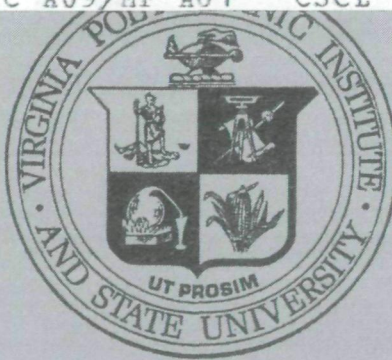


NASA CR-156848

Data Report for December 1976
through March 1978
on
A DEPOLARIZATION AND ATTENUATION EXPERIMENT
USING THE COMSTAR AND CTS SATELLITES

159901
(NASA-CR-159901 A DEPOLARIZATION AND ATTENUATION EXPERIMENT USING THE COMSTAR AND CTS SATELLITES Data Report, Dec. 1976 - Mar. 1978 (Virginia Polytechnic Inst. and State Univ.) 198 p HC A09/MF A01 CSCL 20N G3/32 N78-33287 N78-33287 Unclas 35786



Virginia Polytechnic Institute
and State University
Electrical Engineering
BLACKSBURG, VIRGINIA 24061

Data Report for December 1976
through March 1978

on

A DEPOLARIZATION AND ATTENUATION EXPERIMENT
USING THE COMSTAR AND CTS SATELLITES

Text by

C. W. Bostian
E. A. Manus
R. E. Marshall
W. P. Overstreet
R. R. Persinger
J. D. Powell
P. Santago
W. L. Stutzman
P. H. Wiley

Graphics by

Cynthia R. Will

Electrical Engineering Department
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Prepared for

NASA Goddard Space Flight Center
Greenbelt, Maryland 20771

Contract NAS5-22577

April 28, 1978

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle A Depolarization and Attenuation Experiment Using the COMSTAR and CTS Satellites		5. Report Date	6. Performing Organization Code
7. Author(s) C.W. Bostjan, E.A. Manus, R.E. Marshall, W.P. Overstreet, R.R. Persinger, J.D. Powell, P. Santiago, W.L. Stutzman, P.H. Wiley		8. Performing Organization Report No. 1978-2	
9. Performing Organization Name and Address Department of Electrical Engineering 340 Whittemore Hall VPI&SU, Blacksburg, Virginia 24061		10. Work Unit No.	11. Contract or Grant No. NAS5-22577
12. Sponsoring Agency Name and Address NASA Goddard Space Flight Center Greenbelt, Md. 20771 E. Hirschmann, Code 953, Technical Officer		13. Type of Report and Period Covered Data Report: Dec. 76 - March 78	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract This report presents monthly statistical data on ground rainfall rate and attenuation on satellite downlinks at 11.7 GHz, 19.04 GHz, and 28.56 GHz and on cross-polarization isolation at 11.7 GHz. Regression equations for relating isolation to attenuation, attenuation to rain rate, and attenuation at one frequency to attenuation at another frequency are also included. Longer-term statistics are also presented and discussed.			
17. Key Words (Selected by Author(s)) polarization, depolarization, attenuation, millimeter wave propagation, communications satellites, CTS, COMSTAR, percent-of-time, frequency scaling, monthly statistics		18. Distribution Statement Unlimited	
19. Security Classif. (of this report) U	20. Security Classif. (of this page) U	21. No. of Pages	22. Price

TABLE OF CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
1.1 Description of the Report	1
1.2 Guide to Related Literature	1
1.3 Discussion of the Report Contents	2
2. MONTHLY DATA	6
2.1 December, 1976	11
2.2 January, 1977	15
2.3 Debruary, 1977	19
2.4 March, 1977	20
2.5 April, 1977	29
2.6 May, 1977	37
2.7 June, 1977	48
2.8 July, 1977	58
2.9 August, 1977	68
2.10 September, 1977	79
2.11 October, 1977	89
2.12 November, 1977	98
2.13 December, 1977	106
2.14 January, 1978	116
2.15 February, 1978	127
2.16 March, 1978	135

	<u>Page</u>
3. LONG-TERM STATISTICS	144
3.1 Introduction	144
3.2 Calendar Year 1977 less February	145
3.3 June, 1977, through March, 1978	145
3.4 July, August, and September, 1977	145
3.5 October, November, and December, 1977	145
3.6 January, February, and March, 1978	146
3.7 July through November, 1977	146
3.8 July through October and December, 1977	146

LIST OF TABLES

		<u>Page</u>
Table 2.1-1.	Key parameters for the month of December, 1976.	12
Table 2.1-2.	Attenuation and rain rate percent-of-time data for December, 1976.	14
Table 2.2-1.	Key parameters for the month of January, 1977.	16
Table 2.2-2.	Attenuation and rain rate percent-of-time data for January, 1977.	
Table 2.4-1.	Key parameters for the month of March, 1977.	21
Table 2.4-2.	Attenuation and rain rate percent-of-time data for March, 1977. (Values for 19 and 28 GHz estimated from 11 GHz data.)	24
Table 2.4-3.	Percent of time that 11.7 GHz isolation was less than the indicated value for March, 1977.	26
Table 2.4-4.	Regression equations for the month of March, 1977. . .	28
Table 2.5-1.	Key parameters for the month of April, 1977.	30
Table 2.5-2.	Attenuation and rain rate percent-of-time data for April, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)	33
Table 2.5-3.	Percentage of time that 11.7 GHz isolation was less than the indicated value for April, 1977.	34
Table 2.5-4.	Regression equations for the month of April, 1977. . .	36
Table 2.6-1.	Key parameters for the month of May, 1977.	38
Table 2.6-2.	Attenuation and rain rate percent-of-time data for May, 1977. Note: 19 GHz points are scaled. . .	41
Table 2.6-3.	Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.	44
Table 2.6-4.	Regression equations for the month of May, 1977. . .	47
Table 2.7-1.	Key parameters for the month of June, 1977.	49
Table 2.7-2.	Attenuation and rain rate percent-of-time data for June, 1977.	52

	<u>Page</u>
Table 2.7-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.	54
Table 2.7-4. Regression equations for the month of June, 1977. . .	57
Table 2.8-1. Key parameters for the month of July, 1977.	59
Table 2.8-2. Attenuation and rain rate percent-of-time data for July, 1977.	62
Table 2.8-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.	64
Table 2.8-4. Regression equations for the month of July, 1977. . .	67
Table 2.9-1. Key parameters for the month of August, 1977.	69
Table 2.9-2. Attenuation and rain rate percent-of-time data for August, 1977.	72
Table 2.9-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.	75
Table 2.9-4. Regression for the month of August, 1977.	78
Table 2.10-1. Key parameters for the month of September, 1977. . . .	80
Table 2.10-2. Attenuation and rain rate percent-of-time data for September, 1977.	83
Table 2.10-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977. . . .	85
Table 2.10-4. Regression equations for the month of September, 1977.	88
Table 2.11-1. Key parameters for the month of October, 1977.	90
Table 2.11-2. Attenuation and rain rate percent-of-time data for October, 1977.	93
Table 2.11-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for October, 1977.	95
Table 2.11-4. Regression equations for the month of October, 1977.	97
Table 2.12-1. Key parameters for the month of November, 1977. . . .	99
Table 2.12-2. Attenuation and rain rate percent-of-time data for November, 1977.	102

	<u>Page</u>
Table 2.12-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for November, 1977.	104
Table 2.12-4. Regression equations for the month of November, 1977.	105
Table 2.13-1. Key parameters for the month of December, 1977.	107
Table 2.13-2. Attenuation and rain rate percent-of-time data for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.	110
Table 2.13-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.	112
Table 2.13-4. Regression equations for the month of December, 1977.	115
Table 2.14-1. Key parameters for the month of January, 1978.	117
Table 2.14-2. Attenuation and rain rate percent-of-time data for January, 1978.	120
Table 2.14-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.	122
Table 2.14-4. Regression equations for the month of January, 1978.	126
Table 2.15-1. Key parameters for the month of February, 1978.	128
Table 2.15-2. Attenuation and rain rate percent-of-time data for February, 1978.	131
Table 2.15-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for February, 1978.	132
Table 2.15-4. Regression equations for the month of February, 1978.	134
Table 2.16-1. Key parameters for the month of March, 1978.	136
Table 2.16-2. Attenuation and rain rate percent-of-time data for March, 1978.	139
Table 2.16-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1978.	141
Table 2.16-4. Regression equations for the month of March, 1978.	143
Table 3.2-1. Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.	149
Table 3.3-1. Attenuation and rain rate percent-of-time data for June 1977 through March 1978.	155

	<u>Page</u>
Table 3.4-1. Attenuation and rain rate percent-of-time data for July, August, and September, 1977.	161
Table 3.4-2. Regression equations for July, August, and September, 1977.	164
Table 3.5-1. Attenuation and rain rate percent-of-time data for October, November, and December, 1977.	167
Table 3.6-1. Attenuation and rain rate percent-of-time data for January, February, and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.	172
Table 3.7-1. Attenuation and rain rate percent-of-time data for July through November, 1977.	177
Table 3.7-2. Regression equations for the period July through November, 1977.	180
Table 3.8-1. Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.	183
Table 3.8-2. Regression equations for the period July, August, September, October, and December, 1977.	187

LIST OF FIGURES

		<u>Page</u>
Figure 2.1-1.	Attenuation statistics for December, 1976.	13
Figure 2.2-1.	Attenuation statistics for January, 1977.	17
Figure 2.4-1.	Rain rate statistics for March, 1977.	22
Figure 2.4-2.	Attenuation for March 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)	23
Figure 2.5-1.	Rain rate statistics for April, 1977.	31
Figure 2.5-2.	Attenuation statistics for April, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)	32
Figure 2.6-1.	Rain rate statistics for May, 1977.	39
Figure 2.6-2.	Attenuation statistics for May, 1977. (Values for 19 GHz are estimated.)	40
Figure 2.7-1.	Rain rate statistics for June, 1977.	50
Figure 2.7-2.	Attenuation statistics for June, 1977.	51
Figure 2.8-1.	Rain rate statistics for July, 1977.	60
Figure 2.8-2.	Attenuation statistics for July, 1977.	61
Figure 2.9-1.	Rain rate statistics for August, 1977.	70
Figure 2.9-2.	Attenuation statistics for August, 1977.	71
Figure 2.10-1.	Rain rate statistics for September, 1977.	81
Figure 2.10-2.	Attenuation statistics for September, 1977.	82
Figure 2.11-1.	Rain rate statistics for October, 1977.	91
Figure 2.11-2.	Attenuation statistics for October, 1977.	92
Figure 2.12-1.	Rain rate statistics for November, 1977.	100
Figure 2.12-2.	Attenuation statistics for November, 1977.	101
Figure 2.13-1.	Rain rate statistics for December, 1977.	108
Figure 2.13-2.	Attenuation statistics for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.	109

	<u>Page</u>
Figure 2.14-1. Rain rate statistics for January, 1978.	118
Figure 2.14-2. Attenuation statistics for January, 1978.	119
Figure 2.15-1. Rain rate statistics for February, 1978.	129
Figure 2.15-2. Attenuation statistics for February, 1978.	130
Figure 2.16-1. Rain rate statistics for March, 1978.	137
Figure 2.16-2. Attenuation statistics for March, 1978.	138
Figure 3.2-1. Rain rate statistics for the calendar year 1977 less February.	147
Figure 3.2-2. Attenuation statistics for the calendar year 1977. less February.	148
Figure 3.3-1. Rain rate statistics for June 1977 through March 1978.	153
Figure 3.3-2. Attenuation statistics for June 1977 through March 1978.	154
Figure 3.4-1. Rain rate statistics for July, August, and September, 1977.	159
Figure 3.4-2. Attenuation statistics for July, August, and September, 1977.	160
Figure 3.5-1. Rain rate statistics for October, November, and December, 1977.	165
Figure 3.5-2. Attenuation statistics for October, November, and December, 1977.	166
Figure 3.6-1. Rain rate statistics for January, February, and March, 1978.	170
Figure 3.6-2. Attenuation statistics for January, February, and March 1978.	171
Figure 3.7-1. Rain rate statistics for July through November, 1977.	175
Figure 3.7-2. Attenuation statistics for July through November, 1977.	176
Figure 3.8-1. Rain rate statistics for July, August, September, October, and December, 1977.	181
Figure 3.8-2. Attenuation statistics for July, August, September, October, and December, 1977.	182

1. INTRODUCTION

1.1 Description of the Report

This report summarizes the precipitation attenuation and depolarization data collected by VPI&SU from December 1, 1976, through March 31, 1978, on satellite downlinks operating at 11.7, 19.04, and 28.56 GHz. This was the data collection portion of the period for which the experiment received funds from the Defense Communications Agency (DCA), and the report is submitted to fulfill our contractual requirement of a final data report for DCA.

1.2 Guide to Related Literature

In this report the data are presented without extensive comment. For a theoretical discussion of the phenomena involved, a comparison of theory with experiment, and a computer model for predicting attenuation and depolarization, the reader should consult

R. R. Persinger, "Millimeter Wave Propagation Modeling of Inhomogeneous Rain Media for Satellite Communications Systems, Report 1978-1, NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, May 1, 1978.

A detailed description of the hardware aspects of the experiment is given by

C. W. Bostian et al, "Quarterly Technical Progress Report I on A Depolarization and Attenuation Experiment Using the COMSTAR and CTS Satellites," NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, December 22, 1976.

For an explanation of the statistical data reduction techniques used to prepare this report the reader should see

C. W. Bostian et al, "Final Report (Second Year of Work) on a Depolarization and Attenuation Experiment Using the COMSTAR and CTS Satellites," NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, February 9, 1978.

1.3 Discussion of the Report Contents

DCA funding was formally transferred by NASA to VPI&SU at the end of September, 1976, to pay for the construction of COMSTAR-19.04 and 28.56 GHz terminals. At that time the University was already operating an 11.7 GHz attenuation and depolarization experiment for NASA using CTS.

When DCA funds were received CTS was turned off for the eclipse period, and when spacecraft operations resumed the VPI&SU receiver was found to be damaged by a water leak in the parametric amplifier housing. Operations were resumed on a temporary basis in November, 1976; December, 1976, was the first full month of data collection following eclipse and it is therefore the first month for which data

are presented in this report. With NASA's permission we ceased operations during February, 1977, to make permanent repairs to the CTS equipment, and hence no data appear for that month.

The COMSTAR D-2 28 GHz downlink became operational in April, 1977, and data appear here for that system beginning with the month of May, 1977. Attenuation data for the D-2 19 GHz system became available in May, 1977, and data collected at this frequency appear in the report beginning with June, 1977. For the period in which we have CTS data but not COMSTAR data this report provides estimates of what the COMSTAR attenuation statistics would have been. These were derived by multiplying the 11.7 GHz attenuation in dB by 1.48 to approximate the 19.04 GHz attenuation and by 2.71 to approximate the 28 GHz attenuation. The 1.48 and 2.71 attenuation ratios were obtained from measured attenuation data taken during the summer of 1977.

Chapter 2 of this report is devoted to monthly results and Chapter 3 considers data from longer periods of time. For each time period reported the following tables appear.

Table 1. Key Parameters summarizes the rain and signal behavior for the month. It gives the total rain accumulation, the peak rain rate, and the percent of the total rain accumulation that fell at 10, 20, 30, 40, and 50 mm/hr. Also presented are the monthly mean signal levels at IF; these will give the reader an idea of the overall stability of the satellite beacon transmitters and the receiver gains from one month to the next. Where available we have also presented

agree closely with theoretical predictions. Power curves, on the other hand, can give similar results for widely differing coefficients. For this reason our a and b coefficients in the table frequently depart from theory while the attenuation : rainrate relationship that they describe agrees well with theory.

Also included in each monthly group are percentage-of-time plots of the attenuation and rain rate data contained in the table.

PRECEDING PAGE BLANK NOT FILMED

2. MONTHLY DATA

This chapter summarizes the data collected on a month-by-month basis. Below is a brief commentary on each month which appears; in it appear the total hours of rainfall* during the month and the percentage of these hours during which attenuation and isolation data were collected. In reading these figures the reader should keep in mind several factors.

(1) Unless otherwise noted, attenuation measurements were made during all periods of heavy rain when the receivers could maintain phase lock. Small departures from 100% for attenuation measurement times generally represent intentional interruptions during light rain for equipment checks, etc. (2) Cross-polarized signal components are almost always at least 10 dB below the corresponding co-polarized signal components, and this means that during severe fades the cross-polarized components will be corrupted by noise first. Thus isolation data will normally be available for a slightly smaller percentage of time than is attenuation data taken over the same time period. (3) For statistical purposes missed attenuation data can be filled in by frequency scaling.

December, 1976. (Section 2.1) Rain fell for 18 hours, but the rain rate was insignificant and no rain rate plots are given. CTS attenuation and isolation data were collected for 100 and 99.9% of the time. Attenuation values for 19 and 28 GHz were scaled.

January, 1977. (Section 2.2) During this month the rain rate was negligible and no rain rate plots appear. Very light rain fell for

* Rainfall is arbitrarily defined as existing when the rain rate exceeds 0.5 mm/hr.

a total of 9 hours, and CTS isolation and attenuation data were collected for 98% of this time. Attenuation values for 19 and 28 GHz were scaled.

February, 1977. (Section 2.3) No data were collected; the VPI&SU earth station was closed down for repairs.

March, 1977. (Section 2.4) Rain fell for 14 hours. CTS attenuation and isolation data were collected for 75.4 and 75.2% of time time, respectively. Attenuation values for 19 and 28 GHz were scaled.

April, 1977. (Section 2.5) There were 27 hours of rain in April. Attenuation measurements were made for 87.0% of this time and isolation data for 86.5%.

May, 1977. (Section 2.6) This was the first full month of 28 GHz data collection. Rain fell for a total of 9 hours, and attenuation data were collected for 93.6% of time time at 11.7 GHz and 87.1% of this time at 28 GHz. The corresponding figures for isolation were 92.6% and 77.4%; problems were encountered with 28 GHz depolarization data because of an antenna problem which affected the cross-polarized channel.

June, 1977. (Section 2.7) We recorded 23 hours of rainfall and collected 11.7 GHz attenuation and isolation data for 99.3% and 98.4% of time time. At 28 GHz attenuation and isolation data were taken for 95.1% and 30.4% of the rain time. Continuing antenna problems were responsible for the low isolation percentage. The 19 GHz system became operational during June and collected attenuation data for 88.9% of the rain time.

July, 1977. (Section 2.8) This was the first full month of 19 GHz operational and during 4 hours of rain 19 GHz attenuation and isolation data were collected 89.3% and 78.4% of the time. The corresponding

figures for the 11.7 GHz system were 91.7% and 89%. At 28 GHz attenuation data were collected during 87% of the rain time. Isolation data at this frequency were invalidated by the continuing antenna defect which was located and repaired near the end of the month.

August, 1977. (Section 2.9) Rain fell for six hours and attenuation data were recorded for 96.2% of this time at 19 GHz and 73.2% of this time at 28 GHz. For isolation the corresponding figures were 77.2% and 63.3% respectively. The 11.7 antenna positioner malfunctioned and limited attenuation and isolation data collection to 38.2% and 38.0% of the rain time; missing attenuation data were filled in by scaling.

September, 1977. (Section 2.10) September brought 17 hours of rain. Attenuation data were collected for 94.2% of this time at 11 GHz, for 100% of this time at 19 GHz, and for 97.9% of this time at 28 GHz; the isolation figures were 93.9% (11.7 GHz), 97.9% (28 GHz), 12.3% (19 GHz vertical), and 99.2% (19 GHz horizontal). During this period the CTS spacecraft was shut down every day for eclipse; this biased the isolation data but its effects were removed from the attenuation records.

October, 1977. (Section 2.11) It rained for 15 hours and attenuation data were collected for 94.0% (11.7 GHz), 100% (19 GHz), and 94.5% (28 GHz) of this time. The isolation values were 90.9% (11.7 GHz), 95.8% (19 GHz), and 93.8% (28 GHz).

November, 1977. (Section 2.12) A total of 25 hours of rain were recorded. The experiment collected attenuation data for 73.4% (11.7 GHz), 85.6% (28 GHz), and 85.3% (19 GHz) of this time. The percentages for isolation were 70.8% (11.7 GHz), 85.5% (28 GHz), and 83.8% (19 GHz). Occasional local oscillator malfunction may have biased the 19 GHz data, however.

December, 1977. (Section 2.13) December was a period during which repeated CTS spacecraft maneuvers were conducted. We were not provided timely tracking information and were able to collect 11.7 GHz attenuation and isolation for 65.3% and 65% of the 14 hours of rainfall. At 28 GHz the attenuation percentage was 100% and the value for isolation was 99.1%. The 19 GHz system was disabled by a local oscillator failure and operated only during 38.2% of the rain time for attenuation and 36.5% for isolation.

January, 1978. (Section 2.14) This month and the two months following were marked by heavy falls of snow, sleet, and freezing rain. Data collected during known periods of antenna contamination were deleted from the data base. Under weather conditions like those experienced, tipping bucket rain gauges tend to freeze, fill up with ice and snow, and then send out false indications of rainfall when rising temperatures melt the gauge contents. For this reason, the rain data quoted for January, February, and March, 1978, must be treated with caution. During January, the gauges reported 53 hours of rainfall for which we collected valid attenuation data 78.6% (11.7 GHz), 56.9 (19 GHz) and 56.8% (28 GHz) of the time. The corresponding isolation percentages are 78.1% (11.7 GHz), 48.7% (19 GHz) and 55.8% (28 GHz). It should be emphasized that during these winter months we noted occasional instances of severe attenuation and depolarization from sleet and snow while the antennas were clear and no precipitation was being observed on the ground.

February, 1978. (Section 2.15) Our gauges indicated rain for 5 hours, but they were probably measuring melting snow. Attenuation data for 11.7 GHz may have been influenced by periodic shutdowns of the spacecraft.

March, 1978. (Section 2.16) Snow and rain were mixed during this month, and snow filling the antennas was a recurrent problem. Our gauges recorded 33 hours of rainfall, some of which was melting snow. Attenuation data were collected for 62.3% (11.7 GHz), 20.9% (19 GHz), and 52.7% (28 GHz) of the time that the gauges indicated rain. Corresponding figures for isolation were 61.9% (11.7 GHz), 18.9% (19 GHz), and 52.7% (28 GHz).

2.1 December, 1976

Rainfall was insignificant and no rain rate plots are given. 19 and 28 GHz attenuation are scaled. There was insufficient data from which to develop regression equation.

Table 2.1-1.

Key parameters for the month of December, 1976.

1. Rain Data

VPI&SU Accumulation, 39.83 mm

USWS Accumulation, 72.90 mm

Peak VPI&SU Rate, 12.53 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 2.29%	R > 20 mm/hr, 0%	R > 50 mm/hr, 0%
R > 30 mm/hr, 0%	R > 40 mm/hr, 0%	

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-82.25	9.65	20.88
19.04V	-----	----	-----
19.04H	-----	----	-----
28.56	-----	----	-----

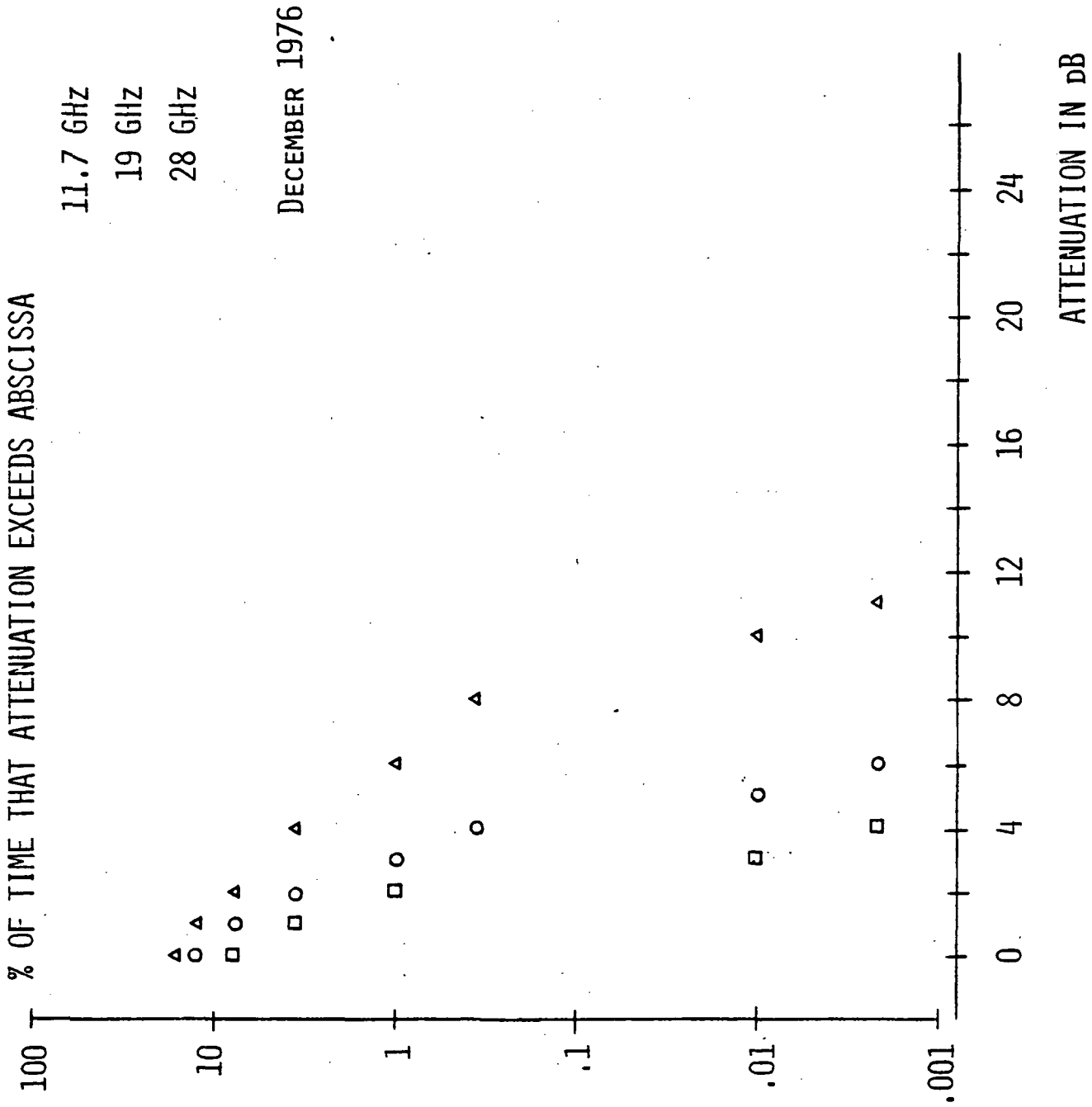


Figure 2.1-1. Attenuation statistics for December, 1976.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	16.405
.	.	1	1	14.527
.	0	.	.	7.259
.	.	1	2	7.198
.	1	2	4	3.693
0	.	.	.	2.274
1	2	3	6	1.190
2	.	.	.	0.903
3	.	.	.	0.672
.	.	4	8	0.485
4	.	.	.	0.395
5	.	.	.	0.231
6	.	.	.	0.108
7	.	.	.	0.057
8	.	.	.	0.027
9	.	.	.	0.021
.	3	5	10	0.015
10	.	.	.	0.011
11	.	.	.	0.006
.	4	6	11	0.003
12	9	14	26	0.002
				0.000

Table 2.1-2. Attenuation and rain rate percent-of-time data for December, 1976.

2.2 January, 1977

Rainfall was insignificant and no rain rate plots are given. 19 and 28 GHz attenuation are scaled. The low attenuation recorded did not justify regression equation.

Table 2.2-1.

Key parameters for the month of January, 1977.

1. Rain Data

VPI&SU Accumulation, 10.66 mm

USWS Accumulation, 50.55 mm

Peak VPI&SU Rate, 4.69 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 0% R > 20 mm/hr, 0% R > 50 mm/hr, 0%

R > 30 mm/hr, 0% R > 40 mm/hr, 0%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-82.90	3.39	28.9
19.04V	-----	-----	-----
19.04H	-----	-----	-----
28.56	-----	-----	-----

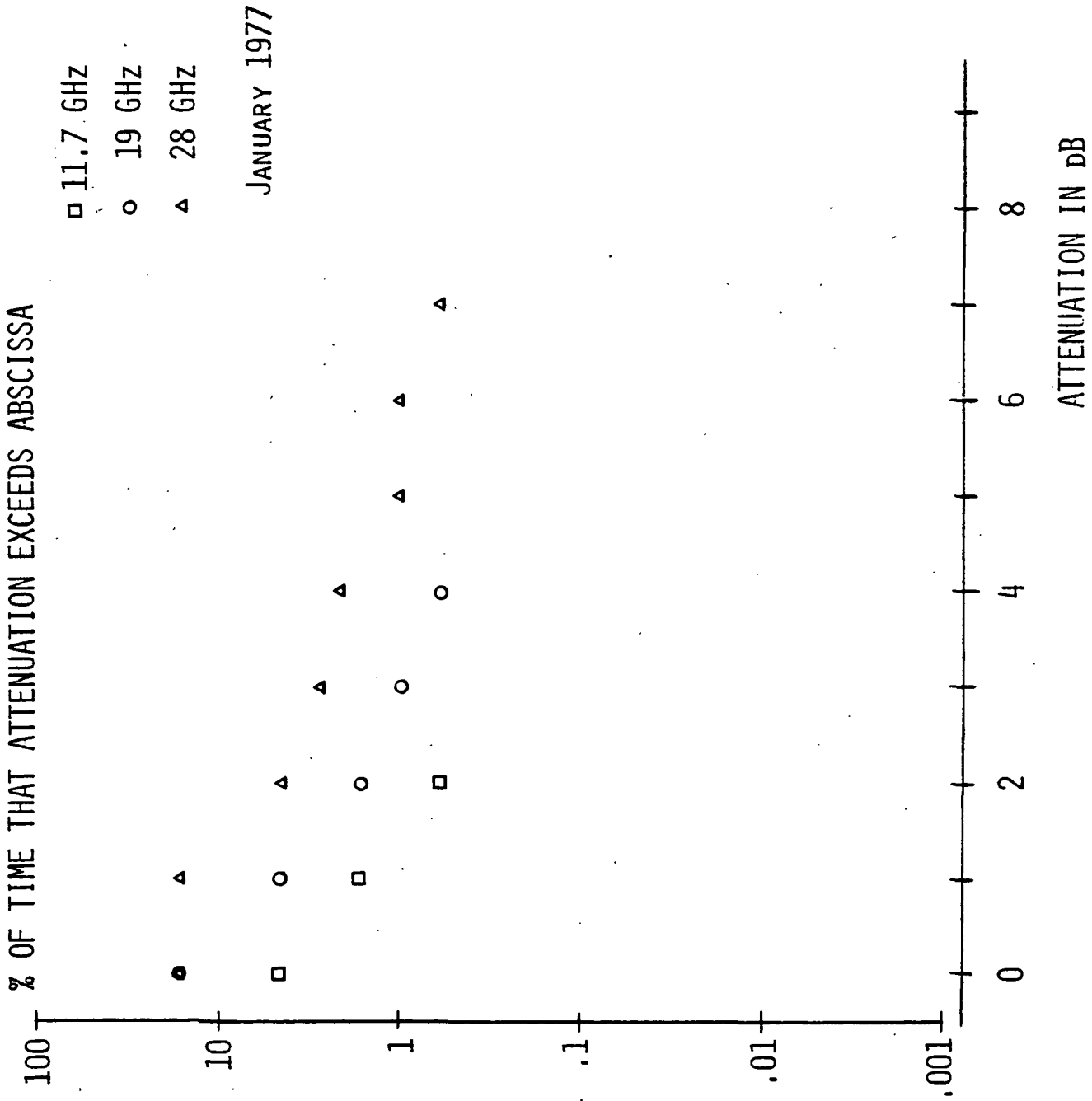


Figure 2.2-1. Attenuation statistics for January, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	15.731
.	.	.	1	14.701
.	0	.	2	4.733
.	.	1	3	4.327
.	.	.	4	3.089
.	1	2	5	2.169
.	.	.	6	1.500
.	.	3	7	1.061
0	.	.	.	1.033
.	2	4	.	0.591
.	.	.	.	0.560
.	.	.	.	0.100
0	.	.	.	0.022
.	.	.	.	0.009
4	3	5	9	0.000

Table 2.2-2. Attenuation and rain rate percent-of-time data for January, 1977.

2.3 February, 1977

No data were collected; our station was shut down for repairs.

~~REPRODUCING PAGE BLANK NOT FILMED~~
~~REPRODUCING PAGE BLANK NOT FILMED~~

Table 2.4-1.

Key parameters for the month of March, 1977.

1. Rain Data

VPI&SU Accumulation, 57.00 mm

USWS Accumulation, 53.59 mm

Peak VPI&SU Rate, 60.93 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 31.42% R > 20 mm/hr, 19.00% R > 50 mm/hr, 2.38%

R > 30 mm/hr, 11.21% R > 40 mm/hr, 7.16%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-80.14	10.89	21.28
19.04V	-----	----	-----
19.04H	-----	----	-----
28.56	-----	----	-----

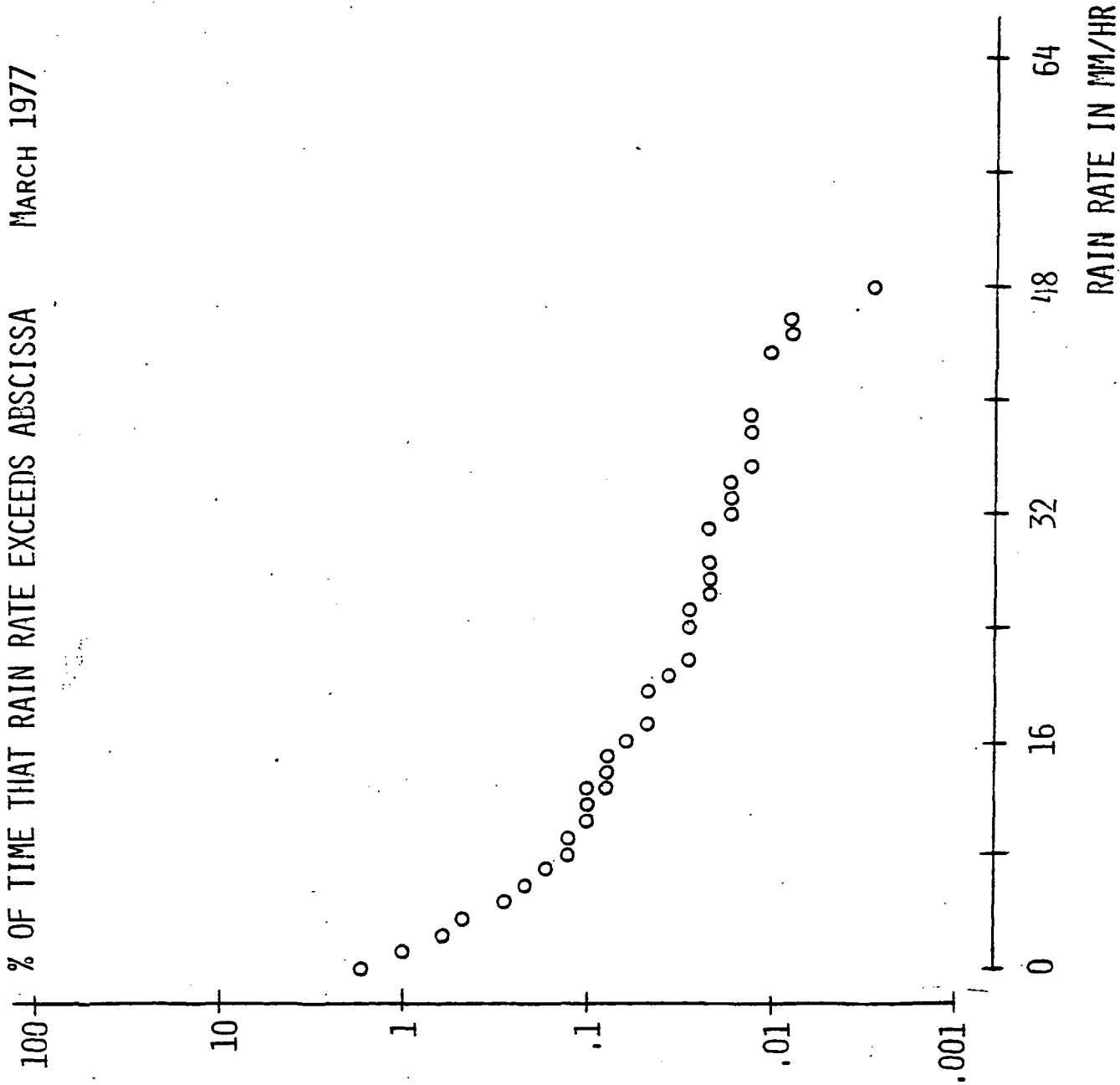


Figure 2.4-1. Rain rate statistics for March, 1977.

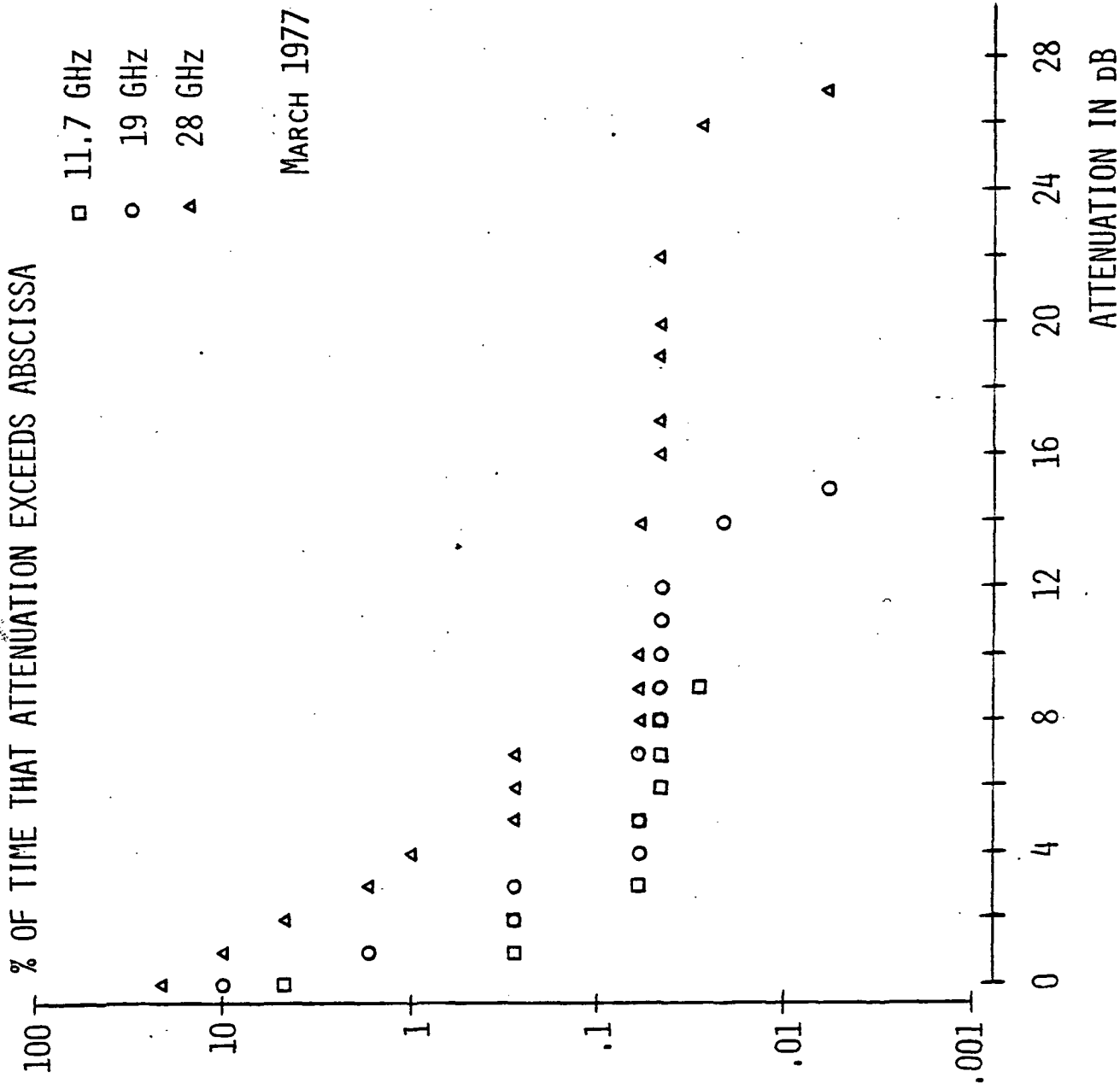


Figure 2.4-2. Attenuation for March 1977.
(Values for 19 and 28 GHz are estimated from 11 GHz data.)

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACIS	AV19	AC28	PER
.	.	0	0	23.367
.	.	0	1	10.848
.	.	.	1	9.155
.	0	.	2	4.459
.	.	.	2	4.446
0	.	1	3	1.567
.	.	.	4	1.519
.	.	.	.	1.104
1	.	.	.	0.970
2	.	.	.	0.676
3	.	.	.	0.423
4	1	2	.	0.315
.	.	.	3	0.281
.	.	.	3	0.279
.	.	3	0	0.273
.	2	.	7	0.270
5	.	.	.	0.268
6	.	.	.	0.255
7	.	.	.	0.200
8	.	.	.	0.168
9	.	.	.	0.142
10	.	.	.	0.115
11	.	.	.	0.108
12	.	.	.	0.103
13	.	.	.	0.095
14	.	.	.	0.087
15	.	.	.	0.075
16	.	4	8	0.069
.	.	.	9	0.060
.	3	5	10	0.059
.	5	7	14	0.056
17	.	.	.	0.053
.	.	8	16	0.052
19	6	9	17	0.051
.	.	10	19	0.047
.	7	11	20	0.045
20	8	12	22	0.044
21	.	.	.	0.042
22	.	.	.	0.035
.	9	.	26	0.031
24	.	.	.	0.031
25	.	.	.	0.030
26	.	.	.	0.027
27	.	14	.	0.025
28	.	.	.	0.024
29	.	.	.	0.023
31	.	.	.	0.022
32	.	.	.	0.021
33	.	.	.	0.020
34	.	.	.	0.017
35	.	.	.	0.016
36	.	.	.	0.015
38	.	.	.	0.014
39	.	.	.	0.013
.	.	.	.	0.012

Table 2.4-2. Attenuation and rain rate percent-of-time data for March, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

RAIN	AC15	AV19	AC28	PER
43	.	.	.	0.010
45	.	.	.	0.008
46	.	.	.	0.007
.	.	15	27	0.006
48	.	.	.	0.003
50	.	.	.	0.001
60	10	16	29	0.000

Table 2.4-2 (continued). Attenuation and rain rate percent-of-time data for March, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

ICIS	PERCENT
21.27999	0.004
22.07999	0.000
23.29	0.000
23.47999	0.010
24.68	0.027
24.88999	0.226
25.08999	0.228
25.28	0.037
25.49	1.113
25.68999	1.154
25.88001	1.391
25.88999	1.393
25.89001	1.500
26.09	1.741
26.29	2.216
26.68	2.391
26.88999	2.551
27.09	2.570
27.68	2.944
27.68999	2.940
27.88999	3.471
28.07999	3.056
28.29	4.026
28.48	4.228
28.49	4.236
28.68999	4.747
29.07999	4.547
29.09	4.697
29.29	4.781
29.40	4.792
29.49	4.847
29.68999	5.333
29.69001	5.546
29.88999	5.619
29.89001	5.625
30.08999	5.777
30.09	6.523
30.29	6.711
30.29999	6.713
30.40	8.263
30.68999	8.460
30.89001	8.851
30.9	8.969
30.88999	9.007
30.89001	9.833
31.08999	10.007
31.09	10.437
31.1	10.444
31.10001	10.531
31.29	11.149
31.30001	12.267
31.49	12.209
31.49001	12.637

Table 2.4-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
31.49999	12.705
31.50001	12.731
31.68999	12.758
31.69001	13.392
31.88999	13.404
31.89001	13.908
31.9	13.447
32.09	13.451
32.1	16.219
32.10001	16.462
32.29	16.737
32.30001	16.834
32.49	17.097
32.49001	17.258
32.49999	17.328
32.68999	18.262
32.69001	18.278
32.88999	18.632
32.7	19.348
32.88999	19.552
32.89001	20.385
32.9	21.552
33.08999	21.557
33.09	22.459
33.1	23.192
33.10001	23.260
33.29	23.687
33.29999	23.731
33.30001	23.983
33.49	25.144
33.49001	25.278
33.49999	25.574
33.50001	25.771
33.68999	26.548
33.69001	27.352
33.88999	27.958
33.7	28.438
33.88999	28.526
33.89001	28.977
33.9	30.039
34.08999	30.044
34.09	30.645
34.1	31.281
34.10001	31.613
34.29	33.298
34.29999	33.791
34.30001	34.032
34.49	34.405
34.49001	34.750
34.49999	36.419
34.50001	37.090
34.68999	37.279
34.69001	37.454
34.7	38.078
34.88999	38.943

Table 2.4-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1977.

2.5 April, 1977

19 and 28 GHz attenuations are scaled.

Table 2.5-1.

Key parameters for the month of April, 1977.

1. Rain Data

VPI&SU Accumulation, 107.86 mm

USWS Accumulation, 120.14 mm

Peak VPI&SU Rate, 100.73 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 19.5% R > 20 mm/hr, 7.20% R > 50 mm/hr, 1.21%

R > 30 mm/hr, 4.03% R > 40 mm/hr, 2.22%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-79.86	16.84	10.27
19.04V	-----	-----	-----
19.04H	-----	-----	-----
28.56	-80.76	lost lock	-----

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA APRIL 1977

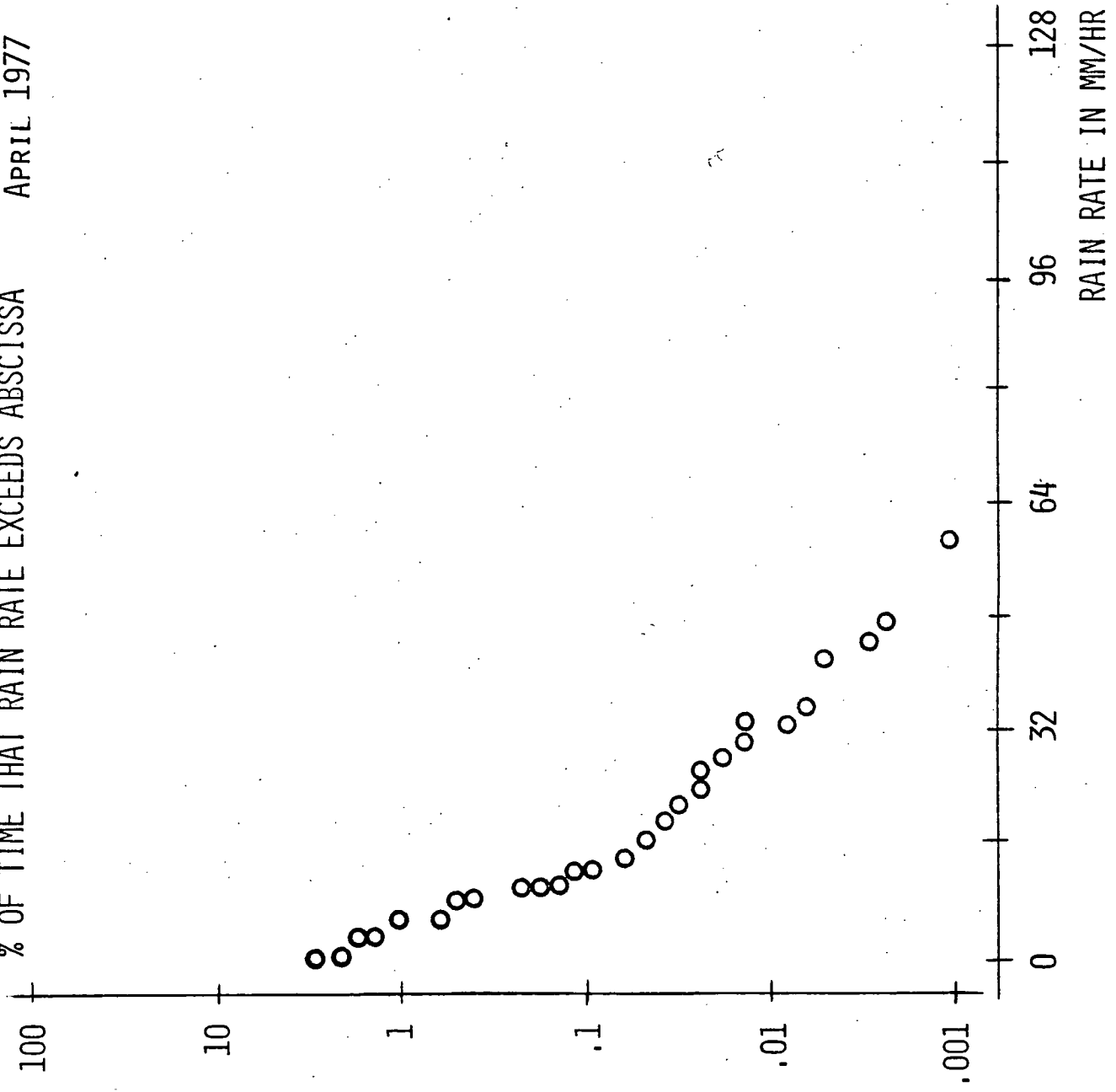


Figure 2.5-1. Rain rate statistics for April, 1977.

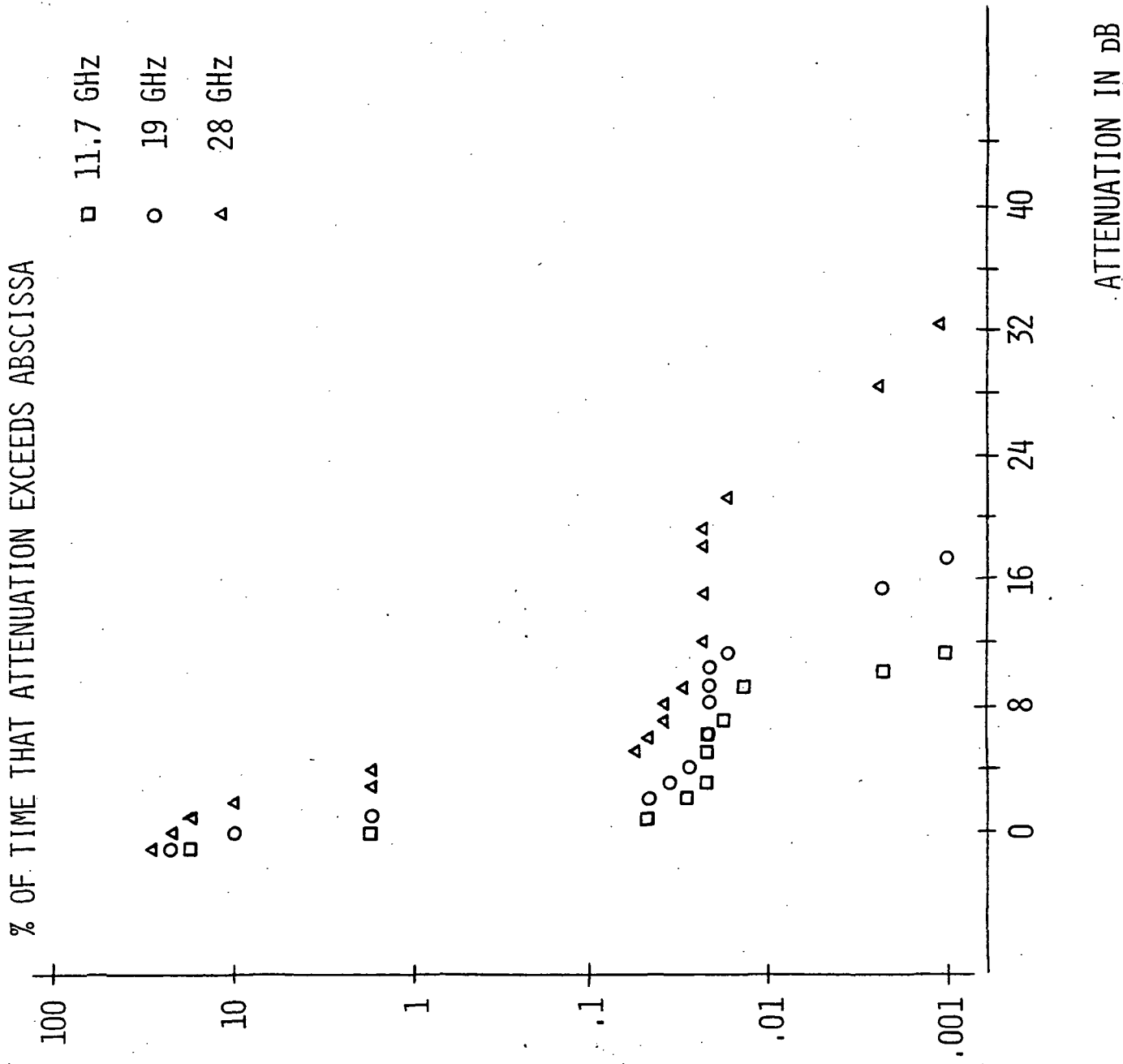


Figure 2.5-2. Attenuation statistics for April, 1977.
(Values for 19 and 28 GHz are estimated from 11 GHz data)

RAIN	ACT	AV19	AV28	PER
.	.	0	0	24.907
.	.	0	1	19.828
.	0	.	2	17.557
.	.	.	2	16.915
.	.	1	3	11.023
.	.	.	3	11.021
.	.	.	.	5.107
.	.	.	.	2.437
.	.	.	.	1.803
.	1	2	4	1.534
.	.	.	5	1.528
.	.	.	.	1.525
.	.	.	.	0.890
.	.	.	.	0.588
.	.	.	.	0.450
.	.	.	.	0.337
.	.	.	.	0.240
.	.	.	.	0.174
10	.	.	.	0.152
11	.	.	.	0.091
12	.	.	.	0.074
13	.	.	.	0.067
14	.	.	.	0.062
.	.	.	6	0.061
15	.	.	.	0.051
16	.	.	.	0.044
17	.	.	.	0.043
.	.	3	.	0.041
18	2	.	7	0.039
18	.	.	.	0.038
19	.	4	8	0.035
20	.	.	9	0.034
21	.	.	.	0.029
22	.	5	10	0.027
23	0	6	14	0.024
.	0	6	14	0.024
24	.	9	16	0.023
.	.	10	16	0.021
25	.	11	20	0.020
26	3	12	22	0.019
27	.	.	.	0.017
28	.	.	.	0.016
29	.	.	.	0.014
30	1	.	.	0.013
31	.	.	.	0.012
32	.	.	.	0.007
33	.	.	.	0.006
34	.	.	.	0.005
35	.	.	.	0.005
36	11	16	29	0.002
37	14	21	39	0.001
100	16	24	45	0.000

ORIGINAL PAGE IS
OF POOR QUALITY

Table 2.5-2. Attenuation and rain rate percent-of-time data for April, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

ORIGINAL PAGE IS
OF POOR QUALITY

ICIS	PERCENT
10.27	0.002
22.08999	0.003
23.80	0.003
23.88999	0.006
24.47	0.008
24.80	0.011
24.08999	0.012
24.88001	0.014
25.28	0.017
25.29	0.019
26.20	0.022
26.40	0.025
26.88001	0.028
26.89001	0.028
27.07999	0.031
27.29	0.033
27.80	0.036
27.80	0.039
28.00	0.042
28.29	0.045
28.47999	0.050
28.48	0.054
28.47	0.056
28.88999	0.057
28.89001	0.060
29.08999	0.063
29.09	0.064
29.27999	0.067
29.20	0.068
29.27	1.174
29.49	1.004
29.49001	1.802
29.88999	1.745
29.88999	2.433
29.89001	2.877
30.08999	2.770
30.09	3.000
30.27	3.000
30.29999	3.059
30.47	3.002
30.49001	3.479
30.49999	0.220
30.88999	0.250
30.88999	0.410
30.88999	0.300
30.89001	0.737
30.9	0.909
31.07	7.120
31.1	7.750
31.10001	0.504
31.29	8.799
31.29999	9.174
31.47	9.810

Table 2.5-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for April, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

LOTS	PERCENT
01.44001	10.749
01.44999	10.750
01.50001	10.905
01.64001	11.379
01.64999	11.577
01.7	13.221
01.88999	13.491
01.89001	13.528
01.9	13.827
02.09	13.890
02.1	16.673
02.10001	16.770
02.29	17.919
02.29999	18.480
02.30001	18.507
02.49	18.570
02.49001	18.630
02.49999	20.702
02.50001	22.402
02.68999	22.540
02.69001	22.613
02.69999	24.493
02.7	24.614
02.88999	25.019
02.89001	25.225
02.9	26.843
03.09	27.204
03.1	27.524
03.10001	27.570
03.29	27.050
03.29999	29.607
03.30001	29.952
03.49	31.132
03.49001	31.142
03.49999	31.344
03.50001	31.719
03.68999	32.029
03.69001	32.183
03.69999	33.631
03.7	34.523
03.89001	34.590
03.9	34.794
04.09	37.341
04.1	36.607
04.29	37.639
04.29999	38.450
04.30001	38.910
04.49	39.184
04.49001	39.251
04.49999	40.508
04.50001	41.513
04.68999	41.541
04.69001	41.600
04.7	41.719
04.88999	42.450

Table 2.5-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for April, 1977.

Table 2.5-4. Regression equations for the month of April, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 24.46 + 7.57 \log_{10} A$	31	.07	ID			ID		
A on R at equal probability levels.	$A = 0.84 * R^{.66}$	5	.82	ID			ID		
Attenuation scaling. A (11) at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (19) at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (28) at equal probability levels.	ID			ID			ID		

2.6 May, 1977

19 GHz attenuation values are scaled. 28 GHz isolation data are suspect because of an antenna defect.

Table 2.6-1.

Key parameters for the month of May, 1977.

1. Rain Data

VPI&SU Accumulation, 49.63 mm

USWS Accumulation, 67.06 mm

Peak VPI&SU Rate, 133.90 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 60.00%	R > 20 mm/hr, 42.27%	R > 50 mm/hr, 13.08
R > 30 mm/hr, 30.18%	R > 40 mm/hr, 19.14%	

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-80.20	30.11	16.67
19.04V	-81.04	44.56(s)	-----
19.04H	-84.01	----	-----
28.56	-85.96	81.60	-----

MAY 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

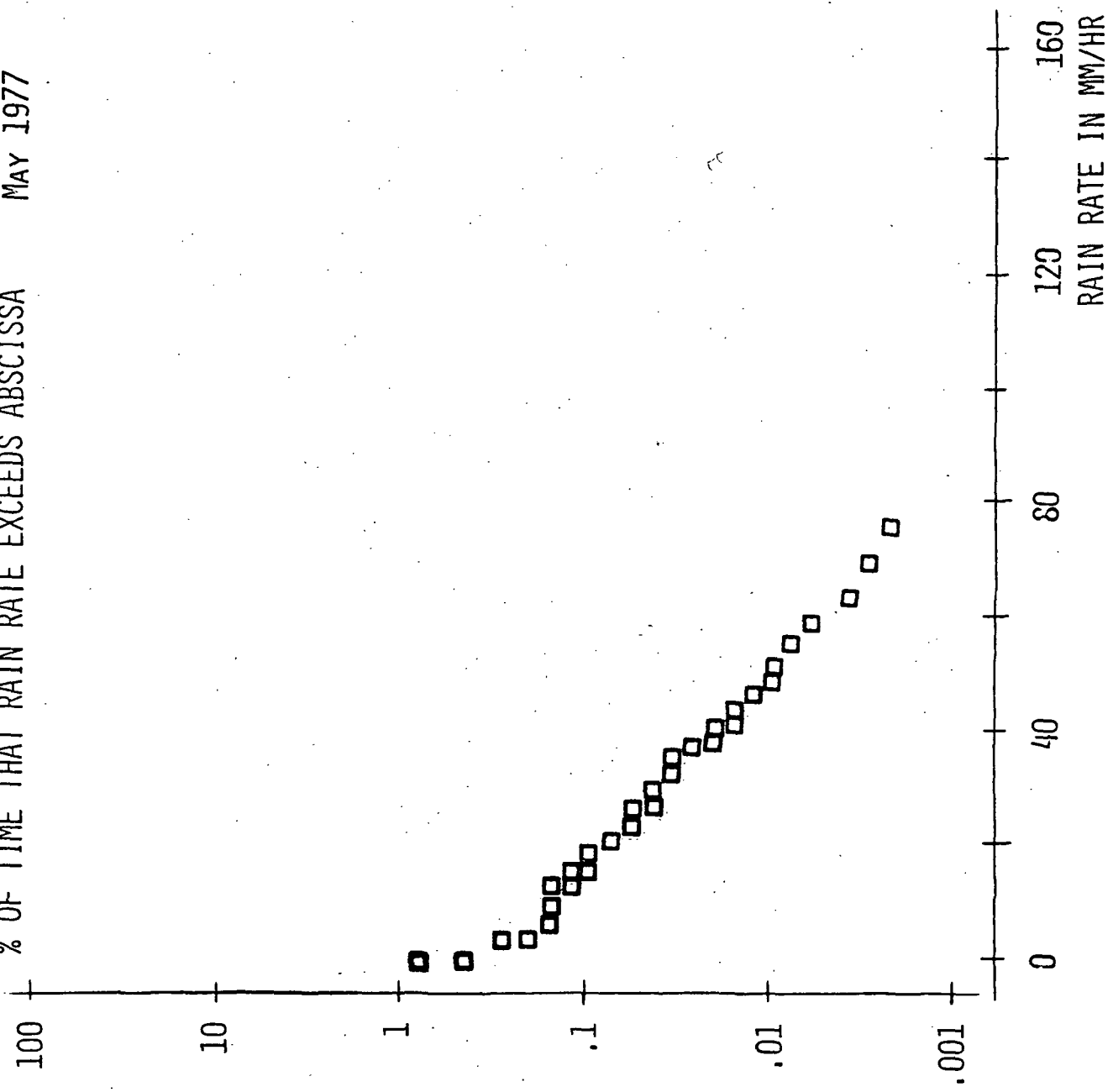


Figure 2.6-1. Rain rate statistics for May, 1977.

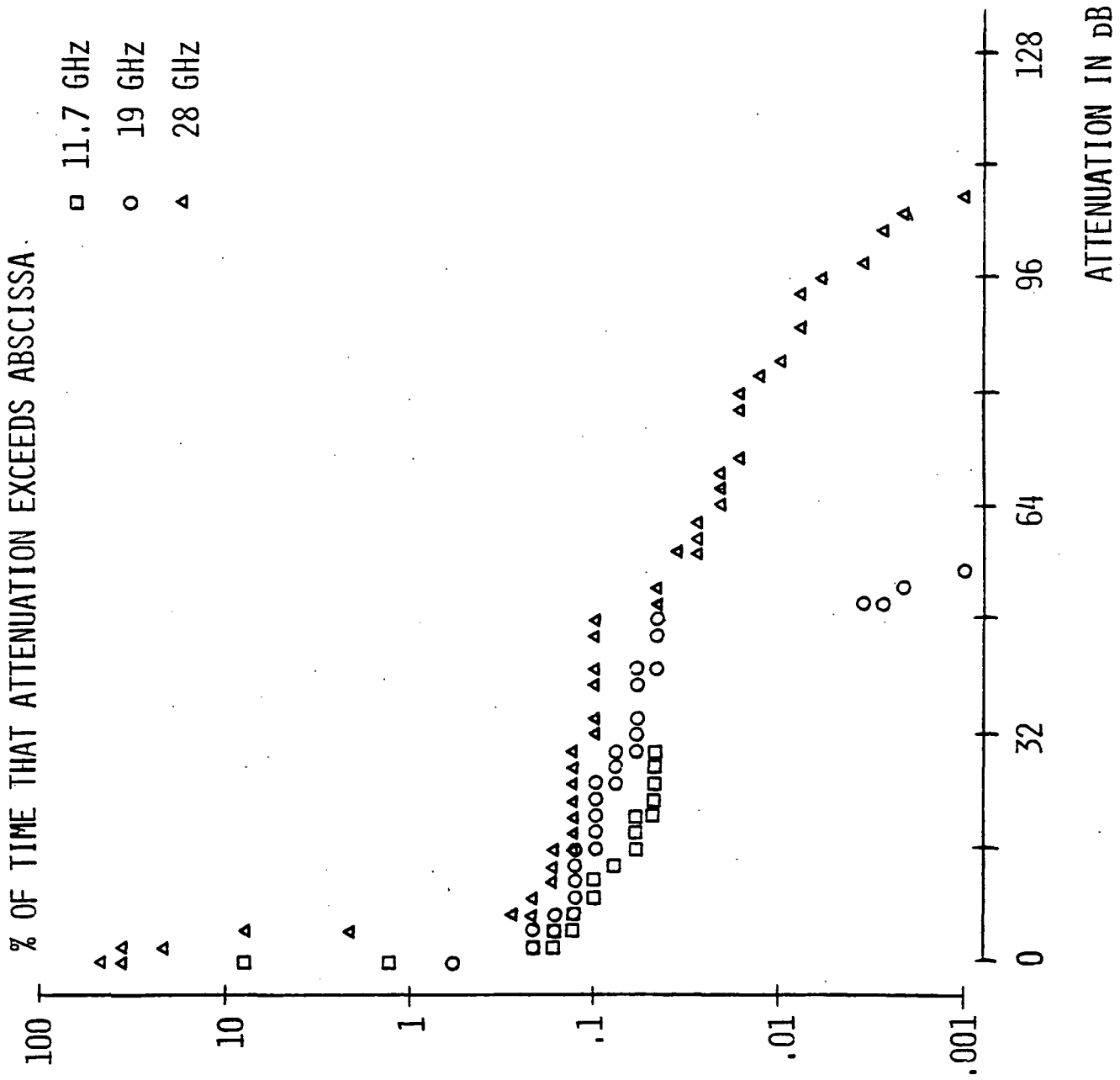


Figure 2.6-2. Attenuation statistics for May, 1977.
(Values for 19 GHz are estimated.)

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	.	0	42.021
.	.	.	1	40.289
.	.	.	2	34.380
.	.	.	3	20.604
.	0	.	4	7.576
.	.	.	5	6.837
.	1	.	.	2.223
0	.	.	.	1.227
.	.	0	.	0.765
.	.	1	.	0.603
1	.	.	.	0.575
.	.	.	.	0.425
2	.	.	.	0.312
.	.	.	.	0.271
.	.	.	6	0.268
.	.	.	7	0.243
.	.	2	.	0.259
.	2	.	8	0.229
.	.	.	.	0.227
.	.	3	.	0.216
.	.	.	9	0.213
4	.	.	.	0.211
.	.	.	10	0.201
.	.	4	.	0.197
.	.	.	11	0.188
5	.	.	.	0.186
.	.	.	.	0.180
6	.	5	.	0.179
.	.	.	12	0.177
7	.	.	13	0.171
.	3	.	.	0.168
.	.	6	.	0.167
.	.	.	14	0.160
8	.	.	.	0.151
.	4	.	.	0.148
.	.	.	15	0.147
10	.	7	.	0.145
.	.	.	16	0.142
11	.	.	.	0.141
.	.	8	17	0.137
.	5	9	18	0.136
12	.	.	.	0.132
.	.	10	21	0.129
.	.	11	23	0.128
.	0	.	24	0.120
.	.	12	25	0.123
.	.	13	27	0.122
13	.	.	.	0.119
.	7	.	28	0.118
.	.	14	29	0.117
.	.	15	30	0.114
.	.	16	33	0.111
14	.	.	.	0.110
.	8	.	.	0.109

Table 2.6-2. Attenuation and rain rate percent-of-time data for May, 1977.
Note: 19 GHz points are scaled.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
15	.	17	35	0.108
.	.	.	38	0.102
.	9	19	39	0.101
.	10	20	41	0.100
16	.	22	45	0.099
.	.	.	46	0.096
.	11	23	47	0.095
.	.	24	48	0.094
.	12	25	.	0.093
17	.	.	.	0.092
18	13	26	.	0.087
.	.	28	.	0.081
19	.	.	.	0.074
.	14	29	.	0.073
20	15	30	.	0.068
21	.	32	.	0.065
22	16	33	.	0.064
.	.	.	.	0.063
.	.	34	.	0.062
.	17	35	.	0.061
23	.	38	.	0.059
24	19	39	.	0.058
25	.	.	.	0.057
.	20	41	.	0.056
.	21	42	.	0.052
.	22	45	50	0.050
26	23	46	.	0.049
27	.	48	.	0.046
.	24	49	.	0.047
.	25	.	.	0.046
28	26	.	53	0.045
.	27	.	.	0.044
.	30	.	.	0.043
29	.	.	.	0.041
.	.	.	56	0.039
30	.	.	57	0.038
31	.	.	.	0.036
33	.	.	.	0.035
34	.	.	.	0.031
.	.	.	58	0.030
35	.	.	.	0.029
.	.	.	60	0.028
.	.	.	61	0.026
36	.	.	.	0.024
37	.	.	65	0.022
.	.	.	67	0.021
38	.	.	.	0.020
40	.	.	69	0.019
41	.	.	70	0.018
43	.	.	77	0.017
44	.	.	79	0.016
45	.	.	.	0.015
46	.	.	82	0.013
48	.	.	.	0.012

Table 2.6-2 (continued). Attenuation and rain rate percent-of-time data for May, 1977.
Note: 19 GHz points are scaled.

RAIN	ACTS	AV19	AC28	PER
49	.	.	85	0.011
51	.	.	90	0.009
52	.	.	93	0.008
54	.	.	97	0.007
59	.	.	99	0.006
63	.	.	102	0.004
75	.	.	105	0.003
102	.	50	108	0.002
112	.	51	120	0.001
155	50	52		0.000
		54		
		60		

Table 2.6-2 (continued). Attenuation and rain rate percent-of-time data for May, 1977.
Note: 19 GHz points are scaled.

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

ICIS	PERCENT
16.00	0.002
17.40	0.004
17.60	0.007
17.80	0.011
17.88001	0.012
18.07999	0.016
18.40	0.018
18.60999	0.019
18.80	0.028
19.27999	0.032
19.28	0.037
19.47999	0.042
19.48	0.046
19.80	0.049
19.88	0.053
19.88001	0.055
20.08001	0.068
20.28	0.082
20.29	0.064
20.40	0.067
20.49	0.071
20.68	0.074
20.88	0.078
21.27999	0.085
21.28	0.088
21.29	0.095
21.60	0.101
21.80999	0.104
22.09	0.108
22.27999	0.108
22.28	0.109
22.49	0.115
22.68999	0.115
23.48	0.116
24.08999	0.118
24.09	0.120
24.29	0.127
25.49	0.131
25.68999	0.138
26.29	0.141
26.49	0.145
26.80001	0.152
26.89001	0.157
27.09	0.291
27.29	0.300
27.40	1.283
27.50	1.284
27.69001	1.288
27.86999	1.305
27.89001	1.307
28.07999	2.079
28.08999	2.402
28.09	3.091

Table 2.6-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
28.23	4.199
28.29	5.181
28.45	5.187
28.49	5.537
28.49001	7.134
28.500	7.130
28.50999	7.296
28.53	9.212
28.88001	9.507
28.88999	11.570
28.89001	11.640
28.89999	12.589
29.07999	15.073
29.09	15.340
29.28	15.160
29.29	15.160
29.40	15.344
29.49	15.710
29.49001	16.200
29.500	16.170
29.50999	18.480
29.59001	19.423
29.59999	20.250
29.69001	20.300
29.69999	21.780
30.04	22.292
30.29	22.414
30.29999	23.610
30.49	23.712
30.49001	24.102
30.49999	24.700
30.50999	24.397
30.59001	25.800
30.59999	26.034
30.7	26.842
30.80999	26.222
30.89001	27.637
30.9	26.034
31.09	28.501
31.1	28.790
31.10001	30.287
31.29	30.520
31.29999	30.504
31.30001	31.040
31.49	31.180
31.49001	31.510
31.49999	31.800
31.50001	32.000
31.50999	32.921
31.7	32.951
31.88999	33.020
31.89001	33.407
31.9	33.201
32.00	34.700
32.1	35.004
32.29	35.004

Table 2.6-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
32.29999	36.795
32.30001	37.326
32.49001	38.125
32.49999	39.047
32.50001	39.592
32.68999	39.802
32.69001	40.460
32.7	41.237
32.88999	42.380
32.89001	43.250
32.9	43.750
33.09	44.282
33.1	45.389
33.10001	45.589
33.29	46.092
33.29999	47.817
33.30001	49.117
33.49	49.807
33.49001	49.810
33.50001	50.133
33.68999	51.956
33.69001	52.861
33.7	53.423
33.88999	53.605
33.89001	53.894
33.9	55.782
34.09	56.066
34.1	56.503
34.10001	56.964
34.29	57.274
34.30001	57.994
34.49	59.095
34.49001	59.245
34.49999	59.471
34.50001	59.621
34.68999	60.259
34.69001	60.709
34.69999	61.314
34.7	62.560
34.88999	62.562
34.89001	62.763
34.9	64.687
35.09	64.920
35.1	65.243
35.29	65.868
35.29999	66.017
35.30001	66.155
35.49	66.968
35.49001	67.012
35.49999	69.048
35.50001	69.521
35.68999	69.724
35.69001	69.870
35.69999	69.974
35.7	71.103

Table 2.6-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.

Table 2.6-4. Regression equations for the month of May, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 38.24 - 15.38^* \log_{10}(A)$	156	.86	ID			$I = 37.07 - 11.95^* \log_{10}(A)$	30432	.10
A on R at equal probability levels.	$A = 3.16^* R^{.56}$	5	.87	$A = 5.33^* R^{.53}$	14	.62	$A = 5.69^* R^{.67}$	19	.89
Attenuation scaling. A (11) at equal probability levels.				$A(11) = .40^* A(19)^{1.07}$	16	.93	$A(11) = .09^* A(28)^{1.32}$	8	.89
Attenuation scaling. A (19) at equal probability levels.	$A(19) = 2.77^* A(11)^{.88}$	16	.93				$A(19) = .44^* A(28)^{1.04}$	20	.96
Attenuation scaling. A (28) at equal probability levels.	$A(28) = 7.44^* A(11)^{.68}$	8	.89	$A(28) = 2.49^* A(19)^{.92}$	20	.96			

ORIGINAL PAGE IS OF POOR QUALITY

2.7 June, 1977

28 GHz isolation data are suspect because of an antenna defect.

Table 2.7-1.

Key parameters for the month of June, 1977.

1. Rain Data

VPI&SU Accumulation, 105.22 mm

USWS Accumulation, 145.54 mm

Peak VPI&SU Rate, 136.57 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 41.92% R > 20 mm/hr, 31.40% R > 50 mm/hr, 14.46%

R > 30 mm/hr, 24.77% R > 40 mm/hr, 18.95%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-79.59	14.08	17.67
19.04V	-83.39	20.85	-----
19.04H	-85.07	-----	-----
28.56	-81.47	38.18	-----

JUNE 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

100

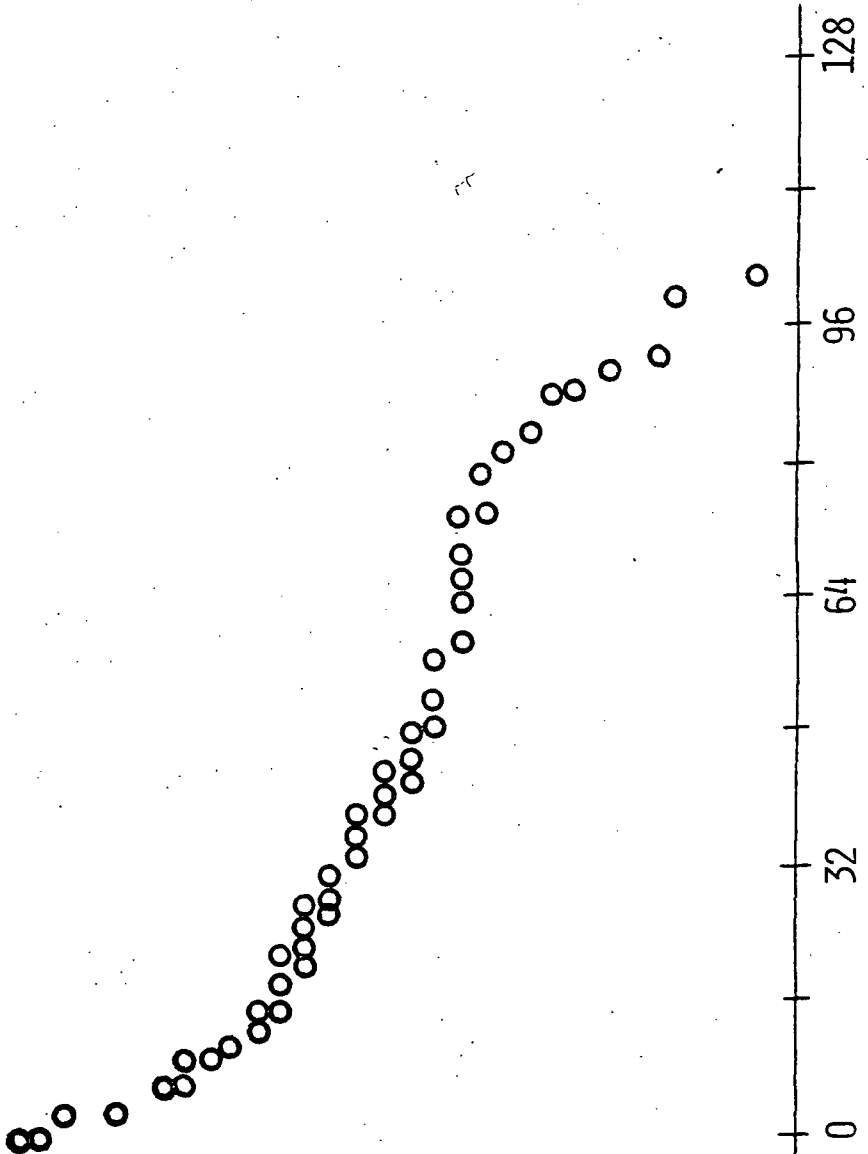
10

1

.1

.01

.001



RAIN RATE IN MM/HR

128

96

64

32

0

Figure 2.7-1. Rain rate statistics for June, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

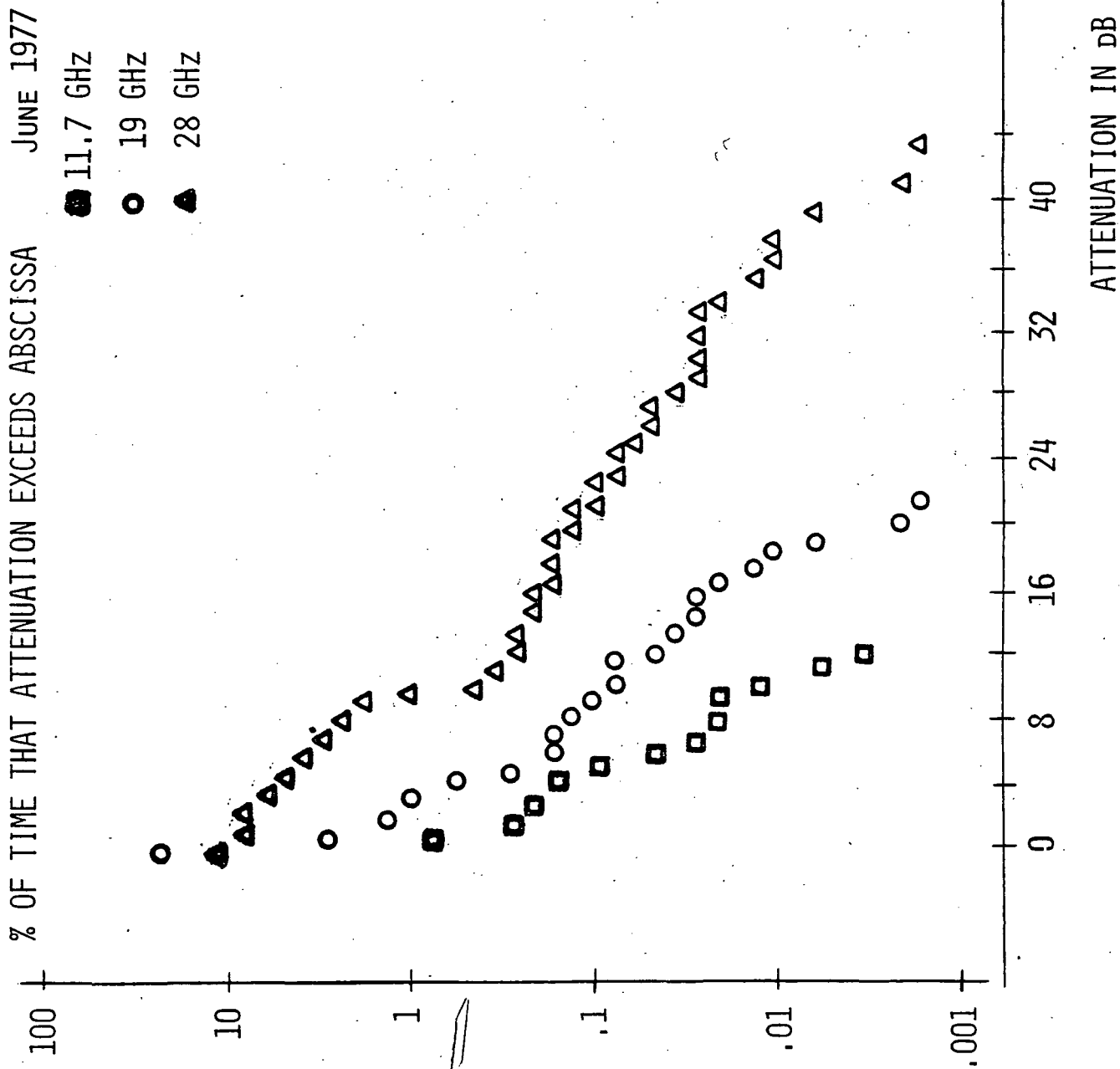


Figure 2.7-2. Attenuation statistics for June, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	.	25.500
.	.	.	0	13.228
.	0	.	.	10.283
.	.	.	1	9.966
.	.	.	2	9.207
.	.	.	3	8.105
.	.	.	4	5.901
.	.	.	5	4.739
.	.	.	6	3.662
0	.	.	7	2.944
.	.	.	8	2.344
1	.	.	.	2.256
.	.	1	.	1.661
2	.	.	9	1.441
.	.	.	.	1.386
3	1	.	.	1.152
.	.	2	.	1.102
4	.	.	.	0.752
.	.	3	.	0.697
5	.	.	10	0.530
.	.	.	.	0.524
6	.	4	.	0.465
.	.	.	.	0.420
7	.	.	11	0.398
.	.	5	.	0.371
8	2	.	.	0.350
.	.	.	.	0.339
9	.	.	.	0.324
10	.	.	12	0.306
.	.	.	.	0.282
11	3	.	13	0.247
.	.	.	.	0.237
12	.	6	.	0.236
.	.	.	14	0.227
13	.	.	.	0.220
14	.	.	15	0.200
.	4	.	.	0.198
15	.	7	.	0.186
.	.	.	16	0.179
16	.	8	.	0.173
.	.	.	17	0.163
17	.	.	.	0.161
.	.	.	.	0.155
.	.	.	18	0.147
.	.	.	.	0.140
.	.	9	.	0.139
.	.	.	.	0.136
.	.	.	19	0.127
.	.	.	.	0.126
.	5	.	.	0.123
.	.	.	.	0.121
.	.	.	20	0.120
.	.	.	.	0.113
.	.	10	.	0.109

Table 2.7-2. Attenuation and rain rate percent-of-time data for June, 1977.

RAIN	ACTS	AV19	AC28	PER
18	.	.	.	0.100
19	.	.	21	0.105
20	.	.	.	0.101
21	.	.	.	0.097
22	.	.	.	0.091
23	.	11	22	0.089
24	.	.	.	0.086
25	.	.	.	0.082
26	.	.	.	0.080
27	.	.	23	0.076
28	.	.	.	0.075
29	.	.	.	0.074
30	.	12	.	0.071
32	6	.	24	0.066
33	.	.	.	0.061
34	.	.	.	0.059
35	.	.	25	0.056
36	.	.	.	0.054
37	.	.	.	0.053
38	.	13	.	0.050
39	.	14	26	0.046
40	.	.	.	0.043
41	7	.	.	0.042
42	.	15	.	0.039
43	.	.	.	0.036
45	8	.	.	0.035
46	.	.	27	0.034
49	9	.	.	0.032
52	.	16	.	0.031
56	.	.	28	0.030
57	.	.	.	0.029
58	.	.	29	0.028
62	.	.	.	0.027
74	.	.	.	0.025
75	.	17	.	0.023
76	.	.	.	0.022
78	10	.	31	0.021
83	.	18	32	0.019
84	.	.	33	0.017
85	11	.	34	0.016
87	.	19	.	0.015
88	.	.	35	0.014
89	12	20	.	0.013
90	.	21	36	0.010
105	13	22	41	0.009
136	14	23	47	0.008

Table 2.7-2 (continued). Attenuation and rain rate percent-of-time data for June, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICIS	PERCENT
17.66999	0.005
18.46999	0.007
19.07999	0.014
19.88001	0.016
20.48	0.017
20.68	0.018
20.88	0.022
21.08001	0.025
21.28	0.026
21.88	0.027
22.07999	0.029
22.29	0.034
22.68	0.035
22.88	0.038
22.88999	0.041
23.09	0.042
23.68	0.046
23.68999	0.047
24.08001	0.050
24.28	0.056
24.29	0.058
24.48	0.060
24.49	0.061
25.29	0.068
25.49	0.073
25.68	0.075
25.88999	0.080
26.09	0.095
26.49	0.099
26.69001	0.111
26.88	0.112
26.88999	0.114
26.89001	0.120
27.07999	0.130
27.08001	0.137
27.09	0.140
27.29	0.143
27.48	0.144
27.49	0.150
27.49001	0.165
27.68	0.211
27.68999	0.220
27.69001	0.810
27.88	0.912
27.88001	0.914
27.88999	3.293
27.89001	3.293
28.07999	4.044
28.08001	4.060
28.09	5.985
28.28	5.986
28.29	6.928
28.48	7.238

Table 2.7-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.

ICTS	PERCENT
28.49	10.880
28.49001	10.867
28.68	11.460
28.68999	14.120
28.69001	15.730
28.88	15.971
28.88001	16.338
28.88999	17.384
28.89001	17.405
29.08999	18.019
29.09	18.129
29.27999	18.433
29.28	18.600
29.29	20.622
29.48	20.737
29.49	23.505
29.49001	25.084
29.68	25.231
29.68999	28.567
29.69001	28.564
29.88999	28.814
29.89001	28.823
30.08999	29.178
30.09	30.169
30.29	31.599
30.29999	34.388
30.49	35.399
30.49001	35.767
30.49999	36.528
30.68999	36.544
30.69001	36.557
30.69999	36.588
30.7	36.591
30.88999	36.893
30.89001	37.191
30.9	37.667
31.08999	38.019
31.09	38.452
31.1	40.355
31.10001	41.390
31.29	42.185
31.29999	43.159
31.49	43.181
31.49001	43.183
31.49999	43.201
31.68999	43.371
31.69001	43.527
31.69999	43.719
31.7	44.122
31.88999	44.120
31.89001	44.410
31.9	48.299
32.08999	48.300
32.09	49.615
32.1	50.914

Table 2.7-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
32.29	50.953
32.29999	51.059
32.30001	51.248
32.49	51.616
32.49001	51.617
32.49999	51.891
32.50001	52.203
32.68999	52.330
32.69001	52.423
32.69999	52.623
32.7	56.466
32.88999	56.651
32.89001	57.648
32.9	58.452
33.08999	58.454
33.09	58.514
33.1	60.189
33.29	60.901
33.29999	61.382
33.30001	62.244
33.49	62.517
33.49001	62.575
33.49999	64.823
33.50001	65.429
33.68999	65.696
33.69001	66.079
33.69999	66.328
33.7	66.821
33.88999	66.827
33.89001	67.526
33.9	69.660
34.08999	69.663
34.09	70.264
34.1	71.259
34.10001	71.640
34.29	72.316
34.29999	73.980
34.30001	74.415
34.49	74.492
34.49999	74.983
34.50001	75.135
34.68999	75.178
34.69001	75.740
34.7	76.348
34.88999	76.349
34.89001	76.964
34.9	78.297
35.09	78.706
35.1	79.753
35.29	79.936
35.29999	80.399
35.30001	81.050
35.49	81.104
35.49001	81.446
35.49999	81.599

Table 2.7-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.

Table 2.7-4. Regression equations for the month of June, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 39.51 - 15.43^* \log_{10}(A)$	283	.33	$I = 29.44 - 5.8^* \log_{10}(A)$	255	.05	$I = 23.70 - 1.32^* \log_{10}(A)$	323	.00
A on R at equal probability levels.	$A = .88^* R - .57$	6	.95	$A = 2.84^* R - .43$	10	.95	$A = 5.77^* R - .41$	12	.88
Attenuation scaling. A (11) at equal probability levels.				ID			$A(11) = .15^* A(28)^{1.17}$	5	.99
Attenuation scaling. A (19) at equal probability levels.	ID						$A(19) = .63^* A(28)^{.85}$	4	.93
Attenuation scaling. A (28) at equal probability levels.	$A(28) = 5^* A(11)^{.84}$	5	.99	$A(28) = 2.05^* A(19)^{.98}$	4	.93			

2.8 July, 1977

All data collected are valid.

Table 2.8-1.

Key parameters for the month of July, 1977.

1. Rain Data

VPI&SU Accumulation, 48.67 mm

USWS Accumulation, 50.8 mm

Peak VPI&SU Rate, 201.10 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 71.65%	R > 20 mm/hr, 69.14%	R > 50 mm/hr, 56.20%
R > 30 mm/hr, 67.77%	R > 40 mm/hr, 64.61%	

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-81.69	50	11.07
19.04V	-85.96	57.26	*
19.04H	-86.92	57.26	*
28.56	-81.70	114.52	**

* System was not yet in operation.

** Antenna problems invalidated data.

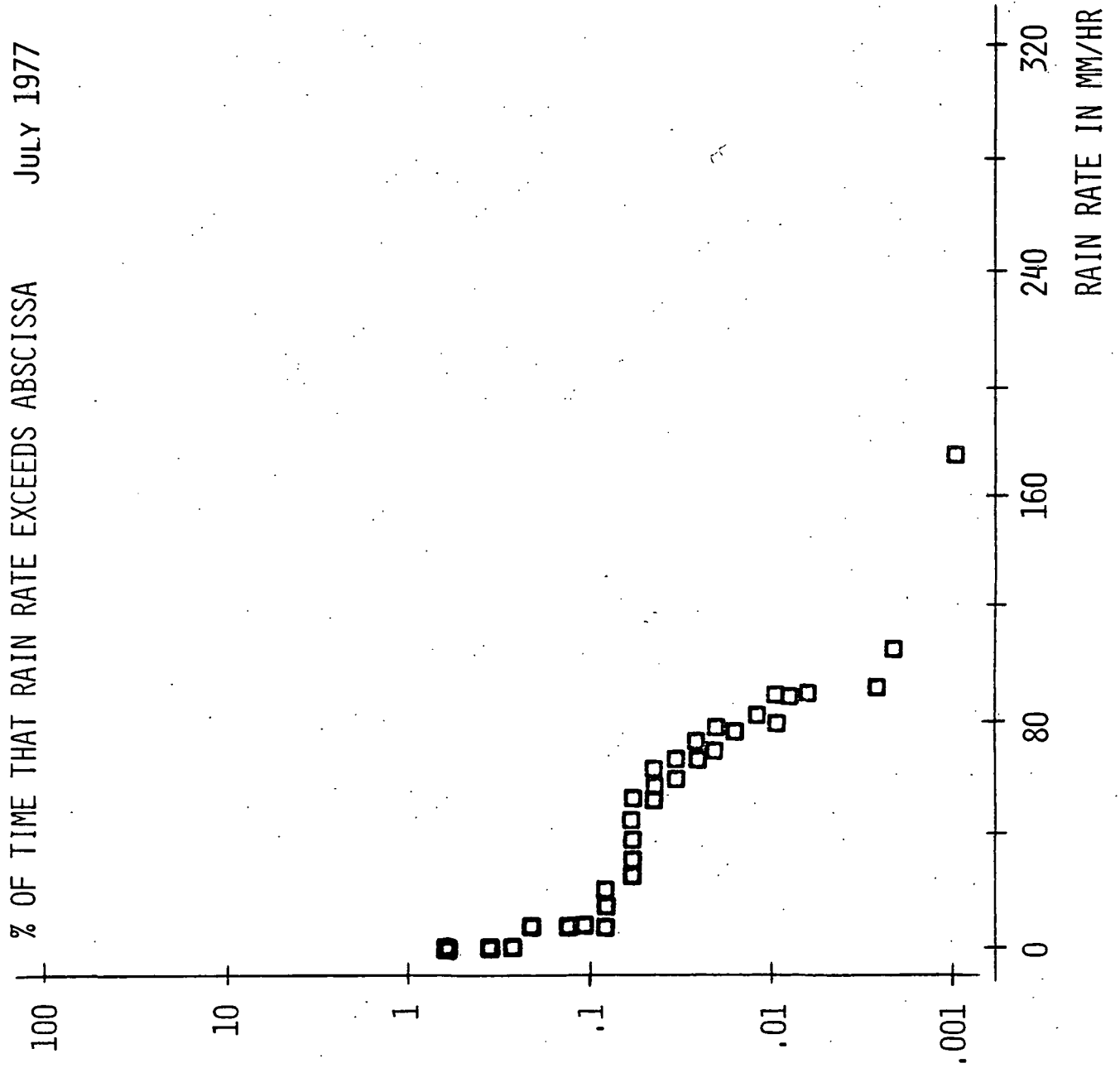


Figure 2.8-1. Rain rate statistics for July, 1977.

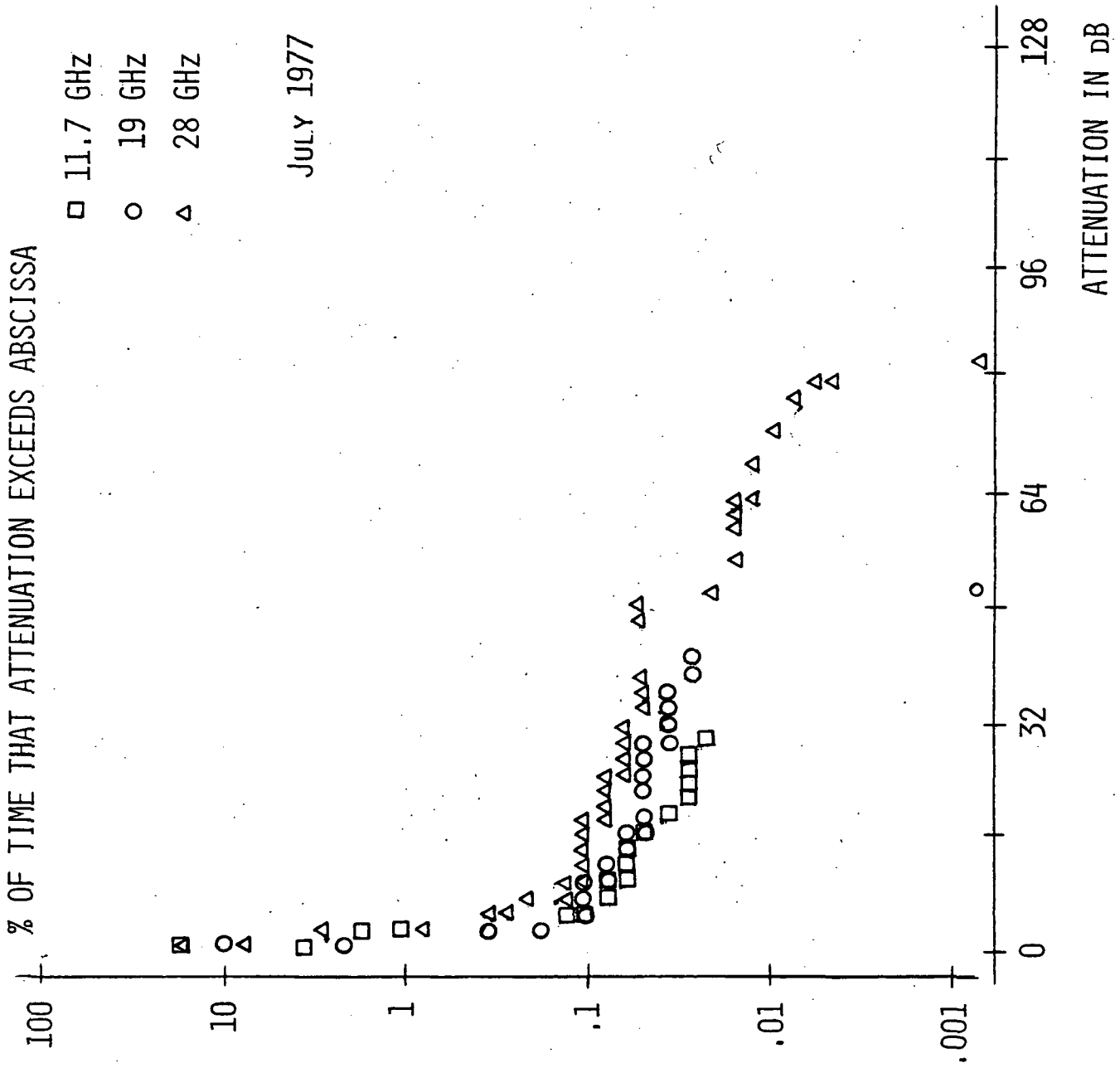


Figure 2.8-2. Attenuation statistics for July, 1977.

RAIN	ACTS	AV19	AC28	PER
.	0	.	0	23.338
.	.	.	.	19.957
.	.	0	.	15.422
.	1	.	1	9.274
.	.	.	2	5.303
.	2	1	.	3.266
.	3	.	.	2.971
0	.	.	3	1.999
.	.	.	4	0.963
1	.	2	.	0.872
.	.	.	5	0.517
2	.	.	.	0.427
.	.	.	6	0.422
3	.	.	.	0.344
.	.	3	.	0.317
.	4	.	7	0.262
.	.	.	8	0.211
.	.	4	.	0.186
.	.	.	9	0.176
4	.	5	.	0.149
.	.	.	10	0.133
5	5	.	.	0.132
.	.	.	11	0.120
.	6	6	.	0.111
.	.	.	.	0.110
.	.	7	.	0.109
.	7	.	12	0.108
.	.	8	.	0.106
6	8	.	13	0.105
.	.	.	.	0.101
7	9	10	11	0.100
.	.	.	12	0.097
.	10	.	13	0.095
8	11	.	.	0.092
.	.	.	14	0.091
.	12	.	.	0.090
10	13	11	15	0.088
.	.	.	18	0.086
.	14	.	.	0.084
13	15	12	.	0.083
15	.	.	19	0.082
24	16	.	20	0.080
27	.	.	21	0.078
29	.	12	.	0.076
31	.	.	22	0.075
34	15	13	.	0.072
.	.	.	.	0.071
.	.	15	.	0.069
.	.	.	23	0.068
.	.	.	.	0.067
.	.	.	.	0.066
.	.	.	24	0.065
.	.	16	26	0.064
.	.	18	27	0.063

Table 2.8-2. Attenuation and rain rate percent-of-time data for July, 1977.

RAIN	ACTS	AV19	AC28	PER
37	.	19	.	0.062
38	.	.	31	0.060
39	.	22	33	0.059
41	16	24	36	0.058
42	.	25	39	0.057
.	.	26	45	0.056
.	17	.	.	0.055
43	.	28	.	0.054
46	.	30	.	0.053
47	18	31	.	0.050
.	.	32	.	0.049
48	.	33	.	0.048
.	.	34	.	0.047
50	.	35	.	0.046
51	19	36	.	0.045
54	.	37	.	0.044
.	.	38	.	0.043
56	.	39	.	0.040
.	.	.	.	0.039
57	20	.	.	0.038
.	21	40	.	0.037
58	23	.	.	0.036
59	24	.	.	0.035
.	25	.	.	0.034
60	27	41	.	0.032
63	28	.	.	0.031
64	.	.	.	0.030
65	.	.	50	0.029
70	.	.	51	0.026
.	.	.	56	0.025
.	.	.	57	0.024
.	.	.	60	0.022
75	.	.	61	0.021
.	.	.	63	0.020
.	.	.	64	0.019
76	.	.	66	0.018
79	.	.	68	0.017
80	.	.	70	0.016
.	.	.	72	0.015
.	.	.	74	0.013
81	.	.	77	0.012
.	.	.	.	0.011
85	.	.	79	0.010
86	.	.	.	0.009
91	.	.	80	0.008
92	.	.	.	0.007
93	.	.	.	0.006
112	.	.	.	0.004
113	.	.	.	0.003
198	.	50	83	0.002
201	50	57	114	0.001
				0.000

Table 2.8-2 (continued). Attenuation and rain rate percent-of-time data for July, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
11.07	0.001
11.28	0.002
11.47001	0.004
11.60999	0.005
11.67	0.006
12.07	0.007
12.46999	0.016
12.48	0.017
13.07	0.020
13.07999	0.021
13.68	0.022
13.87	0.024
14.07999	0.026
14.67	0.028
15.28	0.031
15.48	0.032
15.88	0.034
16.08001	0.035
16.48	0.037
16.68	0.043
16.88	0.044
17.07999	0.045
17.08001	0.047
17.28	0.048
17.47999	0.050
17.48	0.051
17.87	0.052
18.68	0.055
19.27	0.056
19.27999	0.060
19.46	0.062
19.68	0.088
19.88	0.089
20.07999	0.091
20.28	0.095
20.68	0.097
20.68999	0.098
21.07999	0.100
21.08001	0.109
21.09	0.110
21.47999	0.127
21.48	0.130
21.68	0.136
21.88	0.141
21.88001	0.151
21.89001	0.153
22.07999	0.157
22.27999	0.658
22.46	0.641
22.68	0.662
22.88999	0.663
23.07999	0.956
23.08001	0.958

Table 2.8-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

IGTS	PERCENT
23.47999	1.067
23.48	1.105
23.68999	1.100
23.88	1.193
23.88999	1.220
24.27999	1.315
24.29	1.325
24.49	1.320
24.68	1.998
24.68999	2.197
25.07999	2.234
25.08999	2.397
25.27999	2.413
25.28	2.414
25.29	2.466
25.47999	2.745
25.48	3.038
25.49	3.044
25.88999	3.198
25.89001	3.199
26.07999	3.434
26.08001	3.435
26.09	3.714
26.27999	4.108
26.28	4.273
26.29	4.278
26.08	4.424
26.08999	4.447
26.08	5.122
26.88999	5.141
26.89001	5.251
27.08999	5.657
27.09	5.835
27.27999	5.900
27.29	5.945
27.48	6.432
27.49	6.550
27.68999	7.121
27.09001	7.151
27.88001	7.152
27.88999	7.476
27.89001	7.857
28.07999	8.315
28.09	8.364
28.27999	8.442
28.28	8.443
28.29	8.666
28.49	9.382
28.49001	9.601
28.68999	10.348
28.69001	10.788
28.88999	10.984
28.89001	11.100
29.07999	11.208
29.09	11.613

Table 2.8-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

ICTS	PERCENT
29.29	14.150
29.49	14.553
29.49001	14.569
29.68999	15.072
29.69001	15.083
29.88999	16.030
29.89001	16.976
30.08999	17.817
30.09	19.838
30.29	20.311
30.29999	20.344
30.49	20.892
30.49001	20.931
30.68999	22.089
30.69001	22.385
30.88999	23.114
30.89001	23.939
30.9	24.946
31.08999	25.095
31.09	25.180
31.1	25.323
31.29	25.762
31.49	26.408
31.49001	26.619
31.49999	26.867
31.68999	27.529
31.69001	28.524
31.7	28.857
31.88999	29.402
31.89001	29.952
31.9	30.950
32.08999	30.951
32.09	31.654
32.29	32.555
32.29999	32.848
32.49	33.871
32.49001	34.181
32.49999	34.427
32.50001	34.730
32.68999	35.649
32.69001	36.421
32.7	37.539
32.88999	37.956
32.89001	38.945
32.9	39.005
33.09	40.116
33.1	40.636
33.29	41.735
33.29999	41.870
33.30001	41.971
33.49	44.030
33.49001	44.699
33.49999	45.215
33.50001	45.250
33.68999	46.090

Table 2.8-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

Table 2.8-4. Regression equations for the month of July, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	I = 34.46 - 16.99* log ₁₀ (A)			I = 50.56 - 31.41* log ₁₀ (A)	265	.62	[1]		
A on R at equal probability levels.	A = 3.37* R.48	9	.86	A = 3.34* R.55			A = 3.51* R.65	18	.90
Attenuation scaling. A (11) at equal probability levels.				A(11)=1.07* A(19).86			A(11) = .71* A(28).898	6	.88
Attenuation scaling. A (19) at equal probability levels.	A(19) = 1.32 *A(11) 1.04	7	.90				A(19) = 1.42* A(28) 1.05	11	.99
Attenuation scaling. A (28) at equal probability levels.	A(28) = 1.54 *A(11) 1.09	6	.98	A(28) = .75 *A(19).94	11	.99			

[1] System malfunctioned during this month.

2.9 August, 1977

All data collected are valid. 11.7 GHz attenuation values for the last half of the month were scaled; a pedestal malfunction kept these from being recorded.

Table 2.9-1.

Key parameters for the month of August, 1977.

1. Rain Data

VPI&SU Accumulation, 56.61 mm

USWS Accumulation, 161.54 mm

Peak VPI&SU Rate, 121.73 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 74.21% R > 20 mm/hr, 64.46% R > 50 mm/hr, 38.77%

R > 30 mm/hr, 54.18% R > 40 mm/hr, 48.51%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	80.18	13.53	17.68
19.04V	85.74	36.59	6.11
19.04H	86.87	30.44	-----
28.56	83.04	73.18	11.91

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA AUGUST 1977

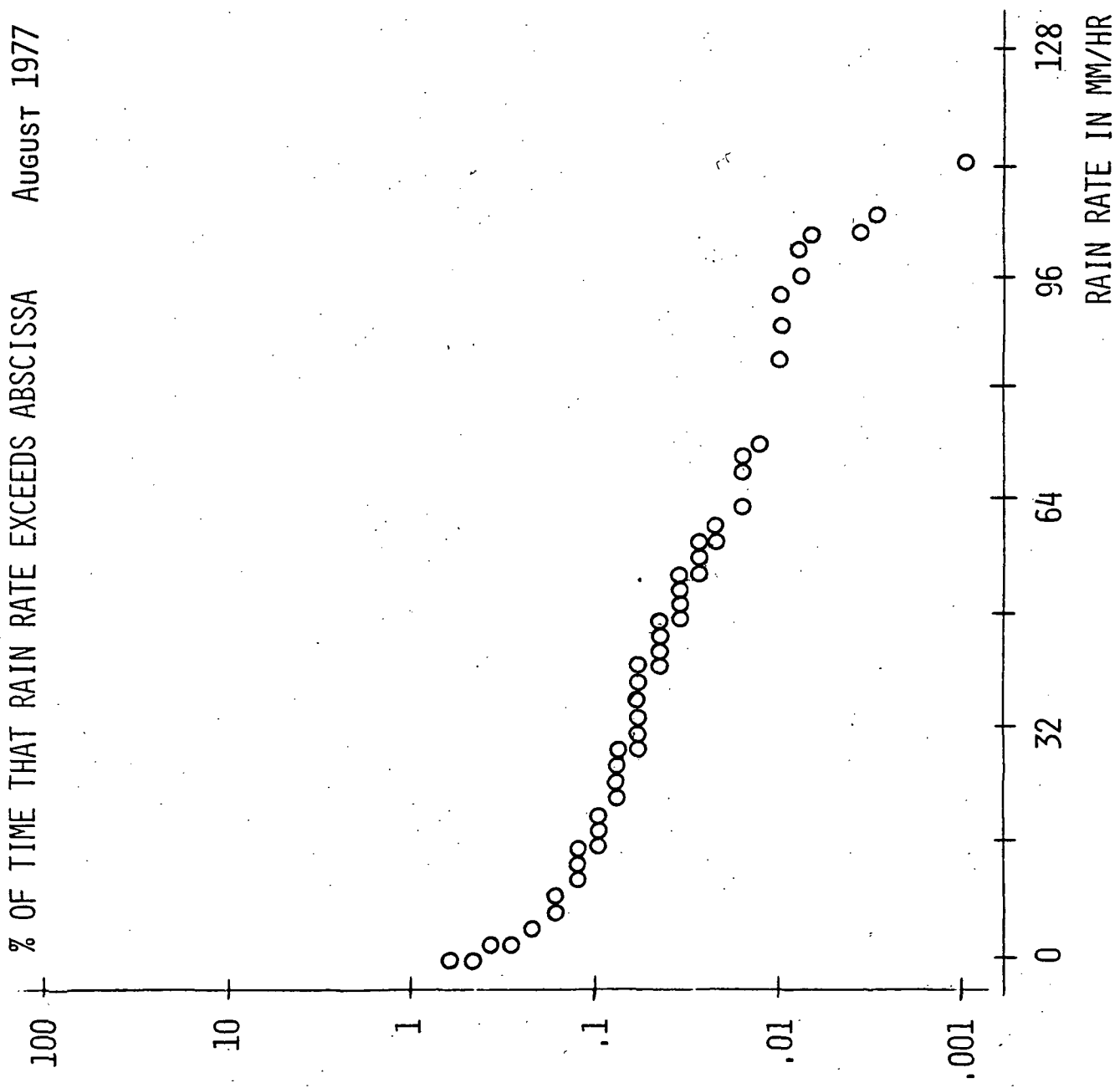


Figure 2.9-1. Rain rate statistics for August, 1977.

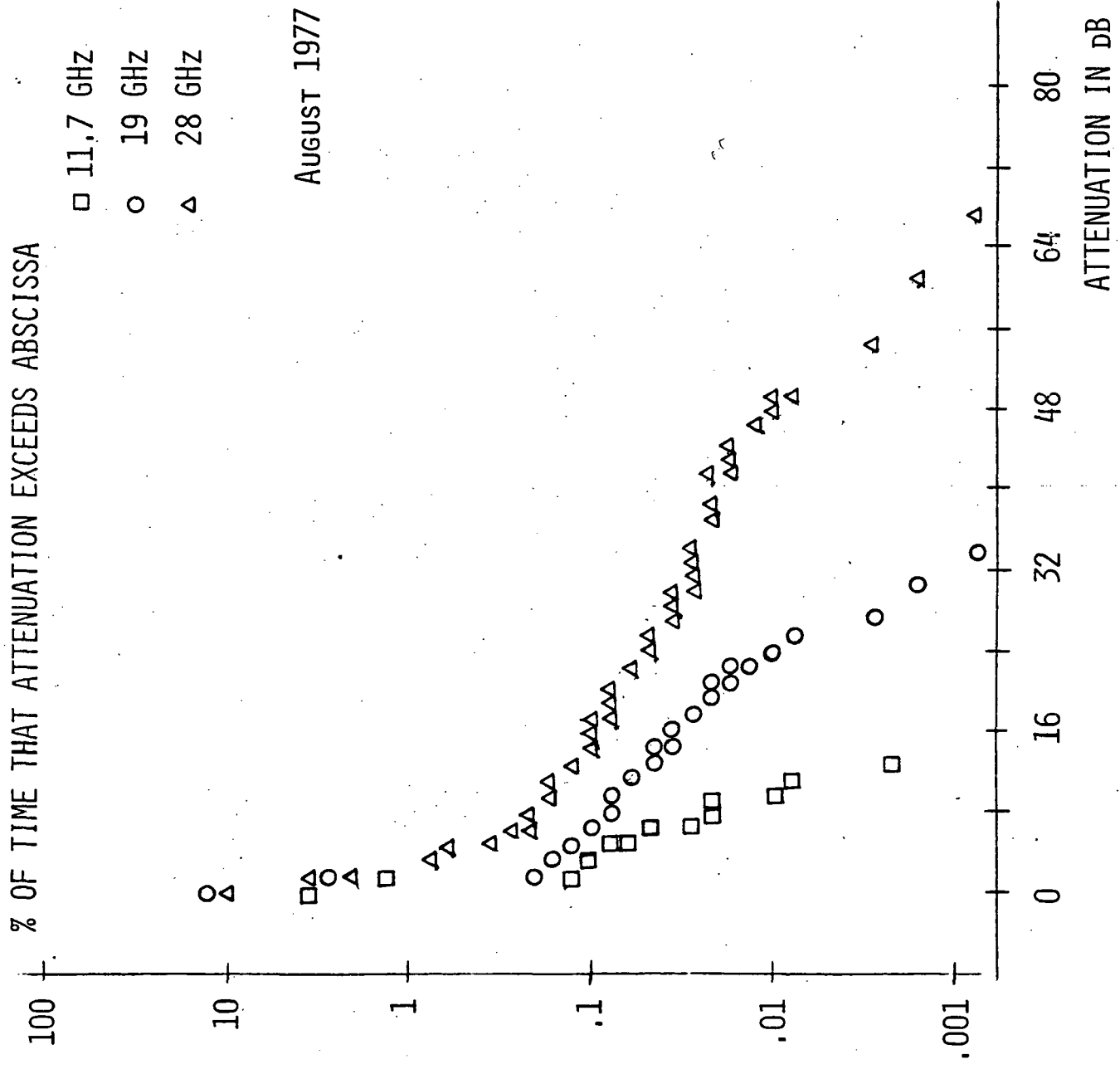


Figure 2.9-2. Attenuation statistics for August, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	.	17.511
.	.	.	0	14.210
.	0	.	1	4.566
.	.	.	1	4.353
.	.	1	2	3.181
.	.	.	2	2.756
.	1	.	3	1.636
.	.	.	3	1.021
0	.	.	4	0.691
.	.	.	5	0.653
1	.	.	.	0.477
2	.	.	.	0.457
.	.	.	6	0.388
3	.	2	.	0.341
.	.	.	7	0.309
.	.	3	.	0.295
4	.	.	8	0.281
.	.	.	8	0.239
5	.	.	9	0.233
6	.	.	.	0.217
7	.	.	10	0.211
8	.	.	.	0.206
9	.	.	11	0.196
.	.	4	.	0.189
10	.	.	11	0.183
11	.	.	.	0.180
12	2	.	.	0.171
13	.	.	12	0.167
14	.	.	.	0.158
15	.	5	.	0.155
16	.	.	.	0.152
17	.	.	13	0.148
18	3	.	14	0.142
19	.	6	14	0.140
20	.	.	15	0.134
21	.	.	.	0.129
.	.	.	16	0.125
22	.	.	17	0.122
23	4	.	.	0.120
24	.	.	18	0.118
.	.	7	.	0.112
.	.	.	.	0.111
.	.	.	.	0.110
.	.	.	19	0.106
.	.	8	18	0.105
.	.	.	.	0.103
.	.	.	19	0.102
.	.	.	20	0.099
.	.	.	20	0.095
.	.	9	.	0.092
.	.	.	.	0.090
22	.	10	21	0.085
23	.	.	.	0.084
24	5	.	.	0.083

Table 2.9-2. Attenuation and rain rate percent-of-time data for August, 1977.

RAIN	ACTS	AV19	AC28	PER
.	.	.	22	0.080
25	.	.	.	0.078
27	.	.	.	0.076
28	.	11	.	0.072
29	.	.	23	0.069
30	.	.	.	0.068
31	6	.	.	0.067
32	.	.	.	0.065
34	.	12	.	0.063
35	.	.	24	0.062
36	.	.	.	0.061
37	.	.	.	0.059
39	.	.	.	0.057
.	.	.	25	0.056
40	.	13	.	0.054
42	.	14	26	0.053
43	.	.	.	0.049
44	.	15	27	0.048
.	.	.	28	0.045
46	.	.	.	0.044
48	.	16	.	0.043
.	.	.	29	0.041
49	.	.	30	0.040
51	.	17	31	0.038
52	.	.	32	0.037
53	.	.	.	0.036
.	7	.	33	0.035
54	.	18	.	0.034
55	8	.	34	0.032
56	.	.	36	0.031
.	.	.	38	0.030
58	.	19	39	0.029
59	9	.	.	0.028
60	.	20	41	0.026
.	.	.	42	0.024
.	.	21	43	0.022
.	.	22	44	0.021
61	.	.	.	0.020
62	.	.	.	0.019
65	.	.	.	0.018
69	.	.	.	0.016
70	.	23	47	0.015
72	10	.	48	0.013
74	.	24	49	0.012
85	11	.	.	0.011
88	.	.	.	0.010
93	.	25	50	0.009
97	.	.	.	0.008
100	.	.	.	0.007
102	.	.	.	0.006
103	.	27	54	0.004
106	12	.	.	0.003
.	.	30	61	0.002

Table 2.9-2 (continued). Attenuation and rain rate percent-of-time data for August, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
112	.	33	67	0.001
121	13	36	73	0.000

Table 2.9-2 (continued). Attenuation and rain rate percent-of-time data for August, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
17.68	0.002
18.27999	0.005
18.48	0.009
19.07999	0.012
19.88	0.019
20.68	0.031
21.07999	0.033
21.08001	0.036
21.09	0.038
21.27999	0.040
21.48	0.043
21.68	0.050
21.88	0.055
22.07999	0.062
22.27999	0.071
22.28	0.078
22.68	0.081
22.69001	0.083
23.07999	0.090
23.48	0.092
23.49	0.095
23.89001	0.104
24.08999	0.107
24.09	0.114
24.29	0.116
24.49	0.119
24.49001	0.121
24.88999	0.123
25.29	0.128
25.08999	0.130
25.89001	0.266
26.08999	0.270
26.49	0.277
26.69001	0.386
26.88	0.389
26.88999	0.567
26.89001	0.605
27.07999	0.915
27.09	1.129
27.29	1.449
27.48	1.661
27.49	2.072
27.49001	2.075
27.68	3.040
27.68999	3.760
27.69001	5.086
27.88999	6.942
27.89001	10.774
28.07999	11.630
28.08001	11.822
28.08999	13.392
28.09	15.912
28.28	16.173

Table 2.9-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICIS	PERCENT
28.29	18.795
28.48	21.350
28.49	21.844
28.49001	22.280
28.68999	26.425
28.69001	30.600
28.88	31.037
28.88001	31.909
28.88999	33.588
28.89001	33.898
29.07999	34.120
29.09	35.340
29.27999	36.587
29.28	37.121
29.29	37.981
29.48	38.110
29.49	39.290
29.49001	39.360
29.68	39.598
29.68999	41.671
29.69001	41.995
29.88999	42.707
29.89001	45.265
30.08999	45.301
30.09	47.003
30.29	47.781
30.29999	48.184
30.49	48.973
30.49001	49.557
30.49999	52.767
30.68999	56.051
30.69001	56.112
30.69999	56.425
30.7	57.445
30.88999	62.476
30.89001	63.439
30.9	63.482
31.09	63.821
31.1	65.044
31.29	67.635
31.29999	68.965
31.30001	68.968
31.49	69.231
31.49001	69.279
31.49999	69.757
31.50001	70.168
31.68999	71.104
31.69001	71.905
31.69999	71.970
31.7	71.975
31.89001	72.942
31.9	74.587
32.08999	74.590
32.09	75.202
32.1	75.209

Table 2.9-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

ICTS	PERCENT
32.29	75.010
32.29999	76.638
32.30001	76.771
32.49	76.992
32.49001	77.878
32.49999	77.886
32.69001	78.187
32.7	79.498
32.88999	79.633
32.89001	79.944
33.09	80.321
33.1	80.650
33.29	82.049
33.49	82.267
33.49001	82.305
33.49999	82.575
33.68999	82.848
33.89001	83.351
33.9	83.872
34.08999	83.875
34.09	85.610
34.29	85.985
34.49	86.061
34.68999	86.099
34.69001	86.601
34.88999	86.608
34.89001	86.945
34.9	86.945
35.09	86.956
35.29	87.346
35.49	88.143
35.49001	88.290
35.68999	88.506
35.69001	88.752
36.08999	88.754
36.09	89.013
36.29	89.738
36.49	89.752
36.49001	90.120
36.68999	90.156
36.69001	90.375
36.88999	90.378
36.89001	90.661
37.09	91.004
37.29	91.287
37.30001	91.305
37.49	92.097
37.49001	92.195
37.69001	92.382
37.89001	92.726
38.09	92.842
38.1	92.956
38.29	94.065
38.30001	94.426
38.50001	94.468

Table 2.9-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

Table 2.9-4. Regression Equations for the month of August, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	I = 44.63 - 22.44 log ₁₀ (A)	131	.76	I = 43.91 - 19.8 log ₁₀ (A)	181	.71	I = 39.55 - 14.96* log ₁₀ (A)	2169	.24
A on R at equal probability levels.	A = .78* R.59	7	.99	A = .92* R.75	15	.99	A = 2.39* R.68	22	.95
Attenuation scaling. A (11) at equal probability levels.				ID			A(11) = .33* A(28).87	5	.99
Attenuation scaling. A (19) at equal probability levels.	ID						A(19) = .33* A(28) 1.11	15	.98
Attenuation scaling. A. (28) at equal probability levels.	A(28) = 3.61 *A(11) 1.13	5	.99	A(28) = 2.85 *A(19) .88	15	.98			

ID insufficient data

2.10 September, 1977

11.7 GHz attenuation data may have been influenced slightly by daily spacecraft shutdowns for eclipse. Where possible these were ignored in the statistical calculations. For the same reason the 11.7 GHz isolation data are questionable.

Table 2.10-1.

Key parameters for the month of September, 1977.

1. Rain Data

VPI&SU Accumulation, 46.61 mm

USWS Accumulation, 104.90 mm

Peak VPI&SU Rate, 60.80 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 32.20%	R > 20 mm/hr, 25.58%	R > 50 mm/hr, 6.75%
R > 30 mm/hr, 19.97%	R > 40 mm/hr, 12.39%	

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-81.63	15.38	14.48
19.04V	-85.42	25.41	22.52
19.04H	-87.01	24.59	-----
28.56	-81.51	50.81	15.51

SEPTEMBER 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

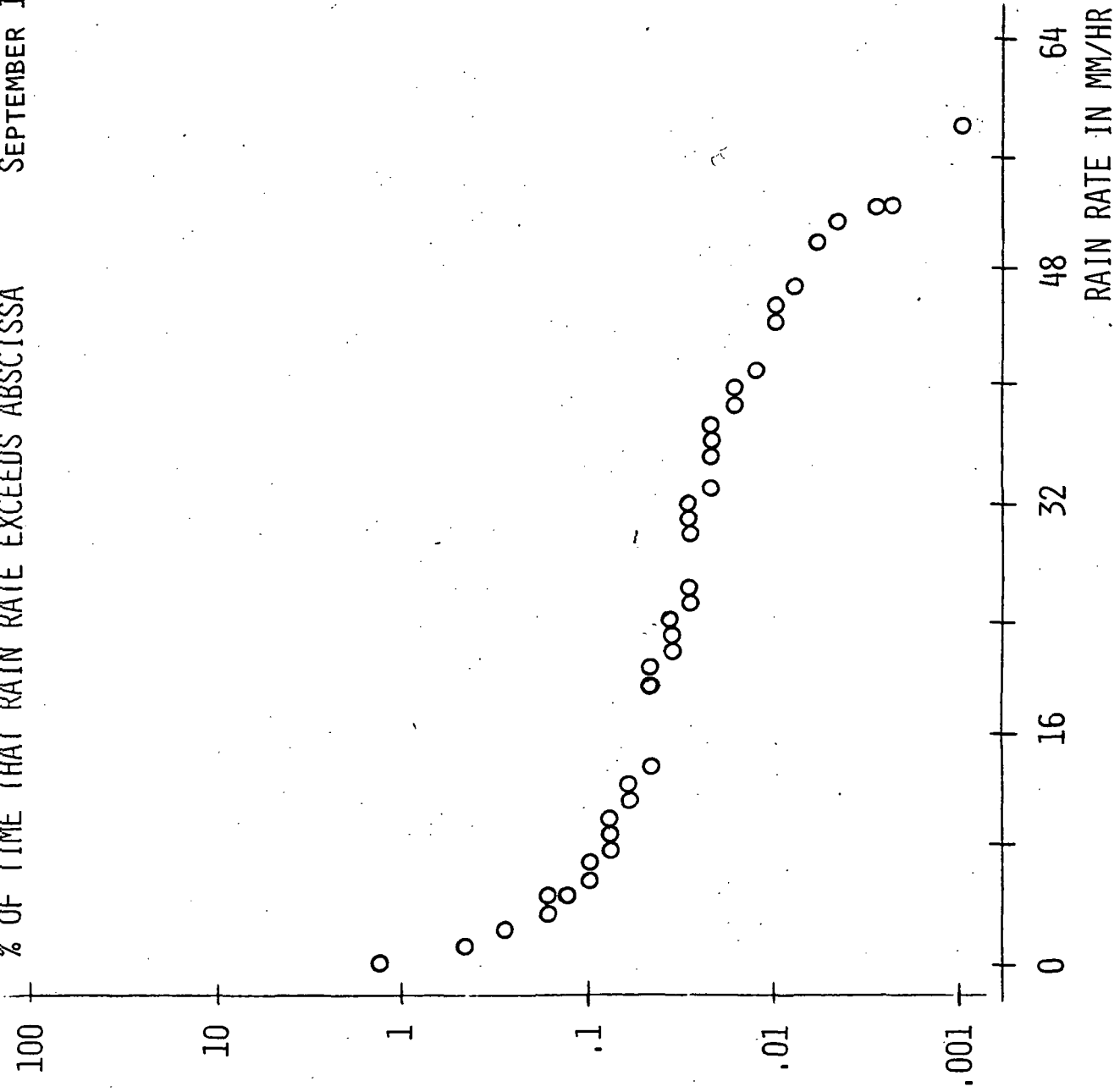


Figure 2.10-1. Rain rate statistics for September, 1977.

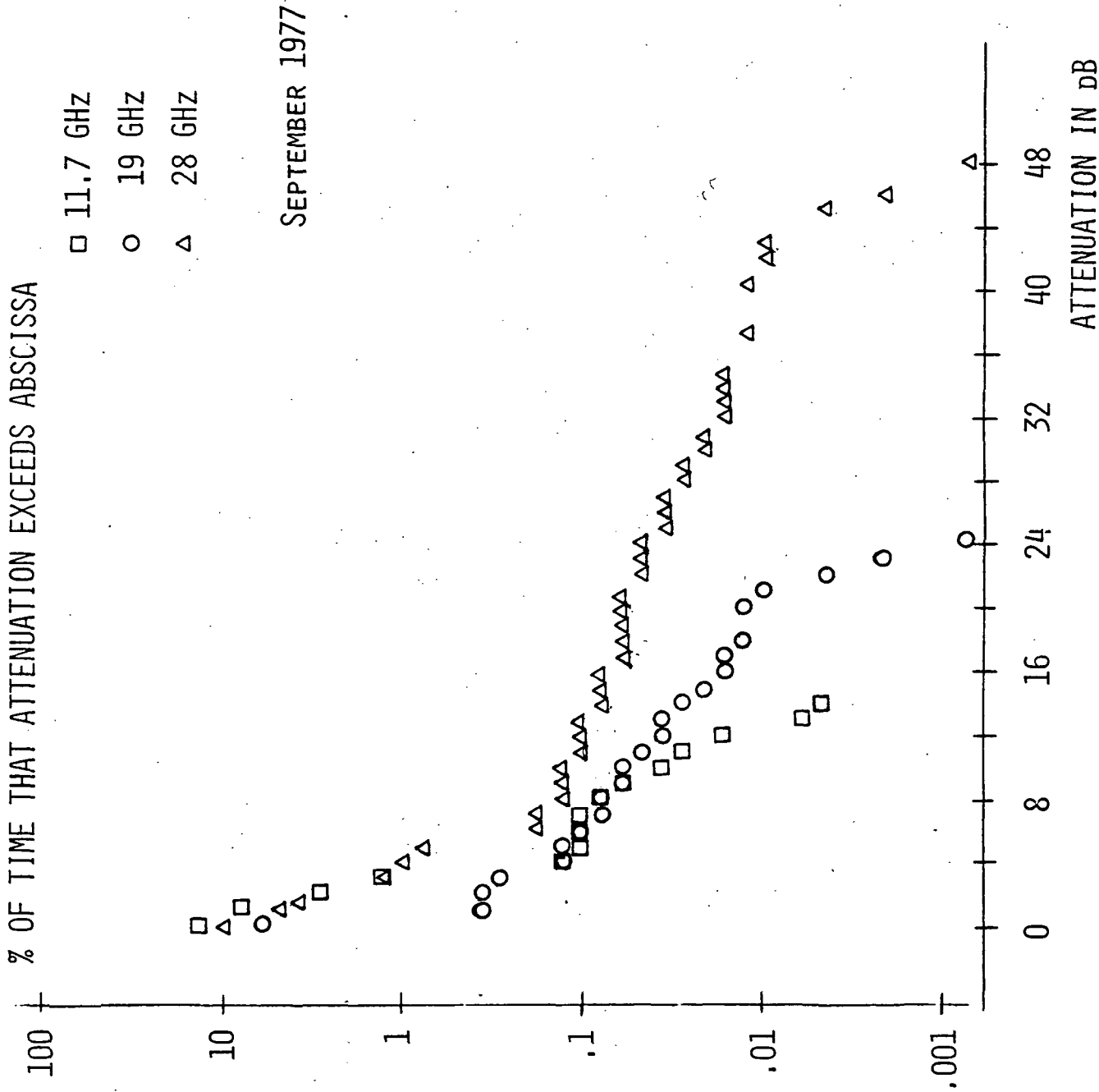


Figure 2.10-2. Attenuation statistics for September, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	0	.	0	18.049
.	1	.	1	13.563
.	2	0	2	10.202
.	3	.	3	8.103
0	4	.	4	5.608
.	5	.	5	4.824
.	6	.	6	3.451
.	7	.	7	2.743
.	8	.	8	1.550
.	9	.	9	1.365
1	10	.	10	1.268
.	11	1	11	0.886
.	12	2	12	0.507
.	13	3	13	0.506
.	14	4	14	0.407
.	15	5	15	0.359
2	16	6	16	0.318
.	17	7	17	0.259
.	18	8	18	0.179
.	19	9	19	0.174
.	20	10	20	0.168
3	21	11	21	0.159
.	22	12	22	0.152
.	23	13	23	0.149
.	24	14	24	0.141
.	25	15	25	0.133
.	26	16	26	0.132
.	27	17	27	0.131
.	28	18	28	0.126
.	29	19	29	0.125
5	30	20	30	0.124
.	31	21	31	0.116
.	32	22	32	0.112
.	33	23	33	0.110
.	34	24	34	0.105
.	35	25	35	0.104
.	36	26	36	0.098
.	37	27	37	0.095
.	38	28	38	0.091
.	39	29	39	0.090
.	40	30	40	0.088
.	41	31	41	0.081
.	42	32	42	0.080
.	43	33	43	0.078
10	44	34	44	0.075
.	45	35	45	0.074
.	46	36	46	0.073
.	47	37	47	0.071
.	48	38	48	0.067
11	49	39	49	0.064
12	50	40	50	0.061
.	51	41	51	0.061
.	52	42	52	0.060
.	53	43	53	0.059
13	54	44	54	0.056

Table 2.10-2. Attenuation and rain rate percent-of-time data for September, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	11	.	0.054
.	.	.	21	0.052
14	.	.	.	0.051
.	.	12	22	0.050
19	.	.	.	0.046
20	.	.	.	0.045
.	10	.	23	0.044
21	.	13	24	0.043
.	.	.	.	0.042
22	11	.	25	0.038
23	.	.	26	0.035
24	.	14	27	0.034
25	.	.	.	0.032
26	.	.	.	0.031
30	.	.	28	0.030
31	.	.	.	0.029
32	.	.	.	0.027
33	.	15	29	0.025
35	.	.	30	0.024
36	12	16	31	0.023
.	.	.	.	0.022
37	.	17	32	0.021
38	.	.	.	0.020
.	.	.	35	0.019
39	.	18	37	0.017
40	.	20	40	0.016
.	.	.	.	0.015
.	.	.	42	0.014
.	.	21	43	0.012
45	.	.	.	0.010
46	.	.	.	0.009
47	13	.	.	0.008
50	14	22	45	0.006
51	.	.	.	0.005
52	.	.	.	0.003
53	.	23	47	0.002
58	.	24	48	0.001
60	15	25	50	0.000

Table 2.10-2 (continued). Attenuation and rain rate percent-of-time data for September, 1977.

ICIS	PERCENT
14.47999	0.001
15.27999	0.009
15.88	0.013
16.68	0.016
17.27999	0.020
17.28	0.021
18.07999	0.030
18.08001	0.035
18.68	0.248
18.88	0.314
19.28	0.317
19.47999	0.444
19.48	0.592
19.68	0.880
19.88001	1.147
20.07999	1.191
20.27999	1.192
20.28	1.453
20.48	1.090
20.68	2.037
20.88	2.076
20.89001	2.077
21.07999	2.140
21.28	2.168
21.47999	2.300
21.48	2.325
21.68	2.552
21.08999	2.554
21.88	2.030
21.88001	2.777
22.08001	2.789
22.27999	2.935
22.28	2.941
22.47999	3.067
22.48	3.114
22.49	3.117
22.68	3.302
22.88	3.370
23.07999	3.509
23.28	3.717
23.47999	3.743
23.68	3.910
23.88001	3.940
24.07999	3.958
24.08001	3.989
24.09	3.991
24.27999	3.999
24.28	4.000
24.48	4.174
24.68	4.188
24.88	4.197
24.88001	4.270
25.08001	4.289

Table 2.10-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
25.28	4.354
25.29	4.355
25.48	4.357
25.49	4.358
25.68	4.716
25.68999	4.745
25.88	4.851
25.88999	4.868
26.08001	4.916
26.08999	4.996
26.09	5.003
26.27999	5.101
26.28	7.896
26.29	7.897
26.48	8.074
26.49	8.044
26.68	20.825
26.68999	20.842
26.88001	20.996
26.88999	21.324
26.89001	21.391
27.07999	21.653
27.08001	21.775
27.27999	32.879
27.28	33.468
27.29	34.815
27.48	35.127
27.49	35.457
27.49001	35.462
27.68	36.058
27.68999	36.506
27.88	36.657
27.88001	36.967
27.88999	37.013
28.07999	38.083
28.09	38.578
28.27999	39.400
28.28	39.462
28.29	40.346
28.48	41.577
28.49	42.048
28.49001	42.435
28.68	43.284
28.68999	43.385
28.88	44.093
28.88999	44.655
28.89001	44.749
29.07999	45.995
29.08999	46.402
29.09	46.833
29.28	46.855
29.29	48.174
29.48	48.385
29.49	49.767
29.49001	49.768

Table 2.10-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.

ICTS	PERCENT
29.68999	50.587
29.69001	50.647
29.88999	51.897
29.89001	52.642
30.08999	52.684
30.09	53.414
30.29	54.102
30.49	54.352
30.49001	54.472
30.49999	54.572
30.68999	55.481
30.69001	55.622
30.69999	55.681
30.88999	55.775
30.89001	56.527
31.09	57.275
31.29	57.798
31.29999	57.883
31.49	58.252
31.49001	58.324
31.49999	58.690
31.68999	58.817
31.69001	59.383
31.88999	59.591
31.89001	60.058
32.08999	60.098
32.09	60.517
32.1	60.640
32.29	61.568
32.29999	61.712
32.49	62.450
32.49001	62.909
32.49999	62.911
32.68999	63.659
32.69001	64.089
32.7	64.236
32.88999	64.442
32.89001	64.692
32.9	64.724
33.08999	64.725
33.09	65.489
33.1	65.825
33.29	67.485
33.29999	67.486
33.30001	67.487
33.49	68.489
33.49001	68.859
33.50001	68.951
33.68999	69.415
33.69001	69.983
33.7	70.036
33.88999	70.102
33.89001	70.310
33.9	70.549
34.09	72.008

Table 2.10-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.

Table 2.10-4. Regression equations for the month of September, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	[1]			$I = 17.03 + 22.84^* \log_{10}(A)$	12	.23	$I = 34.19 + 13.07 \log_{10}(A)$	4120	.54
A on R at equal probability levels.	$A = 4.22^* R^{.30}$	4	.92	$A = 2.25^* R^{.58}$	9	.96	$A = 3.69^* R^{.63}$	12	.94
Attenuation scaling. A (11) at equal probability levels.				$A(11) = 3.02^* A(19)^{.50}$	2	.99	$A = 2.15^* A(28)^{.50}$	2	.99
Attenuation scaling. A (19) at equal probability levels.	$A(19) = .11^* A(11)^{2.01}$	2	.99				$A(19) = .80^* A(28)^{.87}$	9	.99
Attenuation scaling. A (28) at equal probability levels.	$A(28) = .22 A(11)^{2.01}$	3	.99						

[1] Data invalidated by intermittent spacecraft operation during eclipse period.

C-2
- 89 -

2.11 October, 1977

All attenuation data are valid.

Table 2.11-1.

Key parameters for the month of October, 1977.

1. Rain Data

VPI&SU Accumulation, 59.77 mm

USWS Accumulation, 159.77 mm

Peak VPI&SU Rate, 79.45 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 33.73%

R > 20 mm/hr, 21.74%

R > 50 mm/hr, 7.53%

R > 30 mm/hr, 15.00%

R > 40 mm/hr, 12.04%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-81.90	27.08	19.88
19.04V	-87.71	28.08	7.91
19.04H	-88.57	-----	-----
28.56	-85.24	36.16	17.72

OCTOBER 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

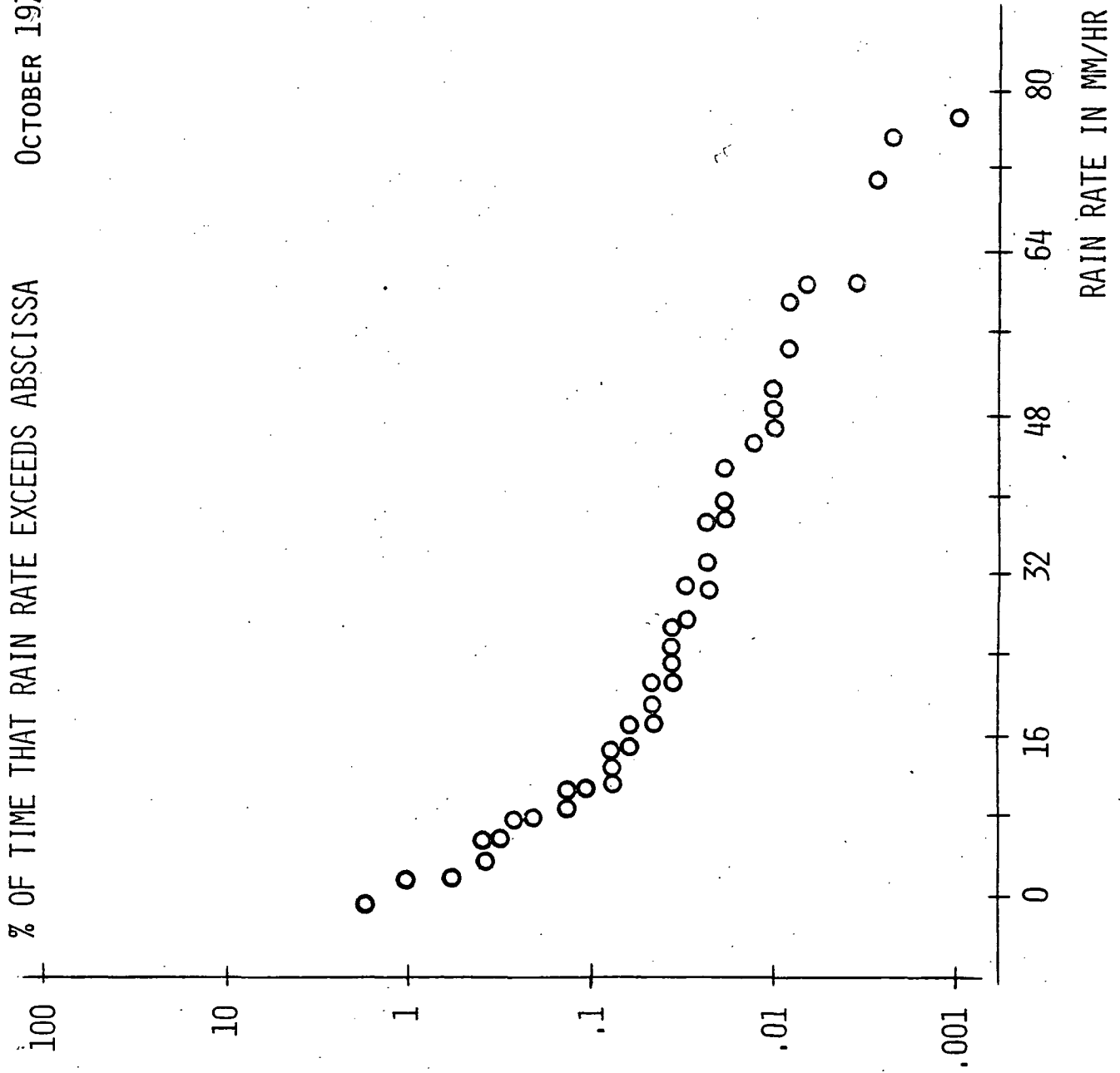


Figure 2.11-1. Rain rate statistics for October, 1977.

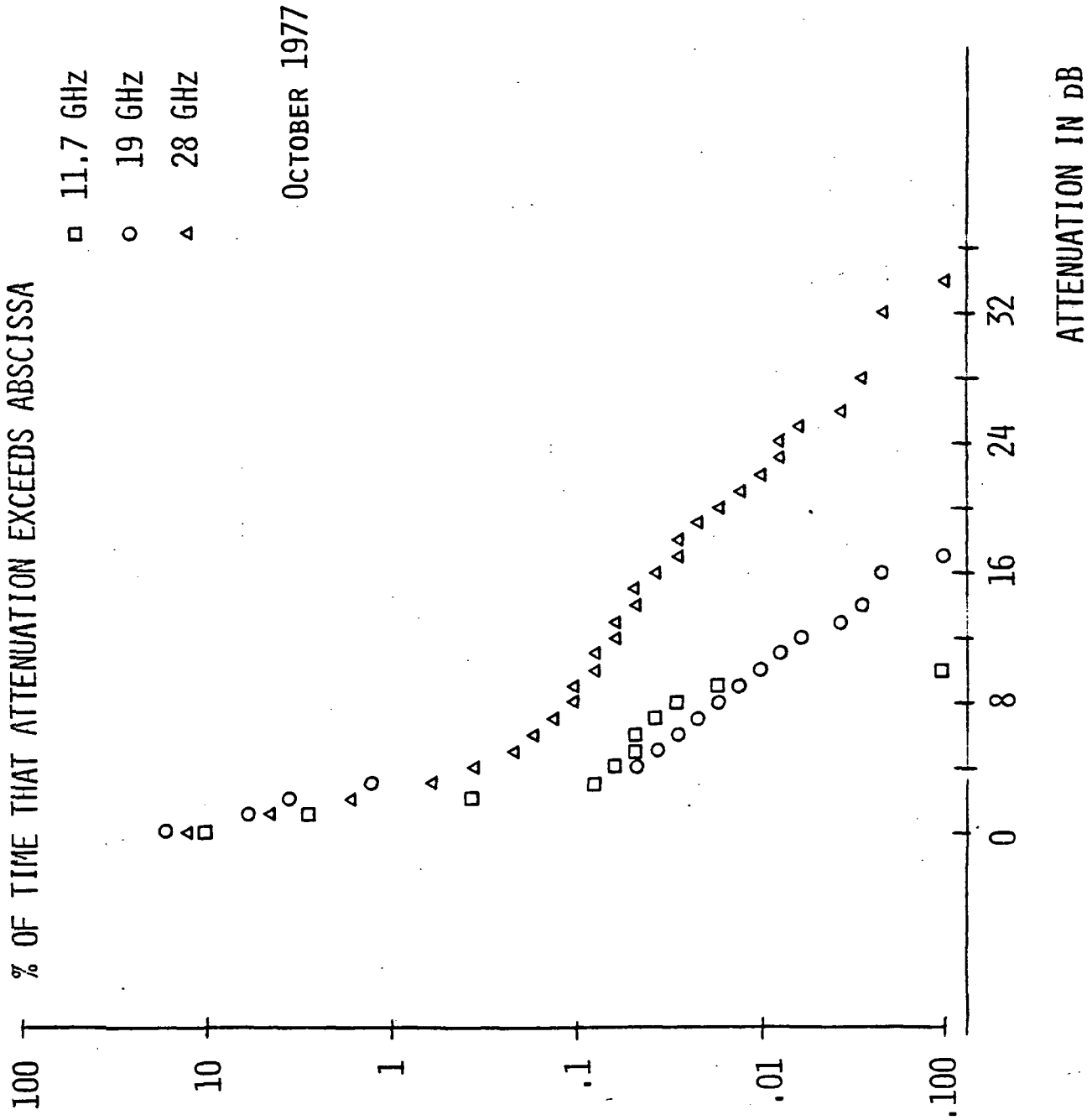


Figure 2.11-2. Attenuation statistics for October, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	.	16.529
.	.	.	0	14.354
.	0	.	.	9.259
.	.	1	.	6.001
.	.	.	1	5.106
.	.	2	.	3.824
.	1	.	.	2.449
.	.	.	2	1.863
0	.	.	.	1.505
.	.	3	.	1.227
1	.	.	.	0.975
.	.	.	3	0.677
2	.	.	.	0.542
.	2	.	.	0.386
3	.	.	.	0.379
.	.	.	4	0.349
4	.	.	.	0.333
.	.	.	.	0.274
5	.	.	5	0.225
.	.	.	.	0.195
6	.	.	6	0.181
.	.	.	.	0.168
7	.	.	7	0.130
.	.	.	.	0.128
8	.	.	.	0.114
.	.	.	8	0.103
10	.	.	.	0.097
.	.	.	9	0.091
.	3	.	.	0.085
11	.	.	.	0.083
.	.	.	.	0.081
12	.	.	10	0.080
.	.	.	.	0.078
13	.	.	.	0.076
14	.	.	11	0.073
.	.	.	.	0.067
15	.	.	12	0.062
.	4	.	.	0.057
16	.	.	.	0.054
.	.	.	13	0.053
18	.	.	.	0.047
19	.	.	.	0.045
.	.	.	.	0.044
20	.	.	14	0.043
.	5	.	.	0.041
21	6	4	15	0.040
.	.	.	.	0.038
23	.	.	.	0.036
24	7	.	.	0.035
.	.	.	16	0.032
25	.	5	.	0.030
26	.	.	.	0.029
.	8	.	.	0.028
.	.	.	17	0.028
28	.	.	.	0.027

Table 2.11-2. Attenuation and rain rate percent-of-time data for October, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	6	18	0.026
.	.	.	.	0.025
29	.	7	.	0.024
30	.	.	.	0.022
31	.	.	.	0.021
36	.	.	19	0.019
37	.	8	.	0.018
39	.	.	.	0.017
.	.	.	20	0.016
42	9	.	.	0.015
45	.	9	.	0.013
.	.	.	21	0.012
47	.	.	.	0.011
48	.	10	.	0.010
49	.	.	22	0.009
55	.	.	23	0.008
59	.	11	24	0.007
60	.	12	25	0.006
61	.	13	26	0.004
71	.	14	28	0.003
75	.	16	32	0.002
77	10	17	34	0.001
79	27	18	36	0.000

Table 2.11-2 (continued). Attenuation and rain rate percent-of-time data for October, 1977.

ICTS	PERCENT
19.88	0.002
21.48	0.004
22.09	0.006
22.27999	0.008
23.29	0.010
23.89001	0.012
24.49	0.014
24.68999	0.016
25.29	0.018
26.09	0.024
26.27999	0.037
26.29	0.039
26.47999	0.303
26.49	0.309
26.49001	0.425
26.88999	0.433
26.89001	0.449
27.08999	0.512
27.09	0.518
27.27999	0.520
27.29	1.022
27.49001	1.024
27.68999	1.109
27.69001	1.243
27.88999	1.253
27.89001	1.274
28.08001	1.278
28.08999	1.456
28.09	1.463
28.28	1.672
28.29	1.674
28.48	2.017
28.49	2.468
28.49001	2.488
28.68999	2.535
28.69001	2.543
28.88	2.560
28.88999	2.943
28.89001	2.950
29.08999	2.952
29.09	2.976
29.29	3.910
29.49	4.315
29.49001	4.414
29.68999	6.750
29.69001	6.762
29.88999	6.766
29.89001	7.551
30.08999	7.593
30.09	7.601
30.29	9.551
30.49	11.057
30.49999	11.865

Table 2.11-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for October, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
30.68999	12.643
30.69001	13.492
30.89001	14.157
31.08999	14.711
31.09	16.702
31.29	17.171
31.29999	17.496
31.49	18.156
31.68999	19.572
31.88999	20.188
31.89001	21.299
32.08999	21.307
32.09	21.837
32.1	22.755
32.29	23.066
32.49	24.458
32.49999	25.355
32.68999	25.618
32.69001	26.095
32.7	27.826
32.88999	28.193
32.89001	28.929
32.9	29.717
33.08999	29.762
33.09	30.676
33.29	33.239
33.29999	33.905
33.49	34.025
33.49001	34.976
33.50001	35.386
33.68999	38.123
33.69001	40.253
33.69999	41.606
33.7	41.678
33.88999	41.714
33.89001	42.908
33.9	42.953
34.09	43.747
34.1	43.944
34.10001	44.217
34.29	46.953
34.30001	47.111
34.49	48.852
34.49001	51.603
34.49999	52.570
34.68999	52.724
34.69001	54.140
34.88999	54.292
34.89001	54.800
34.9	55.414
35.09	56.829
35.1	56.905
35.29	59.724
35.29999	60.640
35.30001	60.695

Table 2.11-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for October, 1977.

2.12 November, 1977

19 GHz data are questionable because of an intermittent failure in the local oscillator.

Table 2.12-1.

Key parameters for the month of November, 1977.

1. Rain Data

VPI&SU Accumulation, 94.79 mm

USWS Accumulation, 188.21 mm

Peak VPI&SU Rate, 67.78 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 26.37% R > 20 mm/hr, 8.69% R > 50 mm/hr, 3.66%

R > 30 mm/hr, 4.49% R > 40 mm/hr, 3.66%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-81.31	30.96	11.87
19.04V	-86.37	26.60	8.91
19.04H	-89.20	-----	-----
28.56	-83.65	32.78	18.72

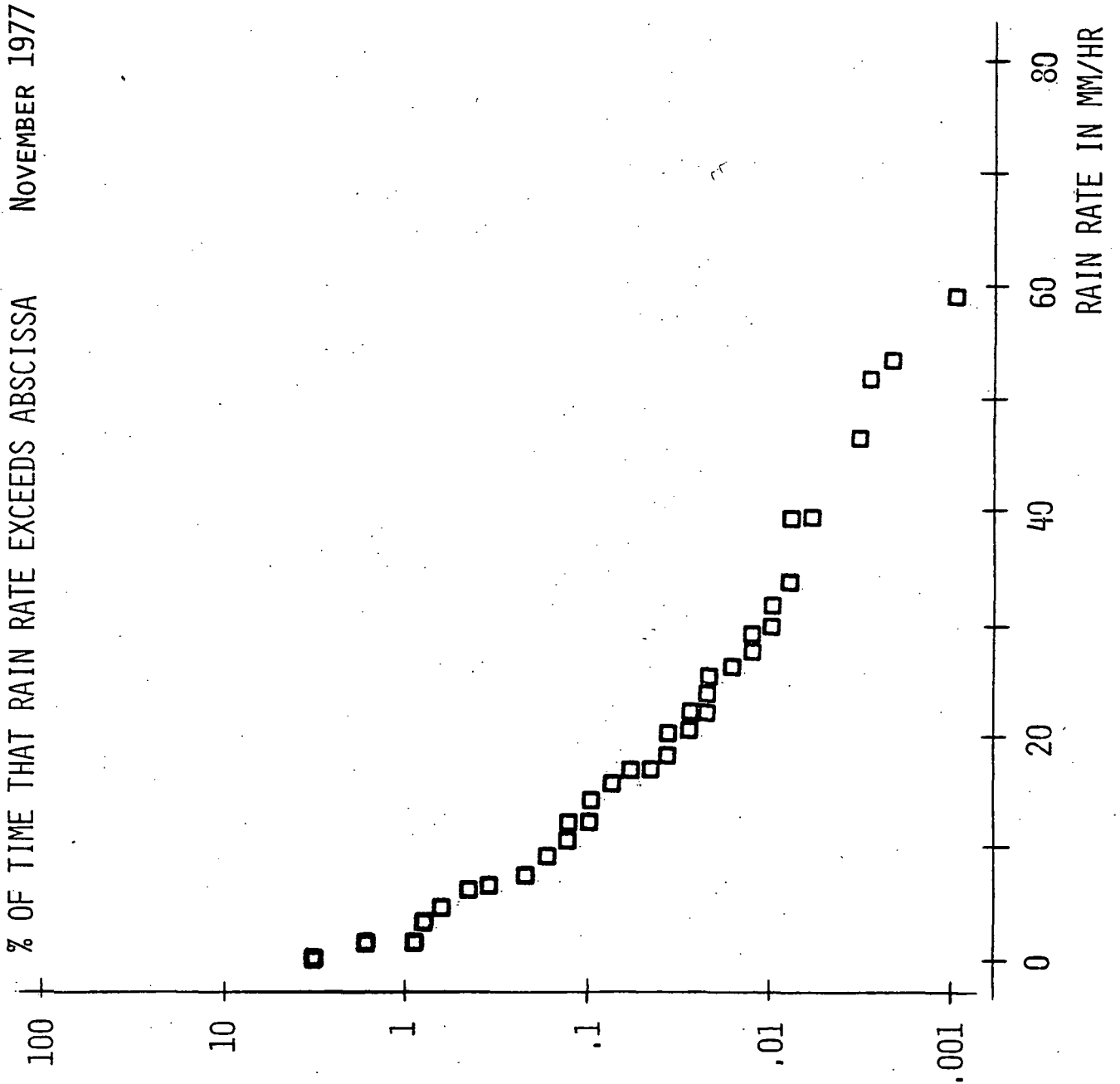


Figure 2.12-1. Rain rate statistics for November, 1977.

% OF TIME THAT ATTENUATION EXCEEDS ABSCISSA

11.7 GHz

19 GHz

28 GHz

NOVEMBER 1977

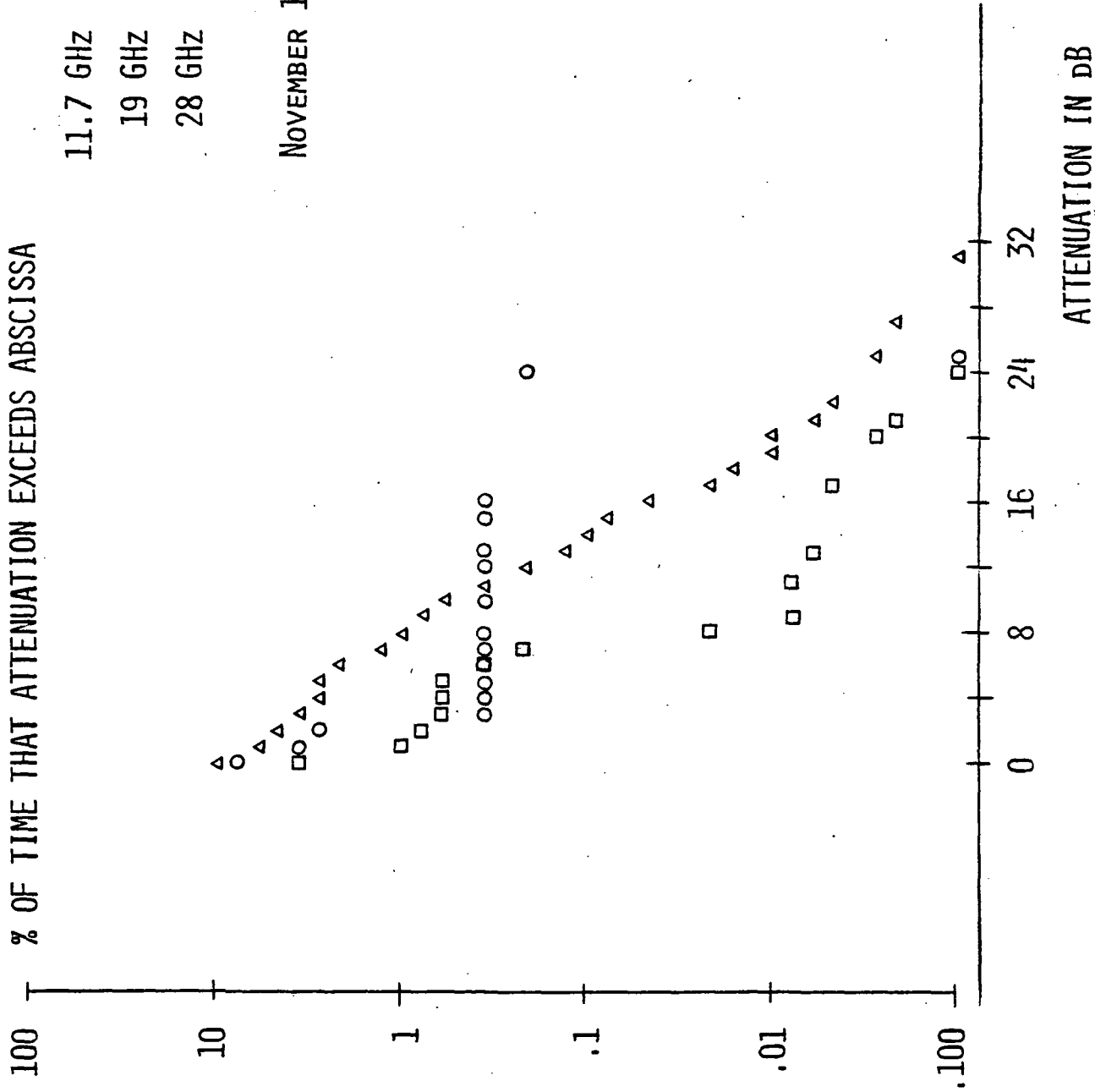


Figure 2.12-2. Attenuation statistics for November, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	11.264
.	.	.	1	7.748
.	.	.	2	6.034
.	.	.	3	4.390
.	.	1	.	3.830
.	0	.	4	3.575
.	.	.	.	3.278
.	.	2	.	3.132
0	.	.	5	2.762
.	.	.	.	2.564
1	.	.	6	2.501
.	.	.	7	1.977
2	1	.	.	1.535
.	.	.	8	1.452
3	.	.	.	1.133
.	2	.	9	1.098
.	.	.	.	0.979
.	3	.	10	0.876
.	.	.	.	0.722
.	4	.	.	0.719
.	.	.	.	0.683
.	5	.	.	0.626
.	.	.	.	0.580
.	6	.	.	0.546
5	.	3	.	0.531
.	.	.	.	0.496
.	7	.	.	0.408
.	.	.	11	0.384
6	.	4	.	0.367
.	.	.	.	0.364
.	.	5	.	0.352
.	.	.	.	0.345
.	.	6	.	0.343
.	.	7	.	0.339
.	.	8	.	0.338
.	.	10	.	0.337
.	.	12	.	0.336
.	.	13	.	0.335
.	.	15	.	0.334
.	.	16	.	0.332
7	.	.	.	0.243
.	.	.	12	0.236
.	.	24	.	0.232
.	7	.	.	0.201
8	.	.	.	0.182
9	.	.	.	0.153
.	.	.	13	0.144
10	.	.	.	0.133
11	.	.	.	0.124
12	.	.	14	0.109
13	.	.	.	0.092
14	.	.	.	0.077
.	.	.	15	0.070
15	.	.	.	0.066

Table 2.12-2. Attenuation and rain rate percent-of-time data for November, 1977.

RAIN	ACTS	AV19	AC28	PER
16	.	.	.	0.049
17	.	.	.	0.043
18	.	.	16	0.042
19	.	.	.	0.035
20	.	.	.	0.034
21	.	.	.	0.028
22	.	.	.	0.026
23	.	.	17	0.025
24	8	.	.	0.023
25	.	.	.	0.021
26	.	.	18	0.020
27	.	.	.	0.016
29	.	.	19	0.014
30	.	.	.	0.012
31	9	.	20	0.011
33	11	.	.	0.010
38	13	.	.	0.009
52	17	.	21	0.008
61	20	.	22	0.007
66	21	.	25	0.006
80	24	25	27	0.005
85	30	26	31	0.003
			32	0.002
				0.001
				0.000

Table 2.12-2 (continued). Attenuation and rain rate percent-of-time data for November, 1977.

ICTS	PERCENT
11.87	0.003
12.27	0.006
12.67	0.009
16.07	0.012
17.48	0.014
21.28	0.017
22.68	0.020
22.88	0.029
23.07999	0.038
23.68	0.084
23.88	0.110
24.29	0.165
24.68	0.361
25.29	0.450
25.48	0.494
25.89001	0.517
26.09	0.557
26.68	0.606
26.89001	0.647
27.48	0.655
27.49	0.675
27.49001	0.678
27.68999	0.742
27.69001	0.771
27.88	0.892
28.29	1.013
28.49	1.157
28.68999	1.657
29.08999	1.660
29.09	1.697
29.29	1.965
29.49	2.173
29.49001	2.176
29.68999	2.214
29.89001	2.445
30.08999	2.447
30.09	2.912
30.29	3.097
30.49	3.339
30.49001	3.368
30.68999	4.482
30.69001	5.048
30.88999	5.051
30.89001	5.530
31.08999	5.602
31.09	6.982
31.29	9.279
31.29999	9.288
31.49	10.967
31.68999	11.002
31.69001	12.454
31.88999	13.086
31.89001	15.554

Table 2.12-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for November, 1977.

Table 2.12-4. Regression Equations for the month of November, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 53.79 - 29.6 \log_{10}(A)$	581	.57	$I = 33.43 - 9.9 \log_{10}(A)$	144	.15	$I = 30.79 - .55 \log_{10}(A)$	3814	.00
A on R at equal probability levels.	$A = .29 R^{1.03}$	7	.98	ID			$A = 4.72 R^{.42}$	9	.96
Attenuation scaling. A (11) at equal probability levels.	ID			ID			$A(11) = .12$ $A(28) = 1.58$	5	.91
Attenuation scaling. A (19) at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (28) at equal probability levels.	$A(28) = 4.60$ $A(11) = .58$	5	.91	ID			ID		

ID: Insufficient Data

2.13 December, 1977

11.7 GHz data were invalidated by repeated spacecraft maneuvers for which we were not provided timely tracking information.

Table 2.13-1.

Key parameters for the month of December, 1977.

1. Rain Data

VPI&SU Accumulation, 33.13 mm

USWS Accumulation, 46.74 mm

Peak VPI&SU Rate, 15.98 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 2.35% R > 20 mm/hr, 0% R > 50 mm/hr, 0%

R > 30 mm/hr, 0% R > 40 mm/hr, 0%

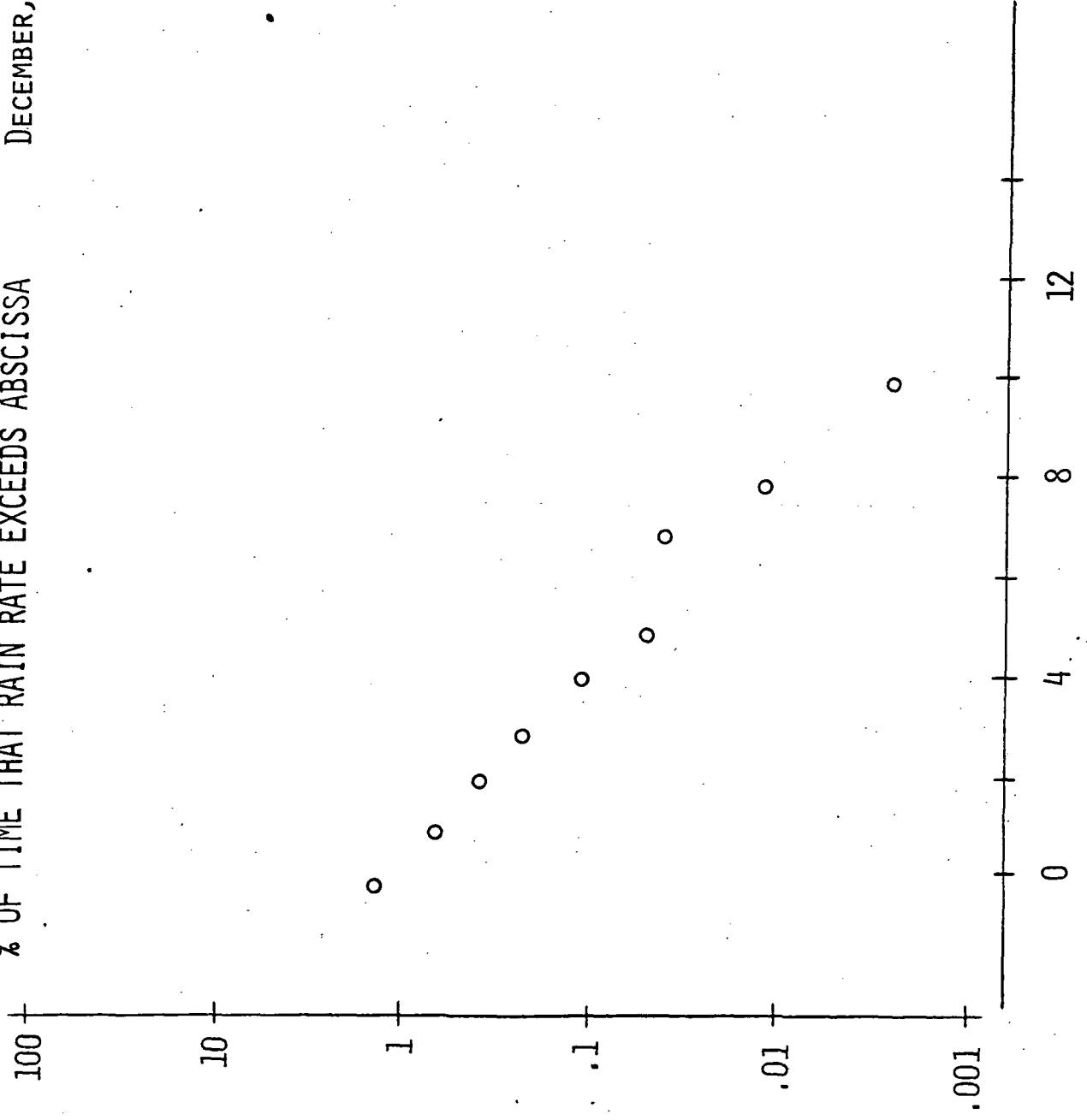
2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-81.74	43.31*	10.27*
19.04V	-87.57	5.37	5.11
19.04H	-92.74	8.14	-----
28.56	-83.67	29.05	15.11

* Data were invalidated by spacecraft maneuvers.

DECEMBER, 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA



RAIN RATE IN MM/HR

Figure 2.13-1. Rain rate statistics for December, 1977.

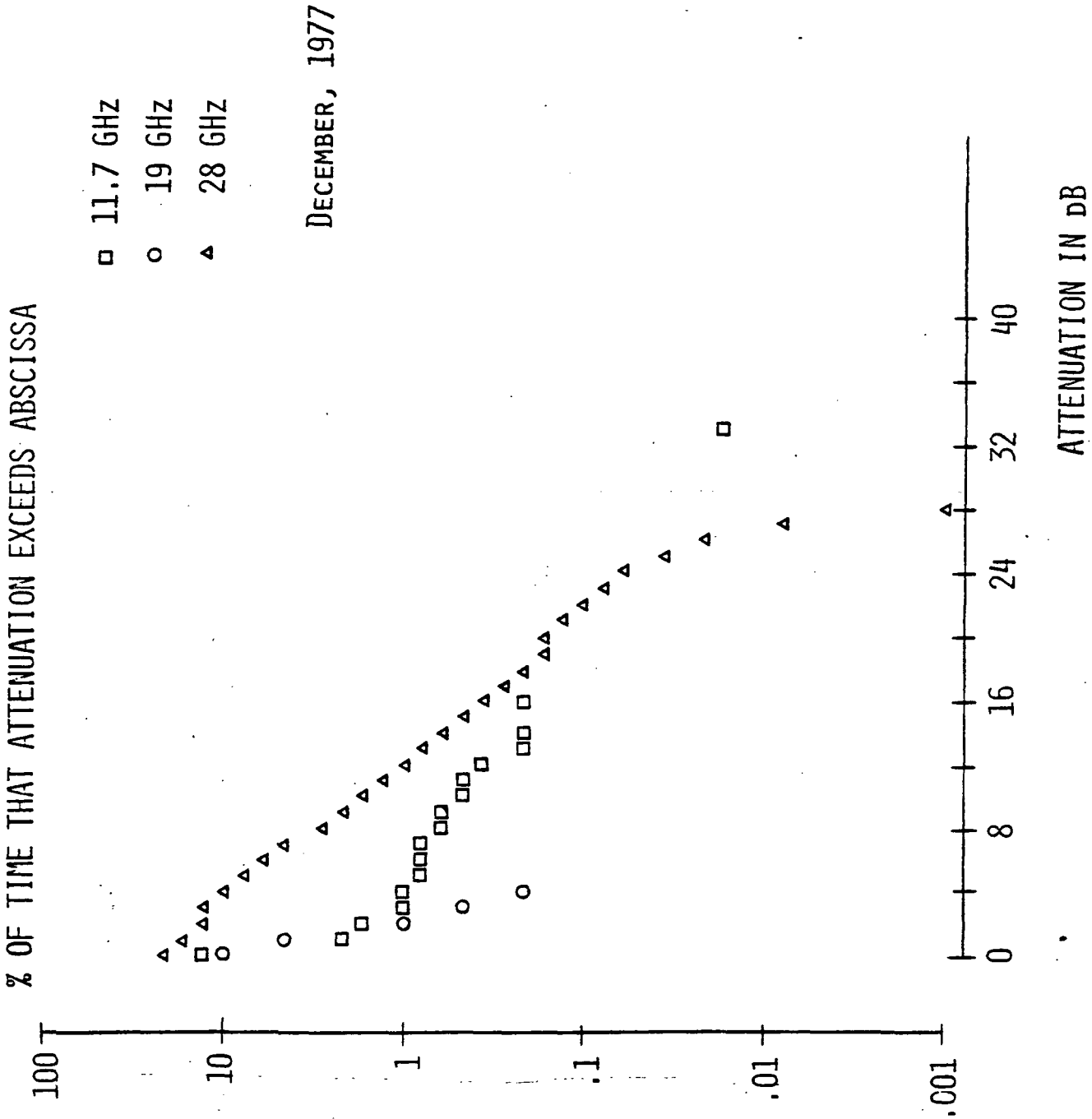


Figure 2.13-2. Attenuation statistics for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.

RAIN	ACTS	AV19	AC28	PER
.	.	.	0	25.519
.	.	.	1	18.743
.	.	.	2	14.843
.	.	.	3	11.722
.	.	0	4	11.269
.	.	.	5	9.383
.	0	.	6	7.546
.	.	.	7	6.469
.	.	1	8	5.708
.	1	.	9	4.936
.	2	.	10	4.240
.	3	.	11	3.075
.	4	.	12	2.906
.	5	.	13	2.259
.	6	2	14	2.084
.	7	.	15	1.695
.	8	.	16	1.532
.	9	.	17	1.427
.	10	.	18	1.321
.	11	.	19	1.265
.	12	2	20	1.225
.	13	.	21	1.123
.	14	.	22	1.106
.	15	.	23	0.988
.	16	.	24	0.774
1	17	.	25	0.740
.	18	.	.	0.662
.	19	.	.	0.622
.	20	.	.	0.612
.	21	.	.	0.599
.	22	.	.	0.482
.	23	.	.	0.452
.	24	.	.	0.430
.	25	3	.	0.411
.	.	.	.	0.337
2	.	.	.	0.331
.	12	.	.	0.273
.	13	.	.	0.242
.	14	.	.	0.241
.	15	.	.	0.235
.	16	.	.	0.234
.	.	.	.	0.232
3	.	.	.	0.221
.	.	4	.	0.203
.	.	.	19	0.198
.	.	.	20	0.178
.	.	.	21	0.152
.	.	.	22	0.120
4	.	.	23	0.089
.	.	.	24	0.087
.	.	.	25	0.069
5	.	.	.	0.051
.	.	.	.	0.041
7	.	.	.	0.037

Table 2.13-2. Attenuation and rain rate percent-of-time data for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.

RAIN	ACTS	AV19	AC28	PER
.	.	.	26	0.029
.	.	.	27	0.017
.	33	.	.	0.014
.	.	.	28	0.012
.	.	.	29	0.010
8	.	.	.	0.009
10	.	.	.	0.002
15	43	5	31	0.000

Table 2.13-2 (continued). Attenuation and rain rate percent-of-time data for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
10.27	0.002
10.87	0.004
12.27	0.011
12.67	0.012
13.47001	0.187
13.86999	0.189
14.07	0.297
14.46999	0.301
14.87	0.371
15.27	0.379
15.67	0.479
16.27	0.550
17.07	0.587
17.87	0.621
18.07	0.623
18.67	0.658
19.28	0.729
20.07999	0.732
20.08001	0.805
20.68999	0.847
21.68	0.909
22.27999	0.950
23.07999	0.953
23.48	1.105
23.89001	1.204
24.27999	1.206
24.49001	1.249
24.68	1.679
24.88999	1.680
25.07999	1.749
25.47999	1.928
25.49001	2.098
25.88	2.179
25.88999	2.206
26.08999	2.303
26.27999	3.240
26.29	3.382
26.66999	3.408
26.88	3.997
26.88001	4.059
26.88999	4.068
27.08999	4.270
27.09	4.277
27.29	4.696
27.49	4.767
27.68	5.244
27.68999	6.111
27.69001	6.286
27.88999	6.520
27.89001	6.942
28.08999	7.538
28.09	7.609
28.49	8.610

Table 2.13-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
28.49001	8.787
28.68999	9.901
28.69001	10.536
28.88999	10.642
28.89001	10.782
29.09	11.288
29.29	13.600
29.49	15.186
29.49001	15.430
29.68999	15.457
29.69001	15.565
29.88999	16.156
29.89001	16.815
30.09	22.330
30.29	25.921
30.49	26.354
30.49001	26.837
30.68999	28.204
30.69001	28.402
30.88999	28.404
30.89001	32.125
31.09	35.300
31.29	35.847
31.49	43.417
31.68999	43.804
31.69001	48.145
31.88999	48.635
31.89001	51.035
32.08999	51.036
32.09	53.308
32.1	53.973
32.29	59.151
32.29999	59.594
32.49	61.055
32.49001	61.907
32.68999	63.028
32.69001	65.250
32.88999	65.554
32.89001	66.021
32.9	66.191
33.09	67.822
33.1	69.274
33.29	70.112
33.49	71.745
33.49001	74.693
33.49999	74.769
33.68999	74.957
33.69999	75.931
33.88999	76.043
33.89001	76.678
33.9	77.180
34.09	78.510
34.29	81.467
34.49	81.591
34.68999	81.814

Table 2.13-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

ICTS	PERCENT
32.09	17.383
32.1	17.392
32.29	19.828
32.29999	19.943
32.49	20.573
32.49001	20.688
32.50001	20.711
32.68999	21.297
32.69001	22.792
32.88999	23.147
32.89001	25.514
32.9	25.517
33.09	26.769
33.1	26.937
33.29	28.974
33.49	30.111
33.49001	30.472
33.50001	30.475
33.68999	32.224
33.69001	32.917
33.88999	33.754
33.89001	34.562
33.9	34.781
34.09	36.092
34.1	36.106
34.29	37.636
34.49	38.614
34.49001	38.626
34.68999	42.311
34.69001	43.789
34.7	43.896
34.88999	43.951
34.89001	46.791
34.9	46.802
35.09	48.765
35.29	49.521
35.49	51.853
35.49001	52.595
35.49999	52.647
35.50001	52.650
35.68999	53.002
35.69001	53.937
35.7	53.940
35.89001	56.370
35.9	56.390
36.08999	56.485
36.09	58.370
36.1	58.396
36.10001	58.402
36.29	62.408
36.29999	62.439
36.30001	62.465
36.49	62.659
36.49001	63.031
36.50001	63.034

Table 2.13-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

Table 2.13-4. Regression equations for the month of December, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	* I = 35.79 - 19.20 log ₁₀ A	1181	.95	I = 37.06 - 9.78 log ₁₀ A	830	.65	I = 33.34 - 1.87 log ₁₀ A	12338	0
A on R at equal probability levels.	*			ID			ID		
Attenuation scaling. A (11) at equal probability levels.	*			*			*		
Attenuation scaling. A (19) at equal probability levels.	*			ID			ID		
Attenuation scaling. A (28) at equal probability levels.	*			ID			ID		

* Data were invalidated by spacecraft maneuvers.

ID: Insufficient Data

2.14 January, 1978

All data are valid. We noted occasionally severe depolarization and attenuation events caused by sleet, freezing rain, and snow which of course are not reflected on our rain statistics. The attenuation values are valid but they do not correlate well with the rain data. [All known instances of data contamination by snow or ice on the antenna surfaces have been removed from the data base.] The same comment applies to the months of February and March, 1978, as well.

Table 2.14-1.

Key parameters for the month of January, 1978.

1. Rain Data

VPI&SU Accumulation, 102.77 mm (includes melted snow)

USWS Accumulation, 110.49 mm (279.4 mm of snow)

Peak VPI&SU Rate, 36 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 8.27% R > 20 mm/hr, 2.51 % R > 50 mm/hr, 0%

R > 30 mm/hr, .29% R > 40 mm/hr, 0%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-85.81	12	8.07
19.04V	-88.10	33	5.71
19.04H	-92.45	--	----
28.56	-83.68	46	7.71

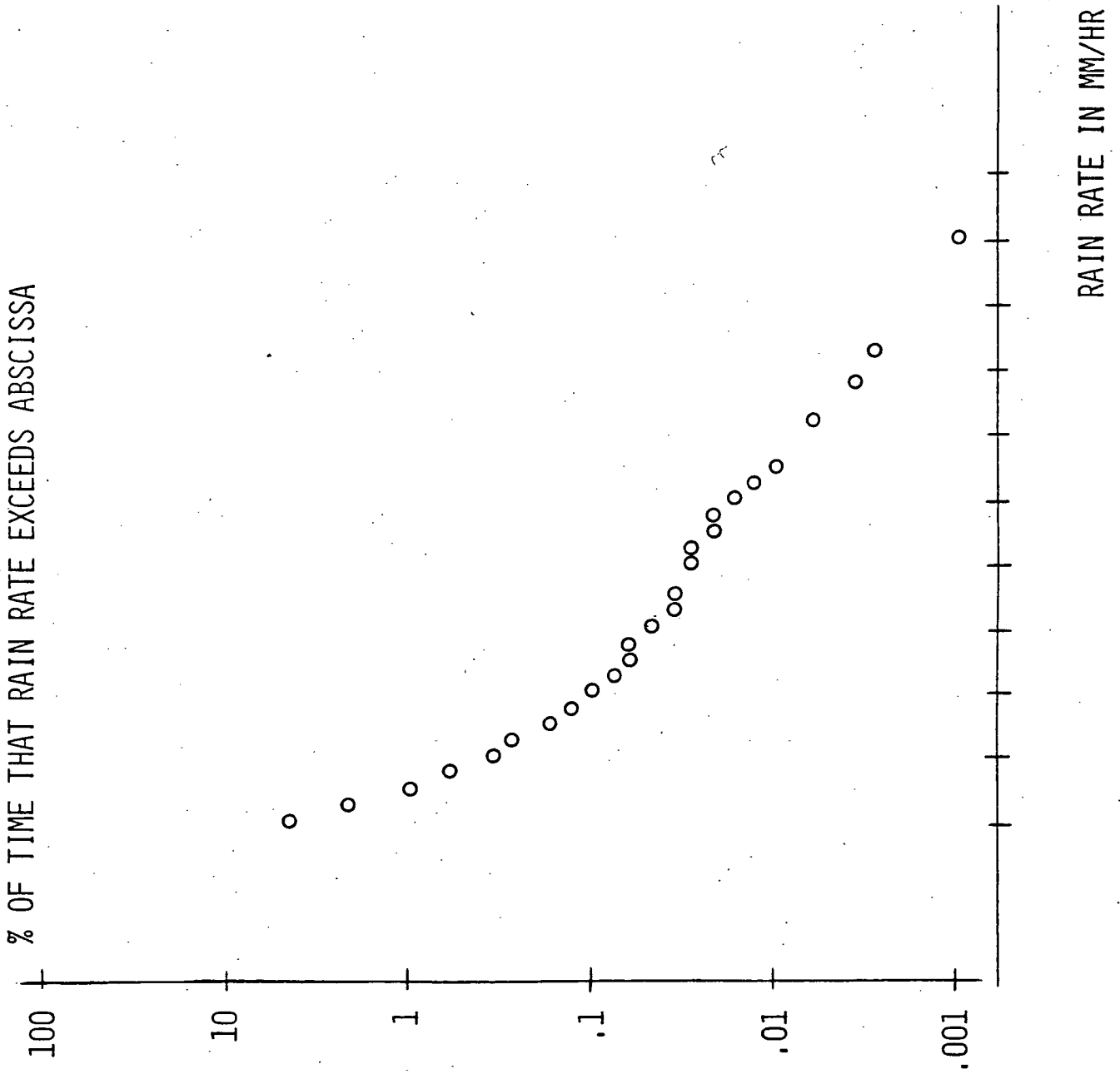


Figure 2.14-1. Rain rate statistics for January, 1978.

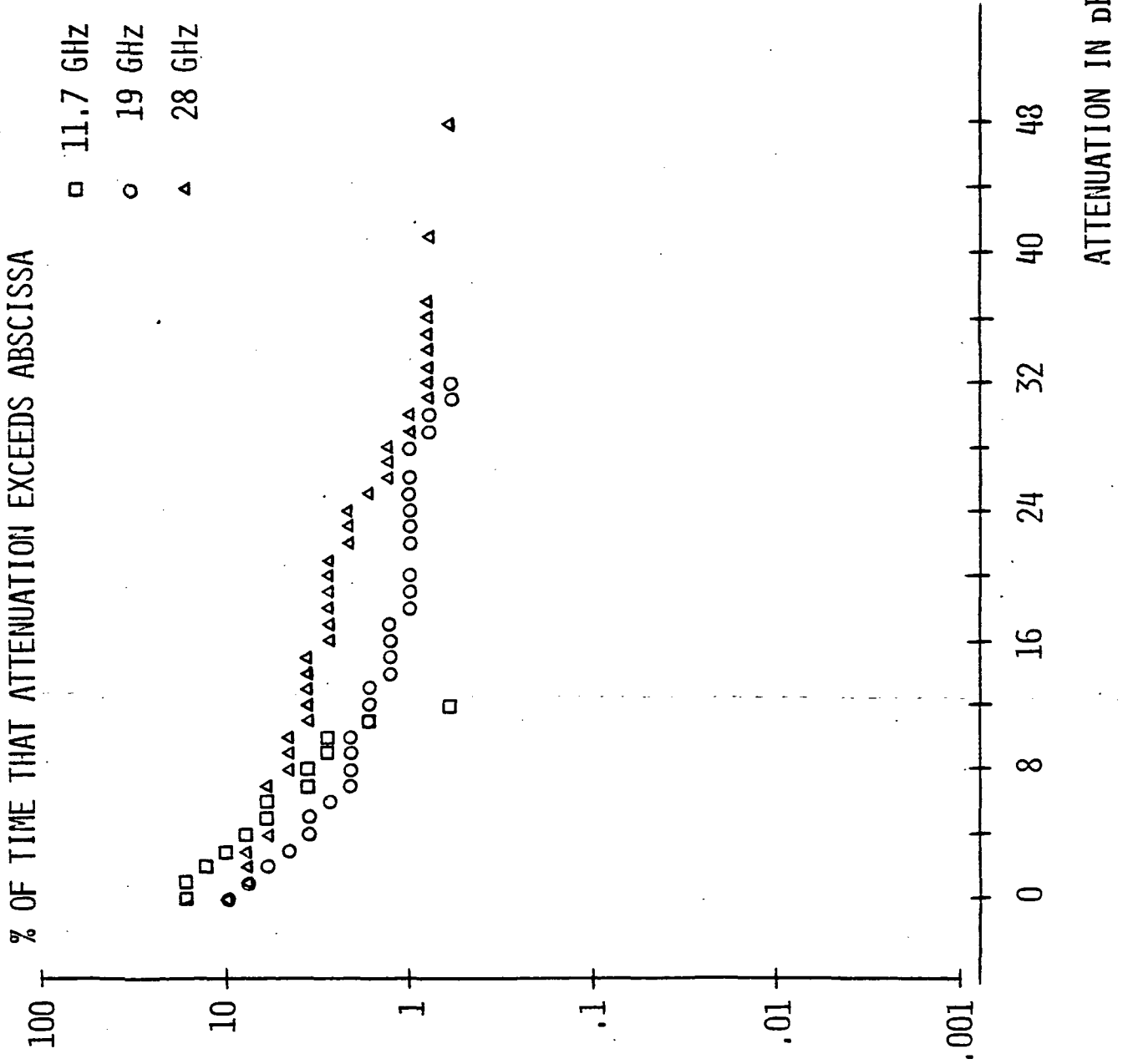


Figure 2.14-2. Attenuation statistics for January, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	0	.	.	18.021
.	1	.	.	14.986
.	2	.	.	12.251
.	.	0	.	10.567
.	.	.	0	10.233
.	3	.	.	10.227
.	4	.	.	8.617
.	.	1	.	8.488
.	.	.	1	8.116
.	.	.	2	7.147
.	.	.	3	6.870
.	.	.	4	6.544
.	.	.	5	6.235
.	5	.	.	6.222
.	.	.	6	5.909
.	.	2	.	5.572
.	6	.	.	5.463
.	.	.	7	5.427
.	.	3	.	5.174
0	.	.	8	5.024
.	.	.	9	4.955
.	.	.	10	4.665
.	7	.	.	4.326
.	.	.	11	3.928
.	.	.	12	3.880
.	.	.	13	3.654
.	.	.	14	3.492
.	8	.	.	3.420
.	.	4	.	3.400
.	.	.	15	3.394
.	.	5	.	3.270
.	.	.	16	3.206
.	9	.	.	3.152
.	.	.	17	3.096
.	.	.	18	3.066
.	.	.	19	2.988
.	.	.	20	2.899
.	.	6	.	2.782
.	10	.	.	2.672
.	.	.	21	2.642
.	.	.	22	2.630
.	.	7	.	2.346
.	.	8	.	2.288
.	.	.	23	2.212
.	.	9	.	2.152
.	.	10	.	2.115
.	.	.	24	1.975
1	.	.	.	1.906
.	.	11	.	1.882
.	11	.	.	1.766
.	.	.	.	1.656
.	.	12	.	1.575
.	.	13	.	1.527
.	.	.	.	1.503

Table 2.14-2. Attenuation and rain rate percent-of-time data for January, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	14	26	1.419
.	.	15	.	1.368
.	.	.	27	1.288
.	.	.	28	1.263
.	.	16	.	1.175
.	.	17	.	1.173
.	.	18	.	1.141
.	.	19	.	1.116
.	.	20	.	1.114
.	.	22	.	1.111
.	.	23	.	1.109
.	.	24	.	1.106
.	.	25	.	1.069
.	.	26	.	1.063
.	.	.	29	1.061
2	.	28	.	0.992
.	.	.	30	0.970
.	.	.	31	0.964
.	.	29	32	0.936
.	.	.	33	0.836
.	.	.	34	0.817
.	.	30	35	0.764
.	.	.	36	0.752
.	.	.	37	0.729
.	.	31	41	0.722
.	.	32	48	0.721
3	12	.	.	0.705
4	.	.	.	0.703
5	.	.	.	0.702
6	.	.	.	0.677
7	.	.	.	0.677
8	.	.	.	0.667
9	.	.	.	0.533
10	.	.	.	0.533
11	.	.	.	0.365
12	.	.	.	0.242
13	.	.	.	0.184
14	.	.	.	0.127
16	.	.	.	0.097
17	.	.	.	0.078
18	.	.	.	0.064
19	.	.	.	0.055
20	.	.	.	0.050
21	.	.	.	0.041
22	.	.	.	0.036
25	.	.	.	0.029
27	.	.	.	0.024
29	.	.	.	0.021
36	50	50	50	0.015
				0.014
				0.012
				0.009
				0.006
				0.004
				0.001
				0.000

Table 2.14-2 (continued). Attenuation and rain rate percent-of-time data for January, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
8.069998	0.183
8.869986	0.932
9.669989	1.463
9.870001	1.829
10.27	1.922
10.47001	2.280
11.07	2.281
11.27	2.380
11.87	2.445
12.07	2.611
12.66999	2.736
12.67	2.738
12.87	2.852
13.27	2.927
13.47001	3.005
13.87	3.006
14.27001	3.140
14.67	3.181
14.87	3.254
15.27	3.362
15.67	3.400
16.07	3.404
16.46999	3.440
16.87	3.514
16.88	4.340
17.27	4.416
17.47999	4.447
17.67	4.515
17.68	5.006
17.86999	5.082
18.27999	5.549
18.46999	5.575
18.66999	5.640
18.68	5.733
18.88	6.076
19.07	6.131
19.07999	6.565
19.46999	6.770
19.47999	7.259
19.48	7.632
19.88	7.763
19.88001	7.771
20.07999	8.896
20.27999	9.234
20.28	9.409
20.68	9.750
20.69001	9.780
20.88	10.601
20.88999	10.939
20.89001	11.023
21.07999	11.080
21.27999	11.188
21.48	11.259

Table 2.14-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

ICTS	PERCENT
21.49	11.261
21.68	11.580
21.68999	11.733
21.69001	11.801
21.88	11.841
21.88999	11.845
21.89001	11.932
22.07999	11.990
22.08001	12.058
22.27999	12.136
22.28	12.528
22.29	12.633
22.48	12.701
22.49	13.287
22.68	13.639
22.68999	13.683
22.69001	13.795
22.88	14.593
22.88001	14.619
22.88999	14.669
23.07999	14.893
23.08001	15.017
23.08999	15.222
23.09	15.321
23.27999	15.359
23.28	15.574
23.29	16.252
23.48	18.779
23.49	19.005
23.68	19.530
23.68999	19.546
23.69001	19.572
23.88	19.641
23.88999	19.778
23.89001	19.907
24.07999	20.592
24.08001	20.670
24.08999	21.074
24.09	21.776
24.27999	22.489
24.28	23.334
24.29	23.785
24.47999	23.861
24.48	23.954
24.49	24.148
24.68	24.268
24.68999	25.045
24.69001	25.083
24.88	25.170
24.88999	25.975
24.89001	26.672
25.07999	27.338
25.09	28.803
25.27999	28.932
25.29	29.145

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

ICTS	PERCENT
25.47999	29.153
25.48	29.160
25.49	29.769
25.49001	30.009
25.68	30.256
25.68999	30.892
25.69001	30.919
25.88	31.158
25.88999	31.588
25.89001	33.427
26.09	33.621
26.27999	33.784
26.29	35.010
26.49	35.438
26.49001	35.499
26.68	35.520
26.68999	37.959
26.69001	38.303
26.88999	38.342
26.89001	39.053
27.07999	39.124
27.08999	39.654
27.09	40.298
27.27999	40.341
27.29	41.384
27.48	41.386
27.49	43.355
27.68999	43.696
27.69001	44.274
27.88999	45.599
27.89001	46.118
28.07999	46.154
28.09	46.866
28.28	46.889
28.29	48.641
28.49	49.623
28.49001	49.833
28.68999	50.949
28.69001	51.210
28.88	51.214
28.88999	51.469
28.89001	52.723
29.08999	52.725
29.09	54.454
29.29	57.238
29.49	59.156
29.49001	59.194
29.68999	60.543
29.69001	62.020
29.88999	62.629
29.89001	64.054
30.08999	64.419
30.09	66.604
30.29	66.872
30.49	68.436

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
30.49001	68.632
30.68999	69.719
30.69001	71.365
30.88999	71.401
30.89001	72.523
31.08999	72.529
31.09	73.024
31.29	75.224
31.49	75.558
31.49001	76.474
31.68999	76.892
31.69001	78.074
31.88999	78.321
31.89001	78.611
31.9	78.654
32.09	80.905
32.29	82.519
32.49	82.875
32.49001	83.293
32.68999	83.457
32.69001	85.641
32.7	85.649
32.89001	86.892
33.09	87.925
33.1	88.205
33.29	88.340
33.29999	88.342
33.49	88.623
33.49001	89.552
33.49999	89.594
33.68999	89.639
33.69001	89.843
33.7	89.871
33.89001	90.494
33.9	90.985
34.08999	91.007
34.09	91.177
34.1	91.321
34.29	92.073
34.29999	92.090
34.49	92.122
34.49001	92.195
34.49999	92.197
34.50001	92.237
34.68999	92.240
34.69001	92.379
34.69999	92.381
34.7	92.636
34.88999	92.649
34.89001	92.695
34.9	93.022
35.09	95.256
35.1	95.344
35.29	95.355
35.29999	95.407

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

Table 2.14-4. Regression equations for the month of January, 1978.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 34.53 - 18.83^* \log_{10}(A)$	9338	.46	$I = 40.41 - 16.40^* \log_{10}(A)$	2824	.71	$I = 49.49 - 22.53^* \log_{10}(A)$	3807	.63
A on R at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (11) at equal probability levels.	ID			$A(11) = .74^* A(19) \cdot 97$	3	.65	ID		
Attenuation scaling. A (19) at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (28) at equal probability levels.	ID			ID			ID		

2.15 February, 1978

11.7 GHz data may have been influenced by daily spacecraft shutdown for eclipse. See comments for January, 1978.

Table 2.15-1.

Key parameters for the month of February, 1978.

1. Rain Data

VPI&SU Accumulation, 8.33 mm (includes melted snow)

USWS Accumulation, 14.99 mm (127.0 mm of snow)

Peak VPI&SU Rate, 4.51 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 0% R > 20 mm/hr, 0% R > 50 mm/hr, 0%

R > 30 mm/hr, 0% R > 40 mm/hr, 0%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-83.76	50	11.48
19.04V	-87.85	50	3.70
19.04H	-93.08	50	-----
28.56	-82.92	50	19.52

FEBRUARY 1978

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

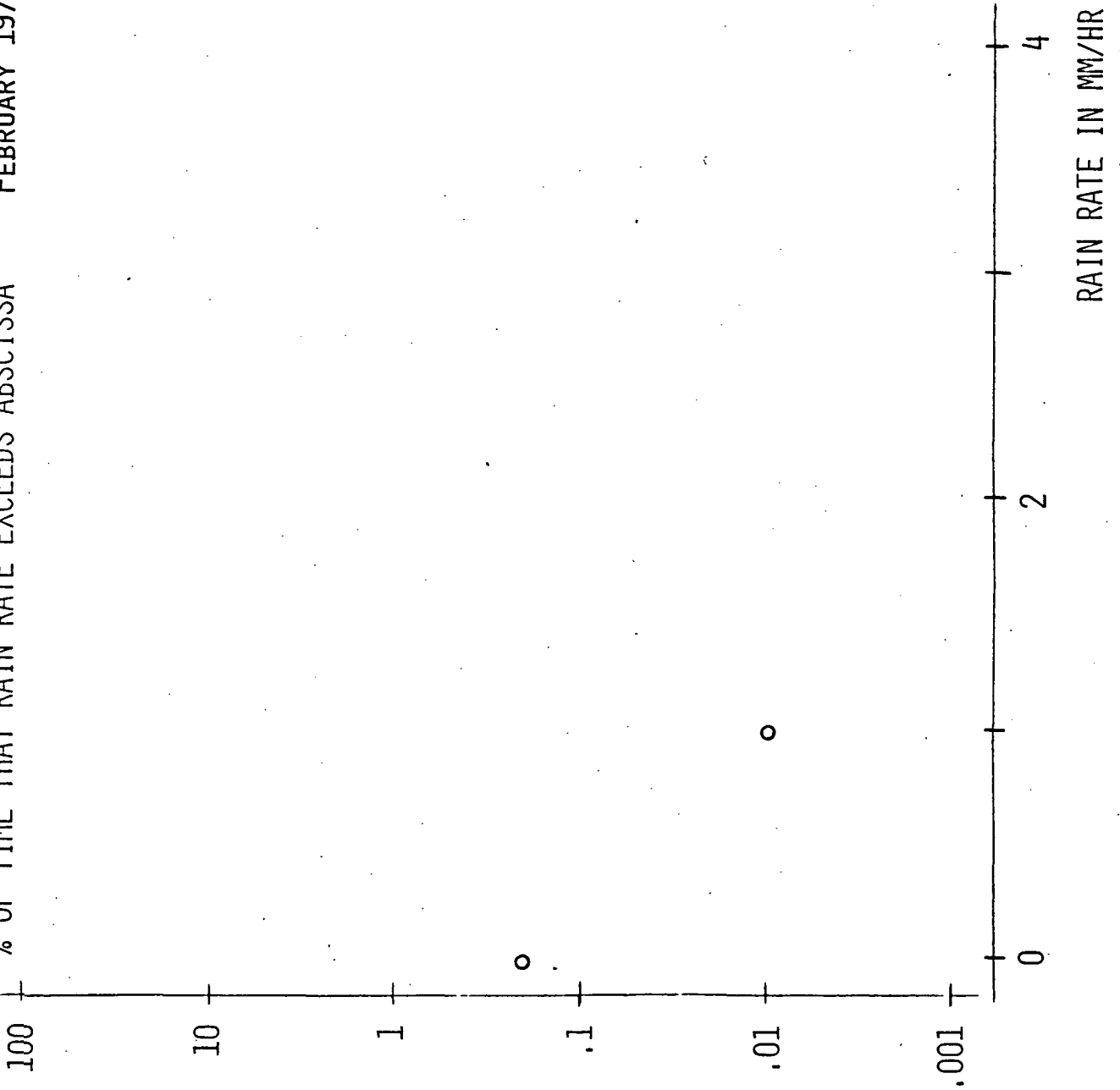


Figure 2.15-1. Rain rate statistics for February, 1978.

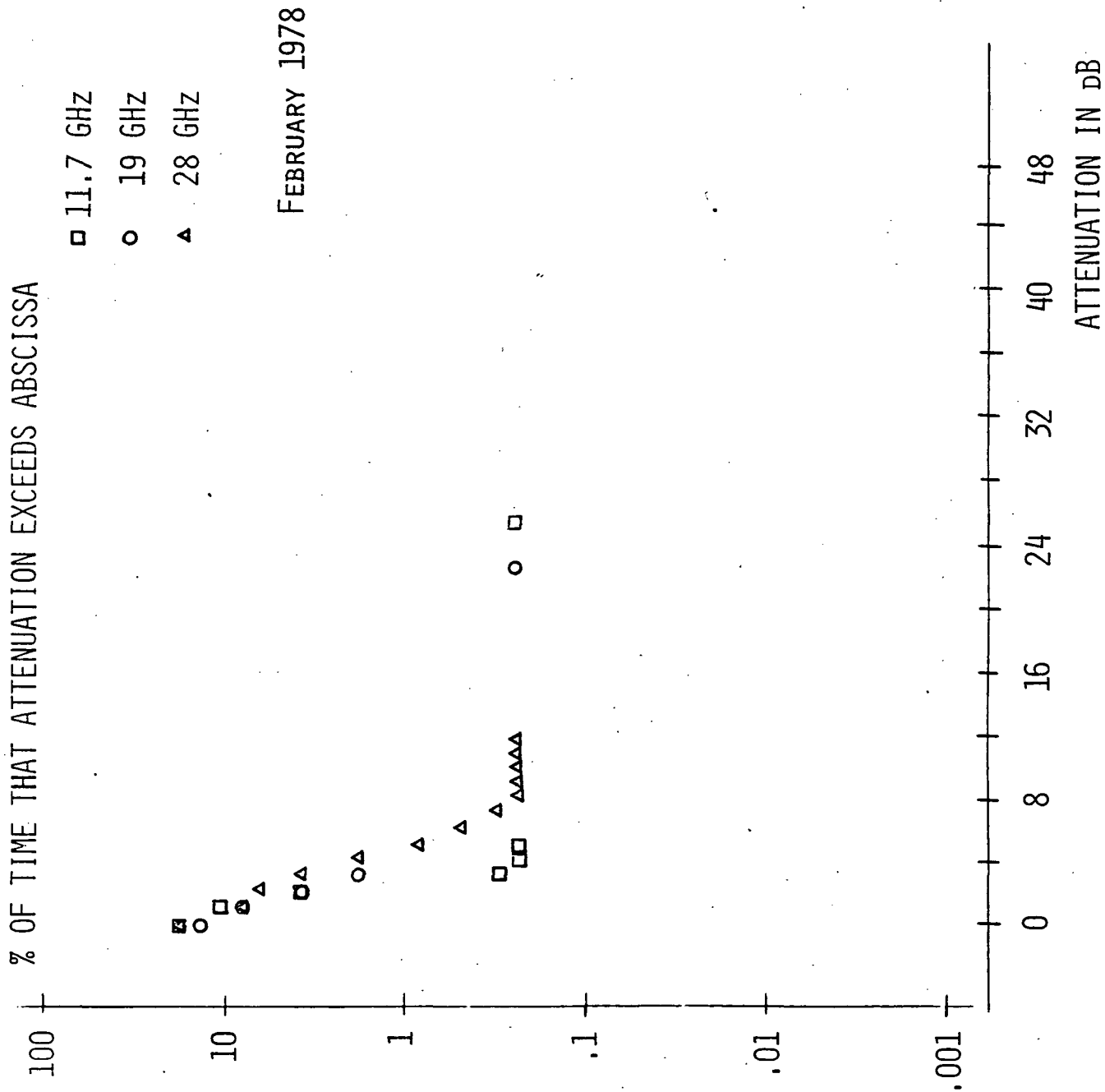


Figure 2.15-2. Attenuation statistics for February, 1978.

RAIN	ACTS	AV19	AC28	PER
0	0	0	0	18.478
0	0	0	0	17.583
0	0	0	0	12.407
0	1	1	1	9.365
0	1	1	1	8.762
0	1	1	1	8.505
0	2	2	2	5.905
0	2	2	2	3.340
0	2	2	2	3.302
0	3	3	3	3.222
0	3	3	3	1.870
0	3	3	3	1.505
0	3	3	3	0.846
0	3	3	3	0.429
0	3	3	3	0.286
0	3	3	3	0.267
0	3	3	3	0.242
0	3	3	3	0.226
0	4	4	4	0.218
0	4	4	4	0.217
0	5	5	5	0.216
0	25	22	11	0.007
0	50	50	50	0.000

Table 2.15-2. Attenuation and rain rate percent-of-time data for February, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
11.48	0.002
23.09	0.004
23.68	0.279
24.47999	0.405
24.48	0.569
24.68	0.718
24.88999	1.428
25.08001	1.816
25.29	1.869
25.47999	2.014
25.48	2.173
25.68999	3.425
25.69001	3.448
25.88	4.015
25.89001	4.054
26.09	4.428
26.28	4.894
26.29	5.860
26.49	7.194
26.69001	7.666
26.88	7.910
26.89001	8.380
27.09	9.411
27.29	10.679
27.49	11.647
27.49001	12.002
27.68	13.071
27.68999	13.423
27.69001	14.608
27.88999	14.866
27.89001	15.792
28.09	17.850
28.27999	17.959
28.29	21.780
28.49	25.387
28.49001	26.653
28.68999	27.922
28.69001	28.447
28.89001	29.471
29.08999	31.791
29.09	35.709
29.29	41.232
29.49	44.304
29.49001	44.469
29.68999	44.090
29.69001	46.626
29.88999	50.529
29.89001	54.785
30.08999	55.172
30.09	57.542
30.29	61.401
30.49	64.543
30.49001	65.996

Table 2.15-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for February, 1978.

IGTS	PERCENT
30.68999	67.455
30.69001	69.577
30.88999	70.541
30.89001	72.103
31.09	74.839
31.29	79.879
31.49	81.460
31.49001	81.991
31.68999	82.388
31.69001	83.074
31.88999	84.047
31.89001	84.762
32.09	86.753
32.29	87.960
32.49001	88.445
32.68999	90.812
32.69001	91.547
32.88999	91.691
32.89001	91.857
33.09	93.291
33.29	95.057
33.49	96.233
33.49001	96.405
33.69001	96.611
33.7	97.231
33.89001	97.575
34.08999	98.133
34.09	99.097
34.49999	99.158
34.68999	99.511
34.69001	99.735
34.88999	99.757
34.89001	99.968
35.09	99.981
35.69001	99.987
35.89001	100.000

Table 2.15-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for February, 1978.

Table 2.15-4. Regression equations for the month of February, 1978.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	$I = 35.76 - 15.68 \log_{10}(A)$	2487	.04 [1]	$I = 19.59 - 27.01 \log_{10}(A)$	2516	.13	$I = 39.90 - 21.39 \log_{10}(A)$	4580	.45
A on R at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (11) at equal probability levels.				$A(11) = .99^*$ $A(19) = 1.02$	3	.99	$A(11) = .77^*$ $A(28) = 1.08$	2	.56
Attenuation scaling. A (19) at equal probability levels.	$A(19) = 1.02^*$ $A(11) = .98$	3	.99				$A(19) = .66^*$ $A(28) = 1.12$	2	.61
Attenuation scaling. A (28) at equal probability levels.	$A(28) = 4.06^*$ $A(11) = .52$	2	.56	$A(28) = 3.78^*$ $A(19) = .55$	2	.61			

[1] Data were invalidated by spacecraft shutdowns during eclipse period

ID = insufficient data

2.16 March, 1978

See comments for January, 1978.

Table 2.16-1.

Key parameters for the month of March, 1978.

1. Rain Data

VPI&SU Accumulation, 78.58 mm (includes melted snow)

USWS Accumulation, 121.67 mm (279.4 mm of snow)

Peak VPI&SU Rate, 63 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 5.59% R > 20 mm/hr, 2.72% R > 50 mm/hr, .67%

R > 30 mm/hr, 1.87% R > 40 mm/hr, 1.11%

2. Signal Data

Channel	Monthly Mean Co Signal, dBm	Maximum Fade, dB	Minimum Isolation While in Phaselock, dB
11.7	-83.48	50	1.86(?) (21.29)*
19.04V	-88.37	50	7.71
19.04H	-94.63	50	-----
28.56	-74.23	50	14.32

* The first number is probably an artifact of the spacecraft off-on operations during the eclipse period.

MARCH 1978

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

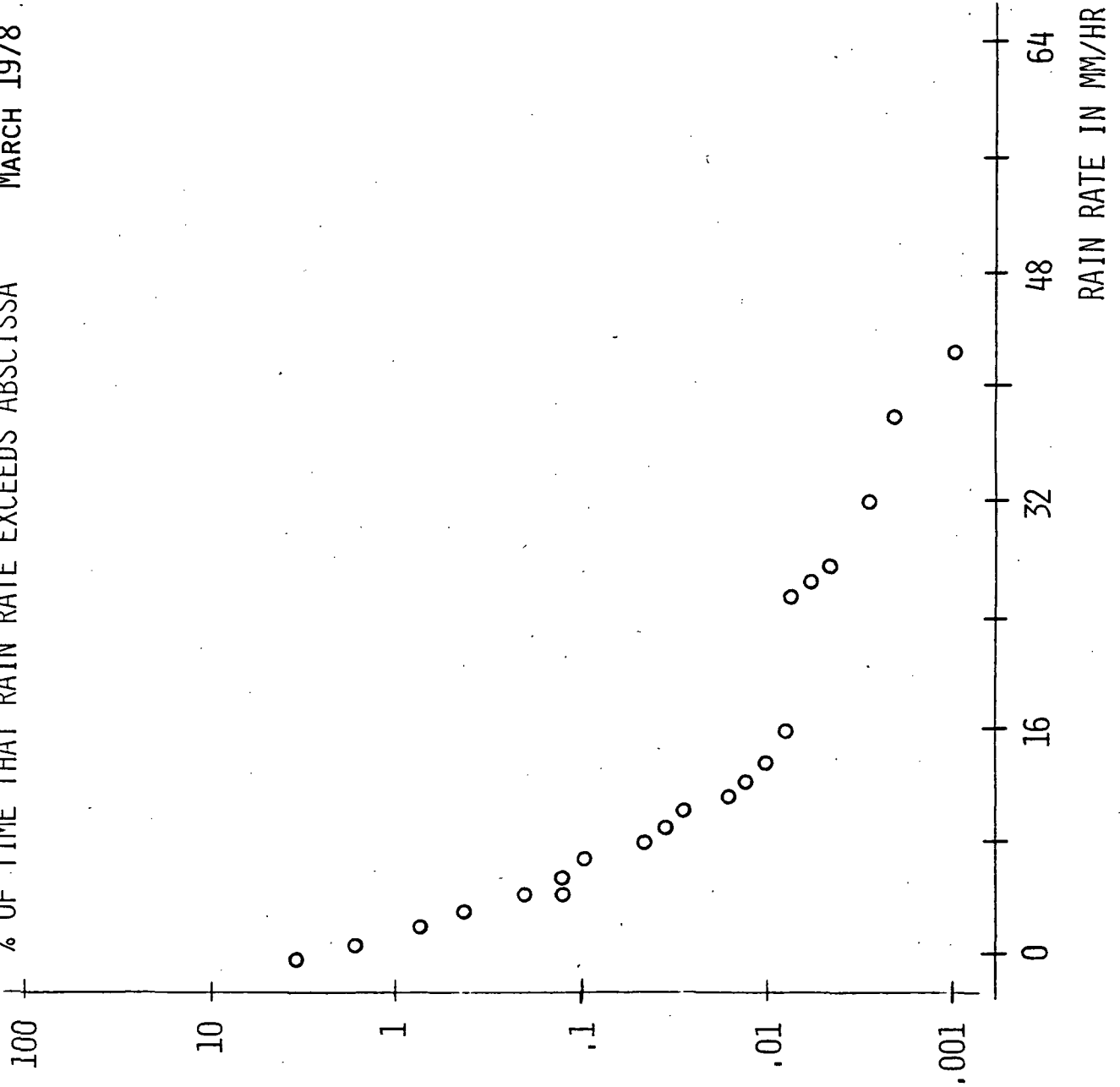


Figure 2.16-1. Rain rate statistics for March, 1978.

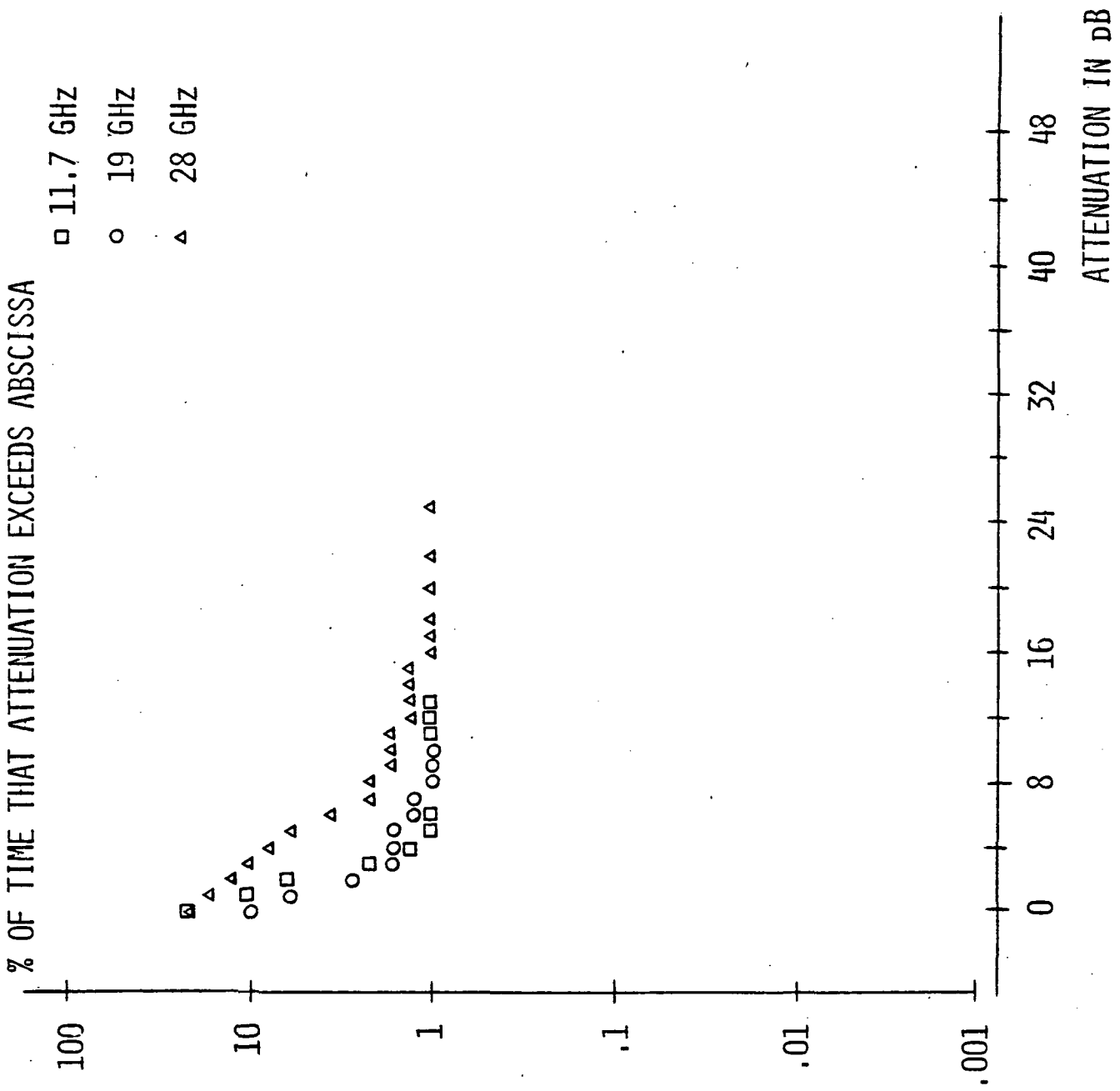


Figure 2.16-2. Attenuation statistics for March, 1978.

RAIN	ACTS	AV19	AC28	PER
.	.	.	0	20.131
.	0	.	.	19.507
.	.	.	1	16.564
.	.	.	2	13.224
.	.	0	.	10.383
.	.	.	3	9.530
.	1	.	.	8.972
.	.	.	4	7.185
.	2	.	.	5.991
.	.	.	5	5.718
.	.	1	.	5.386
0	.	.	6	3.804
.	.	.	.	3.470
.	3	2	.	2.487
.	.	.	7	2.429
.	.	.	8	2.155
.	.	3	.	1.906
.	.	.	9	1.880
.	.	4	.	1.763
.	.	.	10	1.752
1	.	.	.	1.712
.	.	.	11	1.485
.	.	5	.	1.475
.	.	.	12	1.468
.	4	.	.	1.451
.	.	.	13	1.299
.	.	6	.	1.180
.	.	.	14	1.176
.	.	.	15	1.149
.	.	7	.	1.141
.	.	.	16	1.140
.	.	.	17	1.100
.	.	8	.	1.094
.	.	.	18	1.093
.	.	9	.	1.092
.	5	.	.	1.091
.	.	10	20	0.982
.	6	.	.	0.962
.	11	.	.	0.948
.	12	.	.	0.947
.	.	11	.	0.934
.	13	12	22	0.932
2	.	.	25	0.930
3	.	.	.	0.832
4	.	.	.	0.487
5	.	.	.	0.219
6	.	.	.	0.129
7	.	.	.	0.113
8	.	.	.	0.090
9	.	.	.	0.042
10	.	.	.	0.034
11	.	.	.	0.021
13	.	.	.	0.015
.	.	.	.	0.012

Table 2.16-2. Attenuation and rain rate percent-of-time data for March, 1978.

RAIN	ACTS	AV19	AC28	PER
14	.	.	.	0.010
16	.	.	.	0.008
25	.	.	.	0.007
26	.	.	.	0.006
28	.	.	.	0.004
32	.	.	.	0.003
38	.	.	.	0.002
42	.	.	.	0.001
63	50	50	50	0.000

Table 2.16-2 (continued). Attenuation and rain rate percent-of-time data for March, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

ICTS	PERCENT
1.860007	0.002
2.460013	0.003
21.29	0.032
21.88999	0.059
22.09	0.113
22.49	0.116
22.68999	0.245
22.89001	0.263
23.29	0.718
23.49	0.984
23.69001	1.004
24.09	1.318
24.29	1.839
24.49	1.854
24.49001	1.905
24.88999	2.069
24.89001	2.206
25.09	2.718
25.29	3.196
25.49	3.358
25.49001	3.444
25.68999	3.698
25.69001	4.146
25.88999	4.225
25.89001	4.422
26.08999	4.822
26.09	5.477
26.29	6.057
26.49	7.188
26.68999	7.528
26.69001	7.547
26.88999	8.799
26.89001	9.355
27.08999	9.586
27.29	11.099
27.49	11.941
27.49001	12.069
27.68999	13.957
27.69001	14.354
27.88999	14.818
27.89001	15.011
28.08999	15.231
28.09	15.597
28.29	17.137
28.49	19.287
28.49001	20.289
28.68999	20.611
28.69001	22.301
28.88999	22.639
28.89001	23.532
29.08999	23.793
29.09	29.005
29.29	32.204

Table 2.16-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1978.

ORIGINAL PAGE IS
OF POOR QUALITY

ICIS	PERCENT
29.49	32.682
29.49001	32.906
29.68999	33.746
29.69001	34.421
29.88999	35.790
29.89001	40.043
30.08999	41.379
30.09	44.000
30.29	46.084
30.49	48.013
30.49001	48.324
30.68999	50.817
30.69001	53.043
30.88999	54.124
30.89001	57.174
31.08999	57.529
31.09	59.694
31.29	61.764
31.49	63.605
31.49001	63.611
31.68999	64.690
31.69001	67.448
31.88999	70.248
31.89001	72.614
32.08999	72.622
32.09	73.586
32.29	75.263
32.49	77.323
32.49001	78.297
32.68999	79.533
32.69001	81.733
32.7	81.735
32.88999	81.893
32.89001	82.014
33.08999	82.097
33.09	84.312
33.29	86.374
33.49	87.795
33.49001	87.939
33.50001	87.949
33.68999	88.140
33.69001	88.462
33.88999	88.961
33.89001	89.981
34.08999	90.008
34.09	91.239
34.29	92.241
34.49	92.636
34.49001	92.723
34.50001	92.729
34.68999	92.752
34.69001	92.950
34.88999	92.977
34.89001	93.178
35.08999	93.180

Table 2.16-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1978.

Table 2.16-4. Regression equations for the month of March, 1978.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30	I = $\frac{33.67}{14.37} \log_{10}(A)$	3155	.36	I = $\frac{27.68}{4.62} \log_{10}(A)$	258	.04	I = $\frac{41.59}{26.80} \log_{10}(A)$	10356	.54
A on R at equal probability levels.	ID			ID			ID		
Attenuation scaling. A (11) at equal probability levels.				ID					
Attenuation scaling. A (19) at equal probability levels.	ID						A(19) = .04* A(28) 1.82	3	1.0
Attenuation scaling. A. (28) at equal probability levels.	ID			A(28) = 6.08* A(19) .54	3	.98			

[1] A local oscillator malfunction hampered accurate data collection

ID = insufficient data

3. LONG-TERM STATISTICS

3.1 Introduction

Chapter 2 summarized the available data for each month of the report period. In this chapter we present preliminary composite statistics for periods ranging from three to eleven months.

Long-term attenuation and rain statistics are valuable for deriving relationships between attenuation and rain rate and for predicting the long-term performance of satellite communications systems. In the first case it is important that the data base contain only fades due to rain that was recorded by the rain gauges (i.e. data taken during snow, sleet, and rain that fell when the gauges were frozen must be excluded). In our climate this means that data from the months of January, February, and March must be excluded when a comparison of attenuation and rain rate statistics is made.

Predicting link performance, on the other hand, required a statistical data base that includes all fades produced by the propagation medium, whether or not these were associated with measurable precipitation on the ground. Fades due to equipment failure and unplanned satellite motions must be excluded unless these occurred for insignificant periods of time. This has been a particular problem with CTS where satellite maneuvers and beacon shut downs have occurred regularly.

In the pages which follow we present statistics for two long periods (10 or 11 months) and for several shorter periods (3 to 5 months). These are organized as follows.

3.2 Calendar Year 1977 less February

In this data base values for 19 and 28 GHz attenuation were scaled from those measured at 11.7 GHz (See Chapter 2.) for the months before which the COMSTAR system became operational. The 11.7 GHz data for December, 1977, were biased by spacecraft maneuvers. Since a significant number of sleet and snow fades are included in these data (and much of the 19 and 28 GHz data were scaled), tables of regression equations are not included.

3.3 June, 1977, through March, 1978

This section contains data collected for the period beginning with the activation of both COMSTAR systems. It includes the CTS maneuvers and some periods of 19 GHz local oscillator malfunction. However the 28 GHz data were valid for the entire period and the resulting statistics include the effect of some real snow and sleet fades at this frequency.

3.4 July, August, and September, 1977

This quarter contains rain data for all three frequencies and provided the data base for the theoretical work in the accompanying volume. (See Chapter 1.)

3.5 October, November, and December, 1977

All 28 GHz data here are good; the 19 GHz system had local oscillator problems in November and CTS maneuvers biased the 11.7 GHz data in December. For these reasons regression equations are not included.

3.6 January, February, and March, 1978

Data for this quarter reflect the influence of snow and sleet which our rain gauges were unable to record.

3.7 July through November, 1977

This is a period of excellent rain data for the 11.7 and 28 GHz systems and the regression equations represent our largest rain-effects data base at these frequencies.

3.8 July through October and December, 1977

This period was selected to exclude the 19 GHz local oscillator failure. It represents our largest data base for 19 GHz rain attenuation.

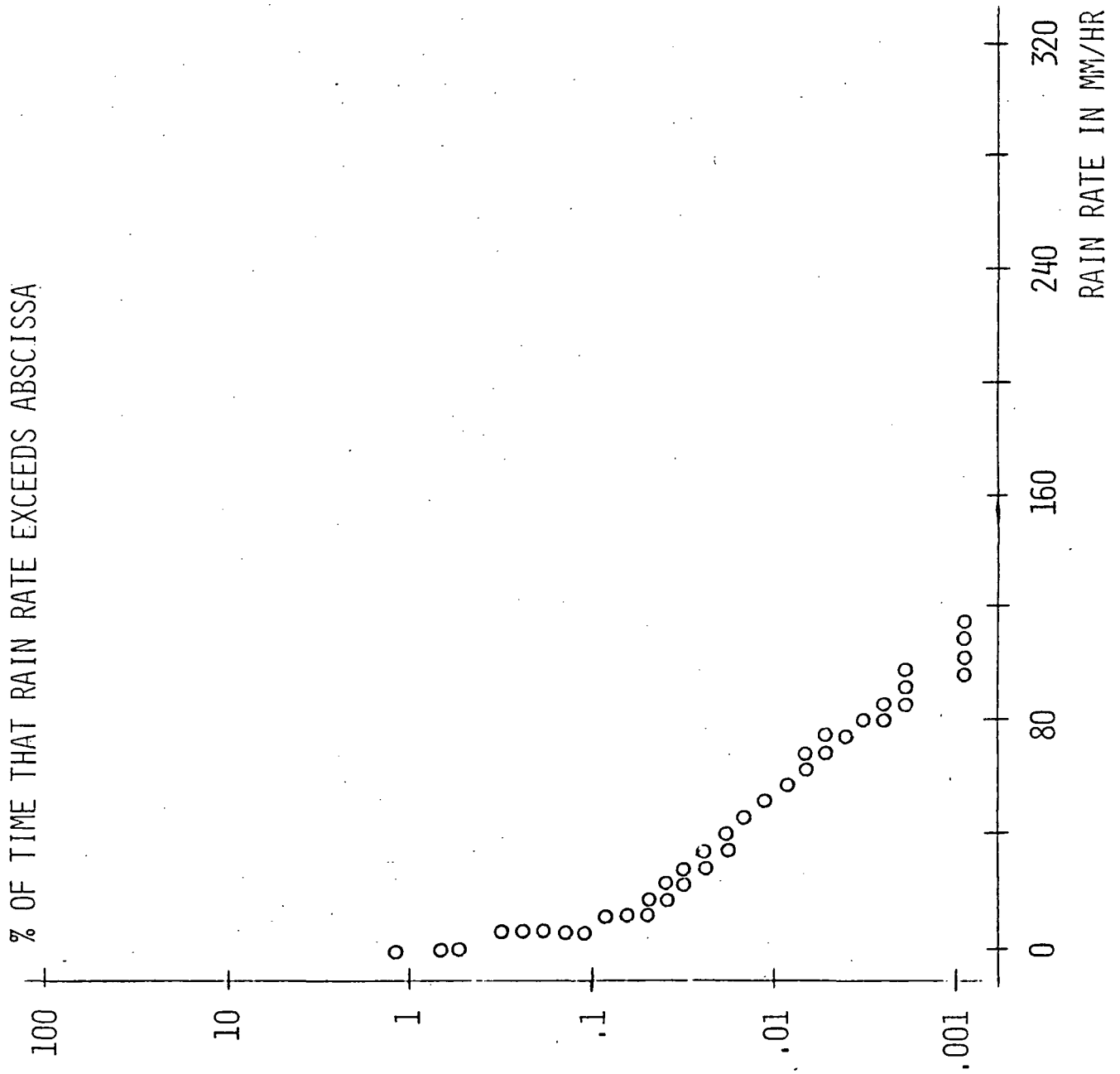


Figure 3.2-1. Rain rate statistics for the calendar year 1977 less February.

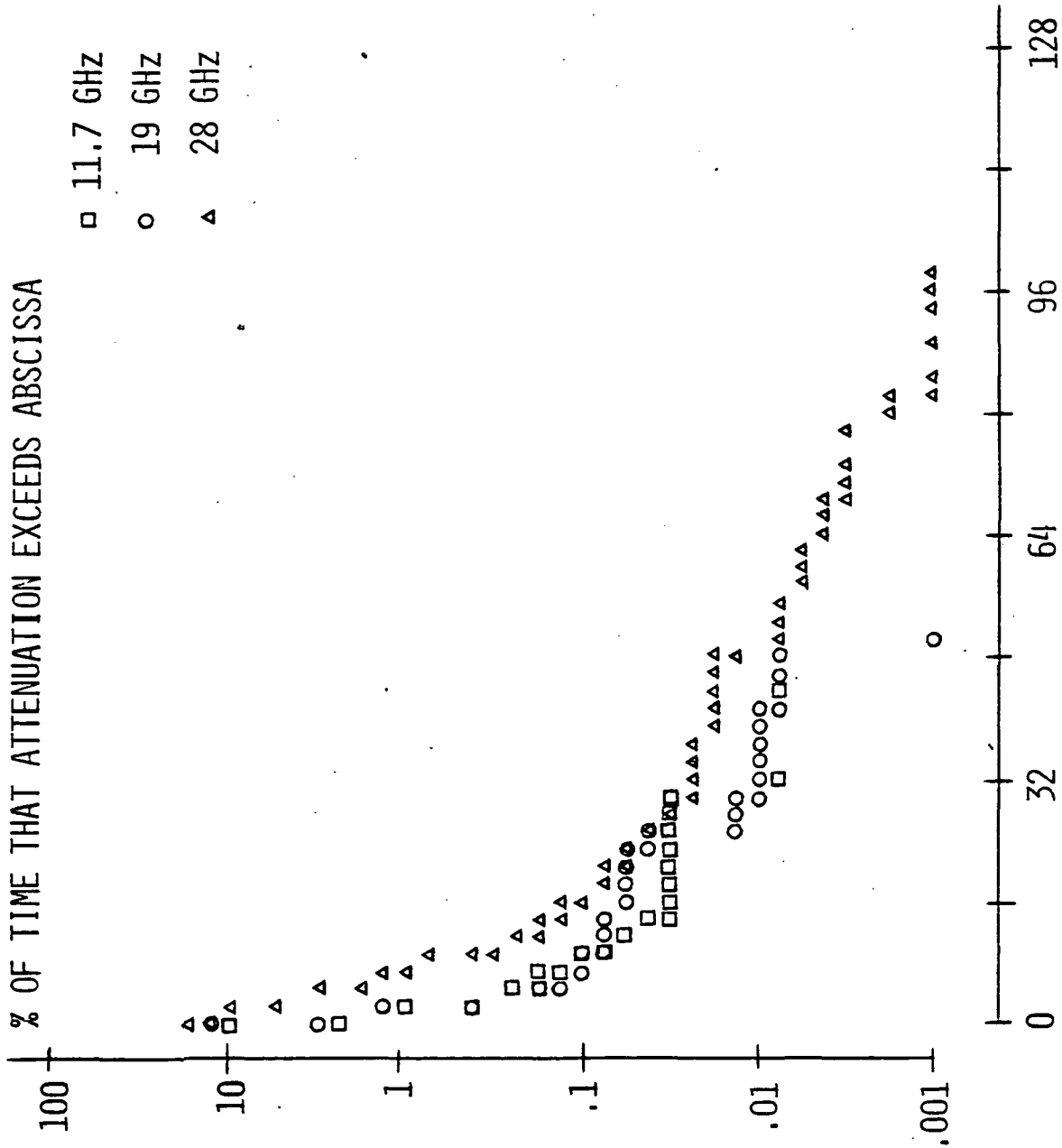


Figure 3.2-2. Attenuation statistics for the calendary year 1977 less February.

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	20.160
.	.	.	1	13.297
.	0	.	2	12.934
.	.	.	3	10.435
.	.	.	4	9.327
.	.	1	5	5.972
.	.	.	6	3.619
.	1	.	7	2.983
.	.	.	8	2.618
0	.	.	9	1.982
.	.	.	10	1.507
.	.	2	11	1.265
.	.	.	12	1.193
1	.	.	13	0.948
.	2	.	14	0.951
.	.	.	15	0.893
2	.	.	16	0.684
.	.	.	17	0.637
3	.	.	18	0.460
.	3	.	19	0.450
.	.	3	20	0.447
4	.	.	21	0.429
.	.	.	22	0.523
5	.	.	23	0.252
.	4	.	24	0.247
6	.	4	25	0.223
.	.	.	26	0.205
7	.	.	27	0.200
.	5	.	28	0.191
8	.	.	29	0.164
.	6	.	30	0.163
9	.	.	31	0.161
.	.	.	32	0.140
10	.	.	33	0.134
.	7	.	34	0.133
11	.	.	35	0.131
.	.	5	36	0.117
12	.	.	37	0.114
.	8	.	38	0.104
13	.	7	39	0.102
.	.	.	40	0.099
14	.	8	41	0.093
.	9	.	42	0.093
15	.	.	43	0.090
.	.	9	44	0.089
16	.	.	45	0.088
.	.	.	46	0.088
17	.	.	47	0.086
.	.	10	48	0.084
18	.	.	49	0.084
.	.	.	50	0.079
19	.	11	51	0.078
.	.	.	52	0.073
20	.	12	53	0.073
.	.	.	54	0.072
21	10	.	55	0.070

Table 3.2-1. Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

RAIN	ACTS	AV19	AC28	PER
.	.	13	20	0.069
15	.	.	.	0.068
.	.	14	.	0.065
.	.	.	21	0.063
.	11	.	.	0.062
16	.	15	.	0.061
17	.	.	.	0.058
.	.	16	.	0.057
.	.	.	22	0.056
18	.	17	.	0.055
.	12	18	.	0.053
19	.	19	.	0.052
.	.	20	.	0.051
.	.	21	23	0.050
20	.	22	.	0.049
.	.	23	.	0.048
21	.	.	.	0.046
.	.	.	24	0.045
22	.	.	.	0.044
23	.	.	.	0.042
.	.	.	25	0.041
24	.	.	.	0.040
.	13	.	.	0.039
25	.	.	.	0.038
.	.	24	26	0.037
26	14	.	.	0.036
27	15	.	.	0.035
28	.	.	.	0.034
.	16	.	.	0.033
.	17	.	.	0.033
29	18	.	.	0.032
30	19	.	27	0.031
31	20	.	.	0.030
31	21	.	.	0.030
31	22	.	.	0.030
31	23	.	.	0.030
32	24	.	28	0.029
32	25	.	28	0.029
33	26	.	28	0.029
33	27	.	.	0.028
33	28	.	.	0.028
33	30	.	.	0.028
34	.	.	.	0.027
35	.	.	29	0.026
36	.	.	30	0.025
37	.	.	31	0.024
38	.	.	32	0.024
39	.	.	33	0.023
40	.	.	34	0.022
40	.	.	35	0.021
40	.	.	36	0.021
41	.	.	37	0.021
42	.	.	38	0.020
.	.	.	39	0.020

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
42	.	.	40	0.020
43	.	.	41	0.019
43	.	.	42	0.019
44	.	.	43	0.018
44	.	.	44	0.018
45	.	.	45	0.017
45	.	.	46	0.017
46	.	.	47	0.016
47	.	.	48	0.016
48	.	.	49	0.015
49	.	25	.	0.014
50	.	26	.	0.014
50	.	27	.	0.014
51	.	28	.	0.013
52	.	28	.	0.013
53	.	29	.	0.012
53	.	29	.	0.012
55	.	29	.	0.012
56	.	30	.	0.011
57	.	31	.	0.011
57	.	32	.	0.011
57	.	33	.	0.011
58	.	34	.	0.010
59	.	35	.	0.010
59	.	36	.	0.010
60	.	37	.	0.010
60	.	38	.	0.009
60	.	39	.	0.009
61	33	40	.	0.009
62	33	41	50	0.008
63	33	42	51	0.008
64	33	45	51	0.008
64	33	46	51	0.008
65	43	48	51	0.008
66	43	49	53	0.007
66	43	49	54	0.007
69	43	49	54	0.007
70	43	49	54	0.007
71	.	.	56	0.006
72	.	.	57	0.006
74	.	.	57	0.006
75	.	.	58	0.005
76	.	.	60	0.005
77	.	.	61	0.005
78	.	.	61	0.005
79	.	.	61	0.005
80	.	.	63	0.004
81	.	.	64	0.004
83	.	.	65	0.004
84	.	.	66	0.004
84	.	.	67	0.004
84	.	.	68	0.004
85	.	.	69	0.003
86	.	.	70	0.003
87	.	.	72	0.003

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

RAIN	ACTS	AV19	AC28	PER
88	.	.	73	0.003
88	.	.	74	0.003
88	.	.	77	0.003
89	.	.	79	0.002
90	.	.	80	0.002
91	.	.	82	0.002
92	.	.	82	0.002
93	.	.	82	0.002
97	.	.	82	0.002
100	.	.	82	0.002
102	.	50	83	0.001
103	.	50	85	0.001
105	.	50	90	0.001
106	.	50	93	0.001
112	.	50	97	0.001
113	.	50	99	0.001
121	50	51	102	0.000
136	50	52	105	0.000
155	50	54	108	0.000
198	50	57	114	0.000
201	50	60	120	0.000

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

ORIGINAL PAGE IS
OF POOR QUALITY

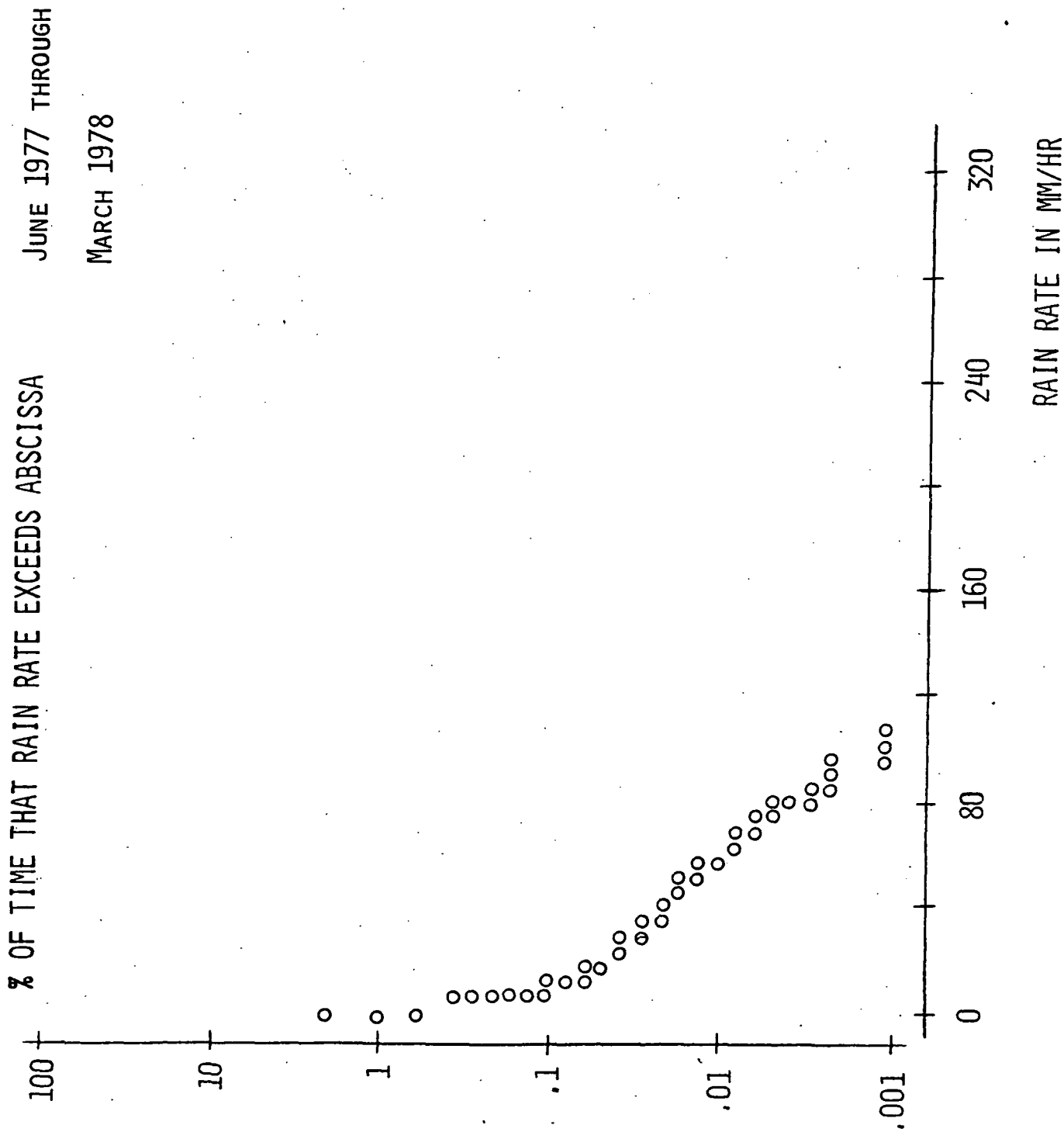


Figure 3.3-1. Rain rate statistics for June 1977 through March 1978.

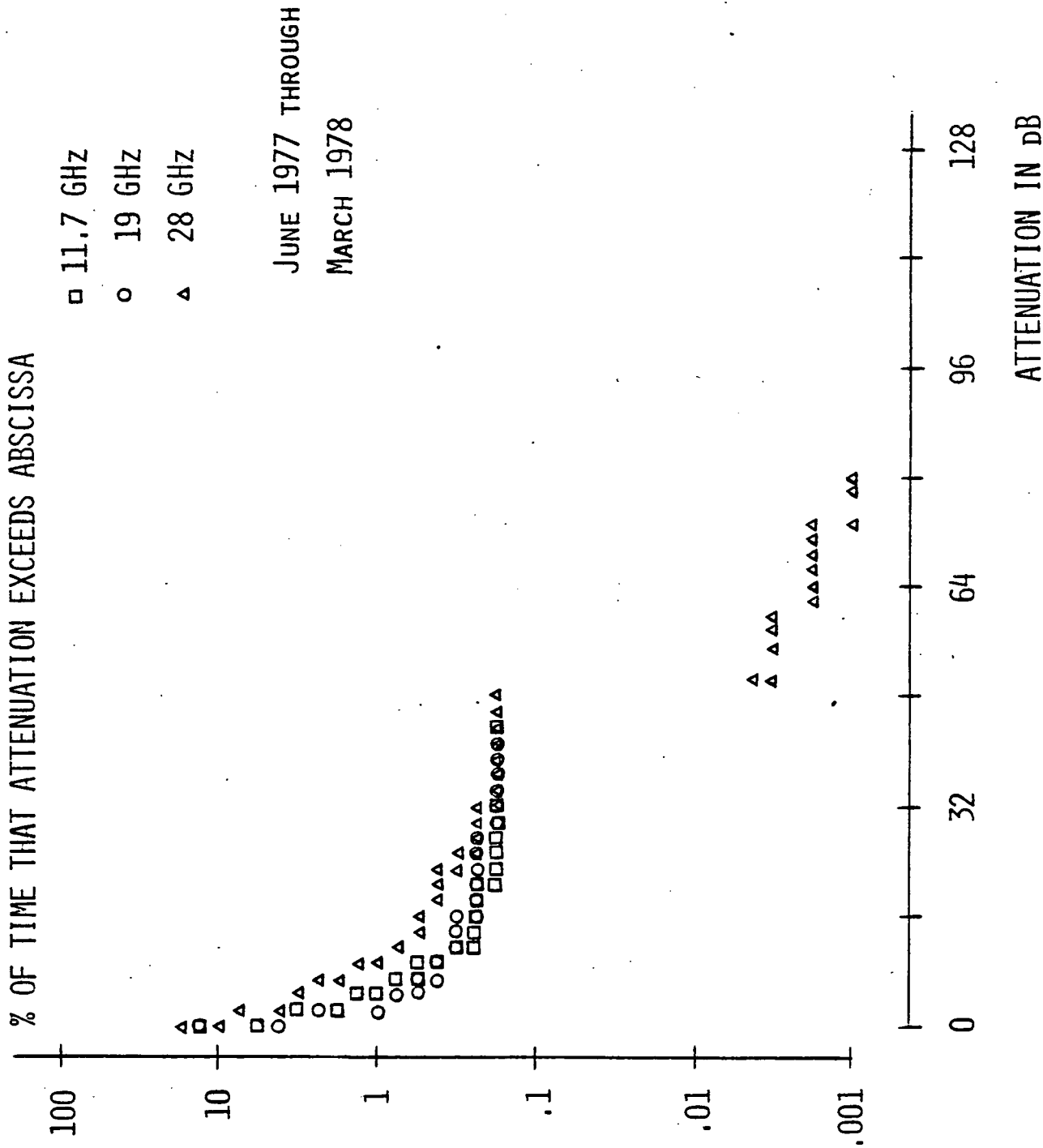


Figure 3.3-2. Attenuation statistics for June 1977 through March 1978.

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	16.360
.	0	.	.	13.455
.	.	.	1	13.349
.	.	.	2	9.206
.	1	.	3	6.698
.	.	1	4	5.620
.	.	.	5	4.814
.	2	.	6	4.441
.	.	.	7	3.639
.	.	.	8	2.941
.	3	.	9	2.916
.	.	2	10	2.221
0	.	.	11	2.086
.	3	.	12	1.889
.	.	.	13	1.689
.	4	.	14	1.688
.	.	.	15	1.356
.	.	3	16	1.176
.	5	.	17	1.152
1	.	.	18	1.106
.	6	.	19	0.951
.	.	.	20	0.922
.	7	.	21	0.897
.	.	.	22	0.784
.	8	.	23	0.780
.	.	4	24	0.701
.	9	.	25	0.688
.	.	.	26	0.617
2	10	.	27	0.611
.	.	5	28	0.589
.	11	.	29	0.585
.	.	.	30	0.546
.	12	.	31	0.546
.	.	.	32	0.528
.	13	.	33	0.513
.	.	6	34	0.495
.	14	.	35	0.489
.	.	.	36	0.489
.	15	.	37	0.476
.	.	7	38	0.476
.	16	.	39	0.461
.	.	.	40	0.439
.	17	.	41	0.433
.	.	8	42	0.428
.	18	.	43	0.428
.	.	9	44	0.421
.	19	.	45	0.412
.	.	.	46	0.412
3	20	.	47	0.405
.	.	10	48	0.387
.	21	.	49	0.376
.	.	.	50	0.374
.	22	11	51	0.374
.	.	.	52	0.351
.	23	.	53	0.351
.	.	11	54	0.346
.	24	.	55	0.329
.	.	.	56	0.324
.	25	12	57	0.324
.	.	.	58	0.319
.	26	13	59	0.319
.	.	.	60	0.312
.	27	14	61	0.312
.	.	.	62	0.298

Table 3.3-1. Attenuation and rain rate percent-of-time data for June 1977 through March 1978.

RAIN	ACTS	AV19	AC28	PER
.	.	.	25	0.289
.	.	15	.	0.283
.	.	16	.	0.275
.	.	17	26	0.270
.	.	18	.	0.267
.	.	19	.	0.266
4	.	20	.	0.265
.	.	21	.	0.264
.	.	22	.	0.262
.	.	23	.	0.261
.	.	.	27	0.252
.	.	24	.	0.247
.	.	.	28	0.242
.	12	.	.	0.226
.	.	.	29	0.224
.	.	25	.	0.222
.	.	26	.	0.221
.	.	27	.	0.221
.	.	.	30	0.219
.	13	28	.	0.212
.	14	.	.	0.210
.	15	.	.	0.209
.	16	.	31	0.208
.	17	.	.	0.207
.	18	.	.	0.207
.	19	.	32	0.206
.	20	.	32	0.206
.	21	.	.	0.205
.	22	.	.	0.205
.	23	.	.	0.205
.	24	.	.	0.205
.	25	.	.	0.205
.	27	.	.	0.204
.	28	.	.	0.204
5	30	.	.	0.204
.	.	.	.	0.201
.	.	.	33	0.199
.	.	.	34	0.196
.	.	.	35	0.195
.	.	29	36	0.193
.	.	29	37	0.193
.	.	29	38	0.193
.	.	.	39	0.192
.	.	.	40	0.192
.	.	.	41	0.192
.	.	.	42	0.191
.	.	.	43	0.191
.	.	.	44	0.191
.	.	.	45	0.190
.	.	.	47	0.189
.	.	30	.	0.188
.	.	.	48	0.185
.	.	.	49	0.185
.	.	31	.	0.184
.	33	32	.	0.183

Table 3.3-1 (continued). Attenuation and rain rate percent-of-time data for June 1977 through March 1978.

RAIN	ACTS	AV19	AC28	PER
33	33	33	.	0.183
34	33	34	.	0.183
35	33	35	.	0.183
36	33	36	.	0.183
37	.	37	.	0.182
38	.	38	.	0.182
39	.	39	.	0.182
40	.	40	.	0.182
41	43	41	.	0.181
6	.	.	.	0.163
7	.	.	.	0.132
8	.	.	.	0.104
9	.	.	.	0.093
10	.	.	.	0.082
11	.	.	.	0.074
12	.	.	.	0.069
13	.	.	.	0.063
14	.	.	.	0.059
15	.	.	.	0.055
16	.	.	.	0.050
17	.	.	.	0.047
18	.	.	.	0.045
19	.	.	.	0.043
20	.	.	.	0.041
21	.	.	.	0.039
22	.	.	.	0.037
23	.	.	.	0.035
24	.	.	.	0.034
25	.	.	.	0.032
26	.	.	.	0.031
27	.	.	.	0.030
28	.	.	.	0.029
29	.	.	.	0.028
30	.	.	.	0.027
31	.	.	.	0.026
32	.	.	.	0.025
33	.	.	.	0.025
34	.	.	.	0.024
35	.	.	.	0.024
36	.	.	.	0.023
37	.	.	.	0.022
38	.	.	.	0.021
39	.	.	.	0.020
40	.	.	.	0.020
41	.	.	.	0.019
42	.	.	.	0.018
43	.	.	.	0.017
44	.	.	.	0.017
45	.	.	.	0.016
46	.	.	.	0.015
47	.	.	.	0.015
48	.	.	.	0.015
49	.	.	.	0.014
50	.	.	.	0.014

Table 3.3-1 (continued). Attenuation and rain rate percent-of-time data for June 1977 through March 1978.

RAIN	ACTS	AV19	AC28	PER
51	.	.	.	0.013
52	.	.	.	0.013
53	.	.	.	0.012
54	.	.	.	0.012
55	.	.	.	0.012
56	.	.	.	0.011
57	.	.	.	0.011
58	.	.	.	0.010
59	.	.	.	0.010
60	.	.	.	0.009
61	.	.	.	0.008
62	.	.	.	0.008
63	.	.	.	0.008
64	.	.	.	0.008
65	.	.	.	0.007
66	.	.	.	0.007
69	.	.	.	0.007
70	.	.	.	0.007
71	.	.	.	0.006
72	.	.	.	0.006
74	.	.	.	0.006
75	.	.	.	0.005
76	.	.	.	0.005
77	.	.	.	0.005
78	.	.	.	0.005
79	.	.	.	0.005
80	.	.	50	0.004
81	.	.	50	0.004
83	.	.	50	0.004
84	.	.	50	0.004
85	.	.	51	0.003
86	.	.	54	0.003
87	.	.	56	0.003
87	.	.	57	0.003
87	.	.	60	0.003
88	.	.	61	0.002
89	.	.	63	0.002
90	.	.	64	0.002
91	.	.	66	0.002
92	.	.	67	0.002
93	.	.	68	0.002
97	.	.	70	0.002
97	.	.	72	0.002
100	.	.	73	0.001
102	.	.	74	0.001
103	.	.	77	0.001
105	.	.	79	0.001
106	.	.	80	0.001
112	.	.	80	0.001
113	50	50	83	0.000
121	50	57	114	0.000
136	50	57	114	0.000
198	50	57	114	0.000
201	50	57	114	0.000

Table 3.3-1 (continued). Attenuation and rain rate percent-of-time data for June 1977 through March 1978.

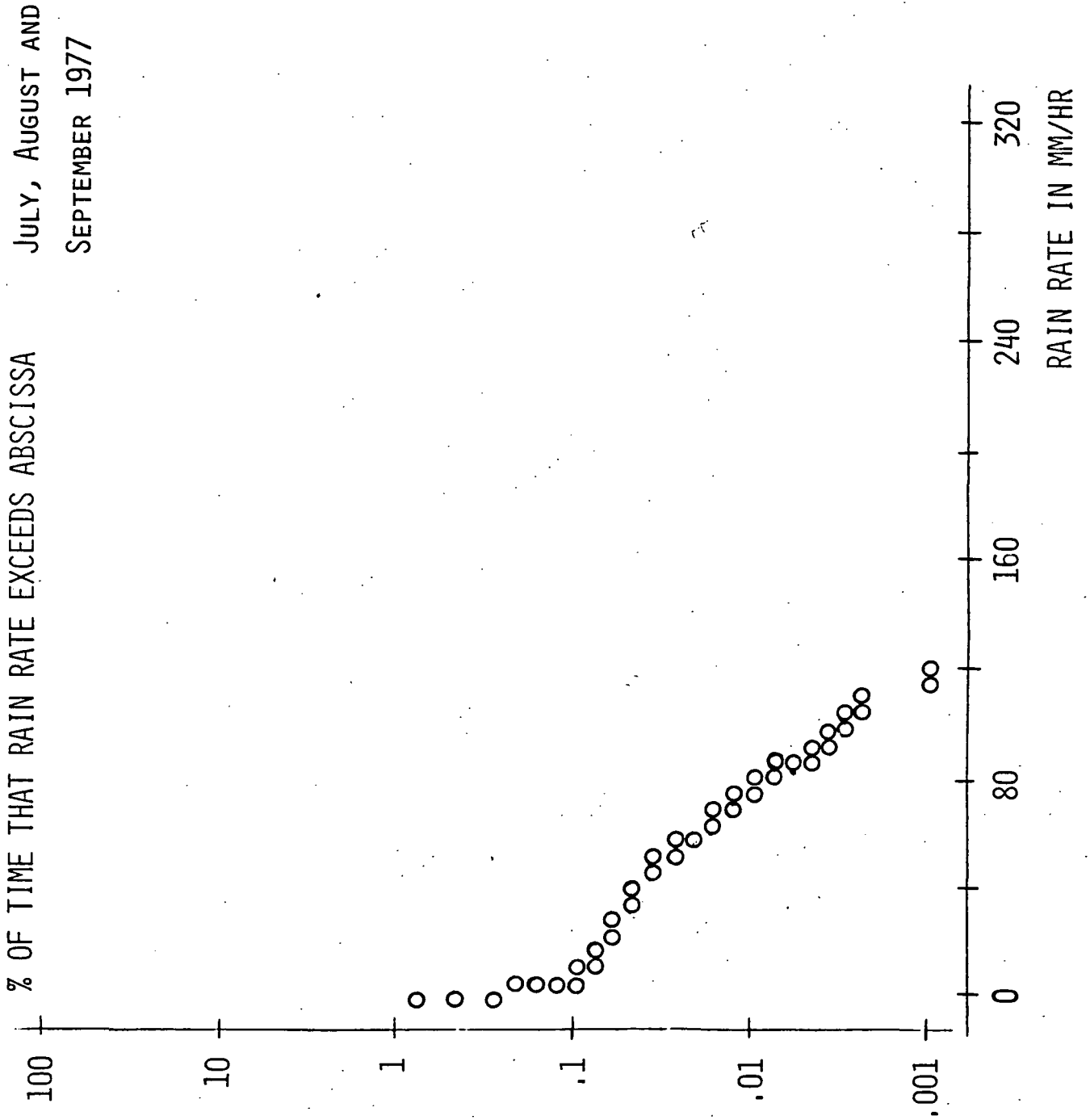


Figure 3.4-1. Rain rate statistics for July, August, and September, 1977.

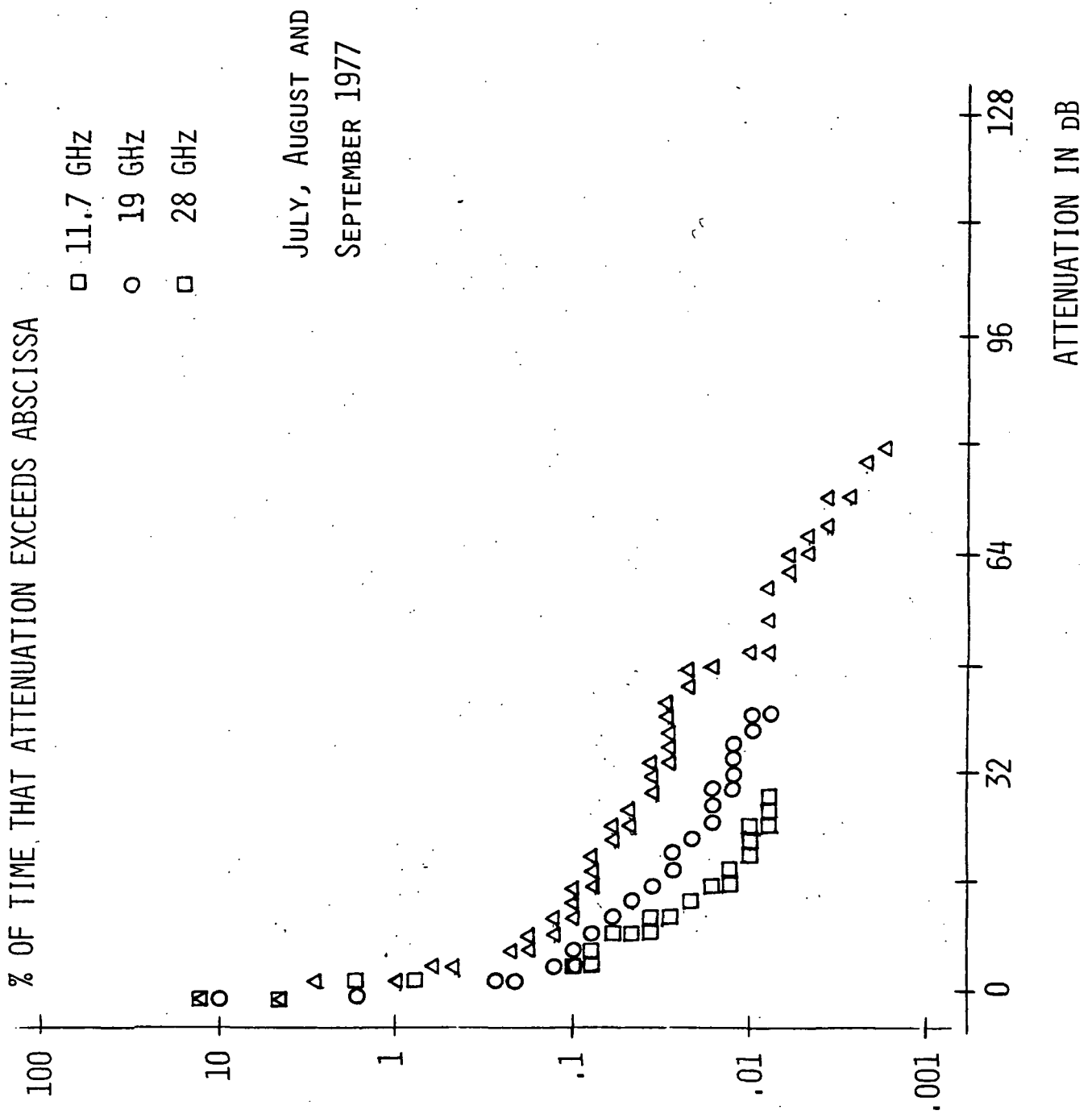


Figure 3.4-2. Attenuation statistics for July, August, and September, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	.	0	17.075
.	0	.	.	14.150
.	.	0	.	13.738
.	.	.	1	6.421
.	1	.	.	5.666
.	.	.	2	3.602
.	.	1	.	2.238
.	2	.	.	1.857
.	.	.	3	1.533
.	3	.	.	0.878
0	.	.	.	0.840
.	.	.	4	0.790
.	.	.	5	0.557
1	.	.	.	0.435
.	.	2	.	0.379
2	.	.	6	0.303
.	.	3	.	0.243
3	.	.	.	0.219
.	.	.	7	0.194
.	.	.	8	0.169
4	.	.	.	0.161
.	.	4	.	0.160
.	.	.	9	0.151
5	.	.	.	0.144
.	.	.	10	0.140
.	4	5	.	0.137
.	.	.	11	0.129
6	.	.	.	0.128
.	.	6	.	0.125
7	.	.	.	0.119
.	.	.	12	0.118
8	.	.	13	0.110
.	5	.	.	0.107
.	.	7	.	0.106
9	.	.	.	0.105
.	.	.	14	0.104
10	.	.	.	0.099
.	.	8	.	0.098
.	6	.	15	0.097
.	.	.	16	0.094
11	.	.	.	0.093
12	.	.	17	0.091
13	.	.	.	0.085
.	.	9	.	0.084
.	7	.	18	0.083
14	.	10	.	0.081
15	.	.	19	0.079
16	8	.	20	0.077
17	.	.	.	0.075
18	.	.	.	0.074
19	.	.	.	0.072
20	.	.	21	0.071
.	.	.	.	0.070
.	.	11	.	0.069

Table 3.4-1. Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

RAIN	ACTS	AV19	AC28	PER
21	.	.	.	0.068
22	.	.	22	0.067
23	.	12	.	0.063
24	9	.	23	0.062
25	.	.	.	0.061
26	.	.	.	0.059
27	.	.	.	0.059
28	.	.	24	0.058
29	.	.	.	0.057
30	.	13	.	0.056
31	.	.	.	0.055
32	.	.	25	0.054
33	.	14	26	0.053
34	.	.	.	0.052
35	.	.	.	0.051
36	.	.	.	0.050
37	10	15	27	0.049
38	.	.	.	0.049
39	.	.	28	0.048
40	11	16	.	0.047
40	11	16	29	0.046
41	.	.	30	0.045
42	.	17	31	0.045
43	.	.	32	0.043
44	.	.	.	0.043
44	.	18	33	0.042
45	.	18	34	0.041
.	.	.	35	0.040
.	.	19	36	0.039
.	.	19	37	0.038
46	12	20	38	0.038
46	12	20	39	0.037
47	.	.	40	0.036
48	.	.	41	0.036
49	.	21	42	0.035
50	.	.	43	0.034
.	.	.	44	0.033
51	13	22	45	0.032
52	.	.	45	0.031
53	.	.	45	0.030
54	14	23	.	0.029
55	14	23	.	0.028
.	.	.	47	0.028
56	.	24	48	0.026
57	.	.	49	0.026
58	.	25	.	0.025
58	.	26	.	0.024
.	15	.	.	0.023
59	16	27	.	0.023
.	.	28	.	0.022
60	17	30	.	0.022
.	.	.	.	0.021
.	.	.	.	0.020
.	.	.	.	0.019
.	.	.	.	0.018

Table 3.4-1 (continued). Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PÉR
61	18	31	.	0.017
62	18	32	.	0.017
63	18	32	.	0.017
64	.	33	.	0.016
64	.	34	.	0.016
65	19	35	.	0.015
65	19	36	.	0.015
69	.	37	.	0.014
69	.	38	.	0.014
70	.	39	.	0.013
72	.	39	.	0.013
74	20	40	50	0.012
74	21	40	50	0.012
74	23	40	50	0.012
75	24	41	51	0.011
75	25	41	51	0.011
75	27	41	51	0.011
76	28	.	54	0.010
79	.	.	56	0.009
80	.	.	57	0.009
80	.	.	60	0.009
81	.	.	61	0.008
85	.	.	63	0.007
85	.	.	64	0.007
86	.	.	66	0.006
88	.	.	67	0.006
91	.	.	68	0.006
92	.	.	70	0.005
93	.	.	72	0.005
93	.	.	73	0.005
97	.	.	74	0.004
100	.	.	74	0.004
102	.	.	77	0.003
103	.	.	79	0.003
106	.	.	79	0.003
112	.	.	80	0.002
113	.	.	.	0.001
121	.	.	.	0.001
198	50	50	83	0.000
201	50	57	114	0.000

Table 3.4-1 (continued). Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

Table 3.4-2. Regression equations for July, August, and September, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30									
A on R at equal probability levels.	A = .54* R ^{.85}	25	.91	A = .89* R ^{.84}	38	.84	A = 2.96* R ^{.68}	51	.96
Attenuation scaling. A (11) at equal probability levels.				A(11) = .73* A(19) ^{.95}	23	.90	A(11) = .23* A(28) ^{.17}	16	.94
Attenuation scaling. A (19) at equal probability levels.	A(19) = 1.85* A(11) ^{.95}	23	.90				A(19) = .33* A(28) ^{.16}	19	.82
Attenuation scaling. A (28) at equal probability levels.	A(28) = 4.06* A(11) ^{.81}	16	.94	A(28) = 4.27* A(19) ^{.71}	19	.82			

OCTOBER, NOVEMBER,
AND DECEMBER 1977

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA

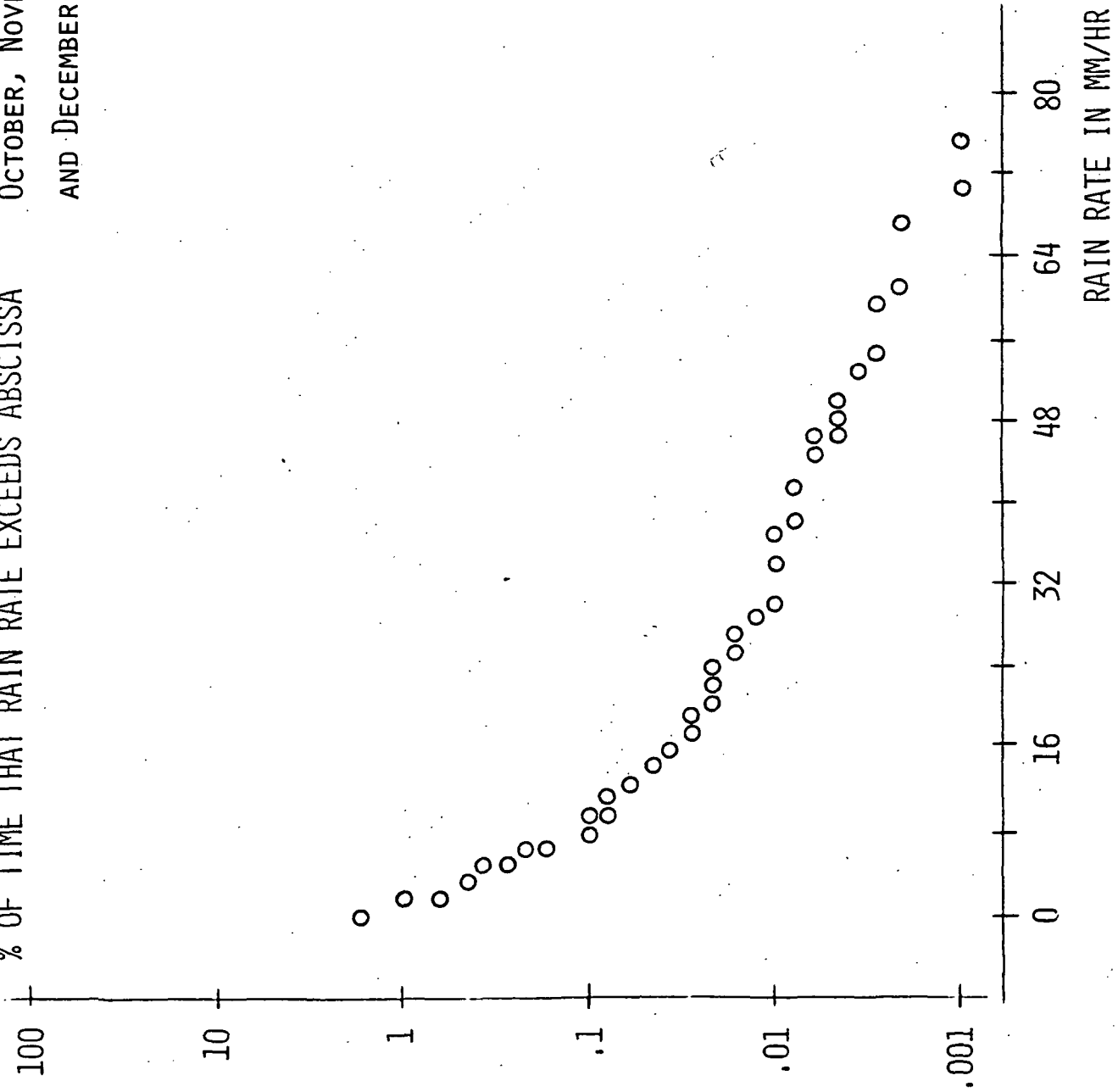


Figure 3.5-1. Rain rate statistics for October, November, and December, 1977.

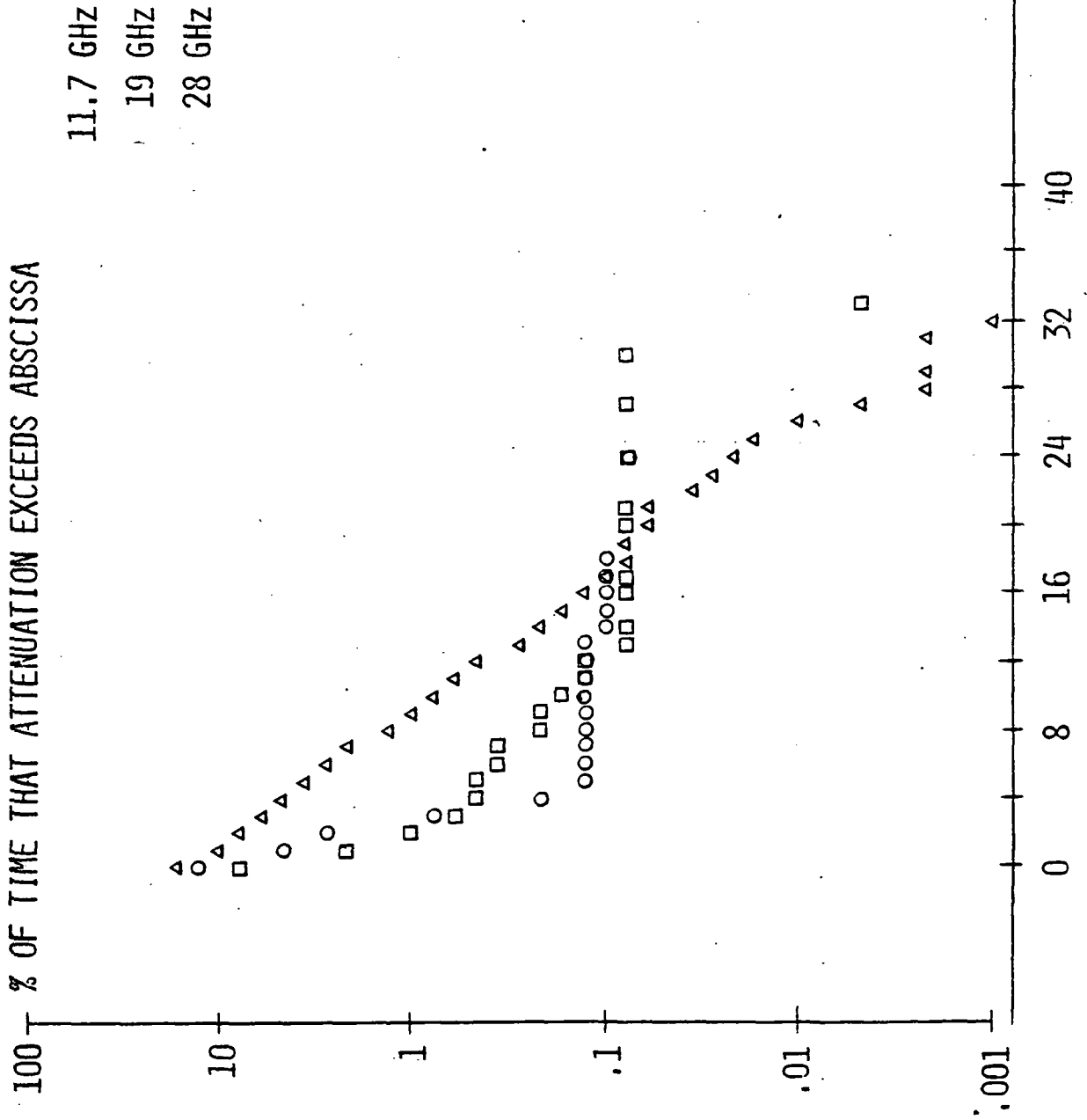


Figure 3.5-2. Attenuation statistics for October, November, and December, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	16.619
.	.	.	1	11.465
.	0	.	2	9.739
.	.	.	3	8.748
.	.	1	4	6.884
.	.	.	5	5.298
.	.	2	6	4.839
.	1	.	7	4.213
0	.	.	8	3.362
.	.	.	9	2.587
1	2	.	10	2.560
.	.	.	11	1.916
.	3	.	12	1.904
2	.	.	13	1.835
.	4	.	14	1.286
.	5	.	15	1.060
3	.	.	16	0.933
.	6	.	.	0.897
.	7	.	.	0.746
4	8	.	.	0.685
.	9	.	.	0.672
.	10	.	.	0.551
5	.	.	.	0.549
.	11	.	.	0.516
.	.	.	.	0.494
6	12	.	.	0.464
.	.	.	.	0.409
.	13	.	.	0.401
7	.	.	.	0.371
.	14	.	.	0.322
.	.	.	.	0.300
8	15	.	.	0.276
.	.	.	.	0.242
.	16	.	.	0.220
9	.	.	.	0.205
.	.	4	.	0.202
.	10	.	15	0.198
.	11	.	.	0.179
.	.	.	.	0.160
.	.	.	.	0.160
.	.	.	.	0.150
.	.	.	.	0.143
.	.	.	16	0.129
.	.	5	.	0.127
.	.	6	.	0.123
.	.	7	.	0.121
.	12	8	.	0.119
.	.	9	.	0.118
.	.	10	.	0.118
.	.	11	.	0.116
.	.	12	.	0.115
.	.	13	.	0.114
.	.	14	.	0.114
.	.	15	.	0.113
.	.	16	.	0.113
.	.	.	.	0.112

Table 3.5-1. Attenuation and rain rate percent-of-time data for October, November, and December, 1977.

RAIN	ACTS	AV19	AC28	PER
.	.	17	.	0.112
.	.	18	.	0.111
8	.	.	.	0.108
.	.	.	17	0.100
9	.	.	.	0.093
.	.	.	18	0.086
.	13	.	.	0.080
.	14	.	.	0.079
10	16	24	.	0.078
10	17	24	.	0.078
.	20	.	.	0.077
.	21	.	.	0.077
.	24	.	.	0.077
.	27	.	.	0.076
.	30	.	.	0.076
11	.	.	.	0.071
.	.	.	19	0.070
12	.	.	20	0.064
13	.	.	.	0.058
.	.	.	21	0.053
14	.	.	.	0.052
15	.	.	.	0.045
.	.	.	22	0.039
16	.	.	.	0.034
17	.	.	.	0.033
.	.	.	23	0.029
18	.	.	.	0.028
19	.	.	.	0.027
20	.	.	.	0.024
.	.	.	24	0.023
21	.	.	.	0.022
22	.	.	.	0.022
23	.	.	.	0.020
24	.	.	.	0.019
25	.	.	25	0.016
26	.	.	.	0.015
27	.	.	.	0.014
28	.	.	.	0.013
29	.	.	.	0.012
30	.	.	.	0.011
31	.	.	.	0.010
33	.	.	26	0.009
36	.	.	26	0.009
37	.	.	.	0.008
38	.	.	.	0.008
39	.	.	.	0.008
42	.	.	.	0.007
45	.	.	.	0.006
47	.	.	.	0.006
48	33	.	27	0.005
49	33	.	27	0.005
52	33	.	27	0.005
55	.	.	.	0.004
59	.	.	.	0.004

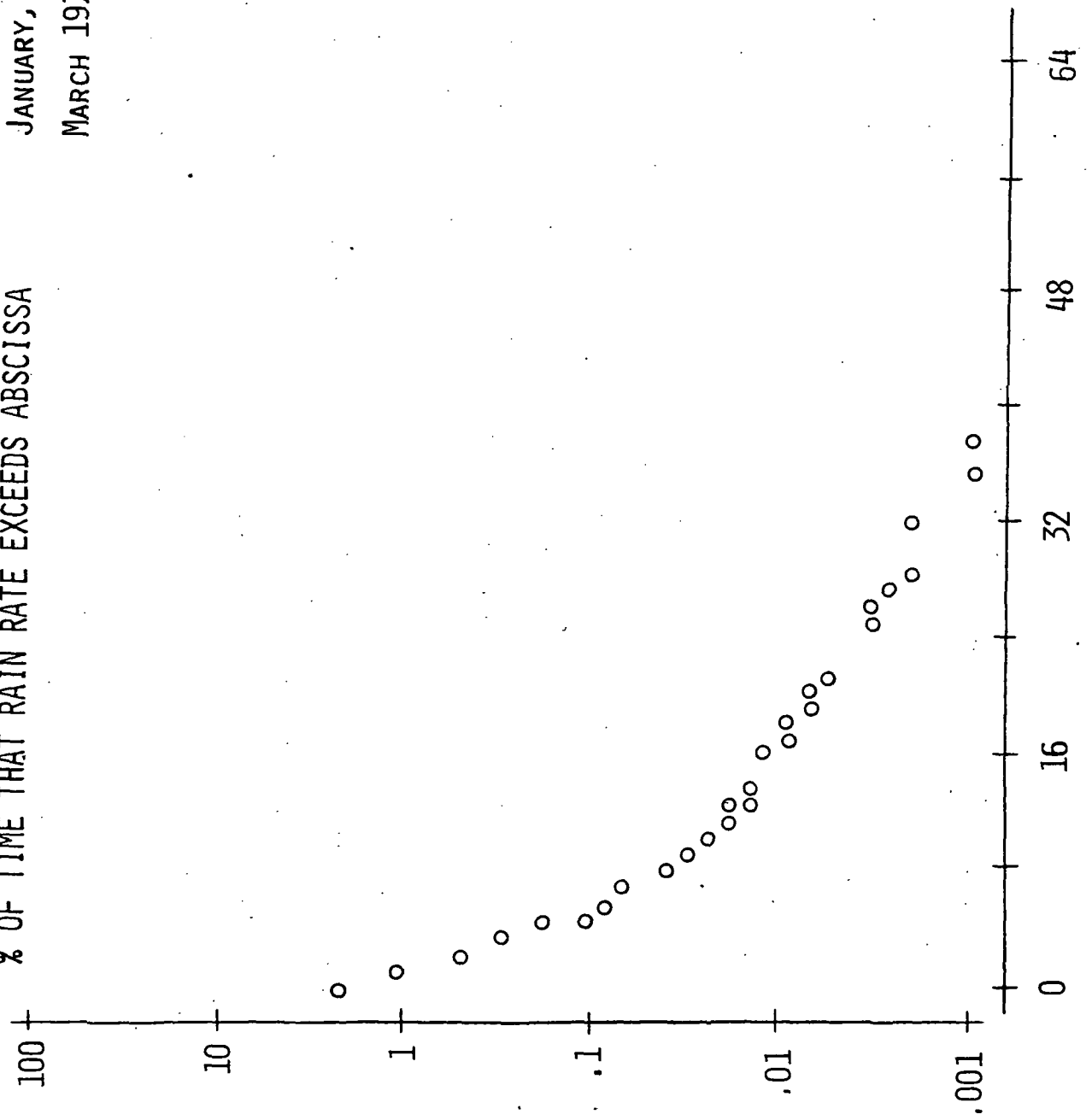
Table 3.5-1 (continued). Attenuation and rain rate percent-of-time data for October, November, and December, 1977.

RAIN	ACTS	AV19	AC28	PER
60	.	.	.	0.003
61	.	.	.	0.003
66	.	.	28	0.002
71	.	.	29	0.002
75	.	.	31	0.002
77	.	.	32	0.001
79	.	.	32	0.001
80	43	25	34	0.000
85	43	26	36	0.000

Table 3.5-1 (continued). Attenuation and rain rate percent-of-time data for October, November, and December, 1977.

JANUARY, FEBRUARY, AND
MARCH 1978

% OF TIME THAT RAIN RATE EXCEEDS ABSCISSA



RAIN RATE IN MM/HR

Figure 3.6-1. Rain rate statistics for January, February, and March, 1978.

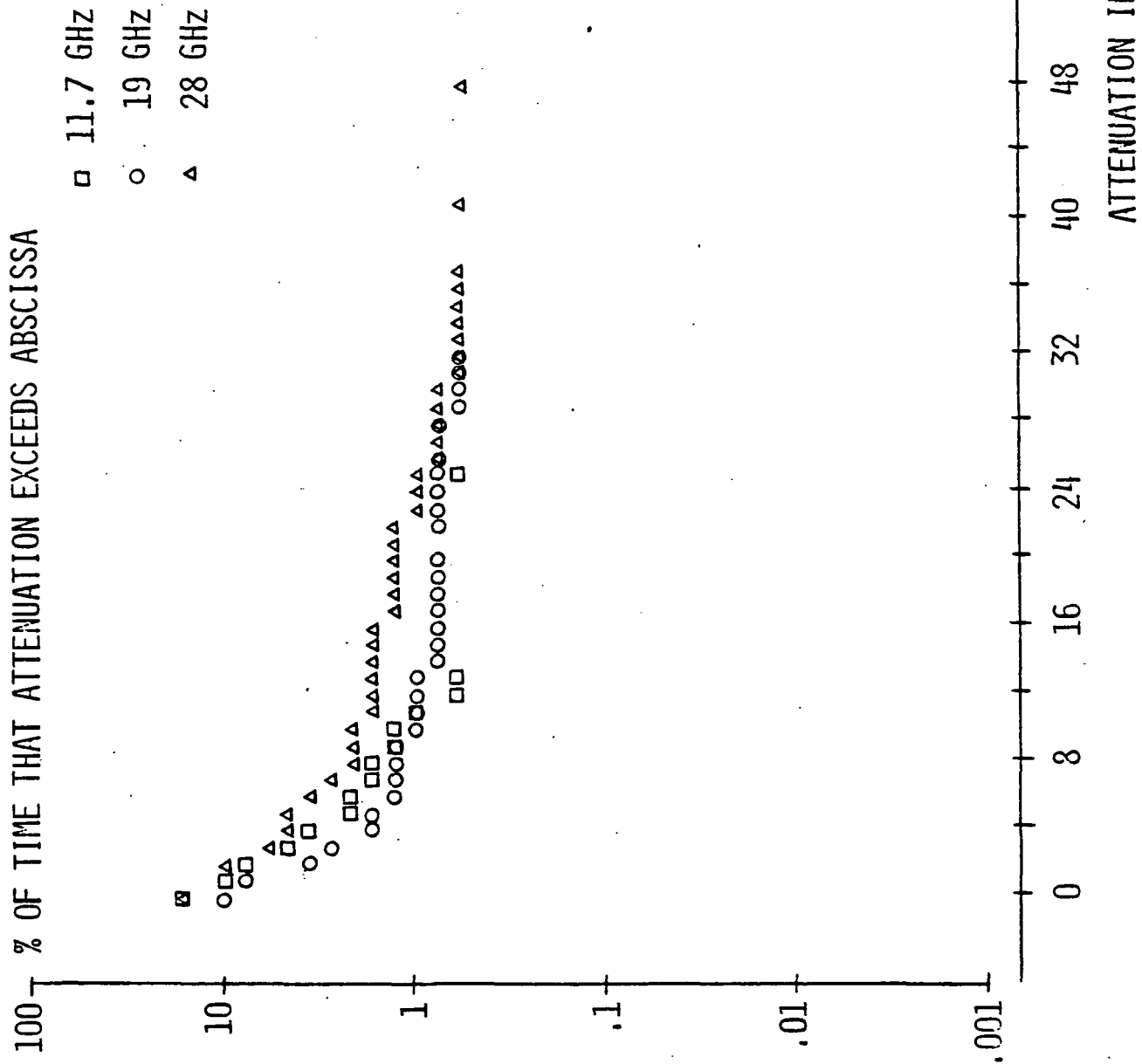


Figure 3.6-2. Attenuation statistics for January, February, and March 1978.

RAIN	ACTS	AV19	AC28	PER
.	0	.	0	18.409
.	.	.	1	16.411
.	.	0	.	11.330
.	1	.	.	11.094
.	.	.	2	11.035
.	.	.	.	8.910
.	2	1	.	7.390
.	.	.	.	7.140
.	.	.	3	6.642
.	.	.	4	5.266
.	3	.	5	4.315
.	.	.	.	4.243
.	.	2	.	3.755
.	4	.	6	3.394
.	.	.	.	3.307
0	.	.	.	2.900
.	.	3	.	2.820
.	5	.	7	2.606
.	.	.	.	2.423
.	.	.	8	2.374
.	.	.	9	2.202
.	6	.	.	2.166
.	.	.	10	2.072
.	.	.	11	1.844
.	.	4	.	1.786
.	.	.	12	1.763
.	7	.	.	1.672
.	.	5	.	1.625
.	.	.	.	1.614
.	.	.	13	1.580
.	.	.	14	1.528
.	8	.	15	1.528
.	.	.	.	1.502
.	.	.	16	1.476
.	.	.	17	1.453
.	.	.	18	1.420
.	9	.	.	1.404
.	.	.	19	1.391
.	.	6	.	1.349
.	.	.	20	1.308
.	10	.	21	1.258
.	.	7	.	1.213
.	.	.	.	1.171
.	.	8	22	1.156
.	.	9	.	1.139
1	.	.	.	1.137
.	.	.	23	1.094
.	.	10	.	1.048
.	.	.	24	1.015
.	.	11	.	0.970
.	11	.	.	0.940
.	.	.	25	0.908
.	.	12	.	0.893
.	.	13	.	0.885
.	.	.	26	0.857

Table 3.6-1. Attenuation and rain rate percent-of-time data for January, February, and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.

RAIN	ACTS	AV19	AC28	PER
.	.	14	.	0.842
.	.	15	.	0.816
.	.	.	27	0.807
.	.	16	28	0.779
.	.	17	.	0.768
.	.	18	.	0.760
.	.	19	.	0.760
.	.	20	.	0.759
.	.	22	.	0.758
.	.	23	.	0.757
.	.	24	.	0.745
.	.	25	.	0.743
.	.	26	.	0.742
.	.	.	29	0.720
.	.	28	.	0.711
.	.	.	30	0.702
.	.	.	31	0.670
.	.	.	32	0.664
.	.	29	.	0.647
.	.	.	33	0.643
.	.	.	34	0.635
.	.	30	35	0.633
.	.	.	36	0.627
.	.	.	37	0.627
.	.	.	41	0.627
.	.	31	.	0.619
.	12	.	.	0.617
.	13	.	.	0.616
.	25	32	48	0.615
2	.	.	.	0.611
3	.	.	.	0.347
4	.	.	.	0.195
5	.	.	.	0.124
6	.	.	.	0.099
7	.	.	.	0.073
8	.	.	.	0.046
9	.	.	.	0.037
10	.	.	.	0.028
11	.	.	.	0.023
12	.	.	.	0.021
13	.	.	.	0.018
14	.	.	.	0.015
16	.	.	.	0.012
17	.	.	.	0.010
18	.	.	.	0.010
19	.	.	.	0.008
20	.	.	.	0.007
21	.	.	.	0.007
22	.	.	.	0.006
25	.	.	.	0.004
26	.	.	.	0.004
27	.	.	.	0.003
28	.	.	.	0.003
29	.	.	.	0.002

Table 3.6-1 (continued). Attenuation and rain rate percent-of-time data for January, February and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.

RAIN	ACTS	AV19	AC28	PER
32	.	.	.	0.002
36	.	.	.	0.001
38	.	.	.	0.001
42	50	50	50	0.000
63	50	50	50	0.000

Table 3.6-1 (continued). Attenuation and rain rate percent-of-time data for January, February and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.

JULY - NOVEMBER, 1977

ORIGINAL PAGE IS
OF POOR QUALITY

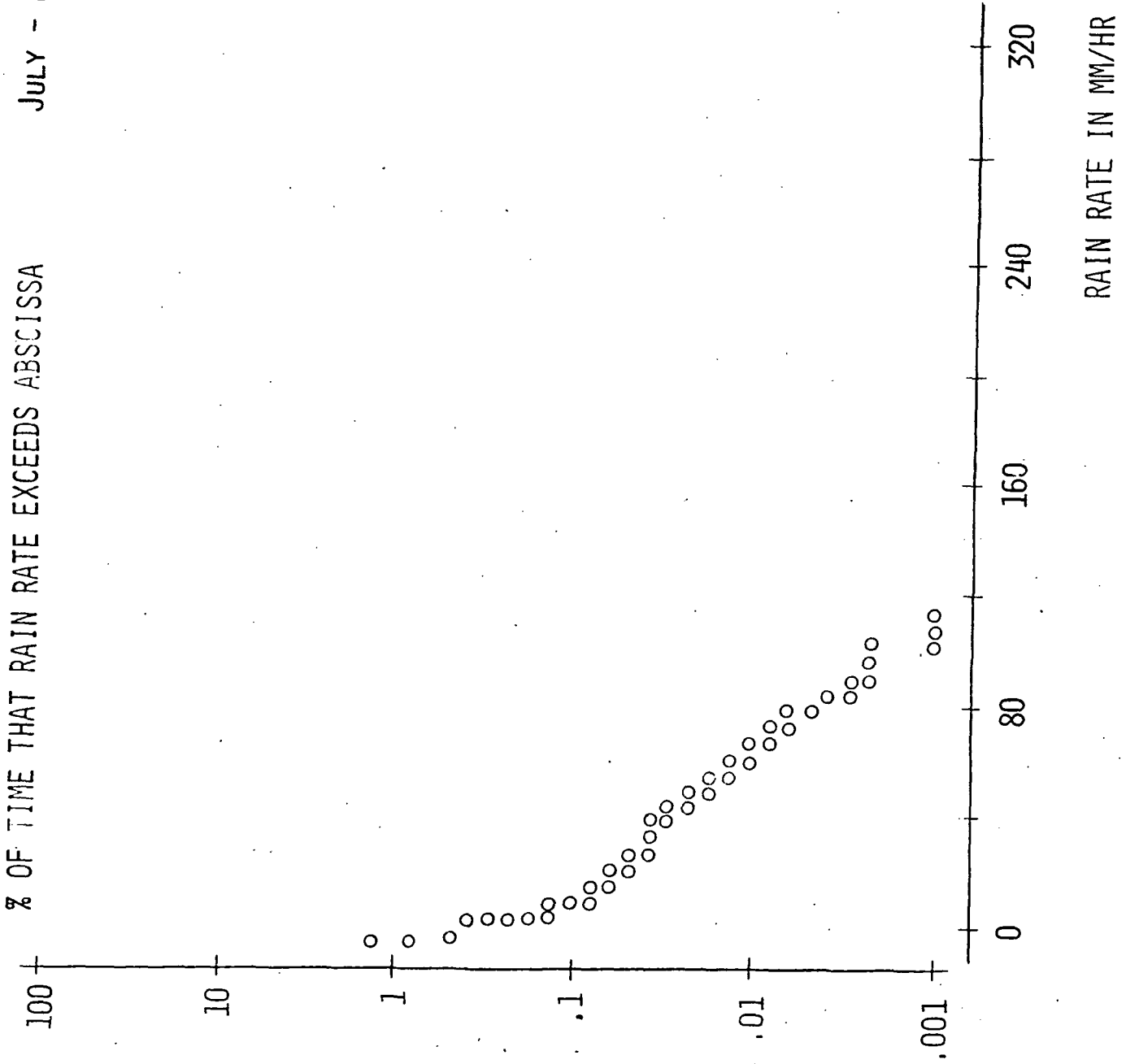


Figure 3.7-1. Rain rate statistics for July through November, 1977.

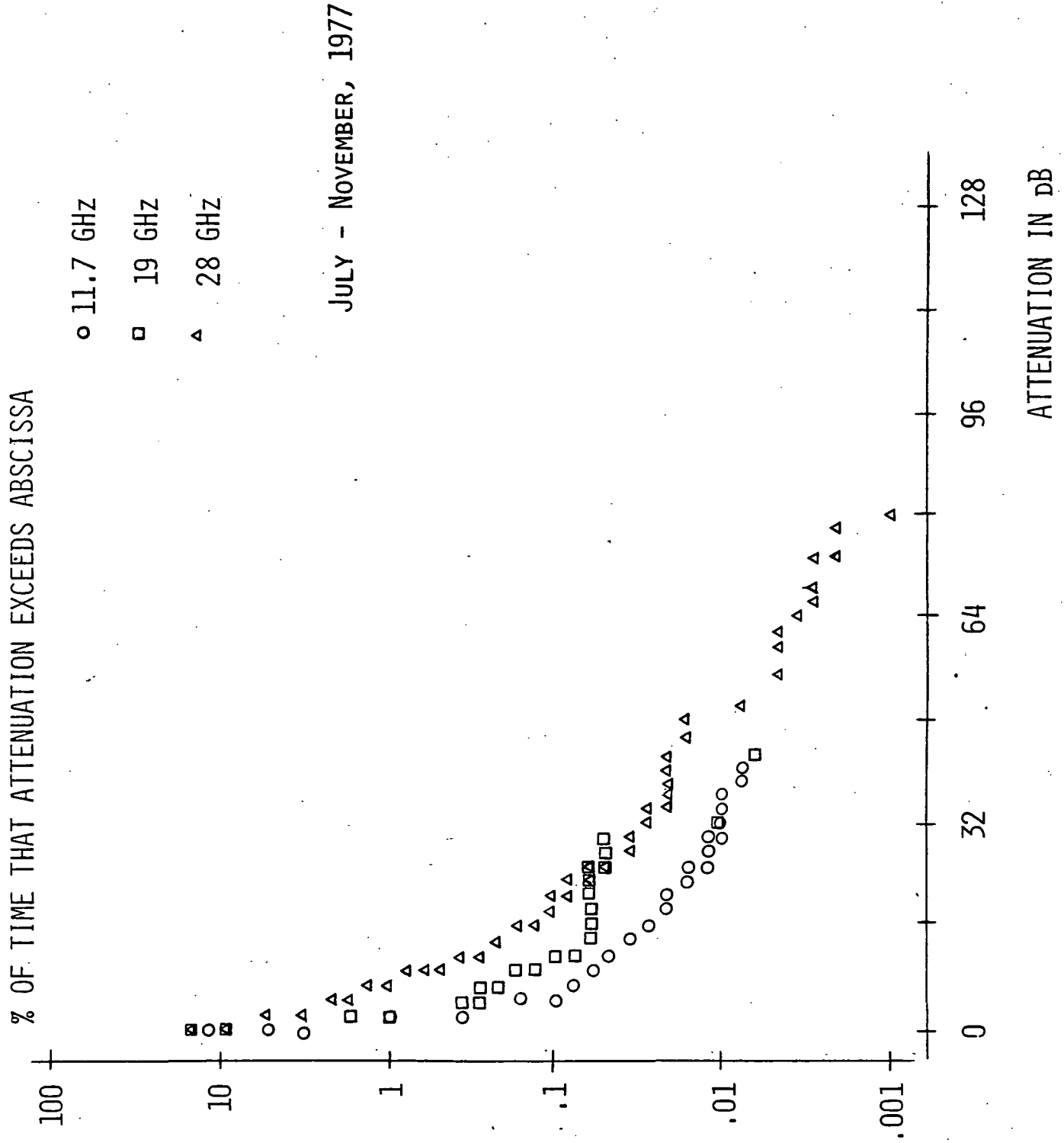


Figure 3.7-2. Attenuation statistics for July through November, 1977.

RAIN	ACTS	AV19	AC28	PER
.	.	0	0	15.365
.	.	.	.	13.104
.	0	.	.	10.991
.	.	.	1	6.078
.	1	.	.	4.104
.	.	.	2	3.409
.	.	1	.	3.264
.	.	.	3	1.819
.	.	2	.	1.550
0	2	.	.	1.333
.	.	.	4	1.319
.	.	.	5	1.169
1	.	.	.	0.878
.	3	.	.	0.764
.	.	.	6	0.668
2	.	.	.	0.613
.	.	3	.	0.517
.	.	.	7	0.475
3	.	.	.	0.433
.	.	.	8	0.382
4	.	.	.	0.318
.	.	.	9	0.300
5	.	.	.	0.253
.	4	.	.	0.241
.	.	.	10	0.210
6	.	.	.	0.209
.	5	.	.	0.189
.	.	4	.	0.179
.	.	.	11	0.175
.	.	5	.	0.166
7	.	.	.	0.157
.	.	6	.	0.154
.	6	.	.	0.148
.	.	7	.	0.143
.	.	.	12	0.136
8	.	8	.	0.130
.	.	.	.	0.128
.	.	9	.	0.121
.	.	10	.	0.118
9	.	.	.	0.116
.	.	11	.	0.110
10	.	12	.	0.106
.	.	.	13	0.105
.	.	13	.	0.101
.	.	14	.	0.098
11	7	.	.	0.097
.	.	15	.	0.095
.	.	16	14	0.093
12	.	.	.	0.092
.	.	17	.	0.091
.	.	18	.	0.089
.	.	19	.	0.088
.	.	20	.	0.087
.	.	21	.	0.086

Table 3.7-1. Attenuation and rain rate percent-of-time data for July through November, 1977.

RAIN	ACTS	AV19	AC28	PER
13	.	.	.	0.085
.	.	22	.	0.084
.	.	23	.	0.082
.	.	.	15	0.081
14	.	.	.	0.079
15	.	.	.	0.074
.	.	.	16	0.072
16	.	.	.	0.067
17	.	.	.	0.065
.	.	.	17	0.064
18	.	24	.	0.061
19	.	.	.	0.059
.	.	.	18	0.058
20	8	.	.	0.056
21	.	.	19	0.054
22	.	.	20	0.051
23	.	.	.	0.049
24	.	.	.	0.048
.	.	.	21	0.046
25	.	.	.	0.045
26	.	.	.	0.044
27	.	.	22	0.043
28	.	.	.	0.042
.	9	.	.	0.041
29	.	.	.	0.040
30	.	.	23	0.039
31	.	.	.	0.037
32	.	.	.	0.037
33	.	.	24	0.036
34	.	.	24	0.036
35	.	.	.	0.035
36	.	.	25	0.034
37	.	.	.	0.033
38	.	.	.	0.033
.	.	.	26	0.032
39	.	.	.	0.031
40	10	.	27	0.030
41	10	.	27	0.030
.	.	.	28	0.029
42	.	.	.	0.028
43	11	.	29	0.027
44	11	.	30	0.027
45	.	.	.	0.026
46	.	.	31	0.025
47	.	.	32	0.024
48	.	.	33	0.023
48	.	.	34	0.023
49	12	.	35	0.022
49	12	.	36	0.022
50	.	.	37	0.021
50	.	.	38	0.021
50	.	.	39	0.021
50	.	.	40	0.021
51	.	.	41	0.020

Table 3.7-1 (continued). Attenuation and rain rate percent-of-time data for July through November, 1977.

RAIN	ACTS	AV19	AC28	PER
52	.	.	41	0.020
53	13	.	42	0.019
54	.	.	43	0.018
55	.	.	44	0.018
56	14	.	45	0.017
57	.	.	.	0.016
58	.	.	47	0.015
59	15	.	48	0.014
59	15	.	49	0.014
60	16	25	.	0.013
60	16	26	.	0.013
61	17	27	.	0.012
62	17	28	.	0.012
63	17	28	.	0.012
64	18	30	.	0.011
65	19	31	.	0.010
66	19	32	.	0.010
69	19	33	.	0.010
70	.	34	.	0.009
71	.	35	.	0.009
72	.	36	.	0.009
74	.	37	.	0.009
.	20	38	.	0.008
.	21	39	.	0.008
.	23	39	.	0.008
75	24	40	50	0.007
76	25	40	51	0.007
77	27	40	51	0.007
79	28	41	54	0.006
80	30	41	56	0.006
81	.	.	57	0.005
81	.	.	60	0.005
81	.	.	61	0.005
85	.	.	63	0.004
86	.	.	64	0.004
88	.	.	66	0.004
88	.	.	67	0.004
91	.	.	68	0.003
92	.	.	70	0.003
93	.	.	72	0.003
93	.	.	73	0.003
97	.	.	74	0.002
100	.	.	77	0.002
102	.	.	79	0.002
103	.	.	79	0.002
106	.	.	79	0.002
112	.	.	80	0.001
113	.	.	30	0.001
121	50	50	83	0.000
198	50	57	114	0.000
201	50	57	114	0.000

Table 3.7-1 (continued). Attenuation and rain rate percent-of-time data for July through November, 1977.

Table 3.7-2. Regression equations for the period July through November, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30									
A on R at equal probability levels.	A = .54 R ^{.85}	28	.84	*			A = 1.02 R ^{.92}	55	.97
Attenuation scaling. A (11) at equal probability levels.				*			A(11) = .15* A(28) ^{1.25}	17	.89
Attenuation scaling. A (19) at equal probability levels.	*						*		
Attenuation scaling. A (28) at equal probability levels.	A(28)=5.84* A(11) ^{.71}	17	.89	*					

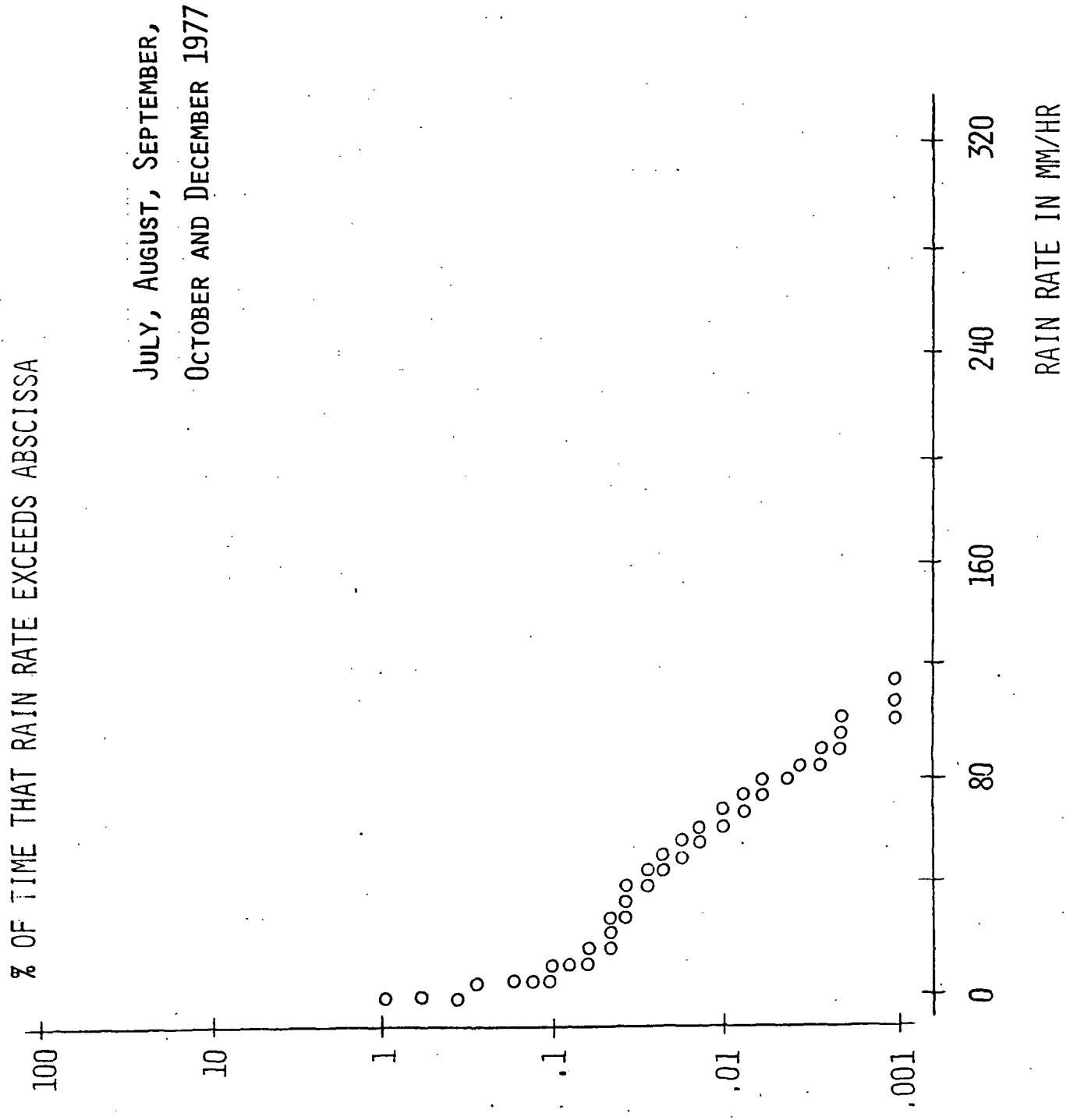


Figure 3.8-1. Rain rate statistics for July, August, September, October and December, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

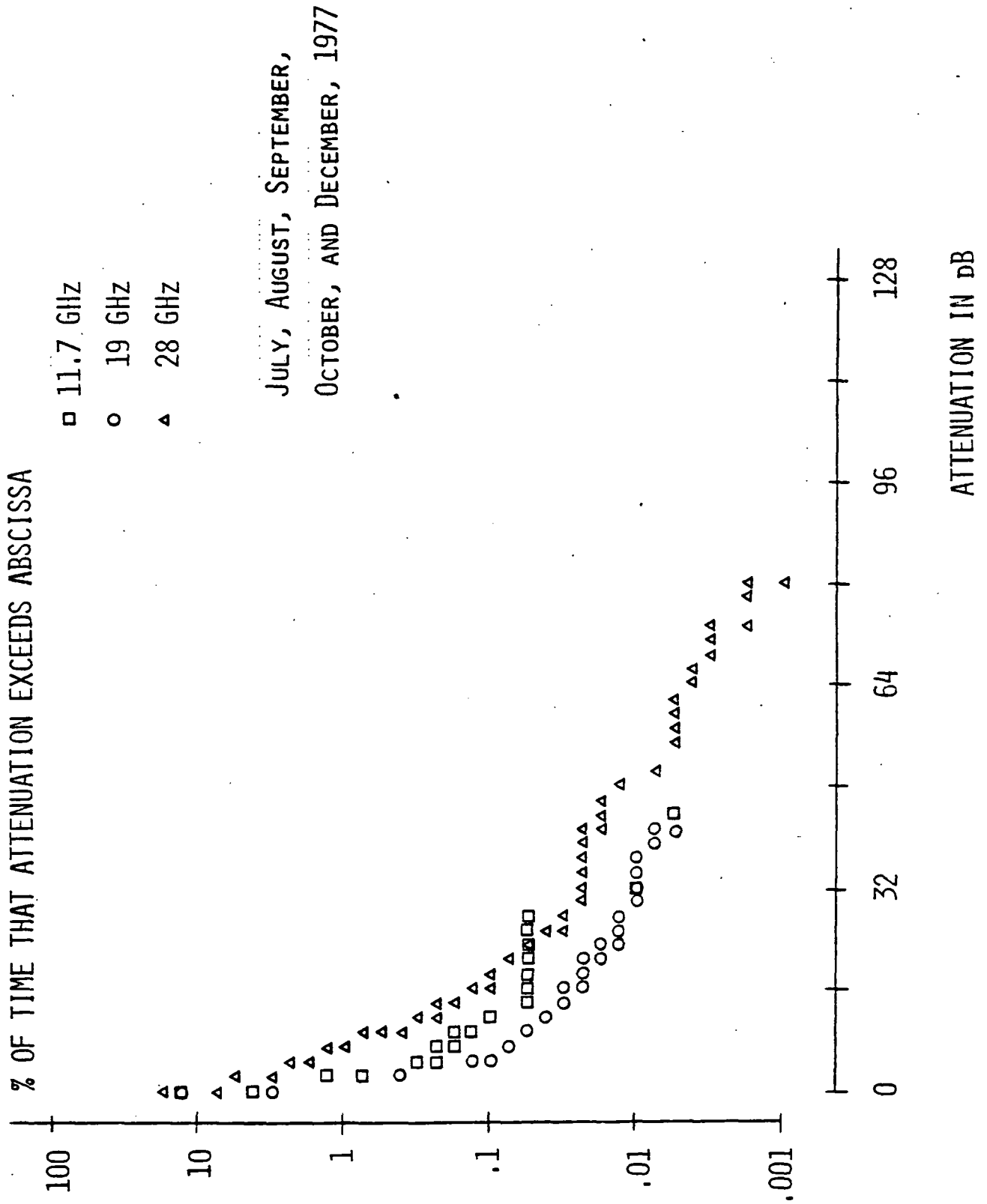


Figure 3.8-2. Attenuation statistics for July, August, September, October, and December, 1977.

ORIGINAL PAGE IS
OF POOR QUALITY

RAIN	ACTS	ACZB	PER
.	.	0.0	17.969
.	.	0.0	13.580
.	0	0.0	13.098
.	.	0.0	8.487
.	.	0.0	5.410
.	1	0.0	4.337
.	.	0.0	3.527
.	.	0.0	3.327
.	.	0.0	2.371
.	.	0.0	1.847
.	2	0.0	1.510
.	.	0.0	1.519
0	.	0.0	1.223
.	.	0.0	1.090
.	.	7.0	0.966
.	3	0.0	0.733
1	.	8.0	0.676
.	.	9.0	0.589
.	.	10.0	0.505
.	.	11.0	0.421
2	.	12.0	0.357
.	.	13.0	0.333
.	4	14.0	0.275
.	.	15.0	0.269
3	.	16.0	0.251
.	.	17.0	0.236
.	.	18.0	0.221
.	5	19.0	0.217
.	.	20.0	0.203
.	.	21.0	0.186
4	.	22.0	0.182
.	.	23.0	0.174
.	6	24.0	0.156
5	.	25.0	0.153
.	.	26.0	0.151
.	.	27.0	0.145
.	7	28.0	0.127
.	.	29.0	0.126
.	10	30.0	0.122
7	.	31.0	0.113
.	11	32.0	0.110
.	.	33.0	0.098
8	.	34.0	0.094
.	12	35.0	0.091
.	.	36.0	0.088
.	.	37.0	0.087
10	.	38.0	0.082
11	.	39.0	0.080
12	.	40.0	0.073
.	.	41.0	0.071
13	.	42.0	0.068
.	.	43.0	0.067

Table 3.8-1. Attenuation and rain rate
per unit time data for
July, September,
October and December, 1977.

RAIN	ACTS	AV19	AC28	PER
14	.	.	.	0.065
.	13	.	.	0.064
.	.	.	22	0.063
.	14	8	.	0.062
15	.	.	.	0.061
.	15	.	.	0.059
16	16	.	.	0.057
16	17	.	.	0.057
17	18	.	.	0.056
.	19	.	.	0.055
18	.	.	.	0.054
19	20	9	23	0.053
19	21	9	23	0.053
19	23	9	23	0.053
.	24	.	.	0.052
.	25	.	.	0.052
.	27	.	.	0.052
.	28	.	.	0.052
20	.	10	.	0.051
21	.	.	24	0.049
22	.	.	.	0.048
23	.	.	.	0.045
24	.	.	.	0.044
.	.	11	.	0.043
25	.	.	.	0.042
26	.	.	.	0.042
27	.	.	25	0.041
28	.	12	.	0.039
29	.	.	.	0.038
30	.	.	.	0.037
31	.	.	.	0.036
32	.	.	26	0.035
33	.	.	26	0.035
34	.	.	26	0.035
35	.	13	.	0.034
36	.	.	.	0.033
37	.	.	.	0.032
38	.	.	.	0.032
.	.	14	27	0.031
39	.	.	.	0.030
40	.	15	28	0.029
41	.	15	28	0.029
42	.	.	29	0.027
43	.	16	30	0.026
44	.	16	30	0.026
45	.	17	31	0.025
46	.	.	32	0.024
46	.	.	33	0.024
47	.	18	34	0.023
48	.	19	35	0.022
48	.	19	36	0.022
48	.	19	37	0.022
49	.	20	38	0.021

Table 3.8-1 (continued). Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.

RAIN	ACTS	AV19	AC28	PER
49	.	20	39	0.021
49	.	20	40	0.021
50	.	.	41	0.020
51	.	21	42	0.019
52	.	21	42	0.019
53	.	.	43	0.018
53	.	.	44	0.018
54	.	22	45	0.017
55	.	22	45	0.017
56	.	.	.	0.016
57	.	.	.	0.016
58	.	23	47	0.015
58	.	24	47	0.015
59	.	.	48	0.014
59	.	.	49	0.014
.	.	25	.	0.013
60	.	26	.	0.013
60	.	27	.	0.012
60	.	28	.	0.012
61	.	30	.	0.011
62	.	30	.	0.011
63	.	30	.	0.011
64	.	30	.	0.011
65	.	31	.	0.010
65	.	32	.	0.010
65	.	33	.	0.010
65	.	34	.	0.010
69	33	35	.	0.009
70	33	36	.	0.009
71	33	37	.	0.009
72	.	38	.	0.008
74	.	39	.	0.008
75	.	40	50	0.007
75	.	40	51	0.007
76	43	41	54	0.006
77	43	41	56	0.006
79	43	41	58	0.006
80	.	.	57	0.005
81	.	.	59	0.005
81	.	.	61	0.005
82	.	.	63	0.004
86	.	.	64	0.004
88	.	.	66	0.004
88	.	.	67	0.004
91	.	.	68	0.003
92	.	.	70	0.003
93	.	.	72	0.003
93	.	.	73	0.003
97	.	.	74	0.002
100	.	.	77	0.002
102	.	.	79	0.002
103	.	.	79	0.002
106	.	.	79	0.002
112	.	.	80	0.001

Table 3.8-1 (continued). Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.

RAIN	ACTS	AV19	AC28	PER
113	50	50	80	0.001
121	50	50	83	0.000
198	50	57	114	0.000
201	50	57	114	0.000

Table 3.8-1 (continued). Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.

Table 3.8-2. Regression equations for the period July, August, September, October, and December, 1977.

Relationship	11.7 GHz			19.04 GHz			28.56 GHz		
	Equation	N _s	R ²	Equation	N _s	R ²	Equation	N _s	R ²
I on log ₁₀ (A) for 3 < A < 30									
A on R at equal probability levels.	*			A = .59 R ^{.93}	47	.91	A = 2.09 R ^{.76}	59	.92
Attenuation scaling. A (11) at equal probability levels.	X			*			*		
Attenuation scaling. A (19) at equal probability levels.	*			X			A(19) = .27* A(28) = 1.19	29	.89
Attenuation scaling. A (28) at equal probability levels.	*			A(28) = 4.02* A(19) = .75	29	.89	X		

* Invalidated by spacecraft motion during December, 1977.