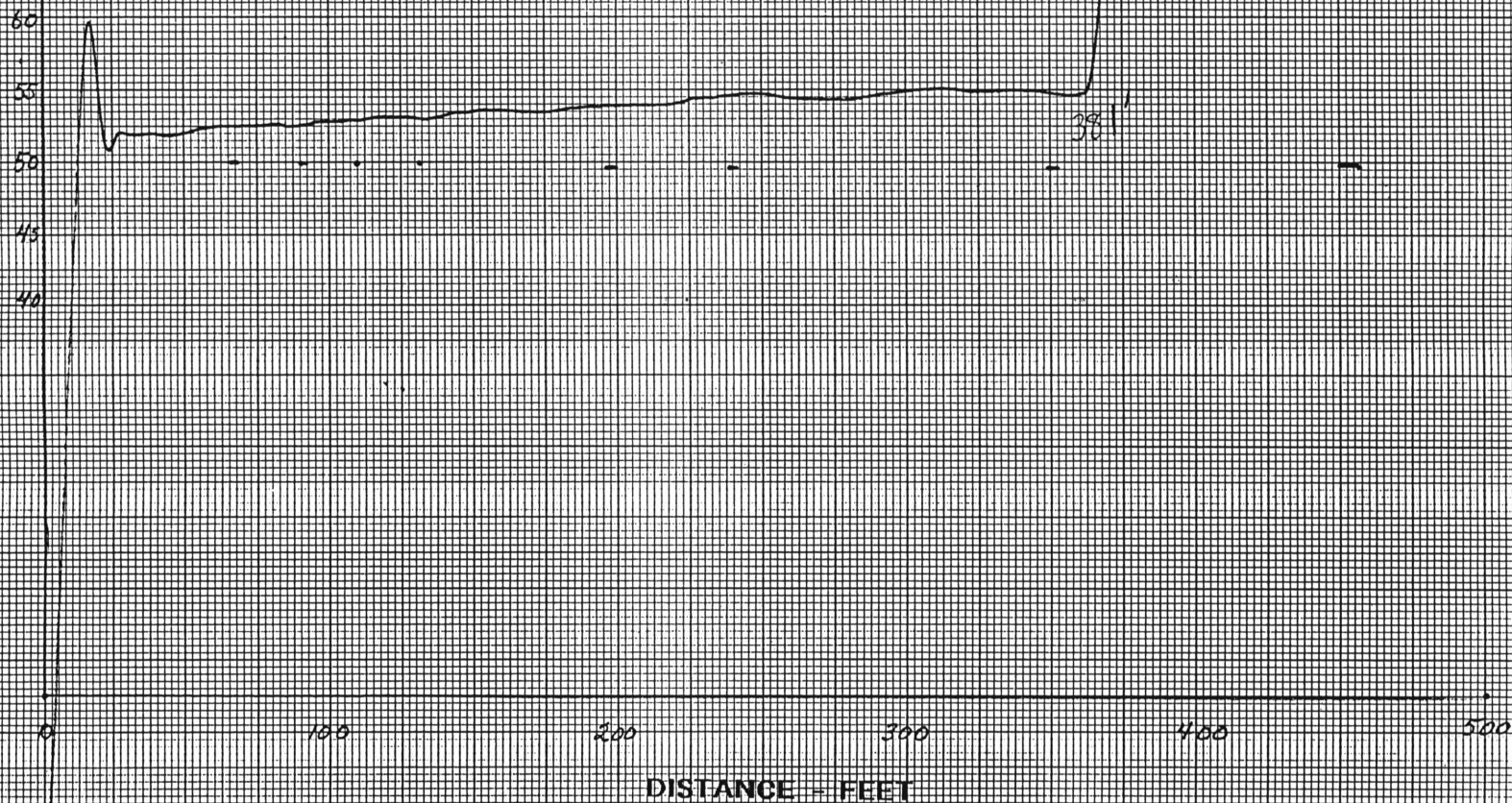


FIGURE 8H. TDR MEASUREMENTS, CABLE #11, RG-9

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IMPEDANCE - OHMS

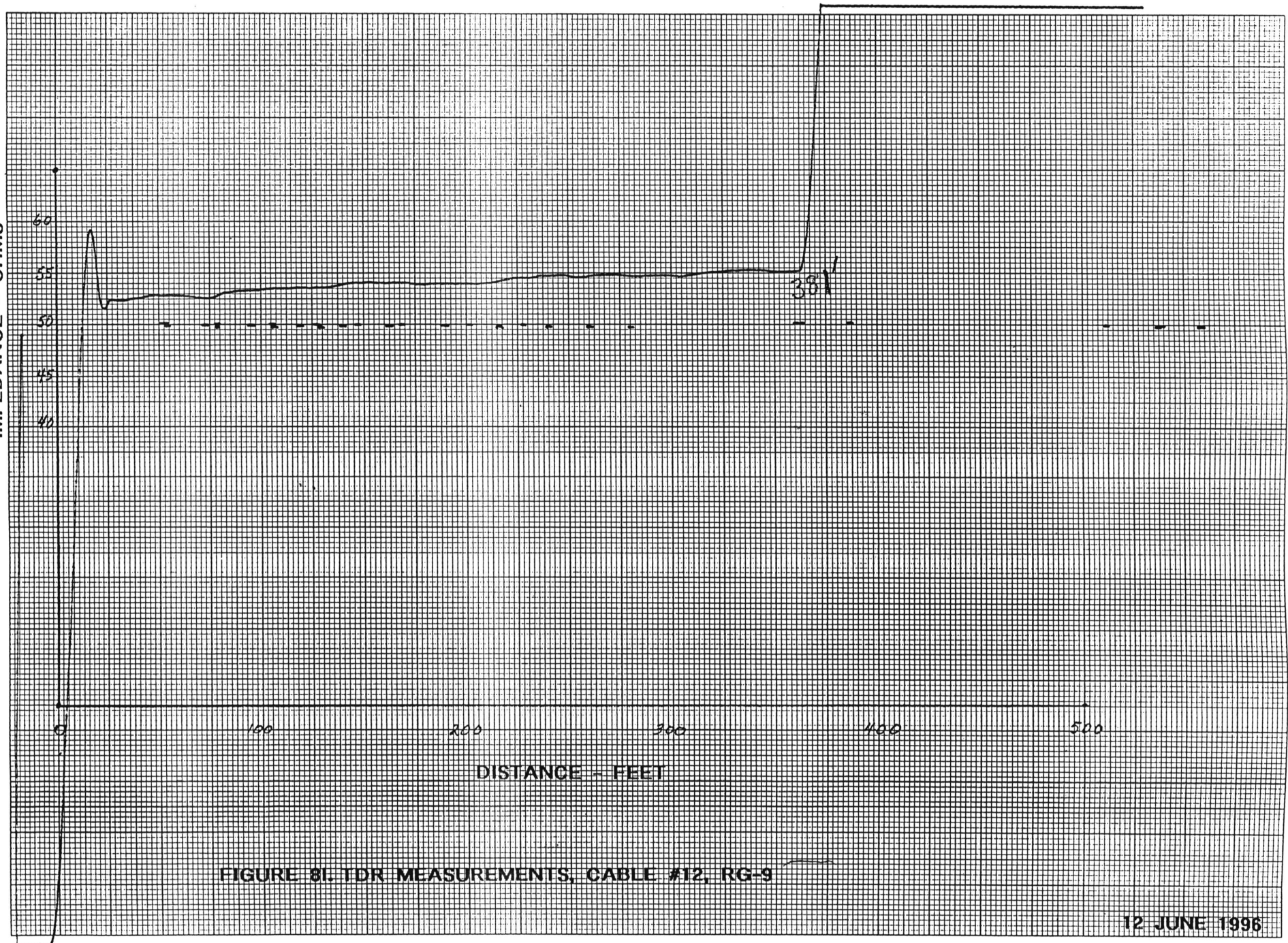


FIGURE 8L TDR MEASUREMENTS, CABLE #12, RG-9

12 JUNE 1996

IMPEDANCE - OHMS

96

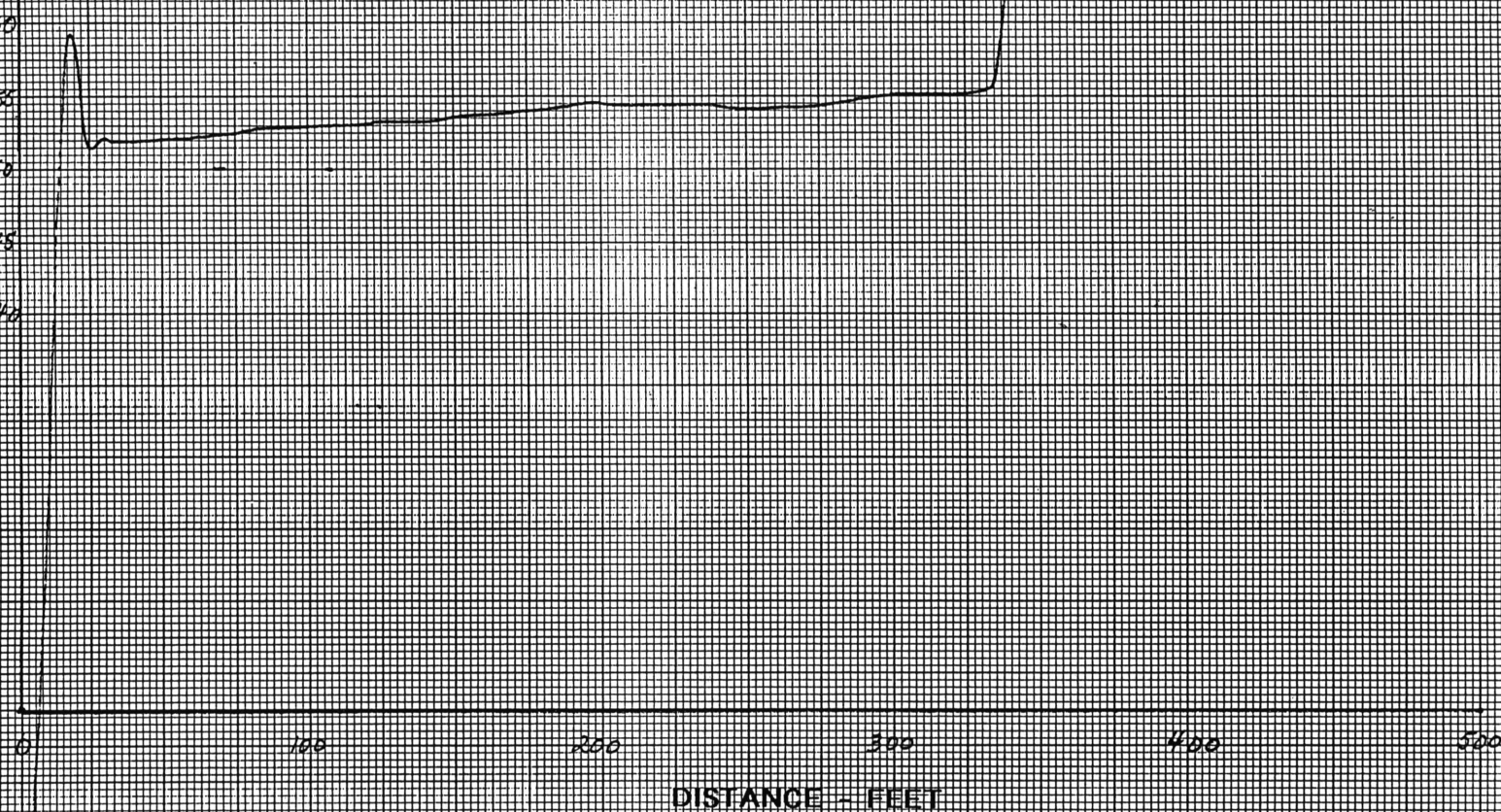
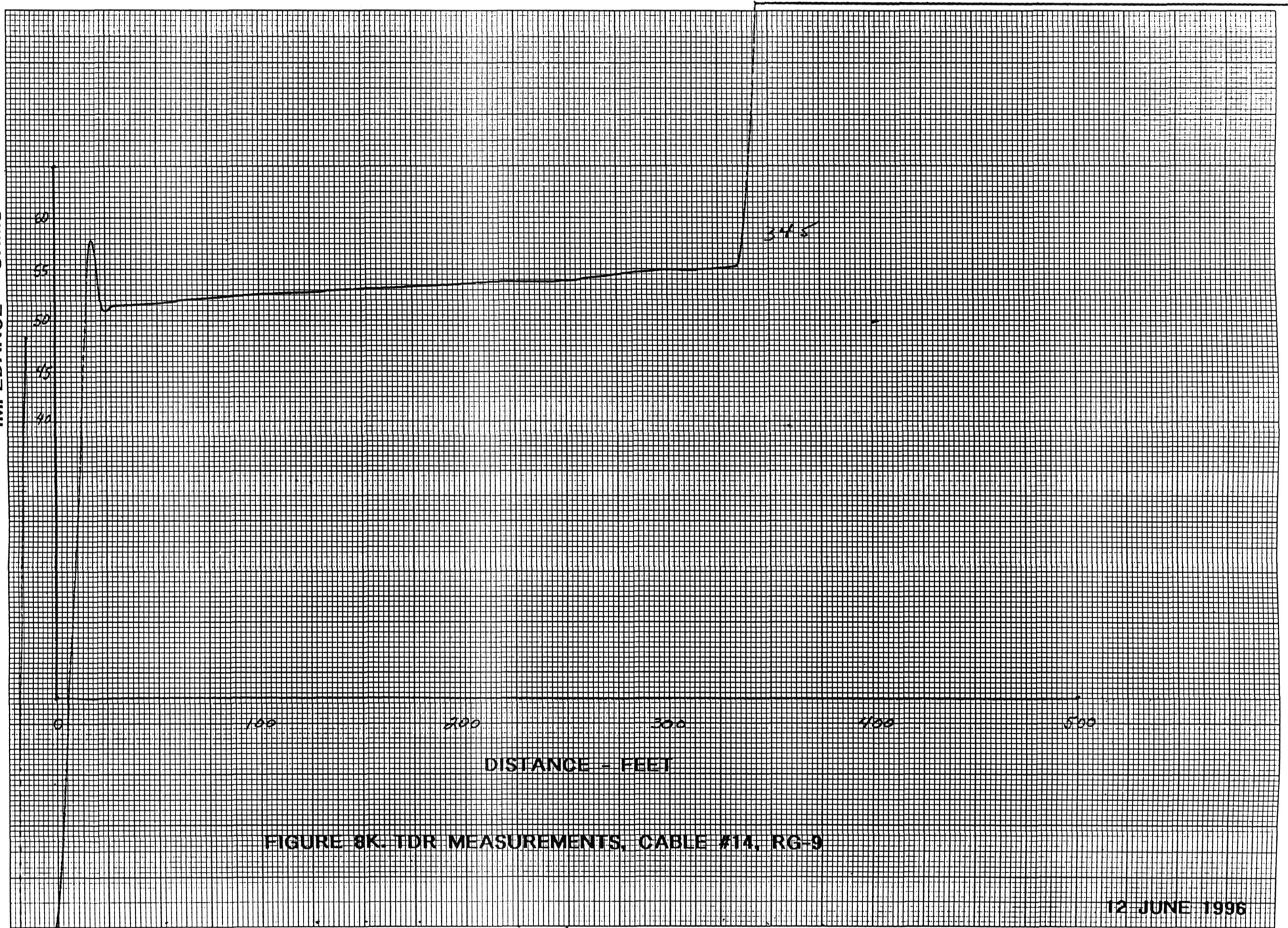


FIGURE 8J. TDR MEASUREMENTS, CABLE #13, RG-9

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IMPEDANCE - OHMS



48

IMPEDANCE - OHMS

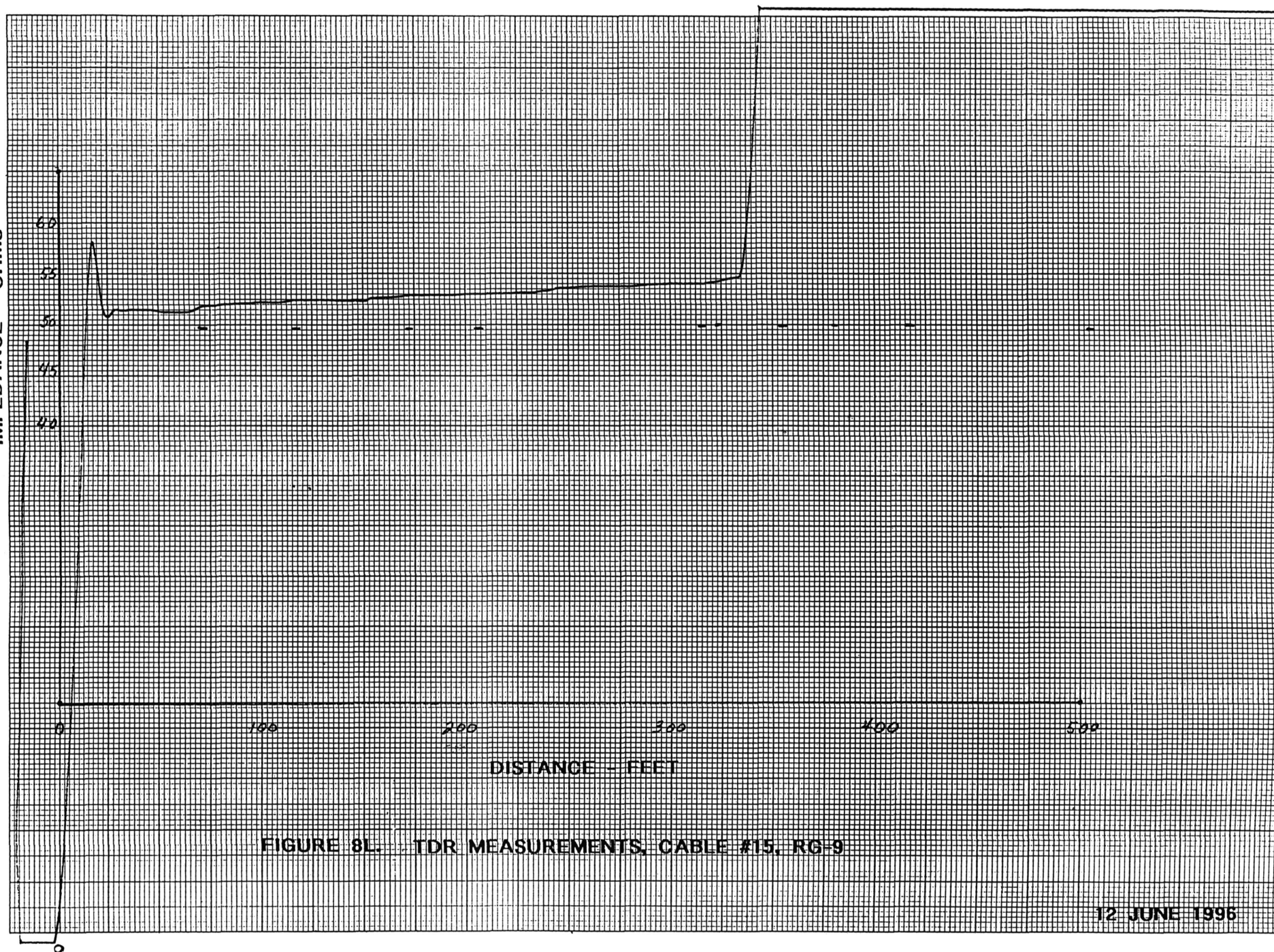
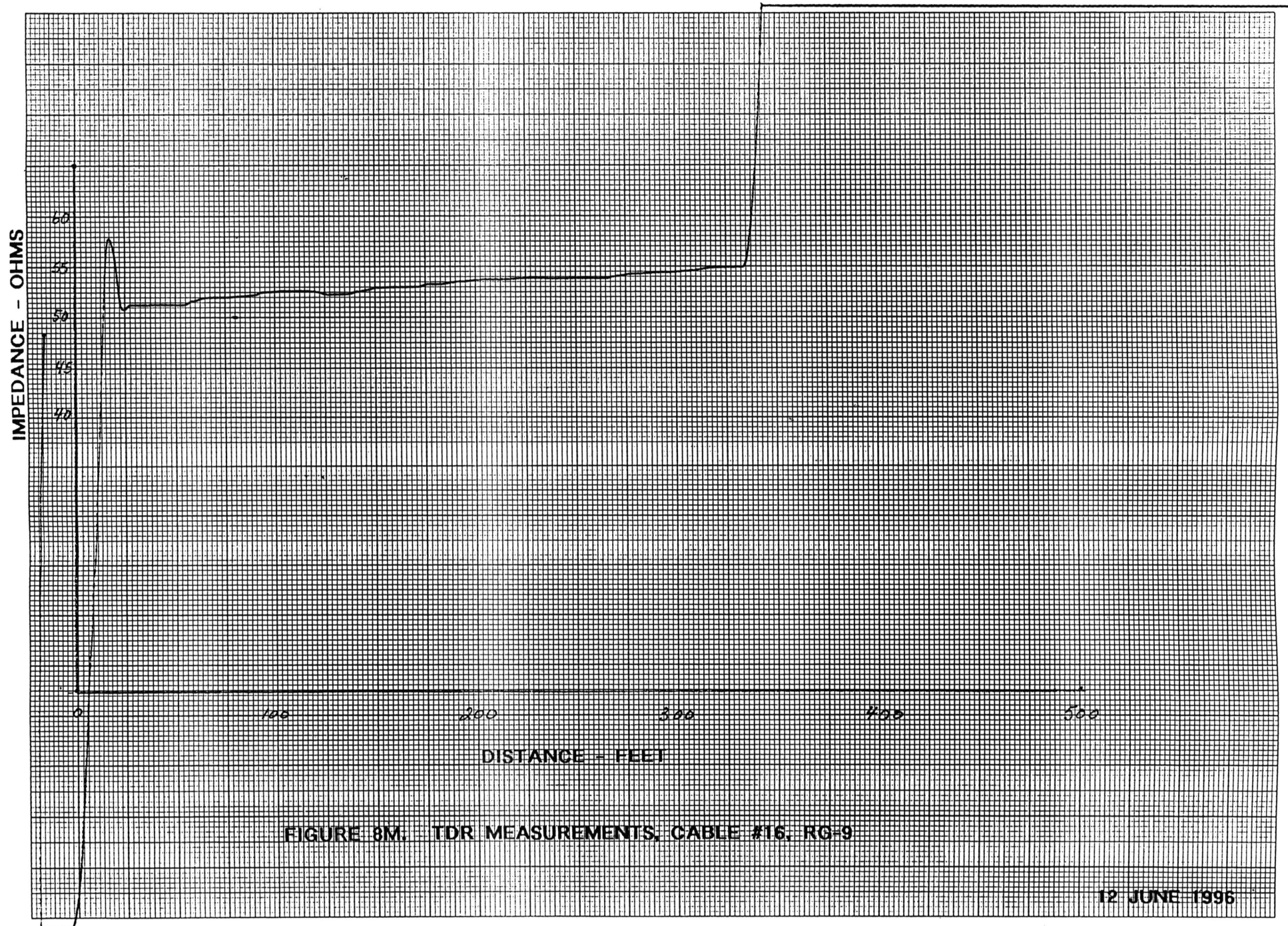


FIGURE 8L. TDR MEASUREMENTS, CABLE #15, RG-9

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

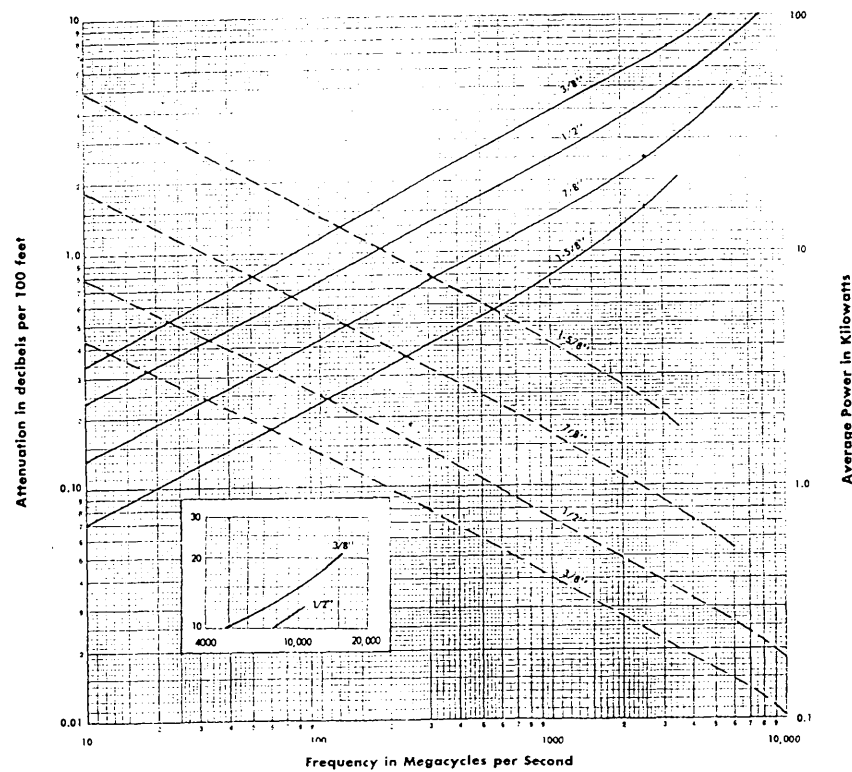
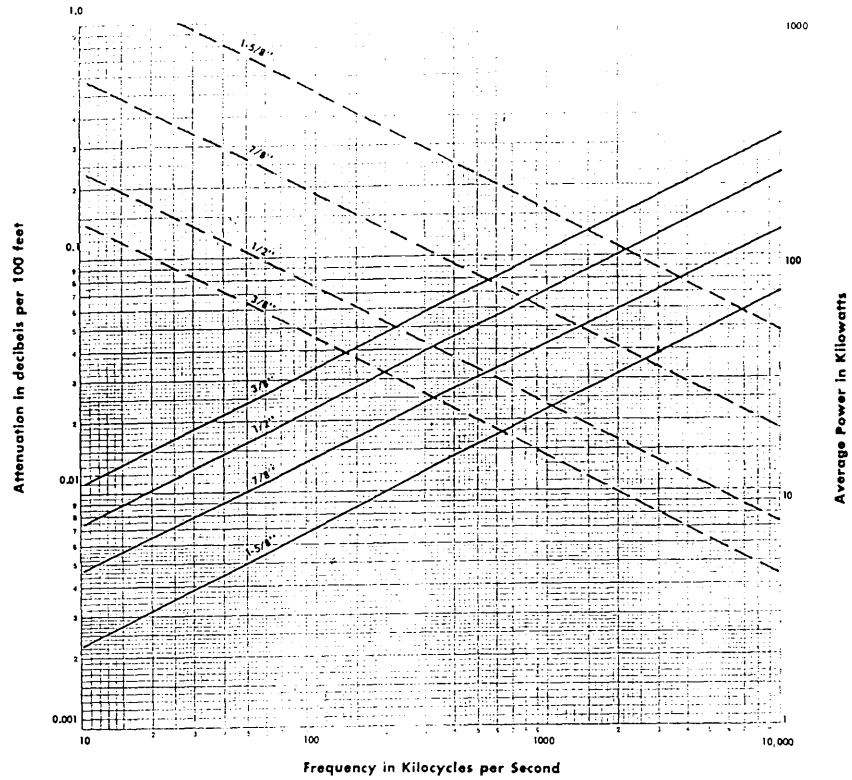


FIGURE 9. SPIROLINE CABLE ATTENUATION

— Attenuation vs Frequency
--- Average Power Ratings

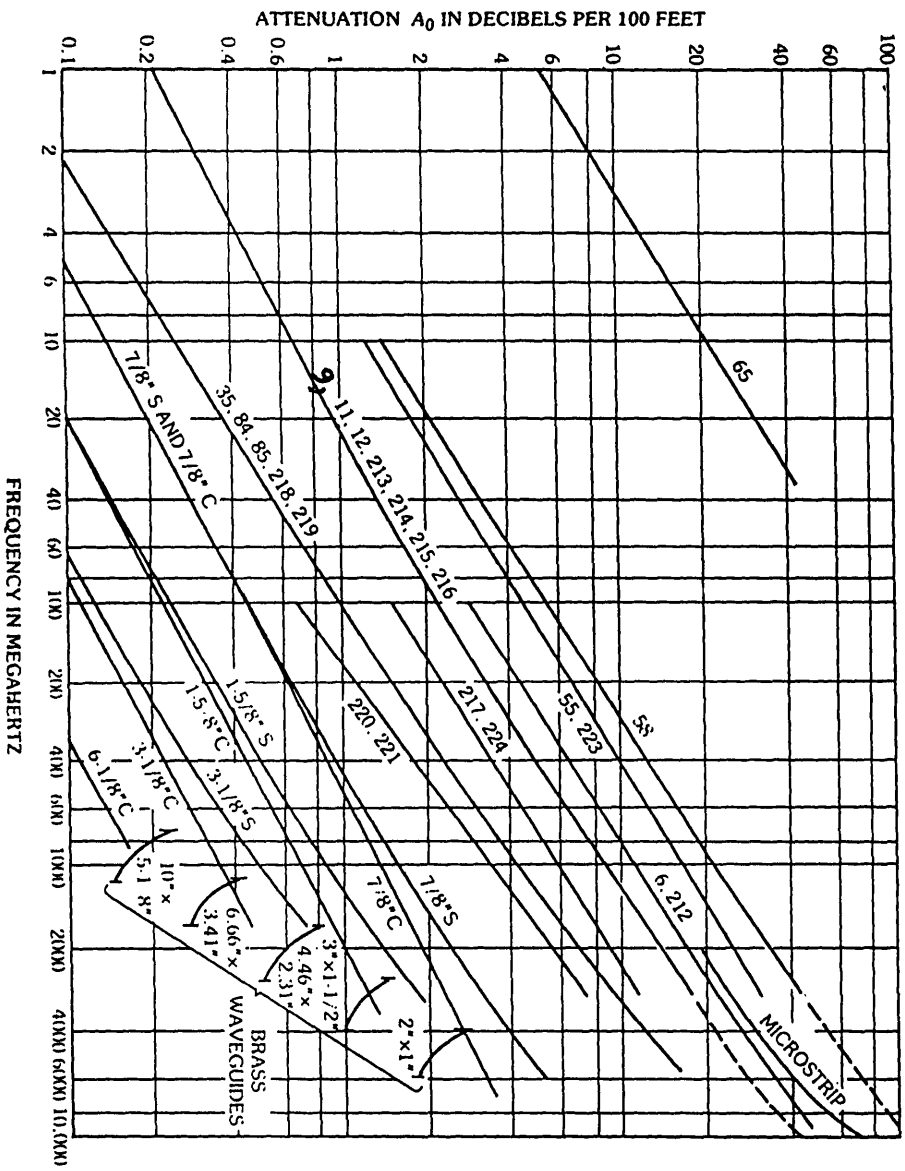


FIGURE 10. COAXIAL CABLE ATTENUATION,
REFERENCE DATA FOR ENGINEERS:
RADIO, ELECTRONICS, COMPUTER,
AND COMMUNICATIONS, EDWARD JORDON
P. 29-27

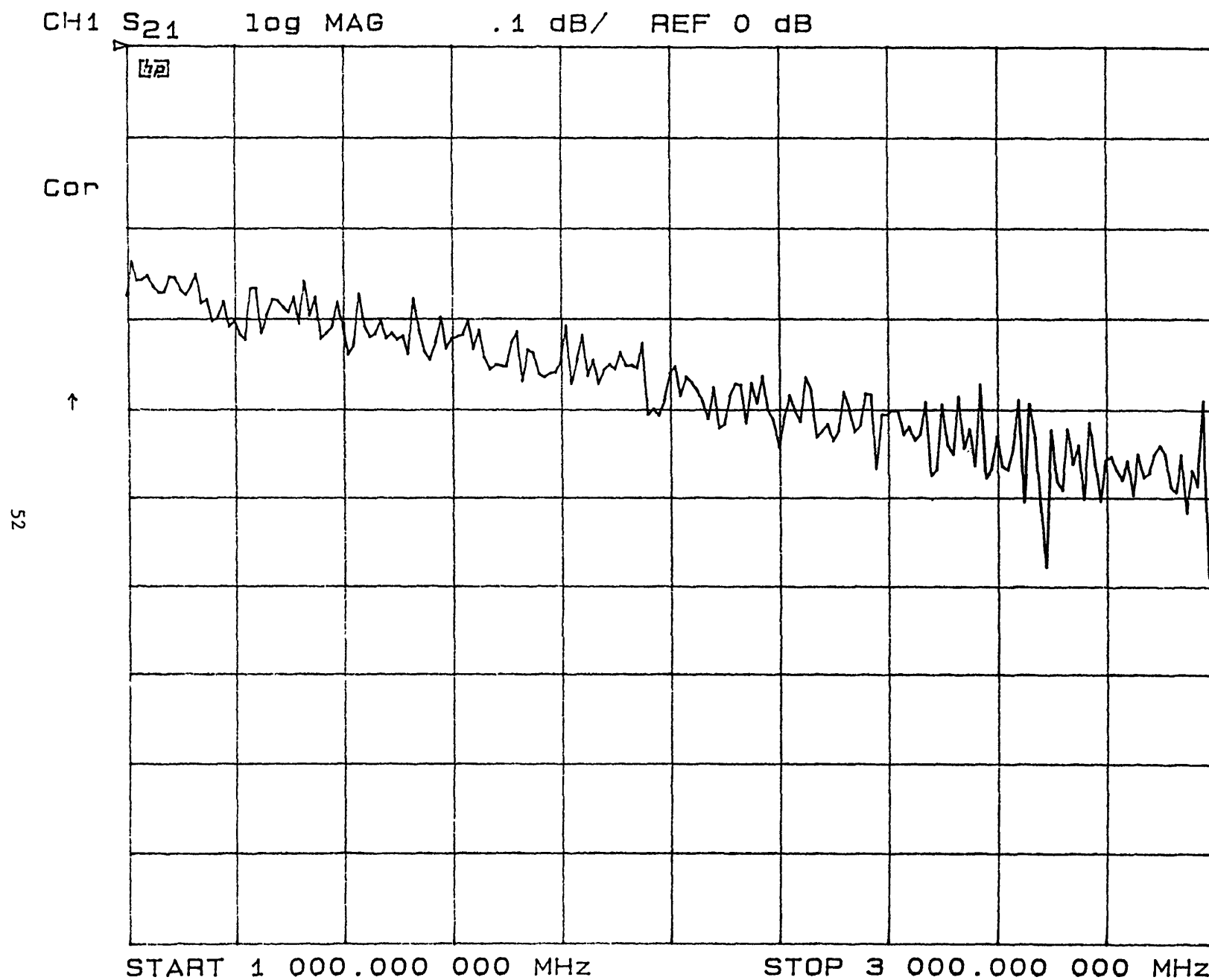


FIGURE 11. REFERENCE JUMPER RG-9 $\approx$ 2 FEET LONG FOR CONNECTING CABLES #9 AND #10 TOGETHER

140' CABLE ROUTING										LEGEND					
JUL 95	FILE CABLER1.WK1					CHART 1				Path = -> Termination =					
CABLE #	FUNCTION	TYPE	ORIGIN	TAIL JUMP	HUB	EAST YOE	WEST YOE	DEC JUMP	TRAY	VERTEX BULKHD	CASS	SKIN	LEG	APE	
01	PRIME FOCUS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW			->	SW		
02	PRIME FOCUS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW			->	SW		
03	PRIME FOCUS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW			->	SW		
04	CASS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW	8W					
04A	CASS RF/IF	7/8 8F	VERTEX						SW	8W	->	->	SW		
05	CASS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW	8W					
05A	CASS RF/IF	7/8 8F	VERTEX						SW	8W	->	->	SW		
06	CASS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW	8W					
07	CASS RF/IF } 48T	7/8 8F	WIND.BX	->	->		->	->	SW	8W					
08	CASS RF/IF	7/8 8F	WIND.BX	->	->		->	->	SW	8W					
09	PRIME FOCUS LO	1-5/8 8F	WIND.BX	->	->		->	->	NW			->	NW		
10	PRIME FOCUS LO	1-5/8 8F	WIND.BX	->	->		->	->	NW			->	NW		
11	PRIME FOCUS IF (LINE)	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
12	PRIME FOCUS IF (LINE)	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
13	PRIME FOCUS IF	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
14	PRIME FOCUS IF	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
15	PRIME FOCUS IF	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
16	PRIME FOCUS IF	RG9B/L	WIND.BX	->	->		->		NW			->	NW		
17	CASS F (LINE)	RG9B/L	WIND.BX	->	->		->		SW	8W					
18	CASS F (LINE)	RG9B/L	WIND.BX	->	->		->		SW	8W					
19	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
20	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
21	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
22	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
23	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
24	CASS F	RG9B/L	WIND.BX	->	->		->		SW	8W					
25	CASS HIGH VOLTAGE	RG9B/L	WIND.BX	->	->		->		SW	8W					
26	PRIME FOCUS HIGH VOLT	RG9B/L	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	CNTRLRM												
31A	CASS AIR COND. CONTROL	30C/#16	CHILLER				->		NW	NW					
32	FOC/POL TACH&BRAKE	30C/#16	CNTRLRM	->	->		->		SW			->	SW		
33	NUT. HYD. MONITOR	30C/#16	CNTRLRM	->	->										
34	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			8E	8E					
34A	RX CONTROL/MONITOR	15P/#16	VERTEX						8E	8E	->	->	8E		
35	Removed 7-11-85	15P/#16	WIND.BX	->	->	->			8E	8E					
35A	Removed 7-11-85	15P/#16	VERTEX						8E	8E	->	->	8E		
36	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			8E	8E					
36A	RX CONTROL/MONITOR	15P/#16	VERTEX						8E	8E	->	->	8E		
37	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			8E	8E					
38	RX CONTROL/MONITOR	15P/#16	WIND.BX	->	->	->			8E	8E					
39	NUTATOR CONTROL	15P/#16	CNTRLRM	->	->	->			8E	8E					
39A	NUTATOR CONTROL	15P/#16	VERTEX	->	->	->			8E	8E	->	->	8E		
40	Eliminated 7-11-85	8C/#16	CNTRLRM	->	->	->			NE	NE					
40A	Eliminated 7-11-85	8C/#16	VERTEX						NE	NE	->	->	NE		
41	Eliminated 7-11-85	8C/#16	CNTRLRM	->	->	->			NE	NE					
41A	Eliminated 7-11-85	8C/#16	VERTEX						NE	NE	->	->	NE		
42	DC TEMP CONTROL	4C/#8	CNTRLRM	->	->	->			8E	8E					
42A	DC TEMP CONTROL	4C/#8	VERTEX						8E	8E	->	->	8E		
43	DC TEMP CONTROL	4C/#8	CNTRLRM	->	->	->			8E	8E		->	8E		

TABLE 1. CABLE ROUTING AND IDENTIFICATION

CABLE	FUNCTION	TYPE	ORIGIN	TAIL	HUB	EAST	WEST	DEC	TRAY	VERTICAL	
#				JUMP		YOKE	YOKE	JUMP	SE	BULKHEAD	
44	DC TEMP CONTROL	4C/#8	CNTRL RM	->	->	->			SE		-> SE
45	REGULATED AC PRIME FOC	4C/#6	CNTRL RM	->	->	->			9E	9E	SE
46	REGULATED AC CASS	4C/#8	CNTRL RM	->	->	->			9E	9E	SE
46A	REGULATED AC PRIME FOC	4C/#8	VERTIX						9E	9E	-> SE
47	REGULATED AC CASS	4C/#8	CNTRL RM	->	->	->			NW	NW	
48	UN-REG. AC CASS	4C/#8	YOKE				->		9E		-> SE
49	FOC/POL DRIVE MOTORS	4C/#8	CNTRL RM	->	->	->					
50	AC 440V NUTATOR	4C/#6	YOKE						NW	NW	
51	CASS HOUSE HEATERS	4C/#6	YOKE				->				
52	VERTIX 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	CNTRL RM	->	->		->		NW	NW	
57	MISC. CASS CONTROL	7P/#16	CNTRL RM	->	->		->		NW	NW	
58	FOC/POL ENCODER	7P/#16	CNTRL RM	->	->		->		SW		-> SW
59	FOC/POL CONTROL	7P/#16	CNTRL RM	->	->		->		SW		-> SW
60	CASS B RX CONTROL/MON.	30C/#16	CNTRL RM	->	->		->		NE	NE	
61	CASS B RX CONTROL/MON.	30C/#16	CNTRL RM	->	->		->		NE	NE	
62	CASS B RX CONTROL/MON.	16P/#16	CNTRL RM	->	->		->		NE	NE	
63	P.F. RX CONTROL/MON.	30C/#16	CNTRL RM	->	->	->			9E		9E
64	P.F. RX CONTROL/MON.	30C/#16	CNTRL RM	->	->	->			9E		9E
65	P.F. RX CONTROL/MON.	16P/#16	CNTRL RM	->	->	->			9E		9E
M55	POLR. SERVO	3C/#16	TB105A								
M56	POLR. TRANSDUCER	4C/#16	TB105A								
M57	DEC. SERVO	3C/#16	TB105A								
M58	DEC. TRANSDUCER	4C/#16	TB105A								

