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Research and Development Technical Report
ECOM-4106

UHF PROPAGATION PATH LOSS MEASUREMENTS AT LOW GRAZING ANGLES

Henry Schlussler

April 1973

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TECHNICAL REPORT ECOM-4106

UHF PROPAGATION PATH LOSS MEASUREMENTS AT LOW GRAZING ANGLES

by

Henry Schlussler

AIR TRAFFIC MANAGEMENT SYSTEMS TECHNICAL AREA

AVIONICS LABORATORY

AMC Code No. 591 700.A1.072.26.01.R910Z-2

April 1973

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U. S. ARMY ELECTRONICS COMMAND, FORT MONMOUTH, NEW JERSEY

ABSTRACT

This report covers RF path loss measurements near Fort Monmouth, N.J., over distances of up to 10 miles and at low grazing angles. Four frequencies were used during these tests, three in the UHF region and one just below it. Measurements were made with antennas vertically, horizontally, and circularly polarized. Paths were varied from non-line-of-sight to definitely line-of-sight. Comparison of losses under varying conditions were made and graphs for estimating losses in the area covered by these tests are included.

TABLE OF CONTENTS

	Page
1. BACKGROUND	1
2. INTRODUCTION AND OBJECTIVE	1
3. TEST PROCEDURE	2
4. RECEIVING EQUIPMENT	10
5. TRANSMITTING EQUIPMENT	10
6. TRANSMITTING SITES	10
a. AEL, Monmouth Country Airport Site 5	14
b. Wayside Site 9	16
c. Wayside Site 9A	18
d. Wayside Site 10	20
e. Wayside Site 14	22
f. Wayside Site 19	24
g. Wayside Site 19B	26
h. Evans Area "F" Site 20	27
7. SAMPLE DATA	29
8. TEST RESULTS	35
a. 229.5 MHz Comparison Plots (Figures 29 through 32)	39
b. 371.4 MHz Comparison Plots (Figures 33 through 41)	43
c. 1,545 MHz Comparison Plots (Figures 42 through 51)	52
9. COMMENTS ON THE TEST RESULTS	62
APPENDIX. REDUCED DATA	66

TABLES

		Page
I.	Antenna and Cable Data	3
II.	Meteorological Data	4
III.	Test Schedule	5
IV.	Test Data Sheet	6
V.	Path Loss - 1972 Low Points	36

FIGURES

1.	Map of the Test Area	7
2.	Sample Received Signal Recording	8
3.	Sample Propagation Path Loss Graph	9
4.	Receiver Recording Equipment	11
5.	Transmitter Van	12
6.	Transmitter Recording Equipment	13
7.	AEL, Monmouth County Airport Site 5	14
8.	Site 5 Profile Chart	15
9.	Wayside Site 9	16
10.	Site 9 Profile Chart	17
11.	Wayside Site 9A	18
12.	Site 9A Profile Chart	19
13.	Wayside Site 10	20
14.	Site 10 Profile Chart	21
15.	Wayside Site 14	22
16.	Site 14 Profile Chart	23
17.	Wayside Site 19	24
18.	Site 19 Profile Chart	25
19.	Wayside Site 19B	26
20.	Evans Area "F" Site 20	27
21.	Site 20 Profile Chart	28
22.	Typical Test Sheet	30
23.	Propagation Path Loss Strip Chart	31
24.	Propagation Path Loss Strip Chart	32
25.	Typical Test Data Sheet	33
26.	Propagation Path Loss Graph	34
27.	Propagation Path Loss 1,545 MHz	37
28.	Propagation Path Loss 371.4 MHz	38
29.	Propagation Path Loss (Site 9 to Hexagon, Frequency 229.5 MHz, Antenna AT-197)	39
30.	Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz, Antenna T-29 (Horizontal))	40
31.	Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz, Antenna T-29 (Vertical))	41
32.	Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz, Antenna) (See Graph, Figure 3)	42
33.	Propagation Path Loss (Site 5 to Hexagon, Frequency 371.4 MHz, Antenna AT-197)	43

Page

34. Propagation Path Loss (Site 9 to Hexagon, Frequency 371.4 MHz, Antenna AT-197) 44
35. Propagation Path Loss (Site 19 to Hexagon, Frequency 371.4 MHz, Antenna AT-197) 45
36. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna T-29 (Horizontal)) 46
37. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna T-29 (Vertical)) 47
38. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna EMCO 3101 (Circular)) 48
39. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna (See Graph)) 49
40. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna AT-197) 50
41. Propagation Path Loss (Site 21 to Hexagon, Frequency N/A, Antenna AT-197) 1 February 1972 51
42. Propagation Path Loss (Site 5 to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn) 52
43. Propagation Path Loss (Site 9 to Hexagon, Frequench 1,545 MHz, Antenna - AEL Horn) 53
44. Propagation Path Loss (Site 9 to Hexagon, Frequency 1,545 MHz, Antenna - Andrews Discone) 54
45. Propagation Path Loss (Site 19 to Hexagon, Frequency 1,545 MHz, Antenna - Andrews Discone) 55
46. Propagation Path Loss (Site 19 to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn) 56
47. Propagation Path Loss (Site 21 to Hexagon, Frequency 1,545 MHz, Antenna (See Graph)) 57
48. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn (Horizontal)) 58
49. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn) (Vertical)) 59
50. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - EMCO 3102 (Circular)) 60
51. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna (See Graph)) 61
52. Propagation Path Loss - 1,545 MHz 63
53. Propagation Path Loss - 371.4 MHz 64
54. Propagation Path Loss - 229.5 MHz 65

1. BACKGROUND

The Avionics Laboratory of the U. S. Army Electronics Command is investigating the feasibility and the technology necessary for applying time ordered techniques to multifunction avionics and ground equipment for tactical use. As presently envisioned, the RF frequencies in such a system will be in the high end of the VHF band or in the UHF band. Much of the transmission in such a system would be at very low grazing angles where the transmission path can vary from line-of-sight to non-line-of-sight. If line-of-sight does not exist, the RF signal is subjected to many factors which degrade it. Even if line-of-sight exists, multipath can cause signal distortion and variation. In order to obtain meaningful data concerning the propagation losses which will be encountered in such a system, a series of experiments were conducted to determine the extent of the signal losses when transmitting in an environment typical of the anticipated multifunction system, namely low grazing angles and natural and man-made obstructions.

2. INTRODUCTION AND OBJECTIVE

This report describes a series of propagation path loss tests to measure path losses at low grazing angles in the 225 to 2,300 MHz range. Path loss is the signal attenuation expressed as the ratio of the received power to the transmitted power. It can be expressed as a number, but is usually expressed as transmission loss in dB. The path loss is dependent on such factors as --

a. the distance between the transmitter and receiver;

b. the carrier frequency;

c. the signal absorption factors due to the environment;

d. the multipathing contributions which can either reinforce or reduce the received signal;

e. diffraction losses in paths which are marginally line of sight, and;

f. depolarization.

To be useable, the amplitude of the received signal must be large enough to provide an adequate margin over competing signal interference and noise. In general, the transmitted power required varies with the square of the distance between the transmitter and the receiver and also as the square of the ratio of the carrier frequencies.

The tests described in this report were conducted specifically to obtain input data for the Micro Navigation and Position Locating System (MNPLS). Since MNPLS has to be effective in any azimuth, the allowable means for increasing both the transmitting and receiving antenna gains are restricted to those procedures which entail vertical stacking. Such vertically stacked arrays concentrate the RF energy into a narrower vertical angle, thereby increasing the gain in the horizontal direction and decreasing the vertical coverage. The effects of the propagation path, however, can only be known in general, but not in detail, since the effects of the terrain, buildings, and

foliage that account for multipathing, signal absorption and scattering, diffraction, and depolarization cannot be determined exactly or easily separated. Even though these effects usually cannot be isolated from each other, an accumulated record of path losses can provide a practical range of path losses for which an operable system has to compensate. The tests described in this report were conducted to measure these effects in order to establish some guidelines for future systems design.

3. TEST PROCEDURE

All tests covered by this report were conducted between the Hexagon Building at Fort Monmouth and remote sites. The receiving antenna was always located on the roof of the Hexagon. The transmitter was located at various remote sites within a radius of less than 10 miles from the receiving site. All equipment, antennas, and cables were carefully calibrated for gain or attenuation so that the path loss could be accurately calculated from the transmitted and received power. At the transmitter site, the frequency and power output were continuously monitored and recorded. At the receiving site, received signal strength and transmitting antenna height were recorded on a strip chart recorder. Meteorological data and other pertinent data were recorded. Sample antenna and cable data, meteorological data, and a test schedule are shown in Tables I, II, and III. Figure 1 is a map of the area showing the receiving site and the various transmitting sites.

Three types of antenna supports were used at the transmitting sites. At site 19B, there was a permanent 85-foot high tower with a track on its side on which an antenna could be run up and down. At Monmouth Country Airport, site 5, a semipermanently installed crank-up tower was used, the maximum height of which was 88 feet. The third support was a portable crank-up mast with a maximum height of 33 feet. This crank-up mast could be set up at any of the sites.

The transmitter and all other equipments required at the transmitter site were contained in a truck-mounted shelter. The truck was driven to the various transmitting sites and the RF transmitter was connected either to the permanently emplaced antenna system at a particular site or to a portable one. Tests were conducted with various types of antennas and various polarizations.

A typical test run consisted of elevating the antenna from the lowest height obtainable with the mast being used, up to the highest possible height and then lowering it again. In some of the tests, the maximum height had to be limited due to high winds. During this elevation cycle the transmitter was kept at constant power and the received signal strength was recorded as a function of transmitting antenna height. A sample recording taken at the receiver is shown in Figure 2. Table IV shows a typical data reduction table. The values of received signal strength are read off the strip chart and tabulated with accompanying transmitting antenna heights. These values are then algebraically combined with transmitted power, antenna gains, and cable losses to arrive at the path loss (para 7). Most test runs were repeated two or three times, and the final tabulated path loss value was, at each height, an average of the individual path loss values. This average value was then plotted, as shown on the sample plot in Figure 3.

Table I. Antenna and Cable Data

FREQUENCY: 229.5 MHz

ANTENNA		CABLE		
TYPE	GAIN dB	TYPE	LENGTH FT.	LOSS dB
AT-197	1.2	FHJ4-50	100 130	1.4 1.8
T-29	8.0	RG-319A/U	100 130	0.32 0.42
EMCO 3101	- 3.8	RG-58C/U	100	9.0
		FSJ4	100 150	2.0 3.0

FREQUENCY: 371.4 MHz

AT-197	2.0	FHJ4-50	100 130	1.8 2.3
T-29	8.0	RG-319A/U	100 130	0.4 0.52
EMCO 3101	6.1	RG-58C/U	100	13.0
		FSJ4	100 150	2.6 3.9

FREQUENCY: 1545 MHz

ACL Horn	14.4	FHJ4-50	100 130	4.4 5.7
Andrew Discone	2.5	RG-319A/U	100 130	0.9 1.2
Andrew Biconical	0.3	RG-58C/U	100	29.0
EMCO 3102	- 0.4	FSJ4	100 150	6.5 9.75

FREQUENCY: 2290 MHz

ACL Horn	16.6	FHJ4-50	100 130	5.2 6.8
Andrew Discone	1.3	RG-319A/U	100 130	1.3 1.6
Andrew Biconical	0.7	RG-58C/U	100	36.0
		FSJ4	100 150	8.5 12.75

FHJ4-50, RG-319A/U } Heliax

FSJ4 Superflex

Table II. Meteorological Data

RUN	DATE	TIME	ATMOS. PRESS. (IN.)	TEMP. (°C)	DEW PT. (°C)	REL HUMID. (%)	WIND		REMARKS
							DIR. (DEG)	SP. & GUST (KTS)	
72/01/24.03	1/24/72	0914	30.02	+ 9	+ 1	-	300	5 G10	MCA Site #5
		0959	30.06	+ 8	+ 1	72	330	2-4G7	
		1043	30.09	+11	+ 1	66	270	2-6G10	
		1248	30.06	+12	+ 1	57	000	2-4	
		1455	30.09	+12	- 2	56	000	000	
		1612	30.09	+ 9	- 1	60	050	1-2	
72/01/25.01	1/25/72	0837	29.75	12	10	94	270	5 G20	MCA Site #5
		1045	29.82	10	0	54	000	10 G25	0857 Light Rain Falling At This Time
		1207	29.82	11	- 2	51	270	10 G25	
		1247	29.84	10	-10	32	270	15 G25	
		1450	29.94	8.5	-15	26	270	15 G25	
		1557	30.01	6	-15	31	270	15 G25	
72/01/26.01	1/26/72	0943	30.49	- 5	-20	60	270	2-4 G10	MCA Site #5
		1100	30.49	- 4	-16	74	270	2-4 G8	
		1250	30.42	- 2	-18	88	250	2-4 G8	
		1412	30.40	+ 1	-18	-	250	2-4 G8	
		1619	30.49	+ 1	-17	-	250	5-6 G12	
72/01/27.01 Thru 72/01/27/06	1/27/72	0905	30.44	- 5	-25	-	270	2-3	MCA Site #5
		1053	30.44	- 4	-21	62	-	-	
		1315	30.36	- 3	-21	66	270	2-3	
		1434	30.36	- 1	-19	77	270	2-4 G8	
		1535	30.36	- 3	-19	-	270	2-3 G6	
		1605	30.35	- 3	-19	-	270	2-3 G6	

Table III. Test Schedule

Date	Frequency (MHz)	Site	No. of Runs	Transmitting Antenna
24 Jan 72	1545	MCA 5	3	AEL Horn
25 Jan 72	1545	MCA 5	1	AEL Horn
27 Jan 72	1545	MCA 5	4	AEL Horn
27 Jan 72	371.4	MCA 5	2	AT- 197
28 Jan 72	229.5	MCA 5	1	AT-197
28 Jan 72	371.4	MCA 5	1	AT-197
28 Jan 72	1545	MCA 5	1	AEL Horn
31 Jan 72	1545	Highlands 21	3	AEL Horn
31 Jan 72	1545	Highlands 21	2	Andrews Discone
1 Feb 72	371.4	Highlands 21	3	AT-197
1 Feb 72	229.5	Highlands 21	2	AT-197
1 Feb 72	1545	Highlands 21	1	AEL Horn
1 Feb 72	2290	Highlands 21	2	AEL Horn
7 Feb 72	229.5	Wayside 19	2	AT-197
7 Feb 72	371.4	Wayside 19	2	AT-197
7 Feb 72	1545	Wayside 19	3	Andrews Discone
8 Feb 72	1545	Wayside 19	2	AEL Horn
8 Feb 72	1545	Wayside 19	2	Andrews Discone
8 Feb 72	1545	Wayside 19B	3	AEL Horn
9 Feb 72	371.4	Wayside 19B	2	AT-197
9 Feb 72	1545	Wayside 19B	2	AEL Horn
9 Feb 72	1545	Wayside 19B	3	AEL Horn (Horiz. Pol.)
14 Feb 72	371.4	Wayside 19B	3	T-29 (Vert. Pol.)
14 Feb 72	371.4	Wayside 19B	2	T-29 (Horiz. Pol.)
14 Feb 72	229.5	Wayside 19B	2	T-29 (Vert. Pol.)
14 Feb 72	229.5	Wayside 19B	2	T-29 (Horiz. Pol.)
16 Feb 72	371.4	Wayside 19B	2	Emco 3101 (Circular P.)
16 Feb 72	229.5	Wayside 19B	3	Emco 3101 (Circular P.)
16 Feb 72	1545	Wayside 19B	3	Emco 3102 (Circular P.)
17 Feb 72	1545	Wayside 9	3	AEL Horn
17 Feb 72	1545	Wayside 9	2	Andrews Discone
18 Feb 72	1545	Wayside 9	2	AEL Horn
18 Feb 72	1545	Wayside 9	2	Andrews Discone
18 Feb 72	371.4	Wayside 9	2	AT-197
18 Feb 72	229.5	Wayside 9	3	AT-197
10 Mar 72	371.4	Wayside 19	4	AT-197
10 Mar 72	371.4	Wayside 19B	2	AT-197
10 Mar 72	371.4	Wayside 19B	2	Emco-3101 (Circ. Pol.)
10 Mar 72	229.5	Wayside 19B	2	Emco-3101 (Circ. Pol.)
10 Mar 72	229.5	Wayside 19B	1	T-29 (Vert. Pol.)
10 Mar 72	229.5	Wayside 19B	1	T-29 (Horiz. Pol.)
10 Mar 72	371.4	Wayside 19B	1	T-29 (Horiz. Pol.)
10 Mar 72	371.4	Wayside 19B	1	T-29 (Vert. Pol.)
13 Mar 72	1545	Wayside 19	2	AEL Horn
13 Mar 72	1545	Wayside 19	2	Andrews Discone
13 Mar 72	1545	Wayside 19B	2	AEL Horn
13 Mar 72	1545	Wayside 19B	2	AEL Horn (Horiz. Pol.)
13 Mar 72	1545	Wayside 19B	1	Emco-3102 (Circ. Pol.)
14 Mar 72	371.4	Wayside 9	2	AT-197
14 Mar 72	229.5	Wayside 9	2	AT-197
14 Mar 72	1545	Wayside 9	2	Andrews Discone
14 Mar 72	1545	Wayside 9	2	AEL Horn

Table IV. Test Data Sheet

TEST DATA SHEET

DATE: 9 FEBRUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1328 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44 dBM	AEL HORN	14.4	√.7	XMTR. PWR. 44
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB — -CABLE LOSSES 6.9

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB — =ESP = √1.8 USE √2

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720209-01	TEST 720209-02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720209-01	720209-02		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	97	88		149	140		144.5	2	
10	96	92		148	144		146.0	2	
15	82	82		134	134		134.0	2	
20	85	83		137	135		136.0	2	
25	80	80		132	132		132.0	2	
30	81	81		133	133		133.0	2	
35	81	81		133	133		133.0	2	
40	76	75		128	127		127.5	2	
45	72	70		124	122		123.0	2	
50	68	68		120	120		120.0	2	
55	65	65		117	117		117.0	2	
60	—	62		—	114		114.0	1	END 720209-01 — 1355
65	—	60		—	112		112.0	1	START 720209-02 — 1350
									END 720209-02 — 1400
									MEAN READING OF CHART RECORDINGS

Figure 1. Map of the Test Area

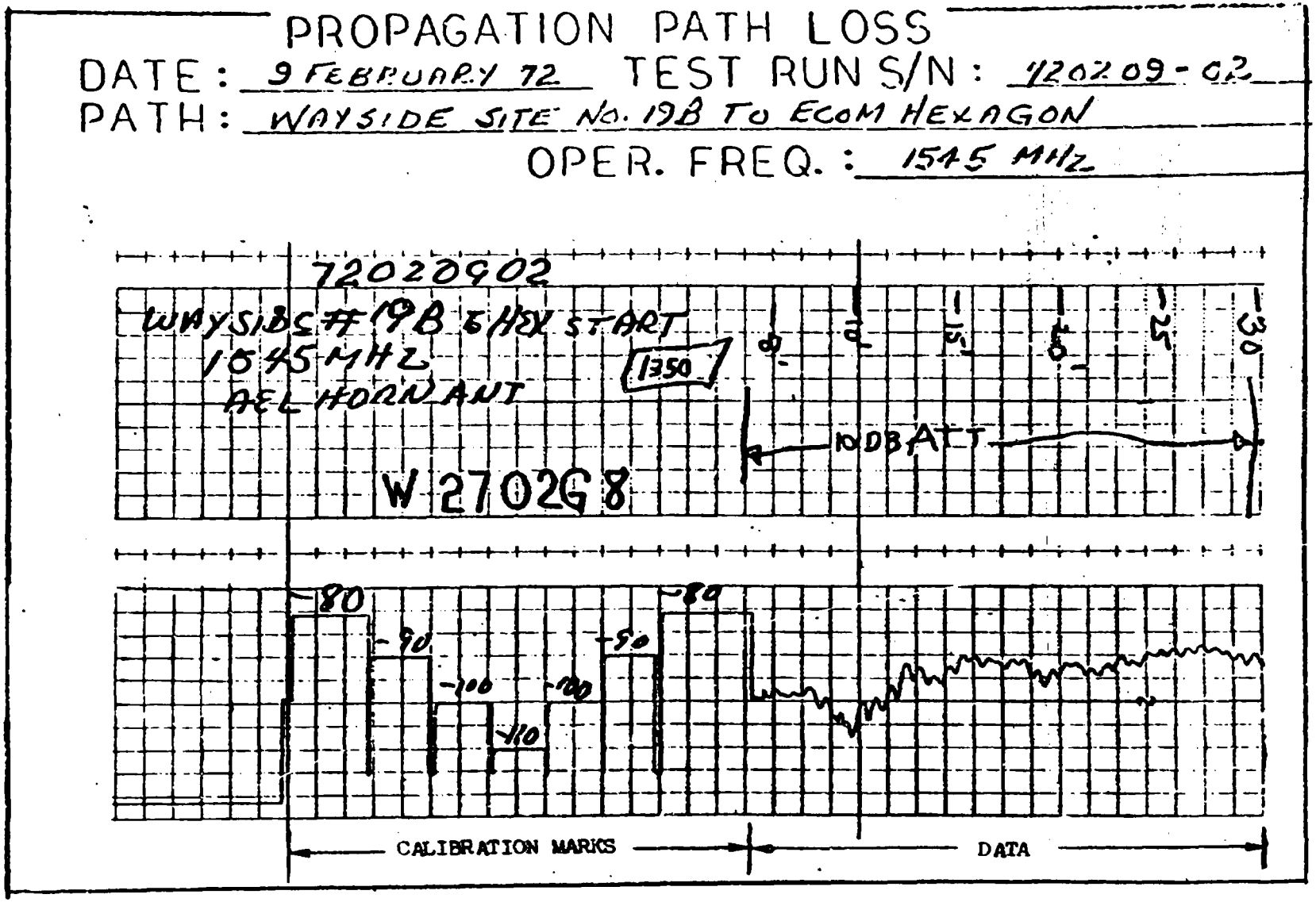


Figure 2. Sample Received Signal Recording

PROPAGATION PATH LOSS

DATE: 9 FEBRUARY 72 TEST RUN S/N: 720209-01-02

PATH: WAYSIDE SITE No. 198 TO ECOM HEXAGON

OPER. FREQ.: 154 MHz

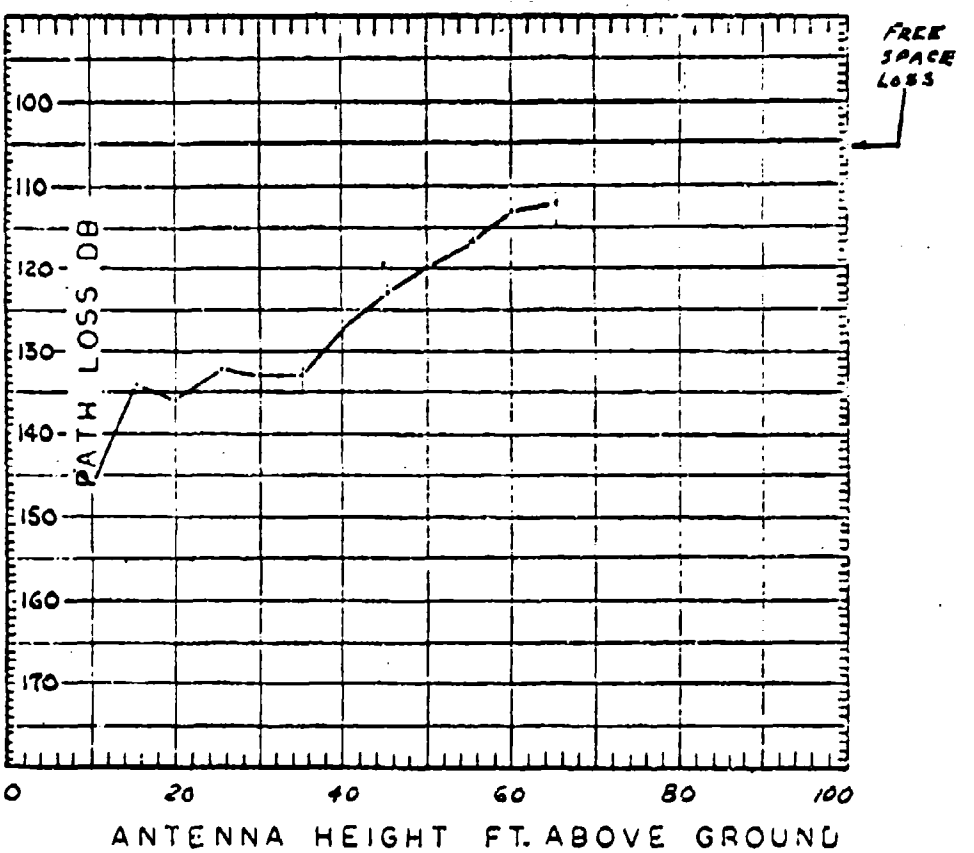


Figure 3. Sample Propagation Path Loss Graph

4. RECEIVING EQUIPMENT

An Airborne Instruments Laboratory (AIL) Model 707 Spectrum Analyzer was used as the receiver for these tests. The output of this analyzer is a dc voltage proportional (in dB) to the input signal strength. The receiving antenna was connected to the spectrum analyzer through a low loss cable for tests at the lower frequencies, and through a low loss cable and a 20-dB preamplifier at the higher frequencies. The output of the spectrum analyzer was recorded on a strip chart recorder and pertinent data was annotated on the strip chart.

An accurately calibrated source of RF was used to calibrate the receiving setup. This RF source was substituted for the antenna during the calibration procedure. All other connections were unchanged (Figure 4). In this manner, the entire receiver setup was calibrated since the signal from the calibrating source passed through the identical path as the received signal from the antenna. To calibrate a strip chart, several calibrated levels of RF were fed into the receiving setup and recorded on the strip chart. On the strip chart, each level was marked with its corresponding signal level which was then used as the standard in reducing the data (Figure 2).

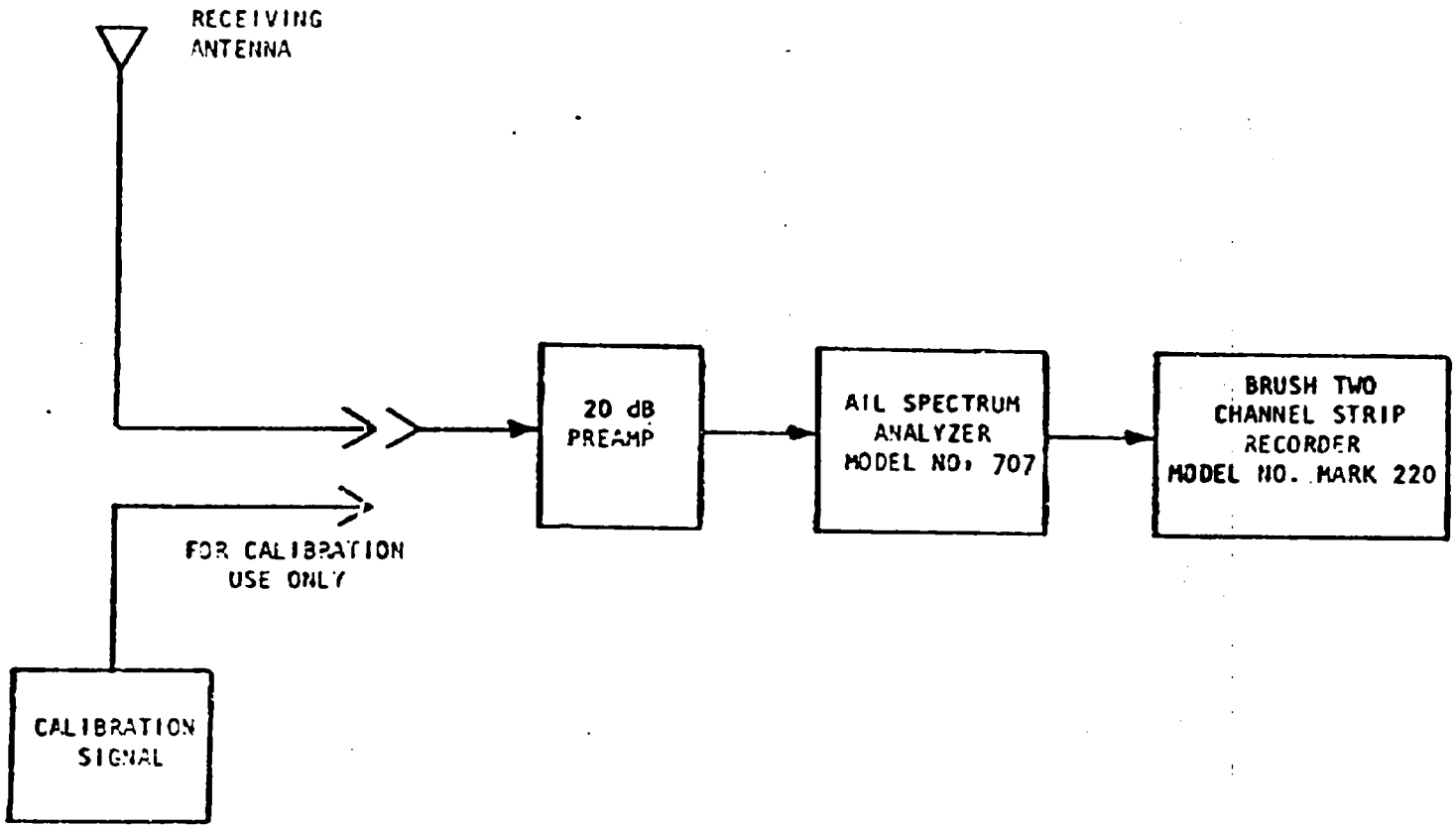
5. TRANSMITTING EQUIPMENT

The transmitter and the RF power and frequency monitoring equipment were installed in an S-280 shelter which was mounted on a M-35 military truck (Figure 5). The transmitter power oscillator was a MICRODOT Model 445. This power oscillator, when used in conjunction with several plug-in modules, provided a CW RF source continuously variable between 2 and 2,500 MHz, with a power output as high as 50 watts.

The RF power output from the transmitter was continuously monitored with a BIRD THRULINE Model 43 WATTMETER, which could also be used to measure reflected power to check for cable or antenna malfunctions. A SYSTRON DONNER Model 1037 Frequency Counter was used to monitor the RF frequency. The binary coded decimal (BCD) output from this frequency counter was fed to a HEWLETT PACKARD D/A CONVERTER Model R50562A, whose output was plotted on one channel of a BRUSH MARK 220 strip chart recorder. The output of the thruline wattmeter was recorded on the second channel of the strip chart recorder (Figure 6). Thus, there was a continuous record of transmitter power output and frequency.

6. TRANSMITTING SITES

The mobile transmitter was located at many different sites for these tests. These sites included areas where permanent or semipermanent antennas were installed, as well as places where the portable antenna mast was used. This section contains brief descriptions of these sites, the physical environment in the vicinity of the antenna which could affect propagation, and terrain profiles for the sight line. The sight line is defined as an imaginary straight line from the transmitting antenna to the receiving antenna. The locations of most of the various transmitting sites are also shown on the map in Figure 1.



TYPICAL EQUIPMENT SETUP FOR
MEASURING AND RECORDING RECEIVER SIGNAL

Figure 4. Receiver Recording Equipment

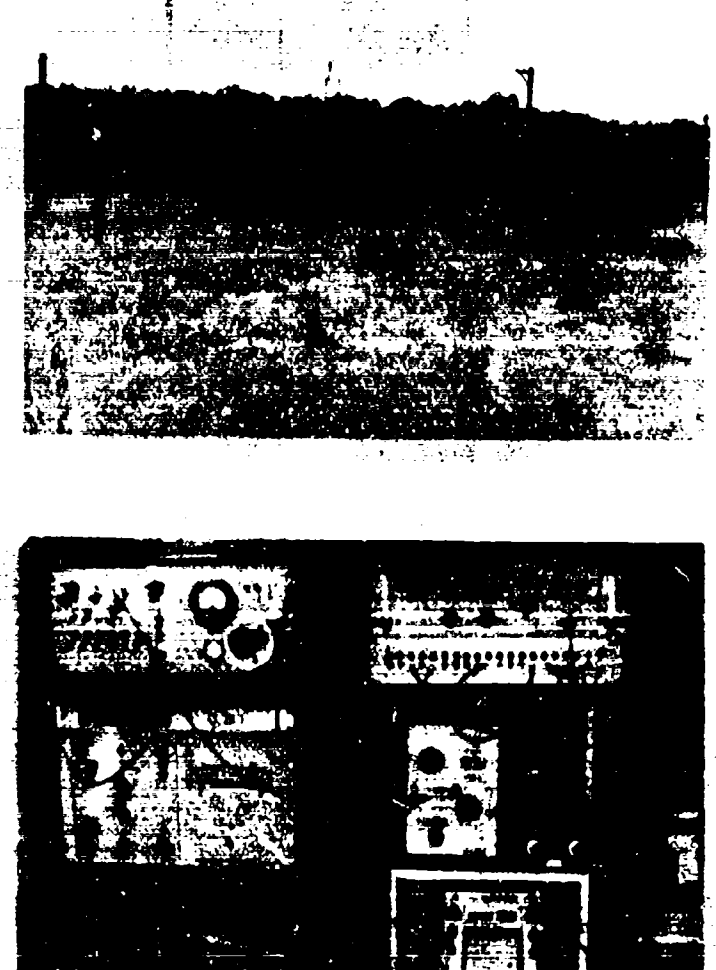
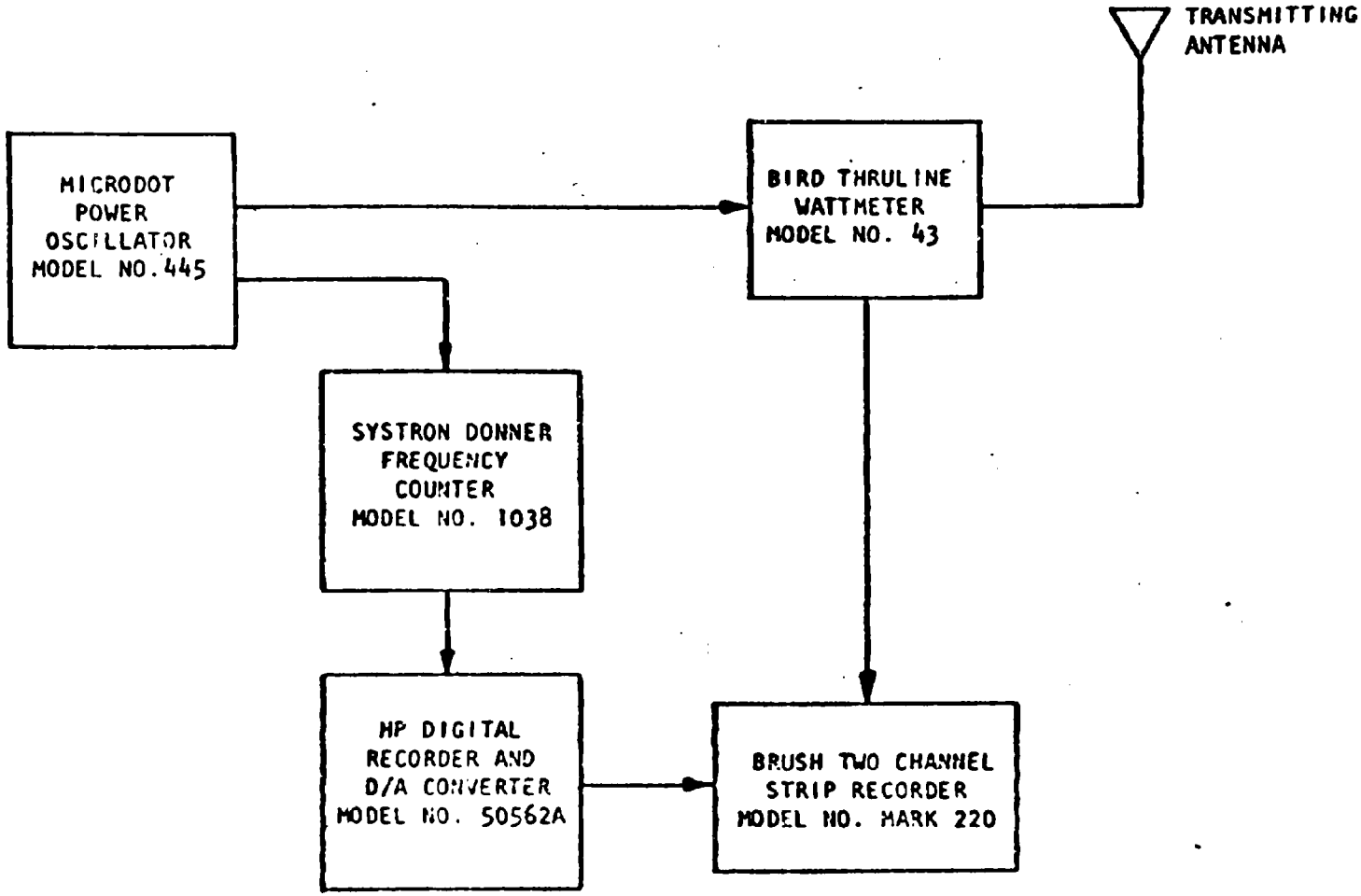


Figure 5. Transmitter Van



TYPICAL EQUIPMENT SETUP FOR
MONITORING FREQUENCY AND POWER OUTPUT
AT THE TRANSMITTER SITE

Figure 6. Transmitter Recording Equipment

a. AEL, Monmouth Country Airport Site 5.

Site 5 (Figures 7 and 8) is located among 20-foot pine trees. The sight line is through this wooded area for 150 feet to a clear area, then 500 feet over a downward slope in the direction of the receiver location. To the right of the sight line, at 45 degrees, 130 feet away, there is a metal hanger the side of which runs +30 degrees relative to the sight line.

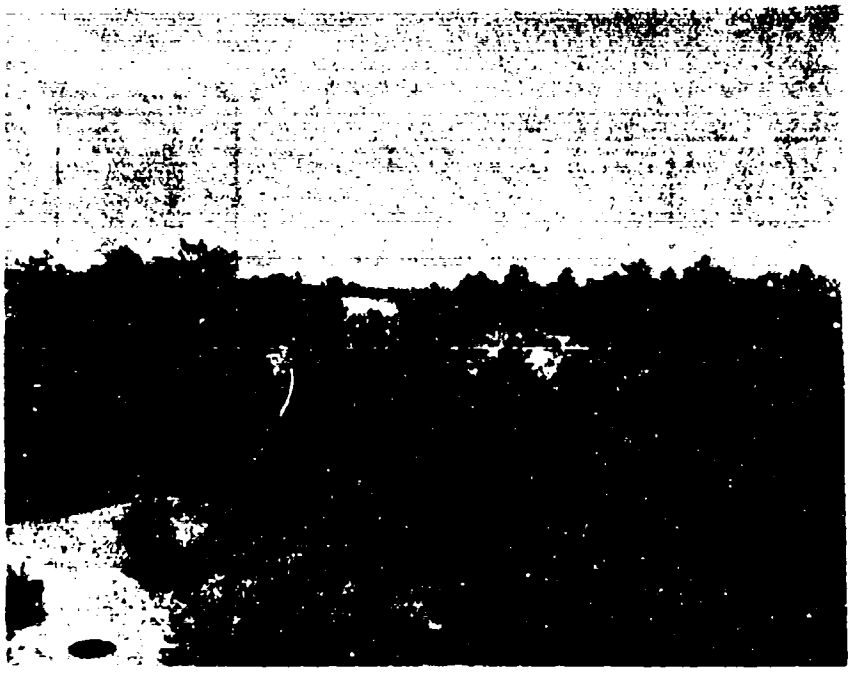


Figure 7. AEL, Monmouth County Airport Site 5

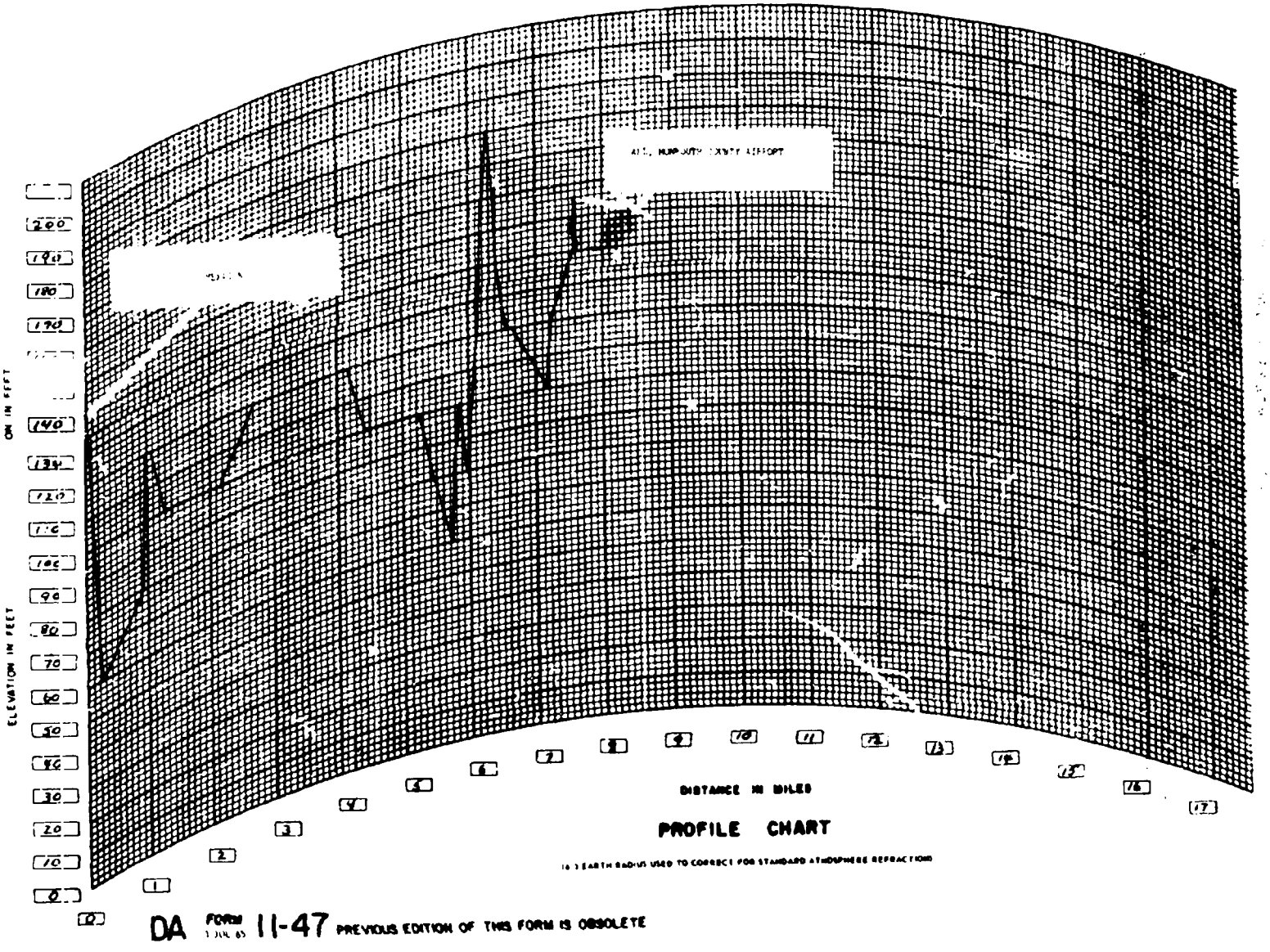
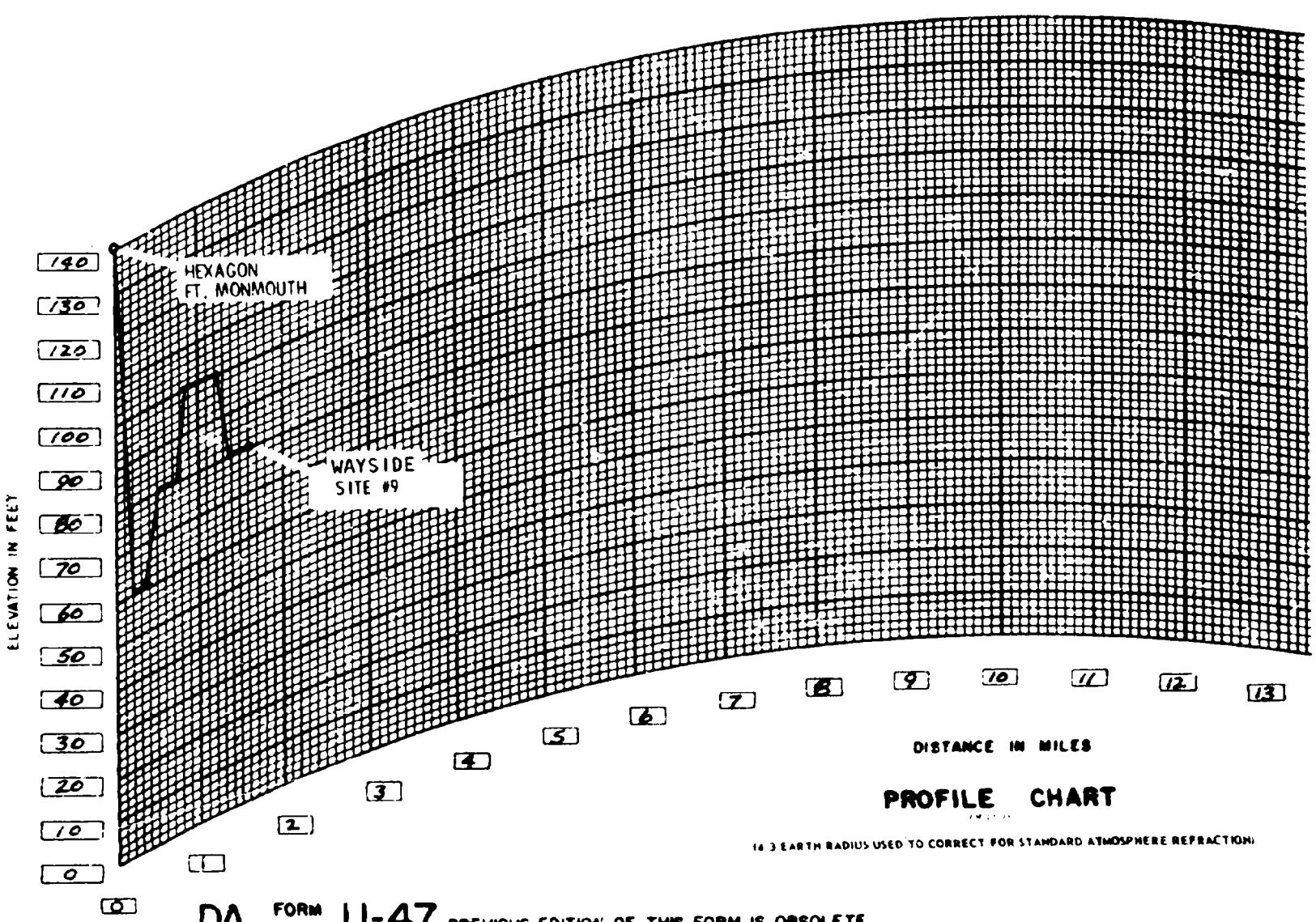


Figure 8. Site 5 Profile Chart

b. Wayside Site 9.

Site 9 (Figures 9 and 10) is located in a grass covered field. In line with the receiving site is a shallow 5-foot rise. A metal screen ventilator, 2 feet high by 3 feet in diameter is located 70 feet from the transmitter. Beyond the ventilator, at 150 feet, there is a pine tree 20 feet tall. Three-hundred feet away there are additional trees, 20 feet in height. To the left of the sight line at an angle of 15 degrees and a distance of 300 feet from the transmitter, there is a pole 40 feet tall with cables leading to three buildings beyond.

Figure 9. Wayside Site 9



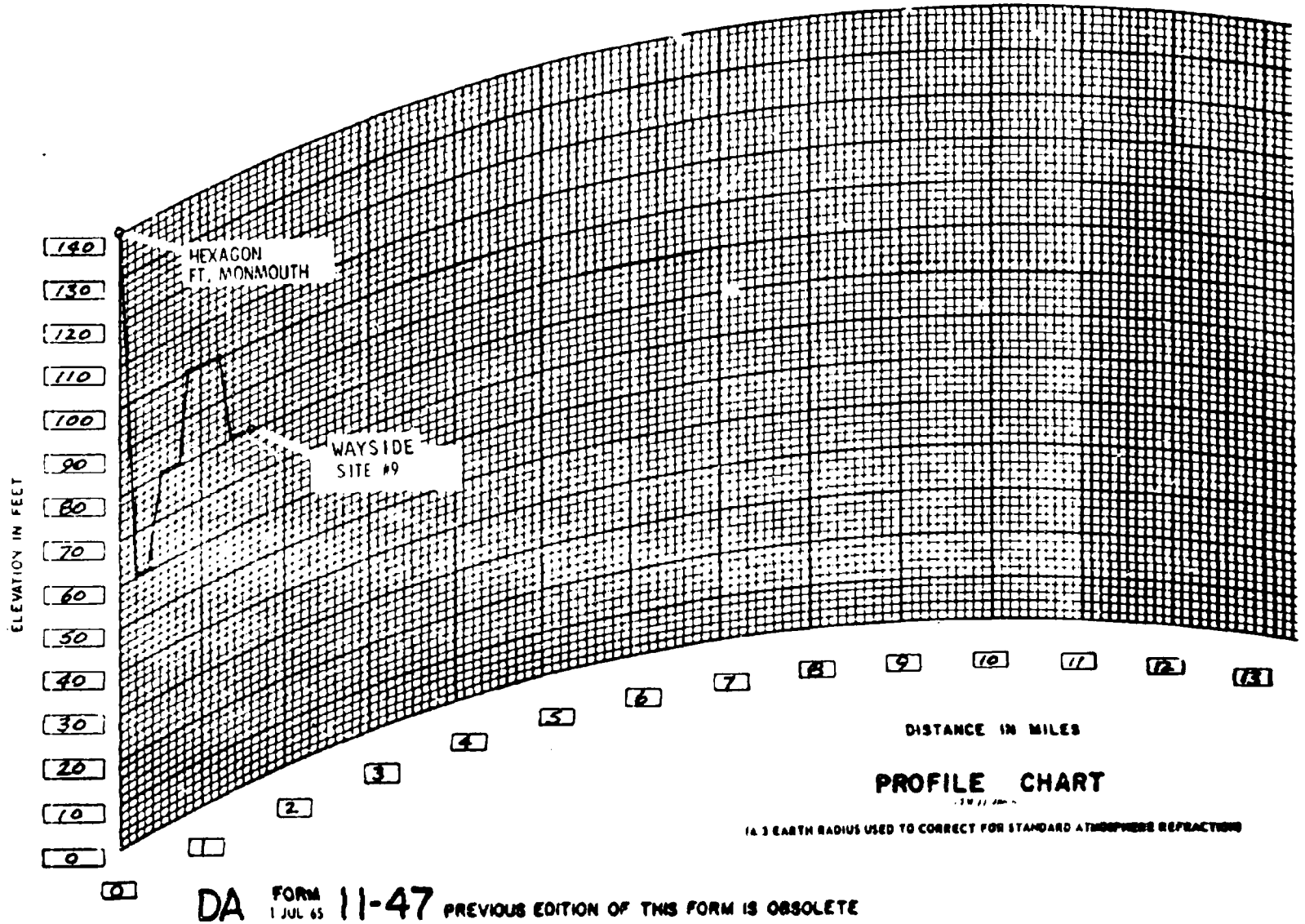
DA FORM 1 JUL 47 11-47 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

Figure 10. Site 9 Profile Chart

c. Wayside Site 9A.

Site 9A (Figures 11 and 12) is located among 30-foot tall trees with approximately 6-inch diameter trunks. In line with the receiving site is a 130 foot stretch of wooded area, a dirt road, and 400 feet of gradually rising, grassy fields, bordered on the far side by trees 20 feet tall. At a distance of 300 feet from the transmitter, in line with the receiving site is a metal screen ventilator, 2 feet high, 3 feet in diameter. The terrain profile chart for this site is the same as for site 9 since it is located in the woods just a few feet from site 9.

Figure 11. Wayside Site 9A



DA FORM 1 JUL 65 11-47 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

Figure 12. Site 9A Profile Chart

d. Wayside Site 10.

Site 10 (Figures 13 and 14) is located in a heavily weeded field. A guy wire crosses the sight line at a distance of 70 feet from the transmitter. There are two metal sheds, located 100 feet and 200 feet, respectively, from the transmitter. In addition, three wires 60 feet high cross the sight line 100 feet and again 275 feet from the transmitter. Three-hundred twenty-five feet from the transmitter, the sight line passes through a heavily wooded area.

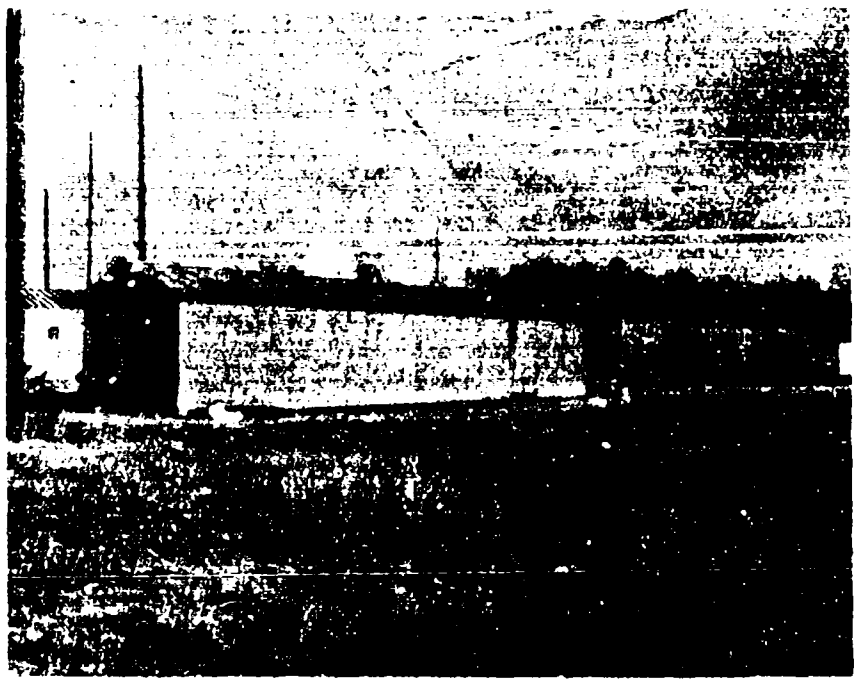
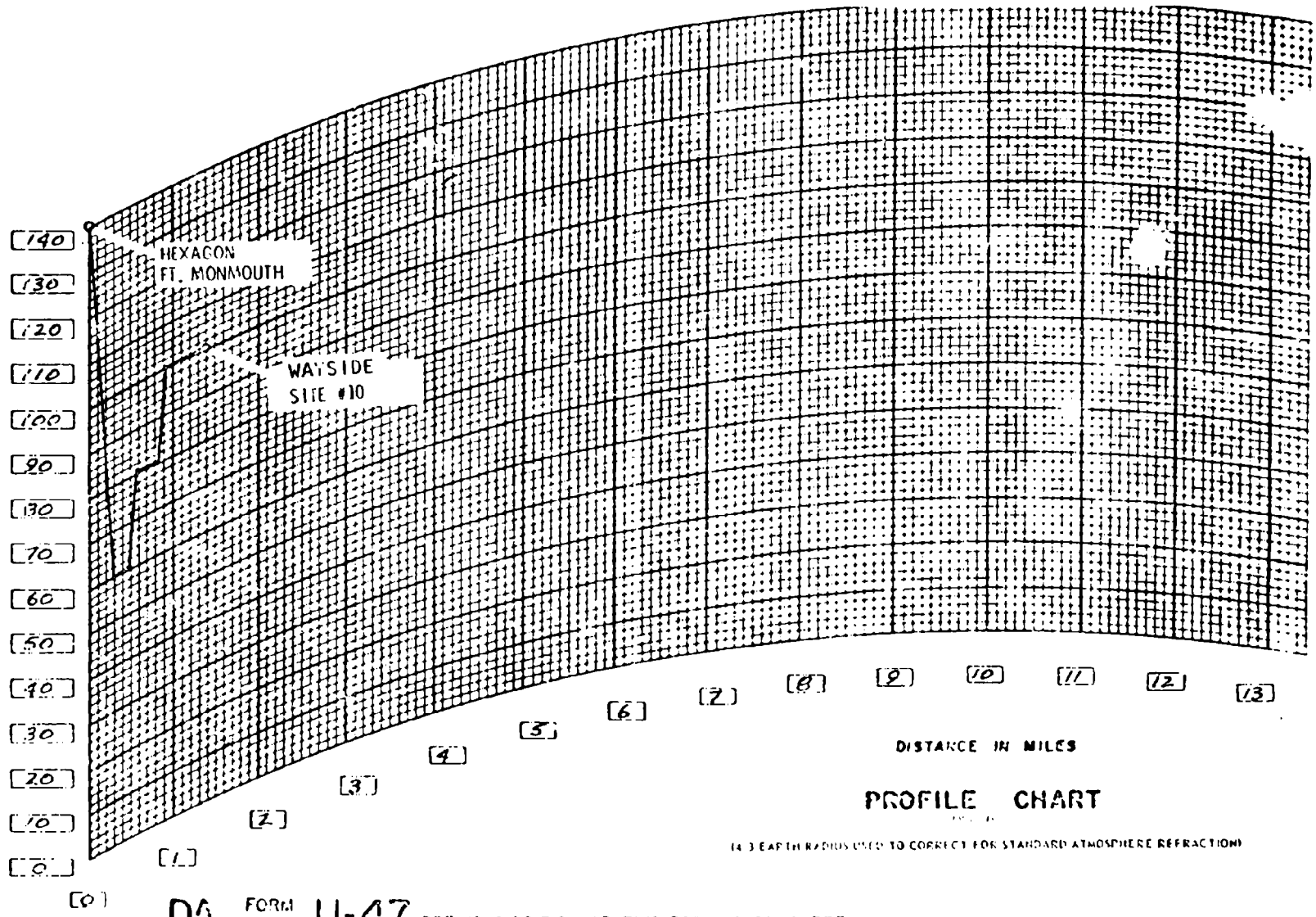


Figure 13. Wayside Site 10



DA FORM 1 JUL 65 11-47 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

Figure 14. Site 10 Profile Chart

e. Wayside Site 14.

Site 14 (Figures 15 and 16) is located in the middle of a 15-foot wide stream which runs perpendicular to the sight line. There is an upward slope along the sight line rising to a level 15 feet above the transmitter site. The crest of this rise is 30 feet from the transmitter site. There are 15-foot trees on top of this rise. One-hundred feet from the transmitter are four 40-foot trees, then brush for 200 feet, and woods of 30-foot trees, all on a plane 15 feet above site 14.

Figure 15. Wayside Site 14

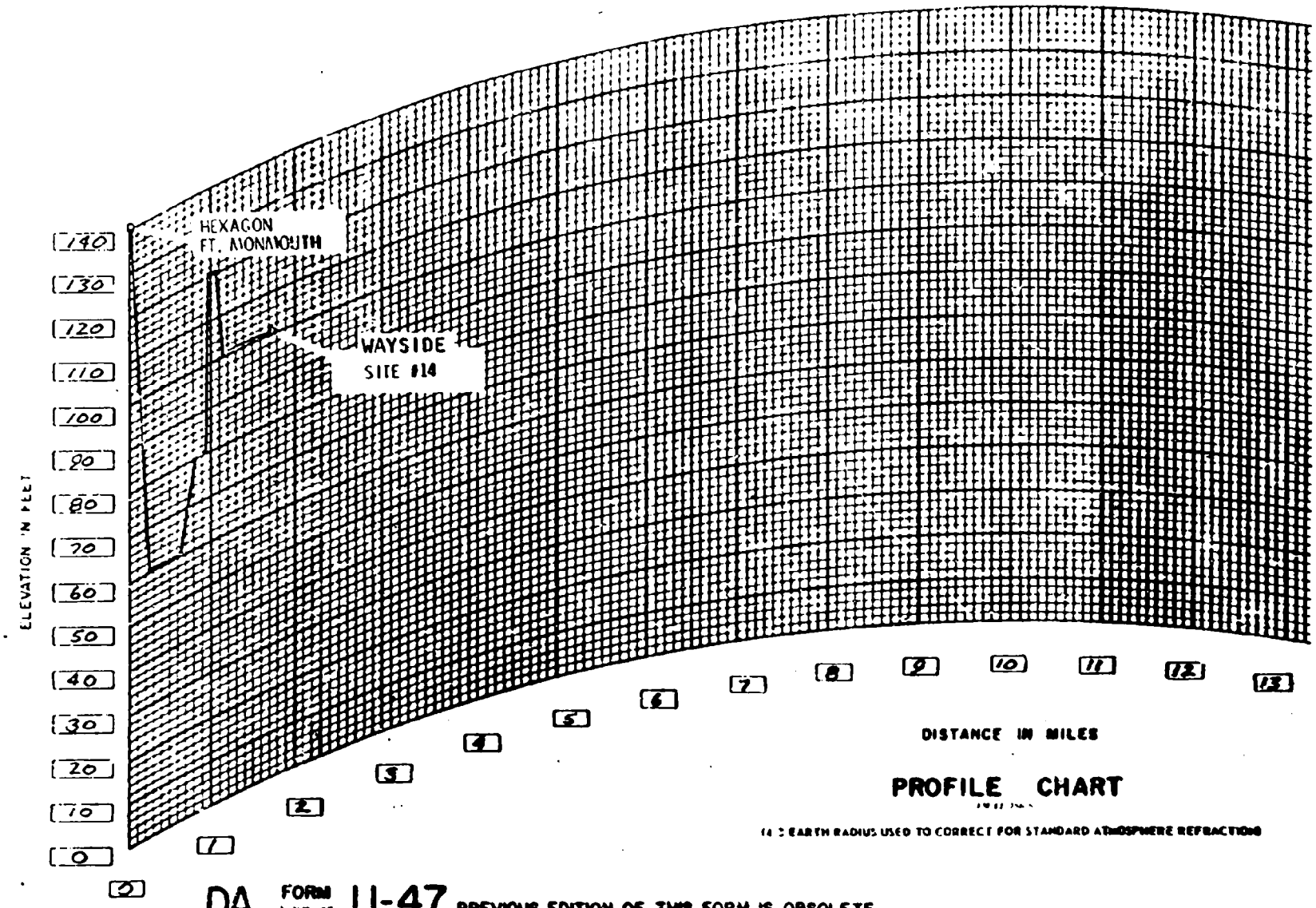


Figure 16. Site 14 Profile Chart

f. Wayside Site 19.

Site 19 (Figures 17 and 18) is located in a heavily weeded field. In line with the receiver site, 340 feet from the transmitter, is a large van beyond which there is a forest of trees 40-feet tall. One-half mile further along the sight line and perpendicular to it there are three large power cables suspended from metal towers 60 feet in height. Thirty feet to the left of the van is a second van, and at 40 and 60 feet, respectively, to the left of this van there are two 45-feet high towers. Thirty degrees to the right, and 100 feet away from the transmitter site 19, there are two metal huts, 15 feet high, 20 feet in diameter. Six hundred feet from the transmitter there is a ground plane, 300 feet in diameter with a 40-foot pole located at its center.

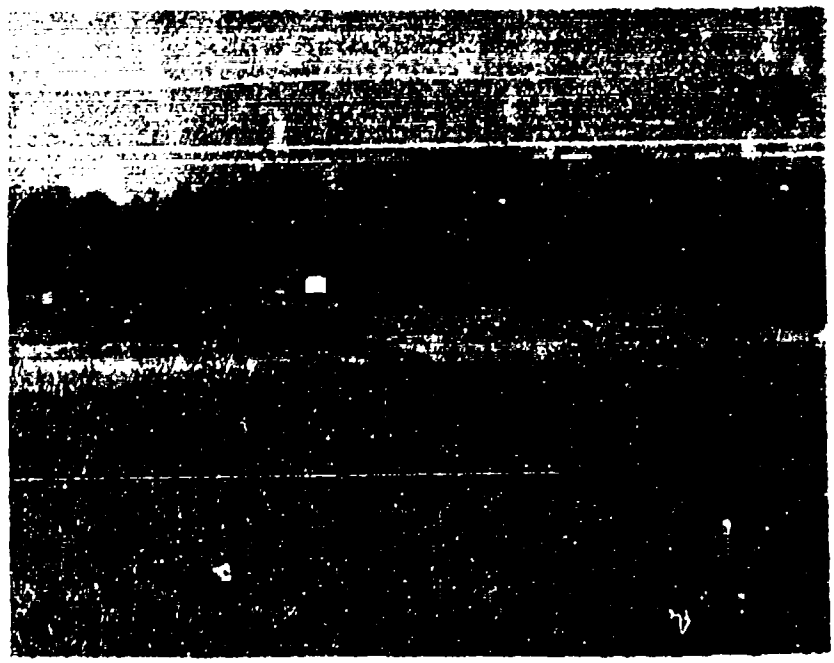


Figure 17. Wayside Site 19

TERRAIN PROFILE - WAYSIDE 19 TO HEX

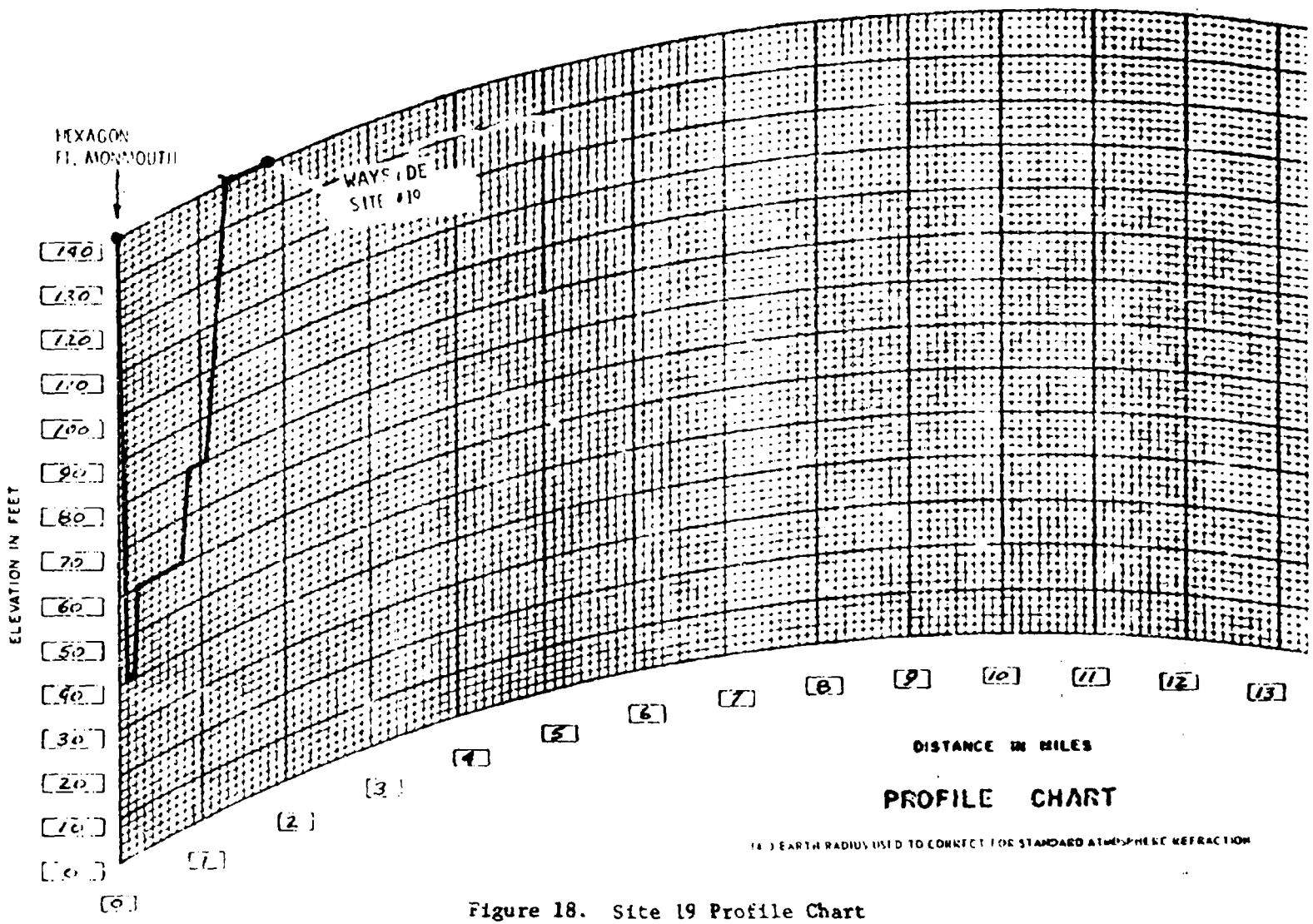


Figure 18. Site 19 Profile Chart

8. Wayside Site 19B.

Site 19B (Figure 19) is located atop an 85-foot tower which is 45 feet behind site 19 and 40 feet to the right, thereby placing site 19 obstacles 40 feet to the left of the receiver sight line. The receiver site is visible, through the power lines, which cross the sight line approximately 1.9 miles from the transmitter site.

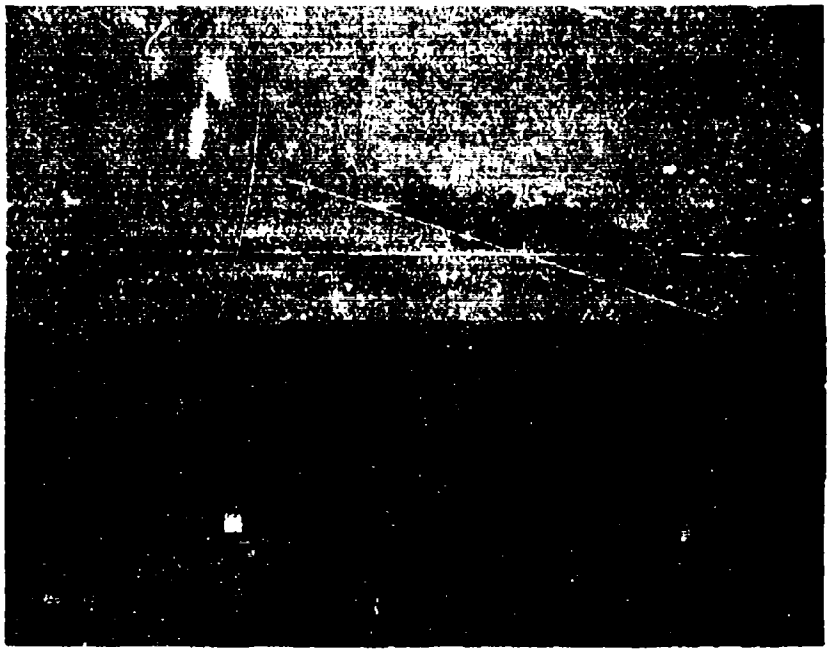


Figure 19. Wayside Site 19B

h. Evans Area "F" Site 20.

Transmitter site 20 (Figures 20 and 21) is located in a vine covered field. In line with the sight path are five 15-foot high cables and a row of trees 20 feet tall, running diagonally from 20 feet to the right of the transmitter site to a point 20 feet to the left of the sight line and 120 feet away from the transmitter site. There is a 40-foot high pole at that point. The aforementioned cables and line of trees cross the sight line 60 feet from the transmitter site. Along the sight line, 120 feet from the transmitter, is a road running approximately perpendicular to the sight line. There are 40-foot tall poles on both sides of this road. The poles support cables at the 30- and 40-foot levels. Two-hundred and twenty feet along the sight line, there is a dual road that runs off 45 degrees to the right of the sight line. Cyclone fence, on both sides of the depressed road, is in close proximity to the sight line at points 220 and 400 feet from the transmitter site. Beyond the farther fence, there are trees 40 feet tall located on a downward slope.

Figure 20. Evans Area "F" Site 20

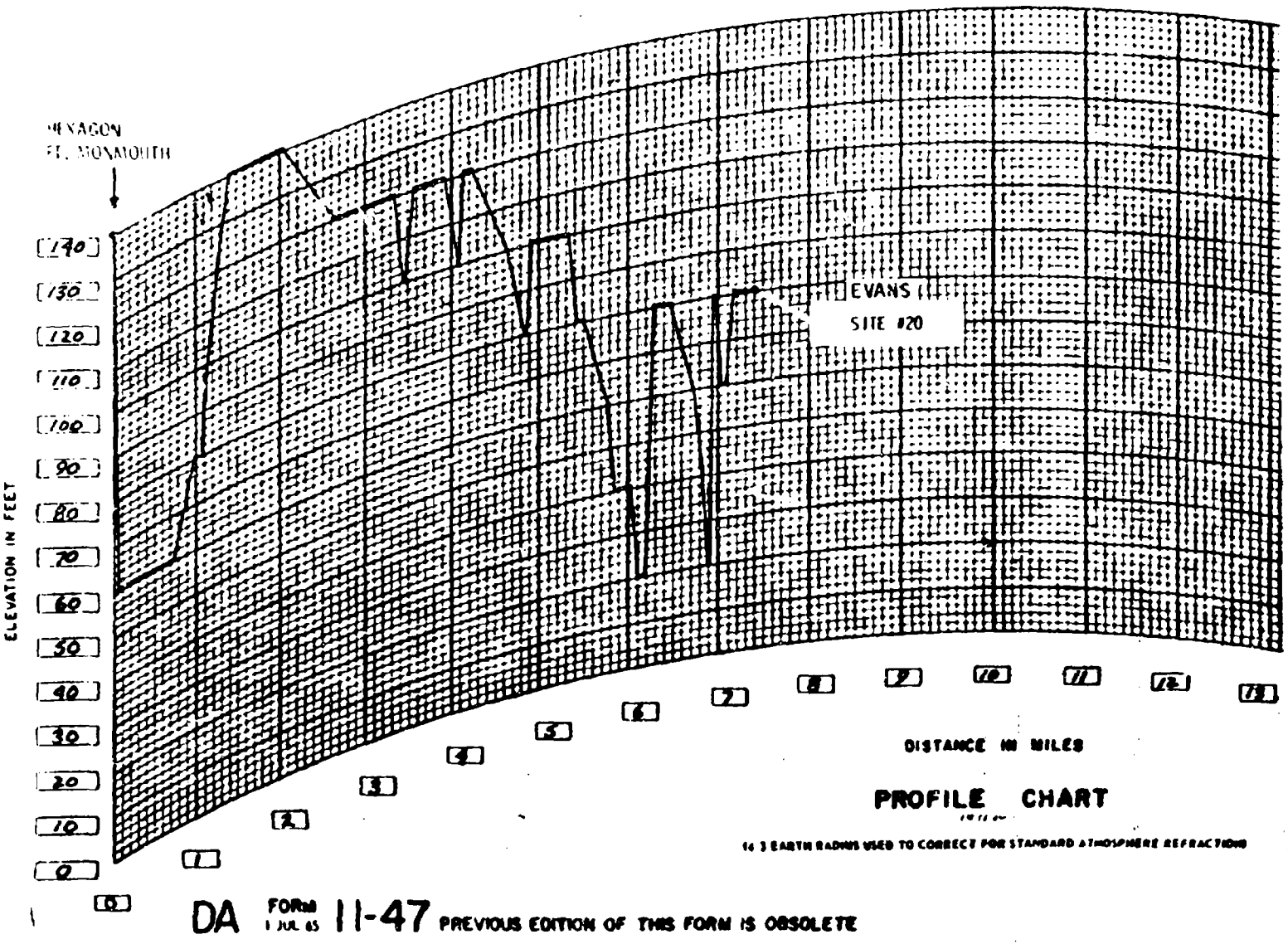


Figure 21. Site 20 Profile Chart

7. SAMPLE DATA

This paragraph contains a complete sample data run and data reduction in order to illustrate the procedures used and to enable the reader to better interpret the data contained in paragraphs 8 and 9. The examples are excerpts from the tests conducted on February 9, 1972.

Figure 22 is a sample of the test condition log, which is generally self-explanatory. Tests were normally conducted with vertical polarization on both the transmit and receive ends, unless otherwise noted. This log sheet indicated that test runs 720209-01 and 720209-02 were done with vertical polarization, and that in run 720209-03, horizontal polarization was used in the transmitting antenna. The receiving antenna was always vertically polarized.

Figures 23 and 24 are full-size reproductions of the strip chart recording of run 720209-02. It shows that the run was started at 1350 hours, the AEL horn antenna was used, and the frequency was 1,545 MHz. The wind was from 270 degrees at 2 knots, gusting to 8 knots. The lower section of the strip chart has the calibration marks on it, showing the -80, -90, -100, and -100 dBm levels. The wiggly line is the recorded signal strength and the annotations on the upper section show the height of the transmitting antenna. The notation 10 dB ATT between 8 and 30 feet indicates the signal was attenuated 10 dB. In order to place the trace into the most linear section of the recording equipment, attenuation was added whenever the signal strength was of such a magnitude that it would cause the trace to fall near the edge of the recording. During the portion of the test run between 30 and 65 feet, 20 dB of attenuation was added. Obviously, these attenuation values have to be added to the signal strength read from the graph. The test ended at 1,400 hours, as indicated, and the equipment was recalibrated at the end of the test to assure us that nothing had drifted sufficiently to invalidate the data.

Figure 25 shows a Test Data Sheet, which is used for establishing path losses with the data from the strip chart recording. As shown in the section on the upper right of this sheet, the equivalent system (input) power is a function of the transmitted power, the antenna gains, and cable losses. The received signal strength is scaled off the strip chart recording and logged in the RCVD PWR column as a function of transmitting antenna height above ground. This particular test data sheet shows the data from two consecutive runs. It should be noted that the received power in dBm was always negative, but for simplicity's sake, the negative signs were omitted on these sheets. The path loss for each test is shown in the next two columns, and the average path loss for each transmitting antenna height together with the number of samples this average is based on, is shown in the last two columns.

Figure 26 is a plot of the average path losses found in test runs 720209-01 and -02, as determined on the test data sheet. The free space loss between the transmitting and receiving stations is also shown. This lets one determine the additional path loss, above that of free space, caused by the physical environment through which the signal is propagated.

TEST SET-UP AND CONDITIONS

DATE: 9 FEBRUARY 72 TYPE OF TEST: RANGING; ____

PATH LOSS: ✓

CONDITION	TEST RUN S/N 720209-01	TEST RUN S/N 720209-02	TEST RUN S/N 720209-03
TRANSMITTER			
OPER. FREQ.	1✓4✓	1✓4✓	1✓4✓
SITE LOCATION	WAYSIDE 19B	WAYSIDE 19B	WAYSIDE 19B
ANTENNA TYPE	AEL HORN	AEL HORN	AEL HORN
POWER (dBM)	44	44	44
ANTENNA GAIN (dB)	14.4	14.4	14.4
CABLE TYPE	FHJ-4	FHJ-4	FHJ-4
(a) LENGTH (FT)	129	129	129
(b) LOSS (dB)	✓.7	✓.7	✓.7
RECEIVER			
ANTENNA TYPE	ANDREW BICONICAL	ANDREW BICONICAL	ANDREW BICONICAL
ANTENNA GAIN (dB)	0.3	0.3	0.3
CABLE TYP.	RG 319 A/U	RG 319 A/U	RG 319 A/U
(a) LENGTH (FT)	130	130	130
(b) LOSS (dB)	1.2	1.2	1.2
WIND	2-4 G 8 270°	2-4 G 8 270°	2-4 G 10 270
TEMP.	29°F	29°F	29°F

REMARKS: RUN 720209-03
HORIZONTAL POLARIZATION

OPERATORS: D. LACLAIR XMTR.
J. YANGA RCVR.

Figure 22. Typical Test Sheet

PROPAGATION PATH LOSS

DATE: [illegible] 72 TEST RUN S/N: [illegible]

PATH: WAYSIDE SITE NO. 19B TO ECCA HEXAGON

OPER. FREQ.: 1545 MHz

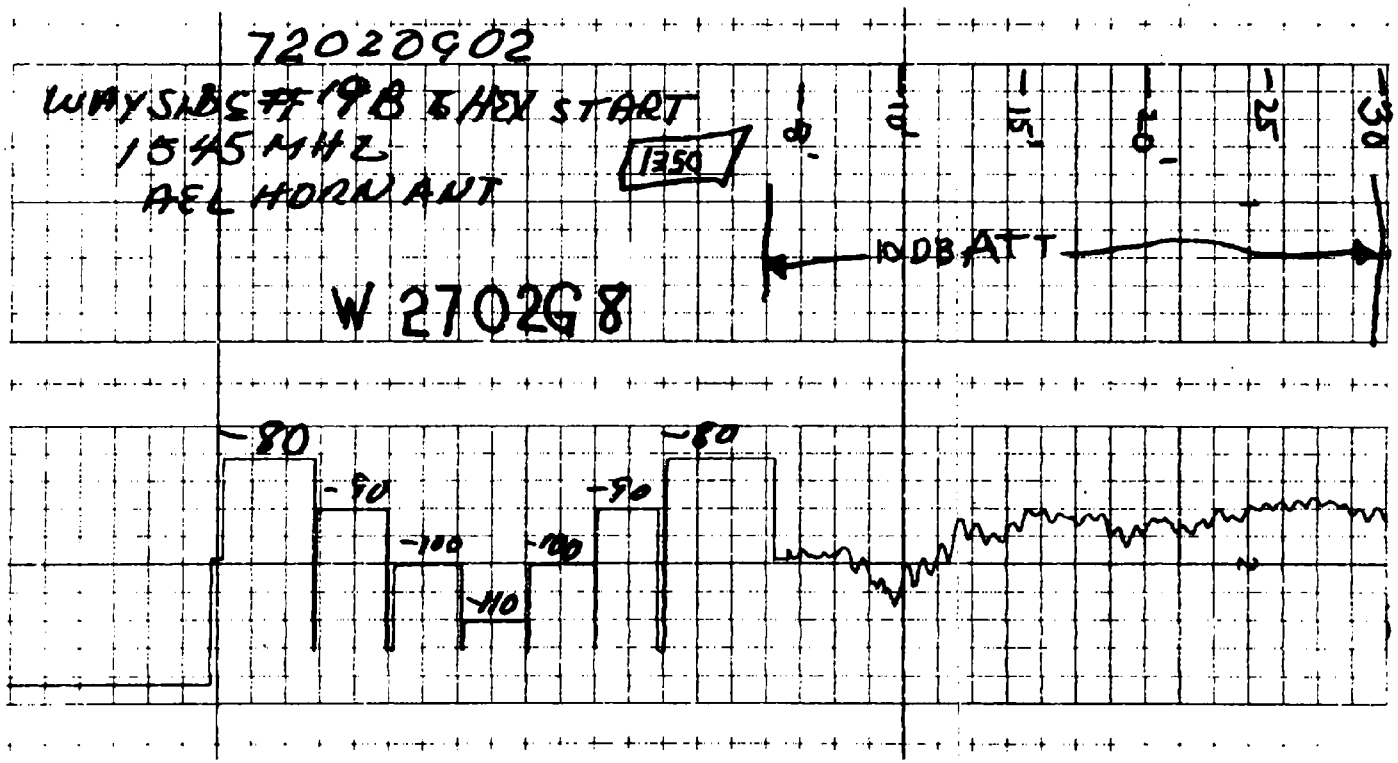


Figure 23. Propagation Path Loss Strip Chart

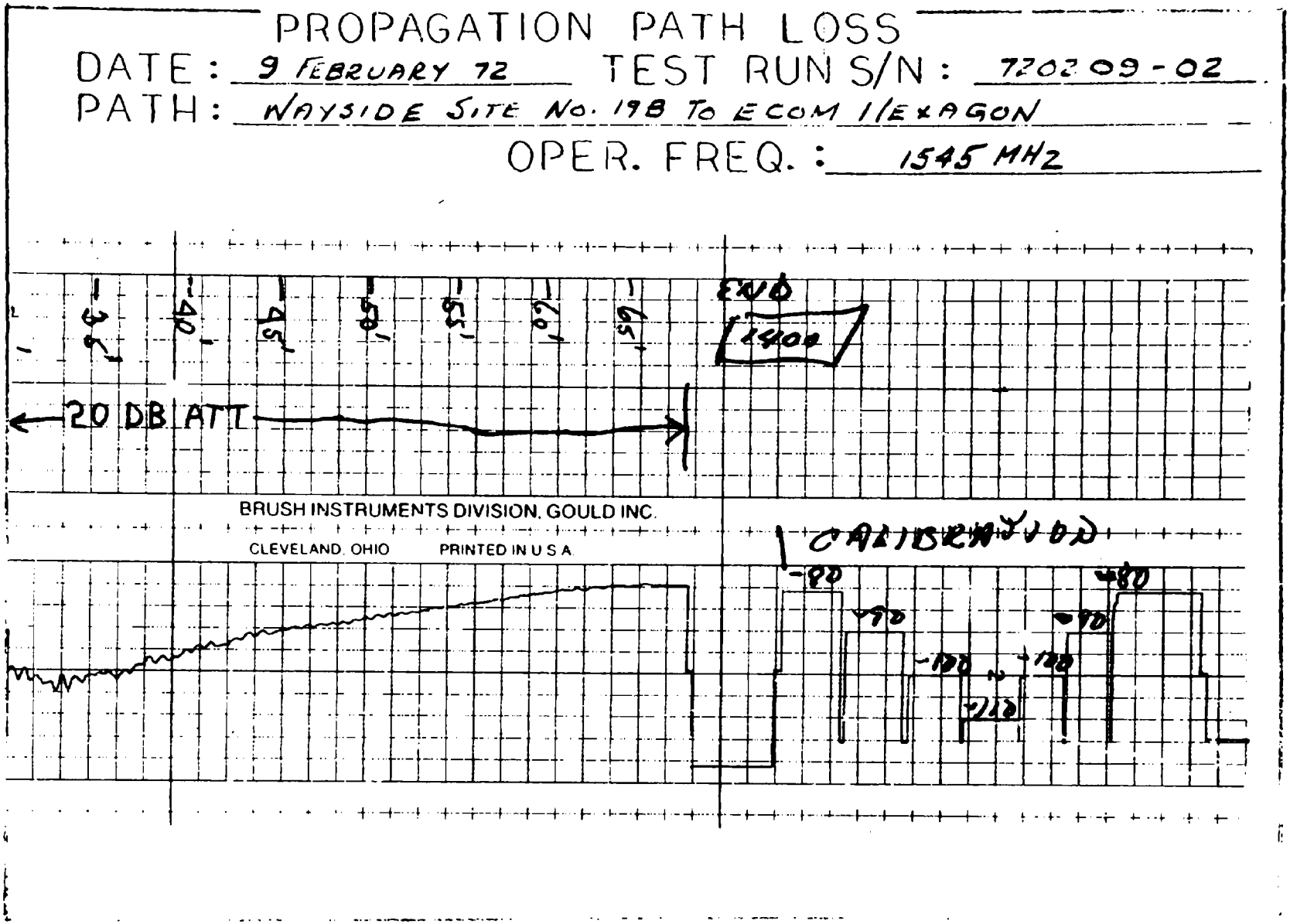


Figure 24. Propagation Path Loss Strip Chart

TEST DATA SHEET

DATE: 9 FEBRUARY 72

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: 1328 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 198	44 dBm	AEL HORN	14.4	√.7	XMTR. PWR. 44
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				=ESP = √1.8 USE √2

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 40 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720209-01	TEST 720209-02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720209-01	720209-02	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	97	88		141	140	144.5	2	
10	96	92		141	144	146.0	2	
15	82	82		134	134	134.0	2	
20	85	83		137	135	136.0	2	
25	80	80		132	132	132.0	2	
30	81	81		133	133	133.0	2	
35	81	81		133	133	133.0	2	
40	76	75		128	127	127.5	2	
45	72	70		124	122	123.0	2	
50	68	68		120	120	120.0	2	
55	65	65		117	117	117.0	2	
60	—	62		-	114	114.0	1	END 720209-01 — 1335
65	—	60		-	112	112.0	1	START 720209-02 — 1350
								END 720209-02 — 1400
								MEAN READING OF STRIP CHART RECORDINGS

Figure 25. Typical Test Data Sheet

PROPAGATION PATH LOSS

DATE: 9 FEBRUARY 72 TEST RUN S/N: 720209-01,-02

PATH: WAYSIDE SITE No. 198 TO ECOM HEXAGON

OPER. FREQ.: 154 MHz

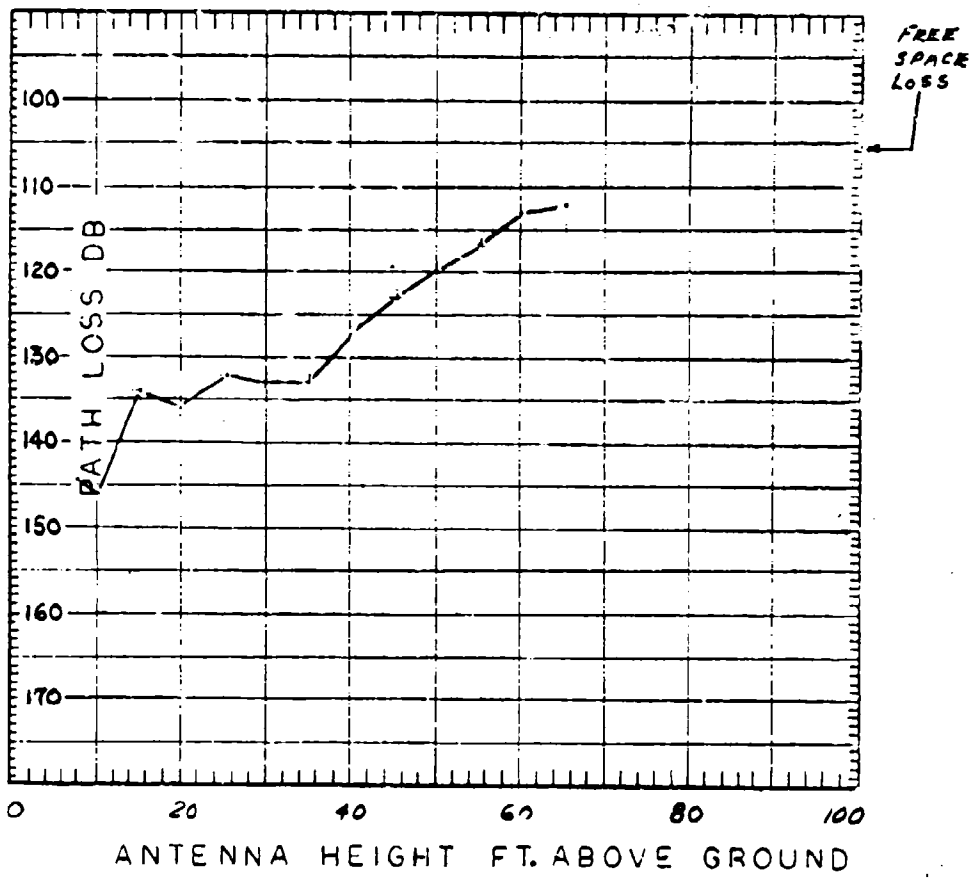


Figure 26. Propagation Path Loss Graph

8. TEST RESULTS

This paragraph contains the reduced data from the tests (refer to the Appendix). The raw data is not included in this report since it would unnecessarily add to the bulk. The results of each set of tests are shown in tabulated and graphical formats. The explanation of how this reduced data was obtained is given in the "Sample Data," paragraph 7.

Table V lists the distribution and cumulative distribution of the maximum path losses obtained during the 1972 tests. Only three of the four frequencies used in the test are shown since there was insufficient data at the highest frequency. This data was obtained over the various paths between the receiver at the Hexagon Building, Fort Monmouth, and the transmitting stations, none of which were more than 10 miles from the receiver. It should be noted here that the maximum path loss did not always occur at the lowest antenna height. The table shows the number of tests in which particular maximum losses were observed, the cumulative total as the losses get larger and larger, and the percentage of the total number of observations that these cumulative totals represent. This data is plotted on Figures 27 and 28.

Figure 27 shows the distribution of the maximum path losses. It can be seen that as the frequency is increased, the path losses increase. The cumulative distribution plot, Figure 28, shows the percentage of path loss which does not exceed a given loss, as a function of antenna height and frequency. For example, at 1,545 MHz, 96 percent of the transmissions had a path loss of 151 dB or less, regardless of antenna height, obstructions, atmospheric conditions, etc. (without our 10-mile test radius of course).

The graphs on the following pages are combinations of various plots selected from the reduced data in the Appendix. These graphs were prepared to allow comparative analysis of typical test runs and contain such combinations as different days and seasons at the same location and the same frequency, different frequencies at the same location, different antennas at the same location and same frequency, and different polarizations over the same path under identical test conditions.

Table V. Path Loss - 1972 Low Points

dB	1545 #	Cum	%	dB	371.4 #	Cum	%	dB	229.5 #	Cum	%
124	3	3	12	109	1	1	8	105	1	1	8
132	1	4	15	122	1	2	15	114	1	2	17
134	1	5	19	123	2	4	31	117	1	3	25
137	2	7	27	124	1	5	39	120	1	4	33
140	1	8	31	126	1	6	46	122	1	5	42
141	1	9	35	127	2	8	62	123	1	6	50
142	3	12	46	129	1	9	69	125	3	9	75
143	1	13	50	130	1	10	77	127	1	10	83
144	3	16	62	132	2	12	92	129	11	11	92
146	1	17	65	133	1	13	100	134	1	12	100
147	3	20	77								
148	2	22	85								
149	1	23	89								
150	1	24	92								
151	1	25	96								
156	1	26	100								

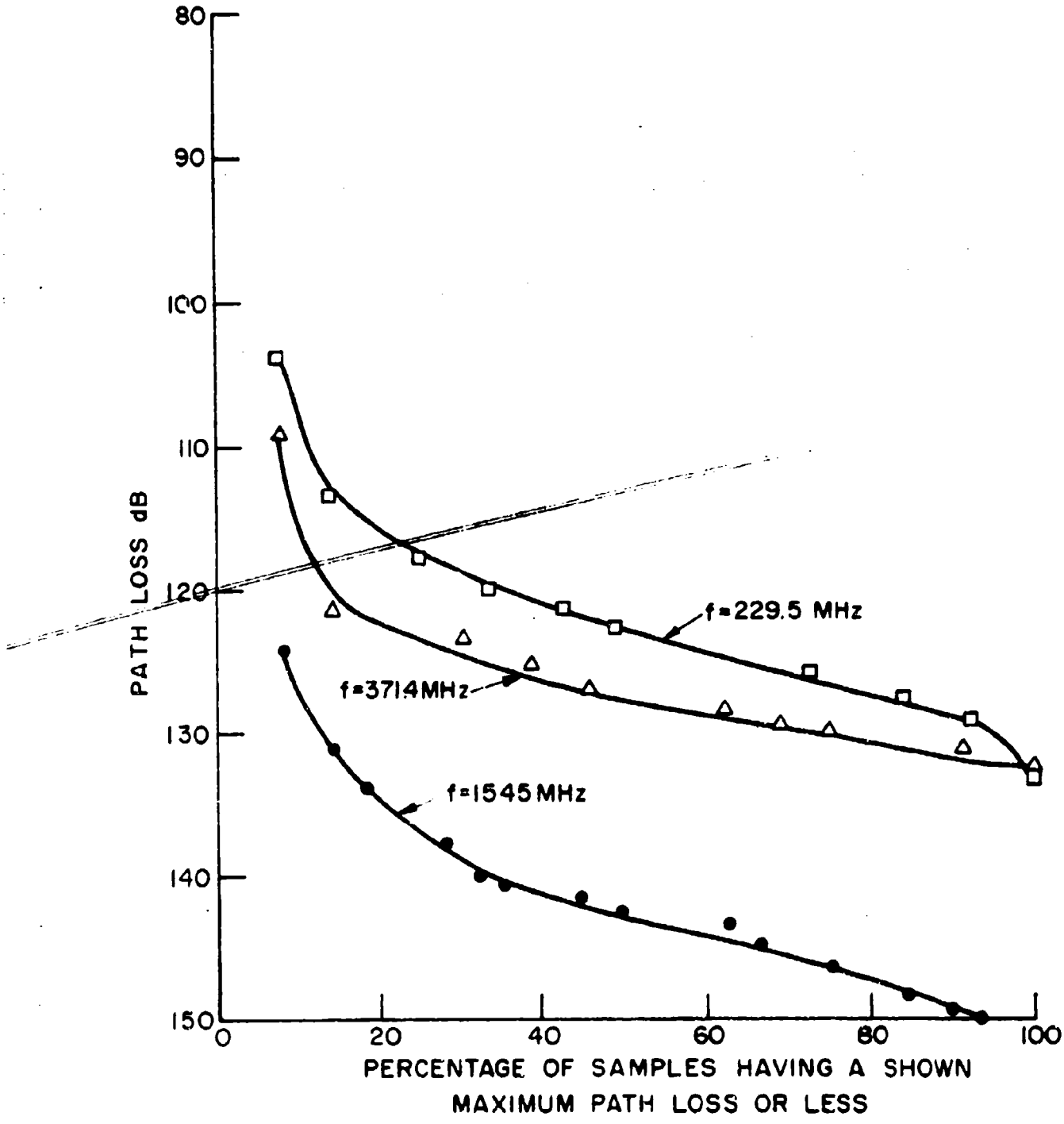


Figure 27. Propagation Path Loss 1,545 MHz

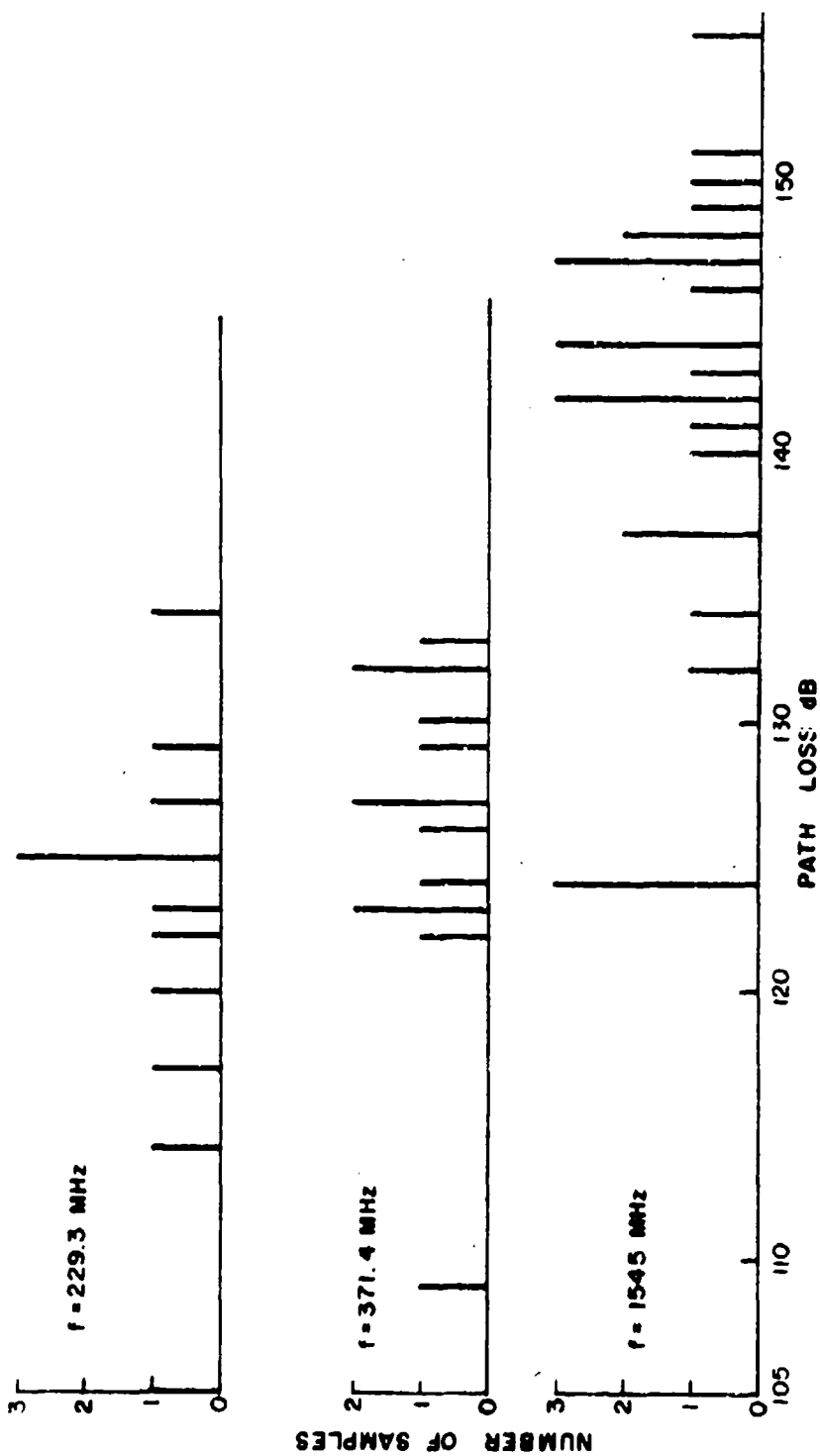


Figure 28. Propagation Path Loss 371.4 MHz

a. 229.5 MHz Comparison Plots (Figures 29 through 32)

Wayside Site No. 9 to ECOM Hexagon 1.61 miles
Oper. Freq. 229.5 MHz, Ant. Type: AT-197

See description of Site 9 for details - Beyond line-of-sight and blocked by trees without leaves except for pines.

18 Feb. 1972 ----------
14 Mar. 1972 ——————

These results of the measurements do not differ by more than 3 dB and there is reasonably good correlation.

The path loss is about 27 dB greater than the free space path loss at antenna heights between 10 to 30 feet.

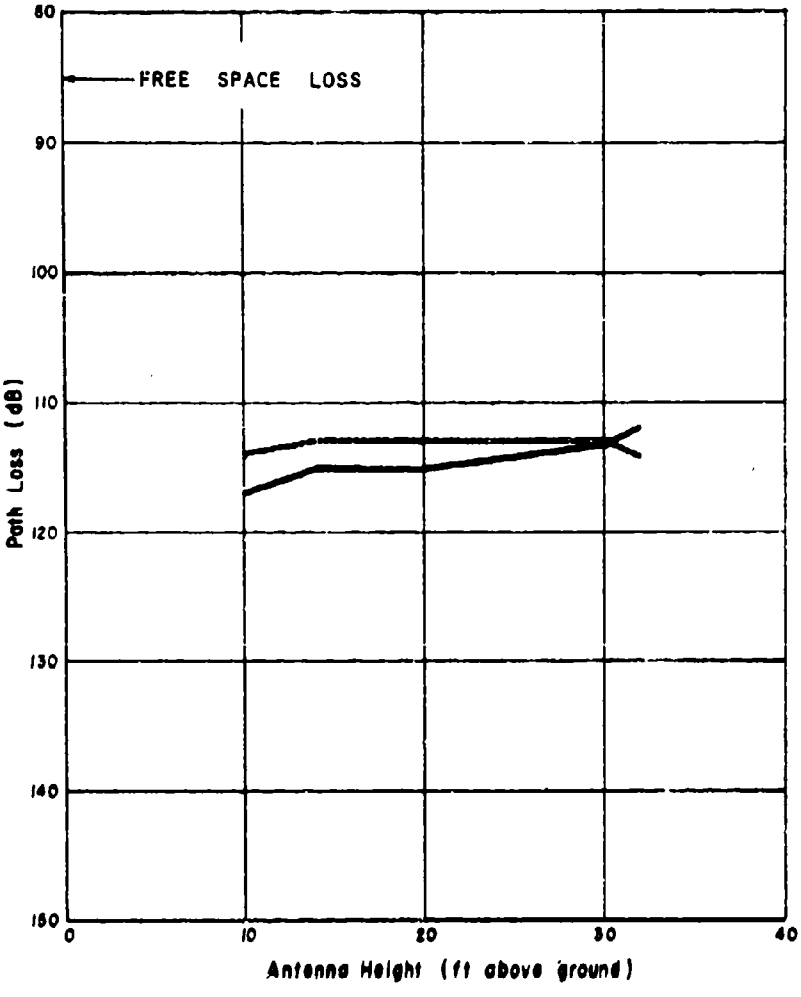


Figure 29. Propagation Path Loss (Site 9 to Hexagon, Frequency 229.5 MHz, Antenna AT-197)

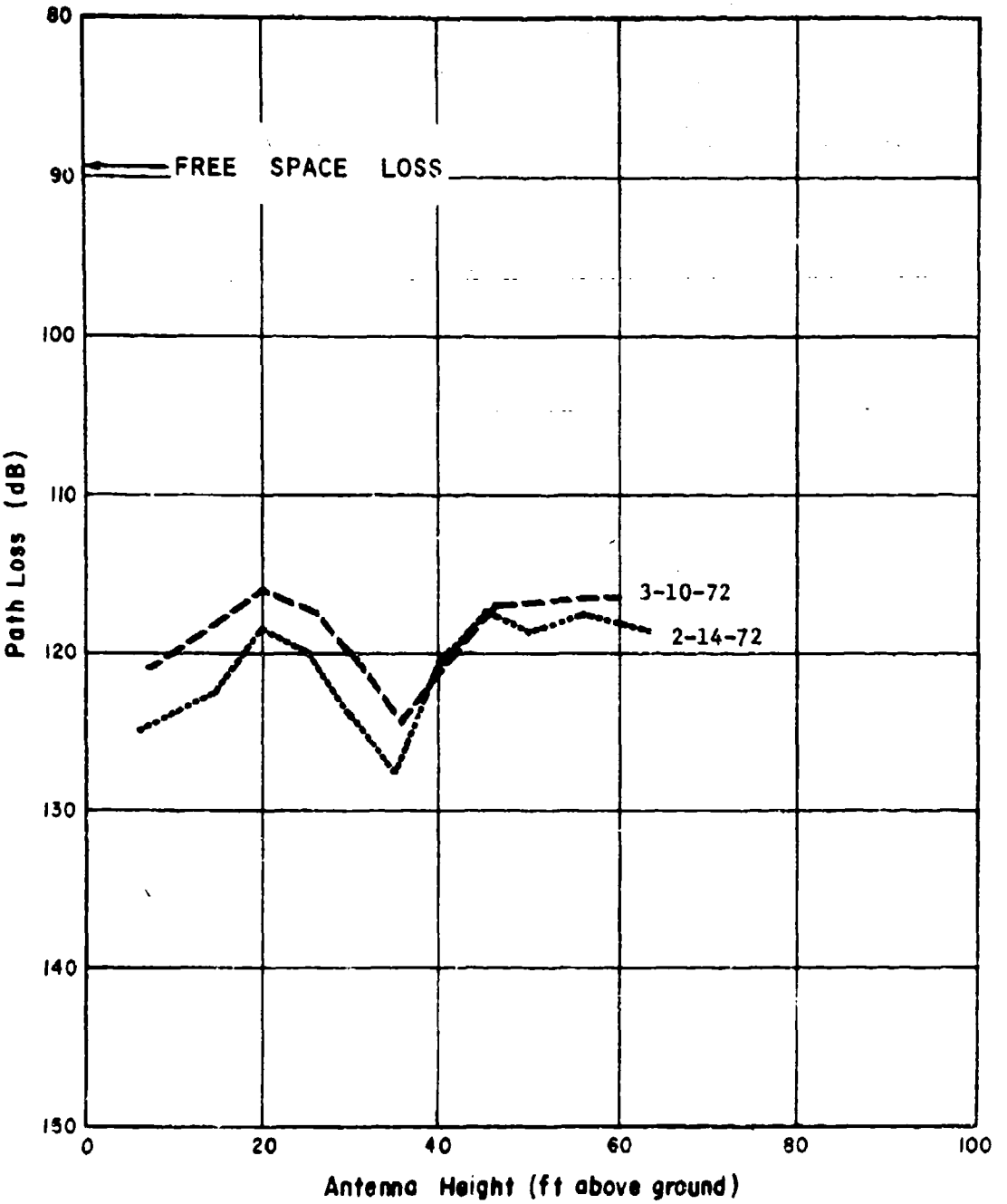


Figure 30. Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz, Antenna T-29 (Horizontal))

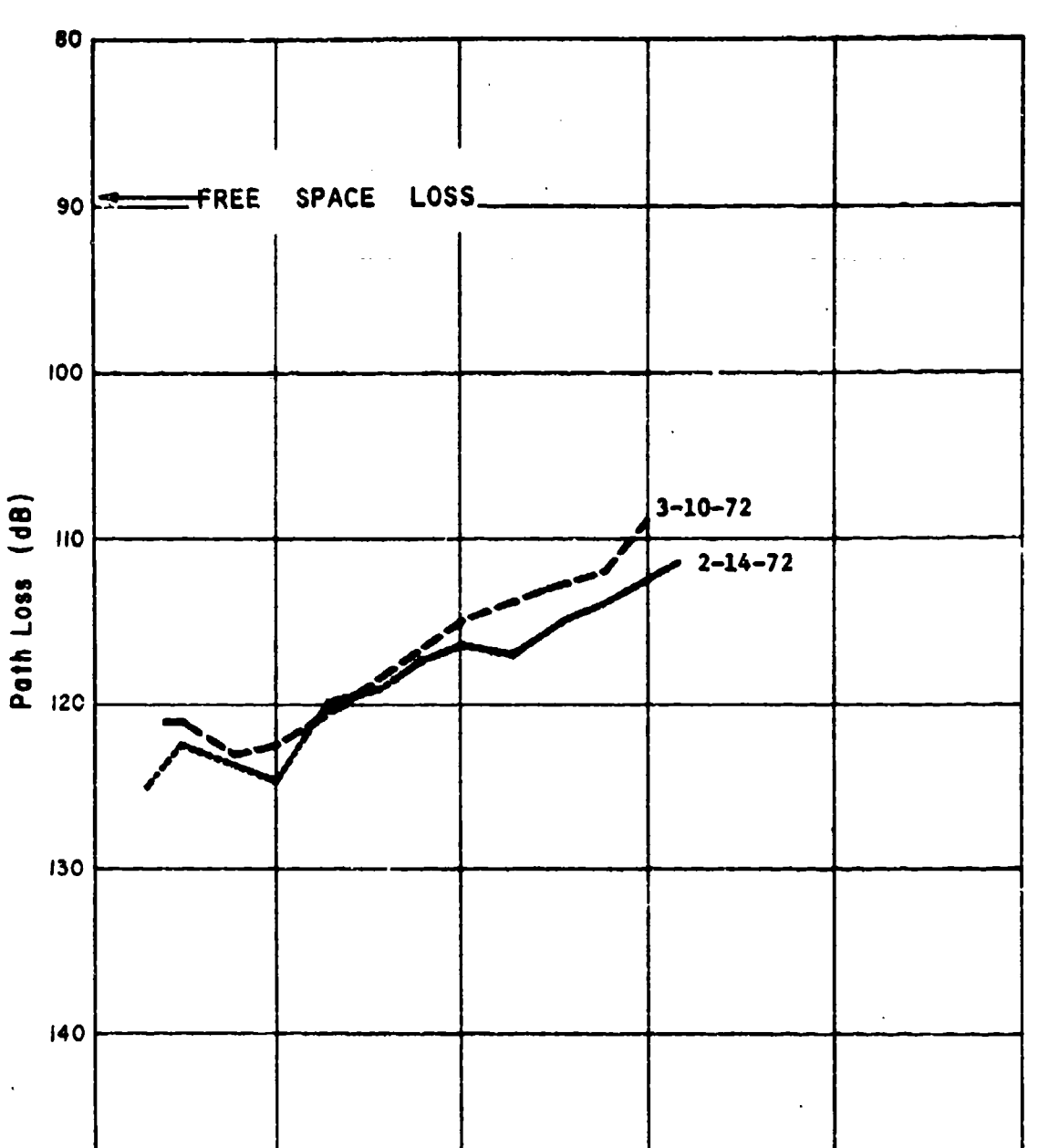


Figure 31. Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz, Antenna T29 (Vertical))

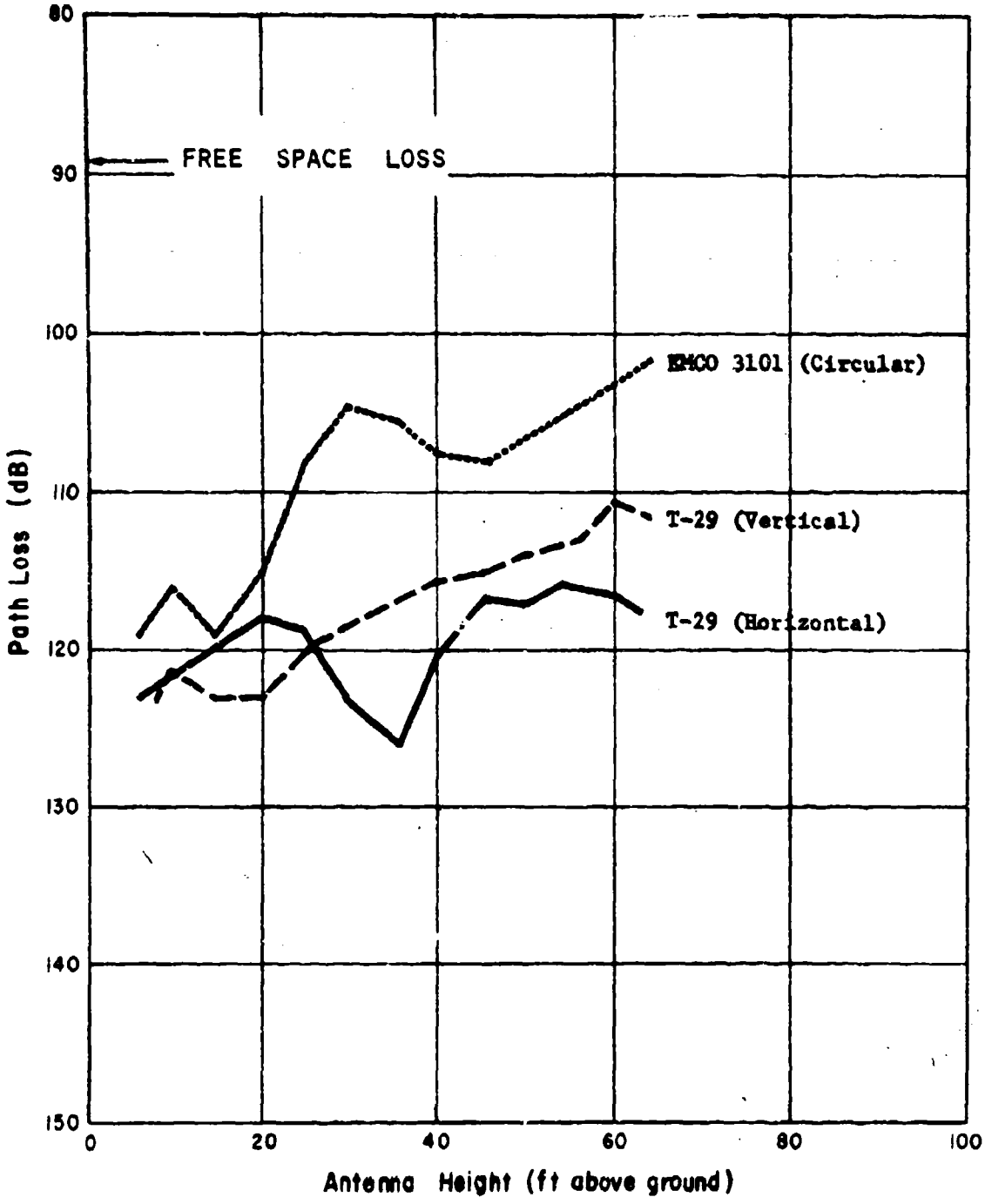


Figure 32. Propagation Path Loss (Site 19B to Hexagon, Frequency 229.5 MHz Antenna) (See Graph, Figure 3)

b. 371.4 MHz Comparison Plots (Figures 33 through 41)

(1) Path AEL MCA No. 5 to ECOM Hexagon.

Oper. Freq. 371.4 MHz Ant. Type - AT-197

Oct. 1971 - ———— Leaves still on trees.
27 Jan. 1972 - ---------- Dry ground, no leaves on trees, tractors moving about 600 feet in front of transmitting antenna.
28 Jan. 1972 - - - - - - 2-1/2 inches of snow on ground with light snow falling - wind 1 to 2 knots gusting to 4 - transmitting antenna had a light coat of ice - no tractor activity.

At this site, the transmitter is beyond the line of sight and at a distance of 7.6 miles from the Hexagon. The maximum data spread of 5 dB occurs at an antenna height of 40 feet. At 60 feet antenna height, the data spread is 4 dB.

The above data spreads are not considered excessive.

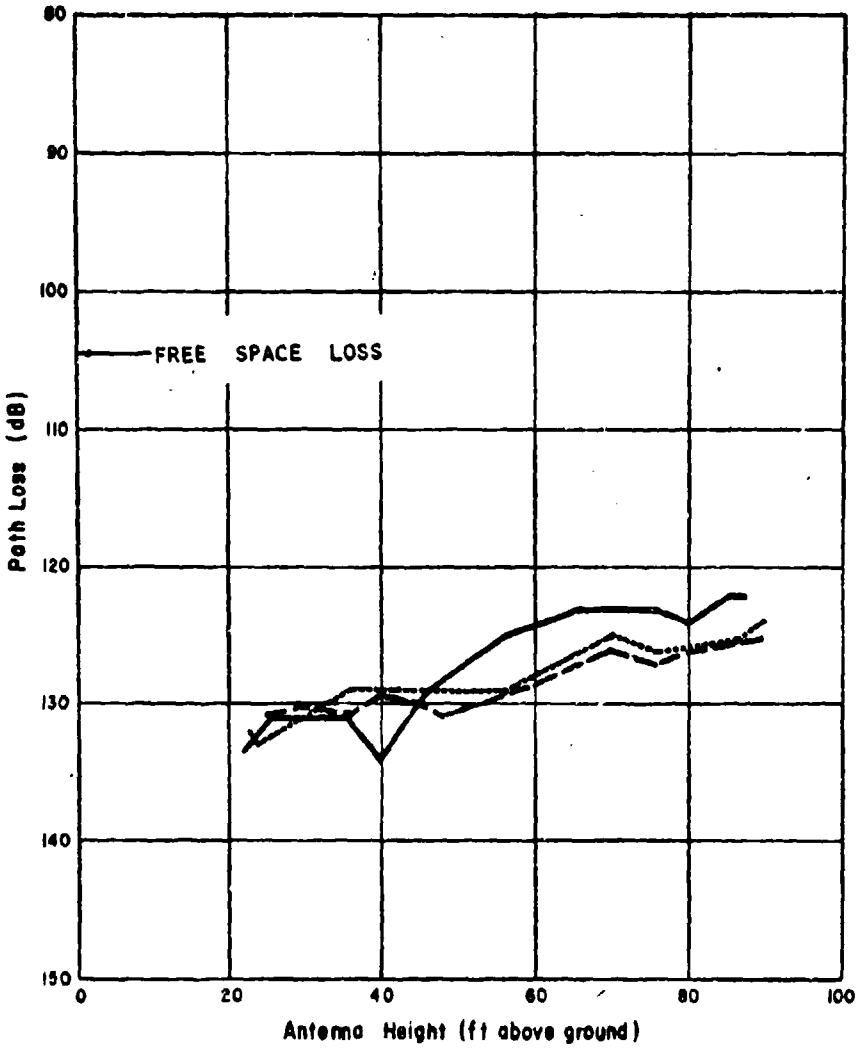


Figure 33. Propagation Path Loss (Site 5 to Hexagon, Frequency 371.4 MHz, Antenna AT-197)

(2) Path Wayside Site No. 9 to ECOM Hexagon - 1.61 miles.

Oper. Freq. 371.4 MHz Ant. Type: AT-197

See description of site No. 9 for details - Beyond line-of-sight and blocked by pine trees and trees without leaves.

9 Nov. 71 - ——— -- ——— --
18 Feb. 72 - ----------
14 Mar. 72 - ———————— Rain and sleet on this day.

On 18 February and 14 March, between 17 and 32 feet of antenna height the difference in path loss does not differ by more than 2 dB. At 32 feet, the difference is 3 dB. Below 17 feet, the difference increases to as much as 9 dB at 10 feet of antenna height. At 30-feet antenna height, the path loss is about 23 dB below the free space loss.

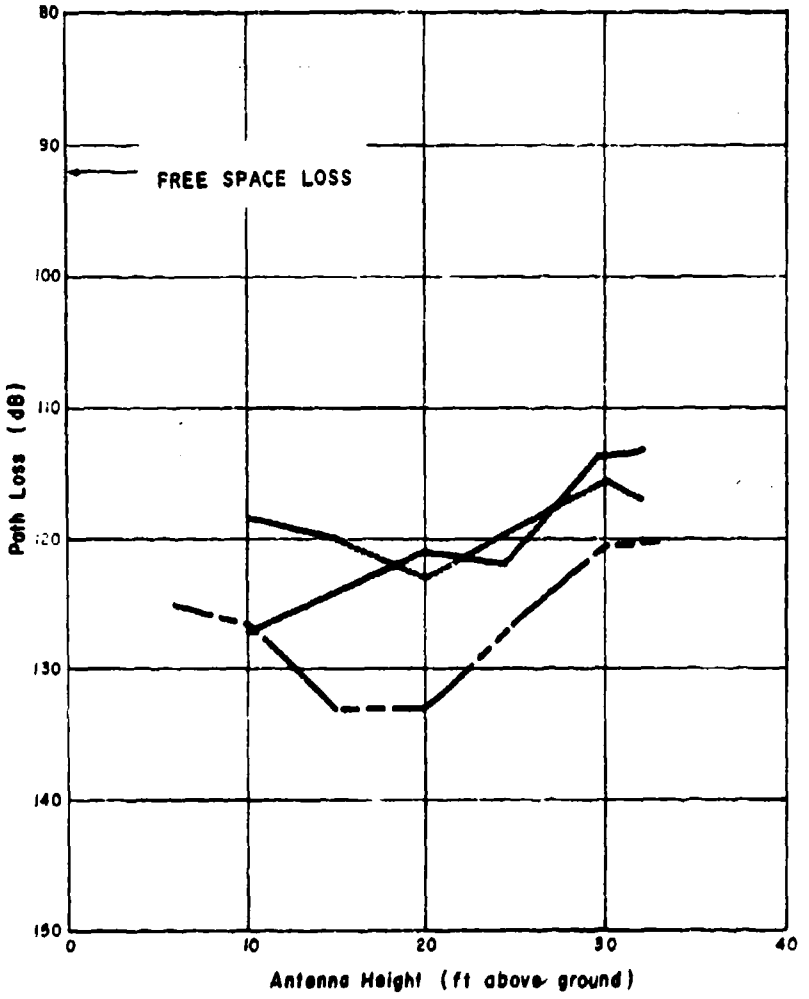


Figure 34. Propagation Path Loss (Site 9 to Hexagon, Frequency 371.4 MHz, Antenna AT-197)

(3) Path: Wayside Site No. 19 to RCOM Hexagon - 1.68 miles.

Oper. Freq. 371.4 MHz Ant. Type: AT-197

15 Nov. 1971 - ——— ——— ———
16 Nov. 1971 - - - - - - - - - - - -
19 Nov. 1971 - ———————

On the average, these data subject to greater path loss at heights of 20 to 30 feet.

7 Feb. 1972 - ——— - - - ———
10 Mar. 1972 - - - - - - - - -
10 Mar. 1972 - - - - - - - - -

...ese data more self-consistent at all heights from 10 to 32 feet.

Within range of heights from 7 to 33 feet, the data indicated a path loss variation of 22 dB. For the 7 February and 10 March data, the path loss variation was reduced to 16 dB.

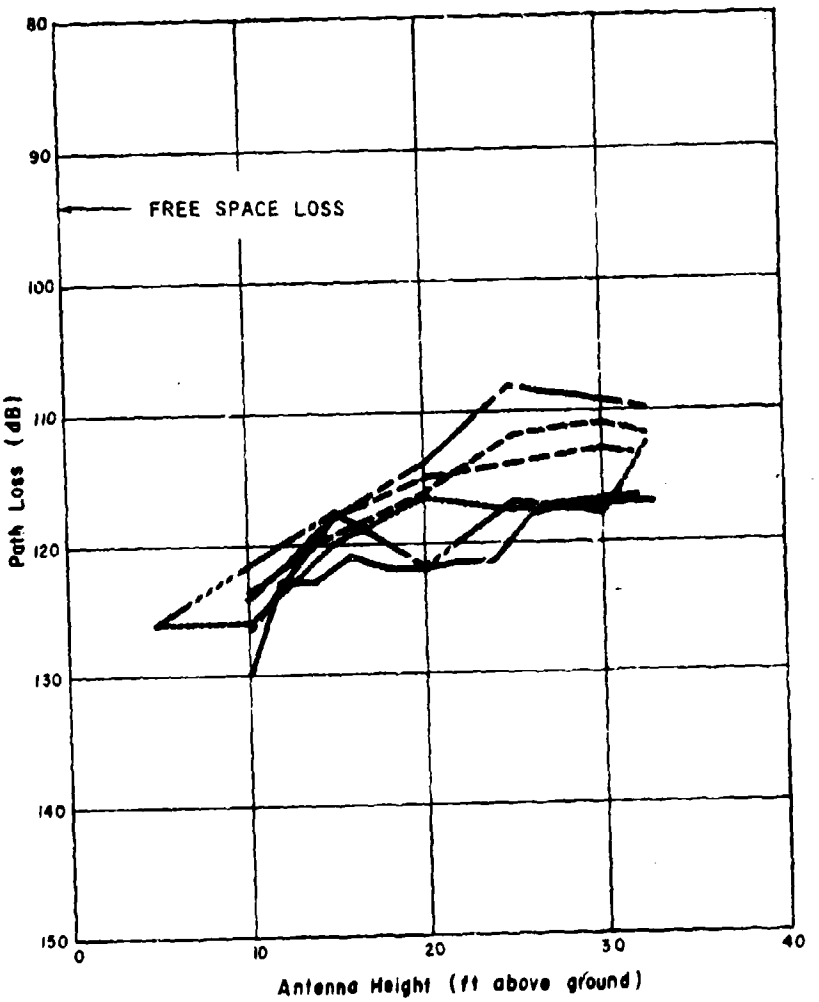


Figure 35. Propagation Path Loss (Site 19 to Hexagon, Frequency 371.4 MHz, Antenna A1-197)

(4) Path: Wayside Site No. 19B to ECOM Hexagon.

Oper. Freq. 371.4 MHz

Three additional plots are included to provide data for the composite plot for comparing the performance when signals are transmitted in horizontal, vertical, and circular polarization modes.

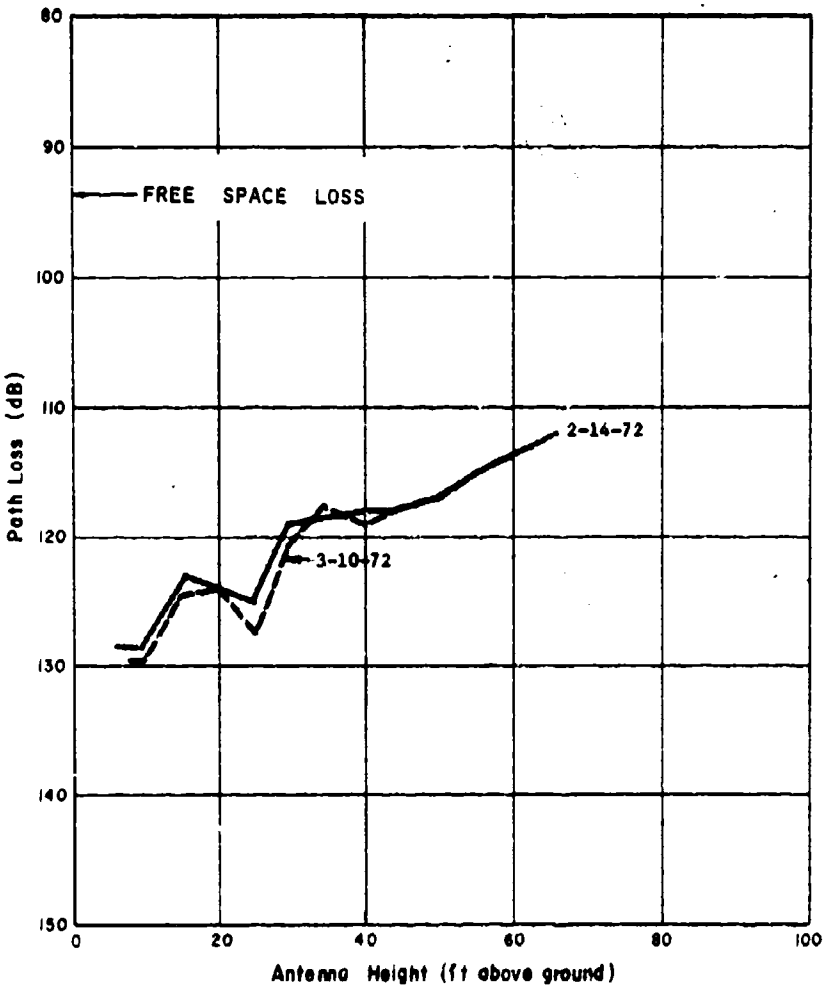


Figure 36. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna T-29 (Horizontal))

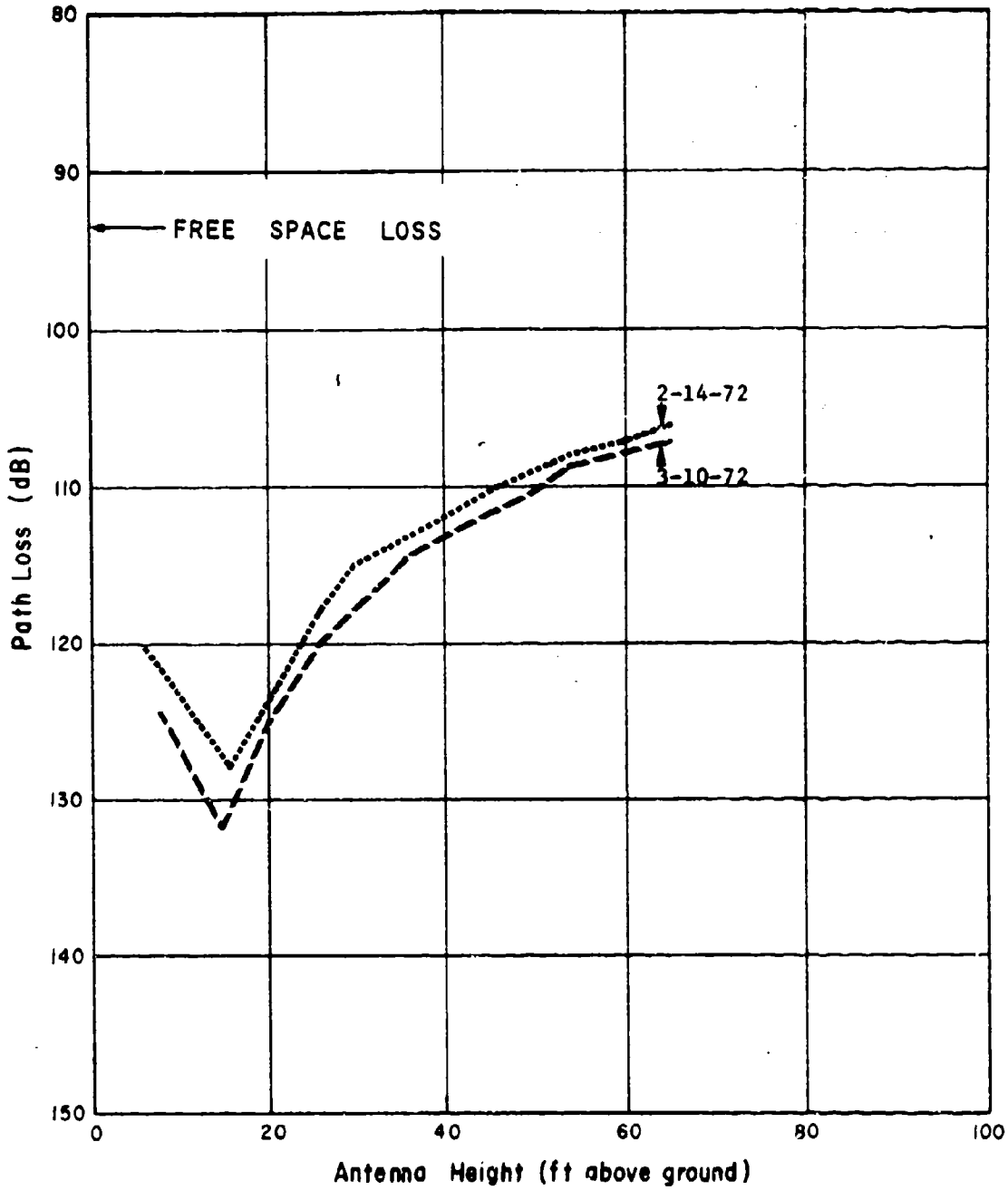


Figure 37. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna T-29 (Vertical))

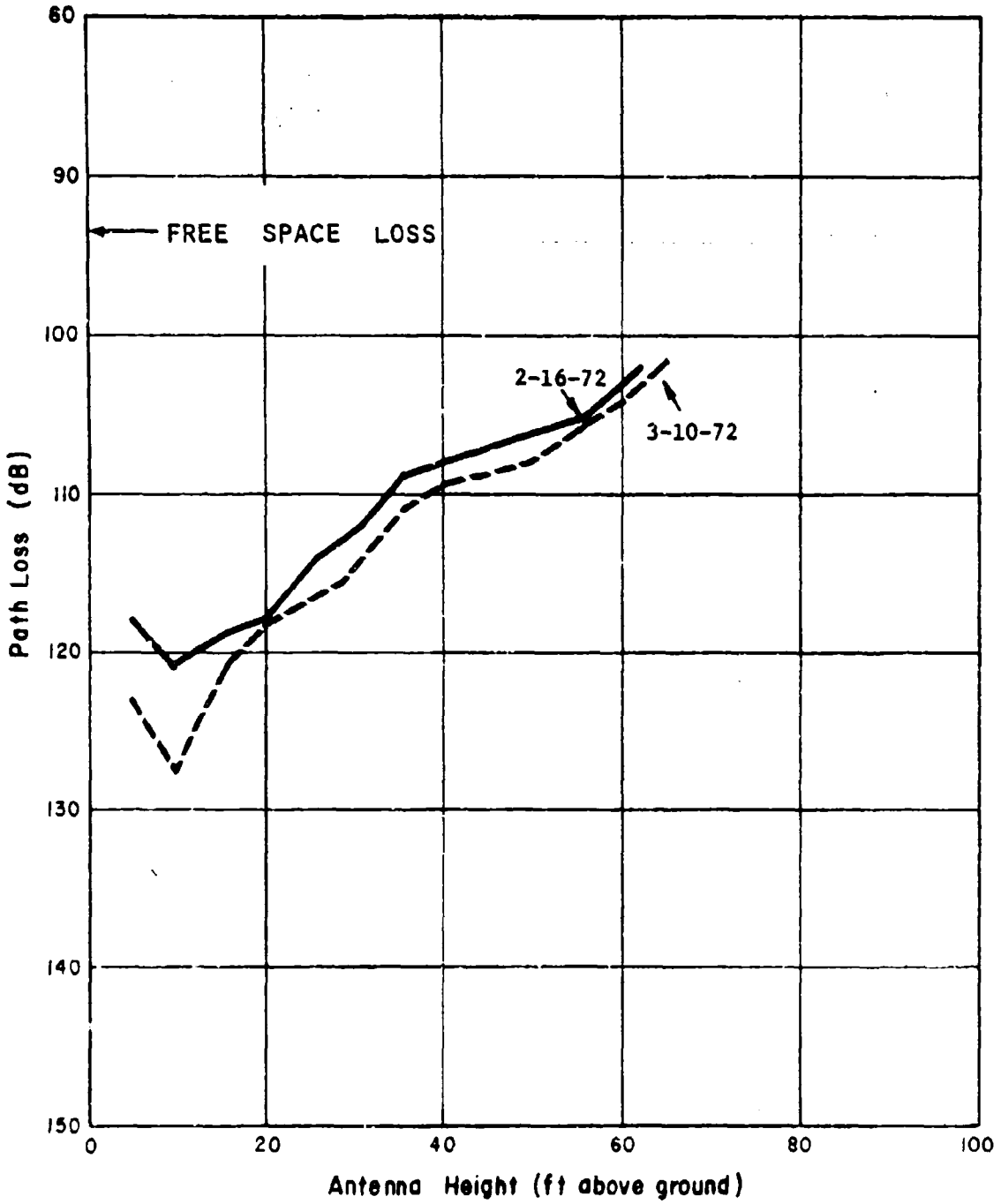


Figure 38. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna EMCO 3101 (Circular))

(3) Path Wayside Site No. 19B to the Hexagon - 1.86 miles.

Oper. Freq. 371.4 MHz Ant. Type - See Graph

At this frequency, the circularly polarized EMCO Model 3102 log spiral antenna was compared with the linearly polarized T-29 log periodic antenna in both horizontal and vertical polarizations. On this path, the path loss was less by 2 to 12 dB at all transmitting antenna heights from 3 to 62 feet using the circularly polarized antenna as compared to the T-29 in either polarization. Between 20 and 62 feet, the depolarization effect in horizontal polarization causes 0 to 8 dB greater loss than in the vertically polarized case. In either case, the received signal is less than when a circularly polarized antenna is used. This indicates the possible advantage of employing circular polarization over tree covered terrain.

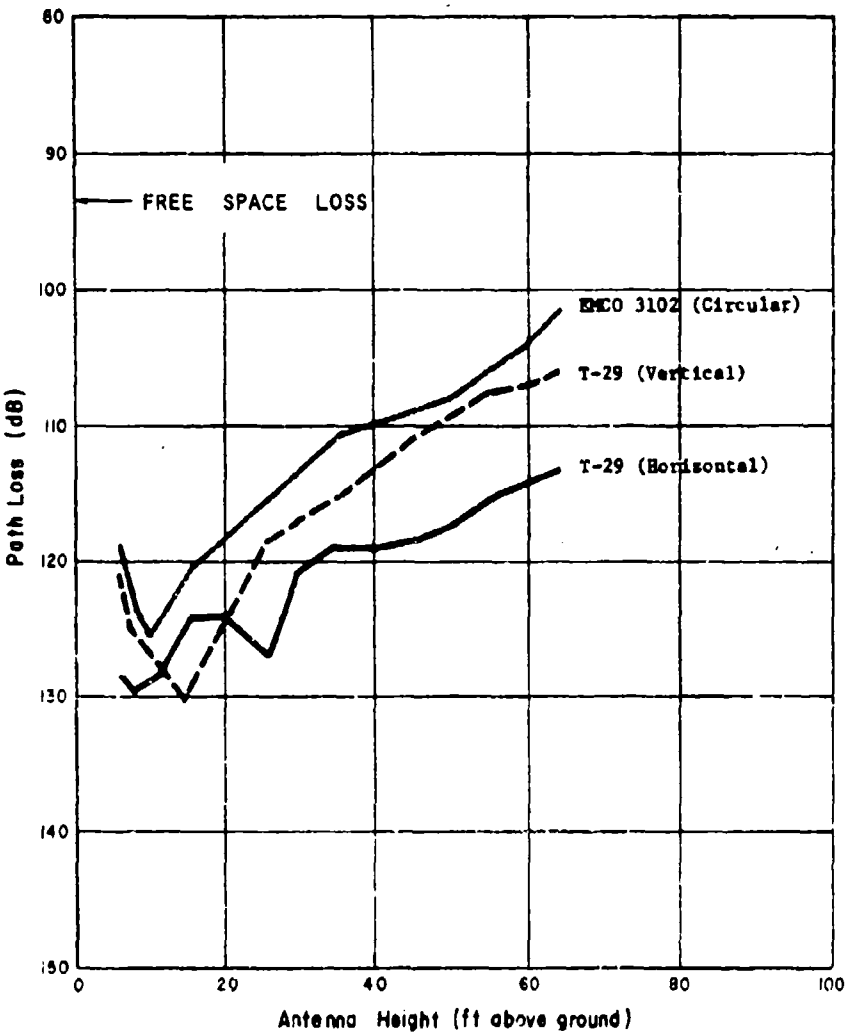


Figure 39. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna (See Graph))

(6) Path: Wayside Site No. 19B to ECOM Hexagon.

Oper. Freq: 371.4 MHz Ant Type: AT-197 - Omni-directional, Vertically Polarized

Although not included with the composite comparison of the effects of transmitting circularly, vertically or horizontally polarized signals on the vertically polarized receiving antenna, the comparative effect on path loss with the AT-197 is included in this discussion of the test data for 9 February and 10 March 1972.

As the height was changed from 4 to 63 feet, the path loss measurements for these two dates differed at heights greater than 20 feet by 2 to 4 dB. The maximum difference of 7 dB occurred at a height of 14 feet.

The range of path loss is between 11 and 33 dB greater than the free space path loss. This range of values is nearly the same as with the use of the T-29 in vertical polarization for the same operating conditions at the same transmitting to receiving transmission path.

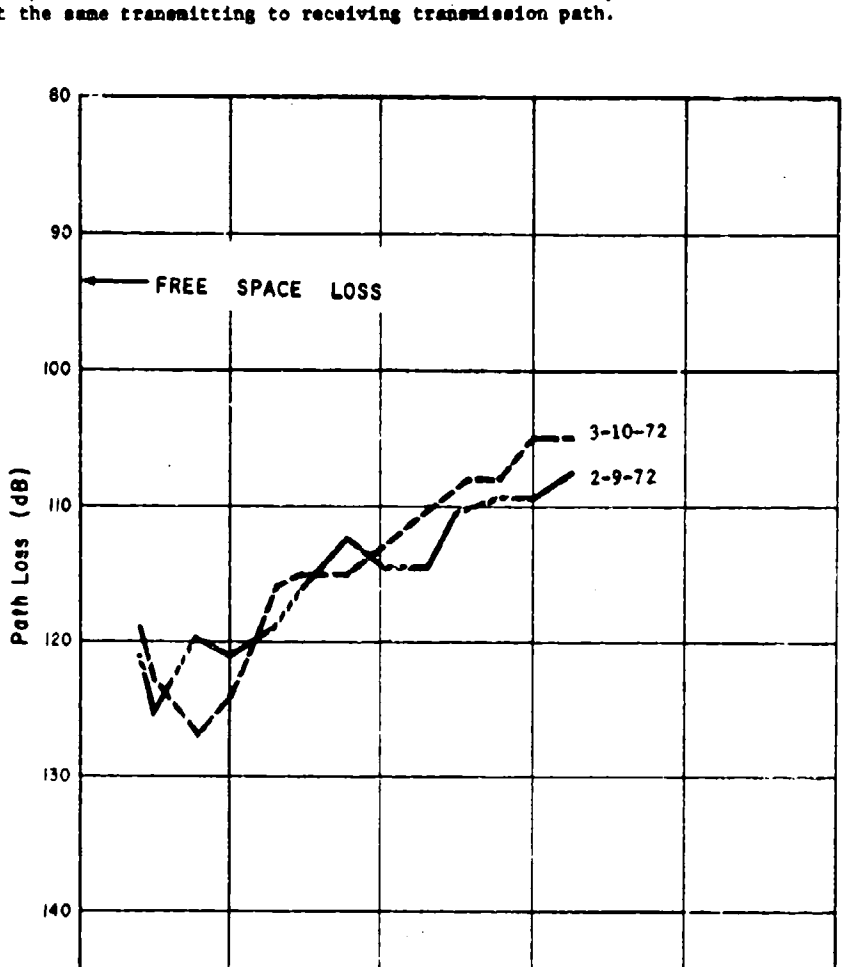


Figure 40. Propagation Path Loss (Site 19B to Hexagon, Frequency 371.4 MHz, Antenna AT-197)

(7) Highlands Site No. 21 to ECOM Hexagon

See Frequencies on Graph. Antenna Type - AT-197 - Discone

This path is within line of sight, 8.1 miles to Hexagon.

Objects in vicinity of the transmitting antenna:

Power line is in front about 50 feet away.
100-foot steel tower 33 feet away is to left and partially behind the antenna.
Storm fence and building is located adjacent to 100-foot steel tower.

Both measurements made 1 February 1972.

———— - 229.5 MHz

---------- - 371.4 MHz

The ground is damp from melting snow.

Path loss variations are possibly subject to the influence of nearby objects.

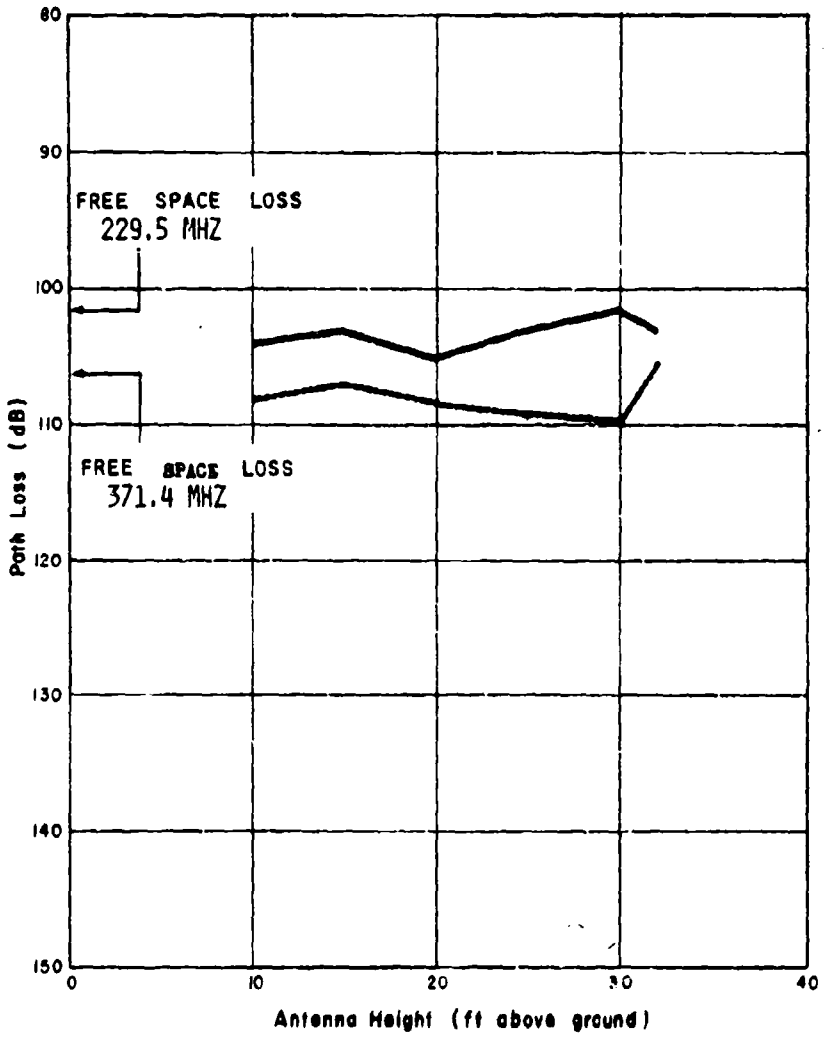


Figure 41. Propagation Path Loss (Site 21 to Hexagon, Frequency N/A, Antenna AT-197) 1 February 1972

c. 1,545-MHz Comparison Plots (Figures 42 through 51)

(1) Path AEL MCA Site No. 5 to ECOM Hexagon.

Oper. Freq. 1,545 MHz Ant. Type - AEL Horn

13 Oct. 71 - ————————
19 Oct. 71 - - - - - - -
24 Jan. 72 - — — — — Tractors operating in line of sight about 600 feet away.
25 Jan. 72 - — — — — Light rain falling.
26 Jan. 72 - ..... Wind from 5 knots gusting to 20 knots.
27 Jan. 72 - ..... Equipment working in area.
28 Jan. 72 - - - - - - - Snow on ground, no snow falling, wind 1 to 2 knots.

There is a self consistency in these plots except for small deviations. Data spread varies from 3 dB at 60-foot altitude to about 6 dB at 38-foot altitude.

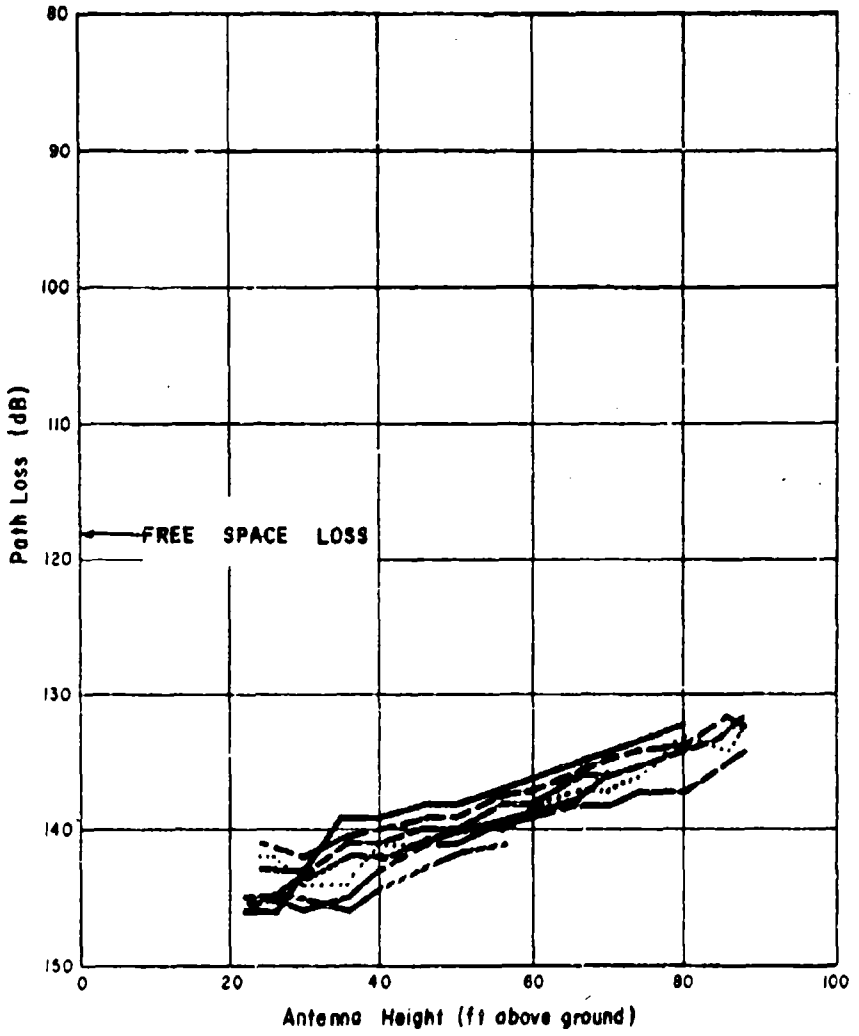


Figure 42. Propagation Path Loss (Site 5 to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn)

(2) Path Wayside Site No. 9 to ECOM Hexagon - 1.61 miles.

Oper. Freq. 1,545 MHz Ant. Type AEL Horn

See Description of Site No. 9 for details. Beyond line-of-sight and blocked by trees without leaves except for pines.

9 Nov. 1971 - — - - —

17 Feb. 1972 - — — —
18 Feb. 1972 - --------
14 Mar. 1973 - ————

These three sets of measurements are self-consistent.
Rain and sleet on 14 March.

The three sets of measurements taken in 1972 correlate reasonably well.

Differences are at most 3 dB.

Path loss is approximately 29 dB greater than free space loss at an antenna height of 30 feet and the loss increases by about 17 dB as the antenna is lowered to 7 feet.

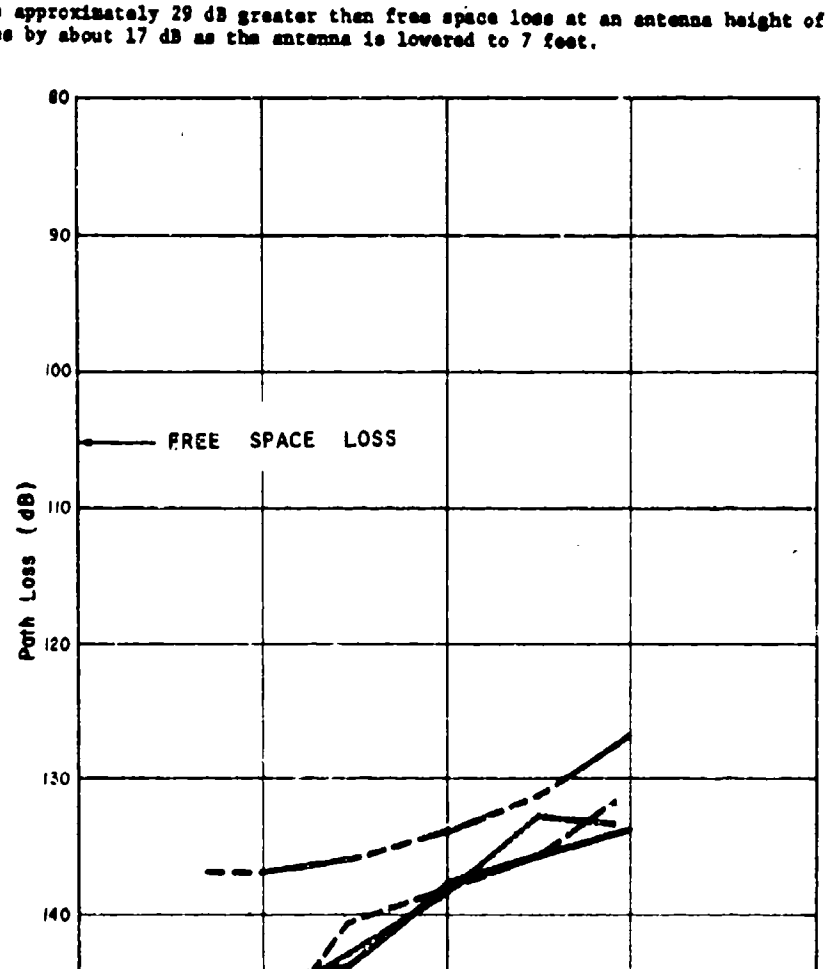


Figure 43. Propagation Path Loss (Site 9 to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn)

(3) Wayside Site No. 9 to ECOM Hexagon - 1.61 miles.

Oper. Freq. 1,545 MHz Ant. Type: Andrews Discone

See description of site 9 for details. Beyond line-of-sight and blocked by trees without leaves except for pines.

17 Feb. 72 - — — — —
18 Feb. 72 - - - - - - - -
14 Mar. 72 - ————————

The three test results correlate reasonably well. Differences are no more than 3 dB.

The path loss is about 27 dB greater than the free space path loss at 30-foot antenna height. Additional path loss of about 12 dB occurs as the antenna height is reduced to about 10 feet.

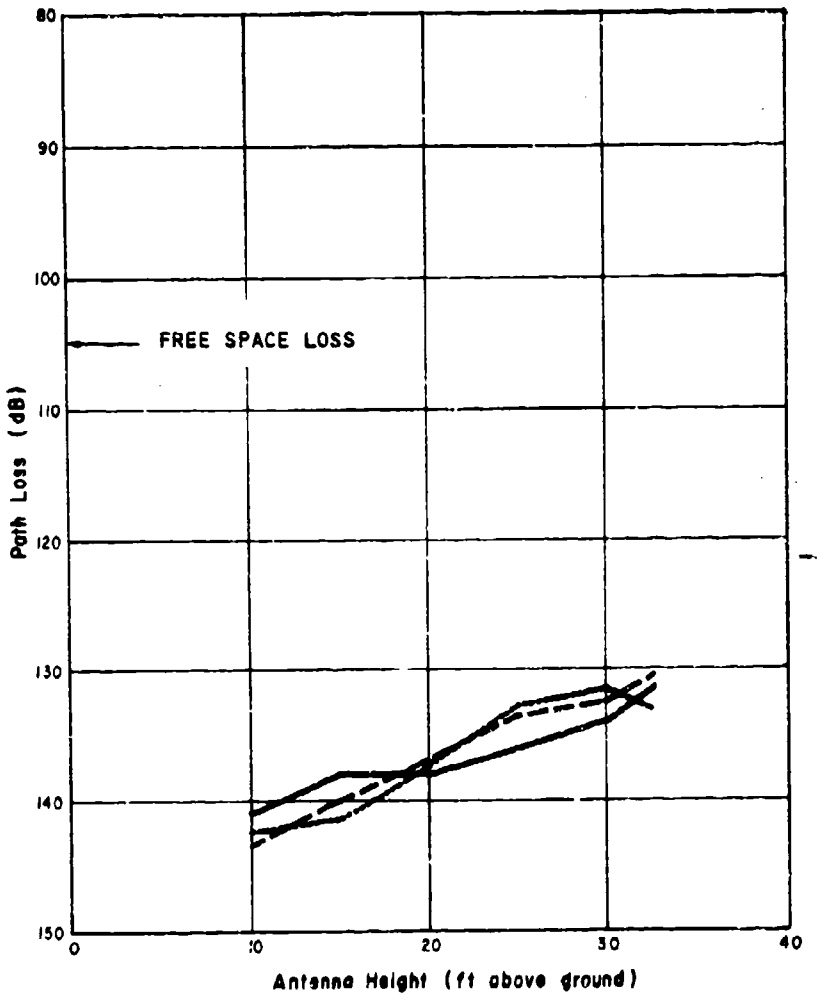


Figure 44. Propagation Path Loss (Site 9 to Hexagon, Frequency 1,545 MHz, Antenna - Andrews Discone)

(4) Path: Wayside Site No. 19 to [redacted] - 1.68 miles.

Oper. Freq. 1,545 MHz Ant. Type: Andrews Discone

The propagation mode vertical polarization transmit to vertical polarization receive. The data is recorded for:

19 Nov. 1971 - ————
7 Feb. 1972 - — — — —
8 Feb. 1972 - — — — —
13 Mar. 1972 - — - — - —

Data recorded on these 3 days more self-consistent

The transmitter antenna height was varied from 10 to 32 feet. There are no known factors which can be used to explain why on 19 November 1971, there was a significant reduction in path loss in the 12- to 21-foot antenna height range.

The latter three runs differ over most of the height range by 2 to 4 dB. Above 30 feet high, the 7 February data does not retain consistency with the 8 February and 13 March data. In general, the last three data runs are not too dependent on antenna height. This differs with other data runs at 1,545 MHz which are much more dependent on transmitter antenna height. In general, the path loss over these heights is about 30 dB greater than free space path loss.

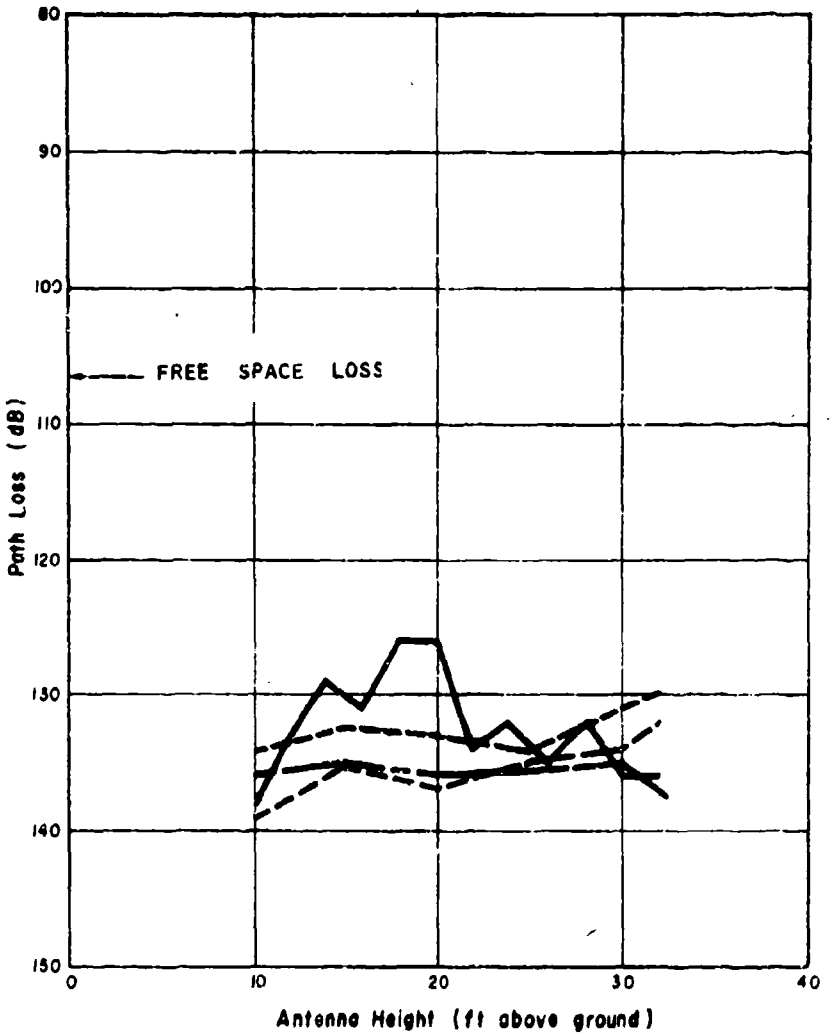


Figure 45. Propagation Path Loss (Site 19 to Hexagon, Frequency 1,545 MHz, Antenna - Andrews Discone)

(5) Path: Wayside Site No. 19 to RCOM Hexagon - 1.68 miles.

Oper. Freq. 1,545 MHz Ant. Type: AEL Horn

The antenna height was varied from 7 to 30 feet. Although the 15 November 1971 data (green) and the 8 February 1972 data (purple) were taken nearly three months apart, path losses with antenna heights between 7 and 25 feet are comparable. However, between 25 and 30 feet, the difference in path losses is as much as 9 dB. Although the leaves were mainly dead, there was a fair amount of leaf cover in November and none in February.

The 13 March 1972 data (red) were taken on a sleety, rainy day with very wet ground. The wet trees in the foreground may have added to the absorption loss and effectively increased the path loss.

In general, the path loss was about 30 dB greater than the free space loss..

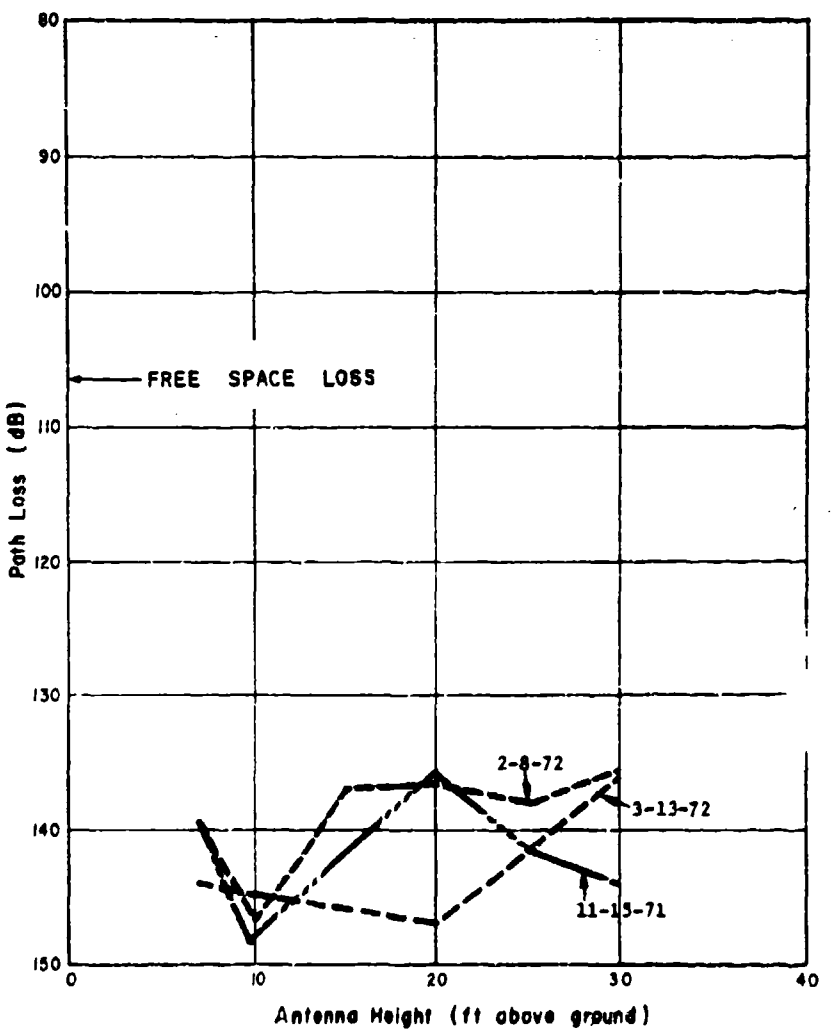


Figure 46. Propagation Path Loss (Site 19 to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn)

(6) Path: Highlands Site No. 21 to ECOM Hexagon.

Oper. Freq. 1,545 MHz Ant. Type - See Graph

Site description: See subparagraph b (7) above.

31 Jan. 72 - ---------- AEL Horn
31 Jan. 72 - ———————— Andrews Discone - 1-1/2 inches of snow on ground and melting
1 Feb. 72 - —— ---- —— AEL Horn

Data spread does not exceed 2 dB.

Path loss never more than 6 dB below free space path loss.

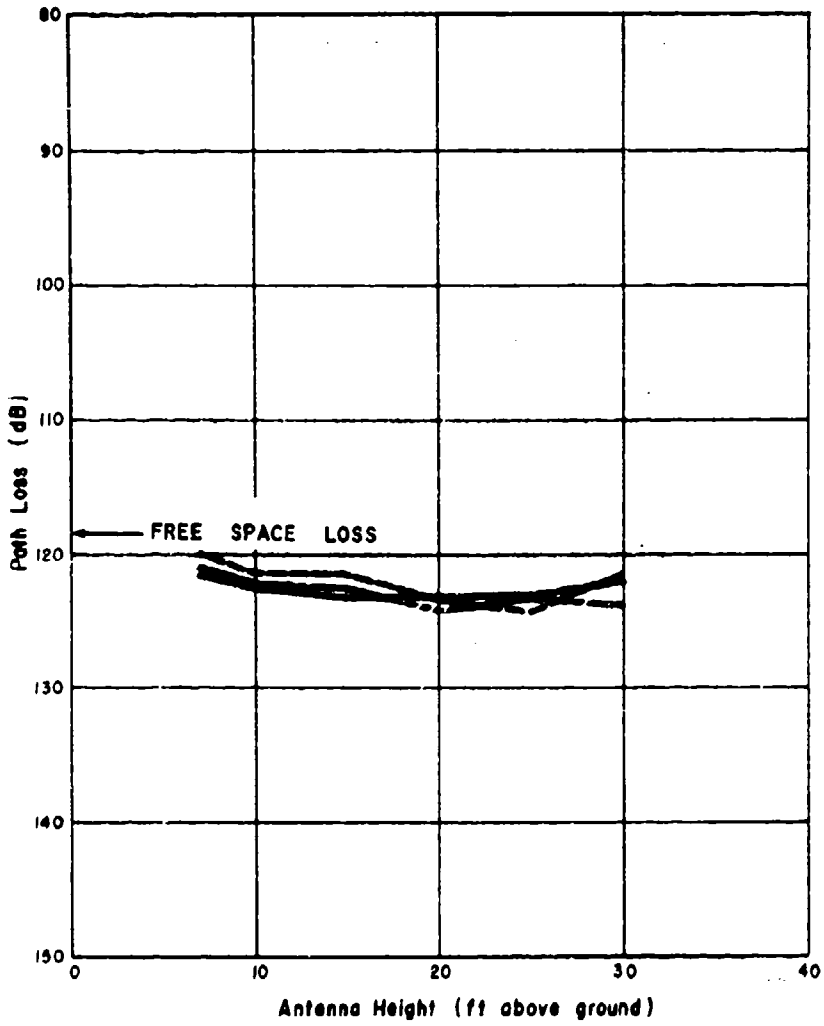


Figure 47. Propagation Path Loss (Site 21 to Hexagon, Frequency 1,545 MHz, Antenna (See Graph))

(7) Path: Wayside Site No. 19B to ECOM Hexagon - 1.86 miles.

Oper. Freq. 1,545 MHz

Three additional plots are included to provide data for the composite plot for comparing the performance when signals are transmitted in horizontal, vertical, and circular polarization modes.

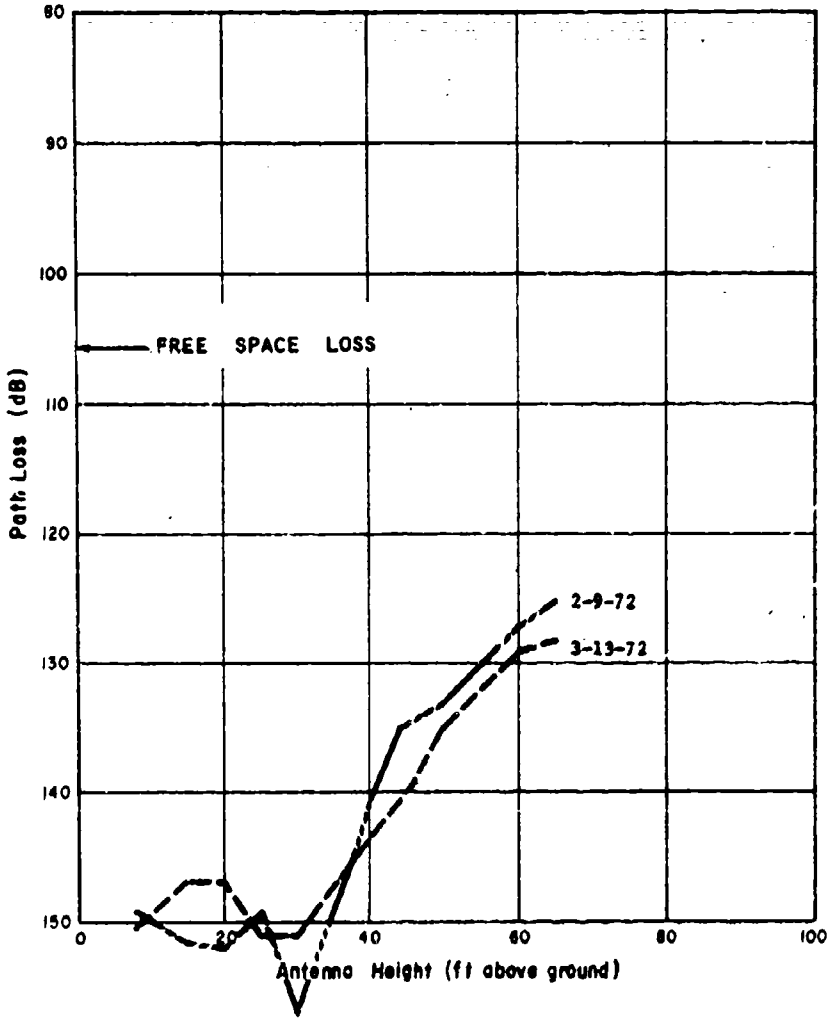


Figure 48. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn (Horizontal))

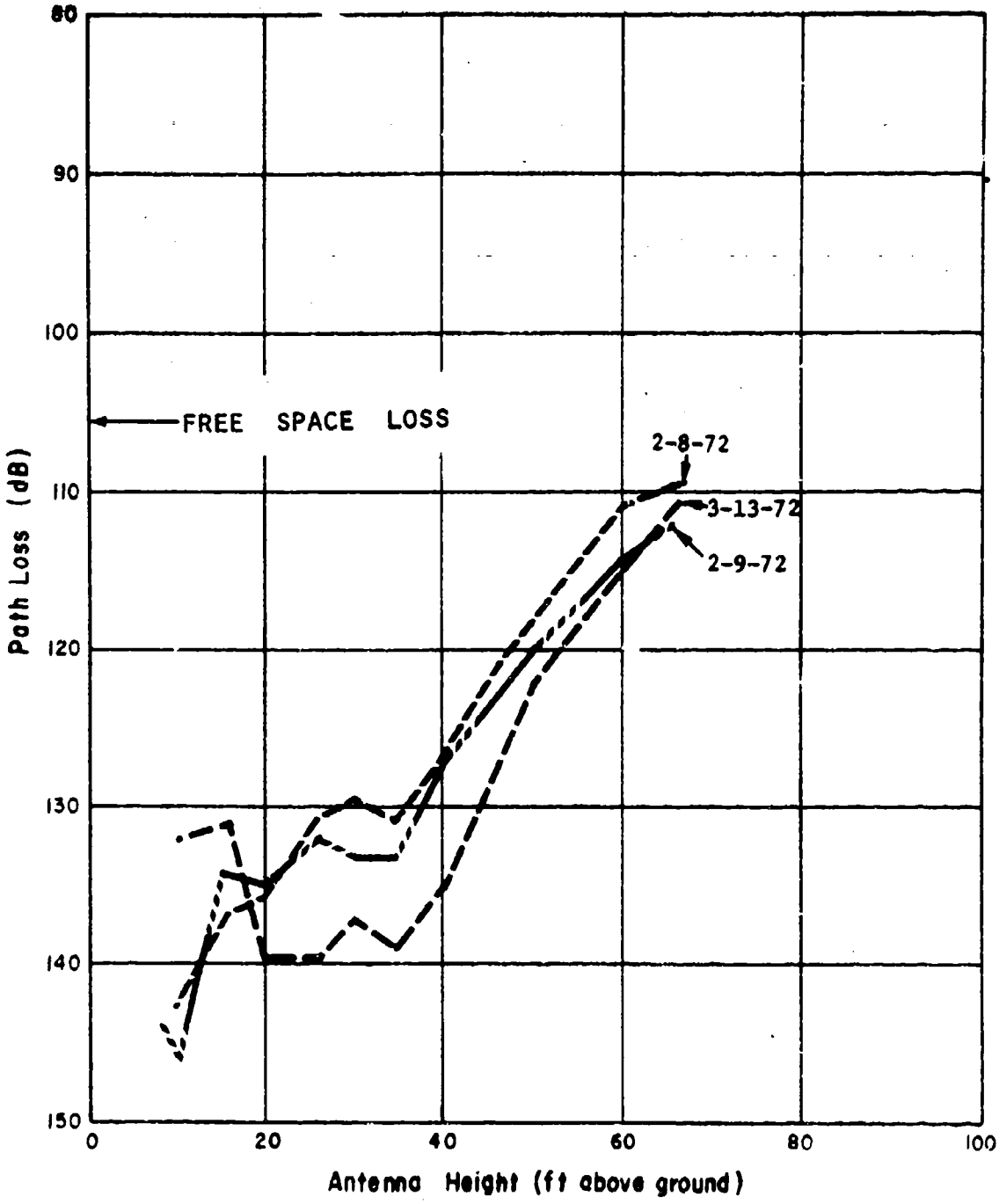


Figure 49. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - AEL Horn (Vertical))

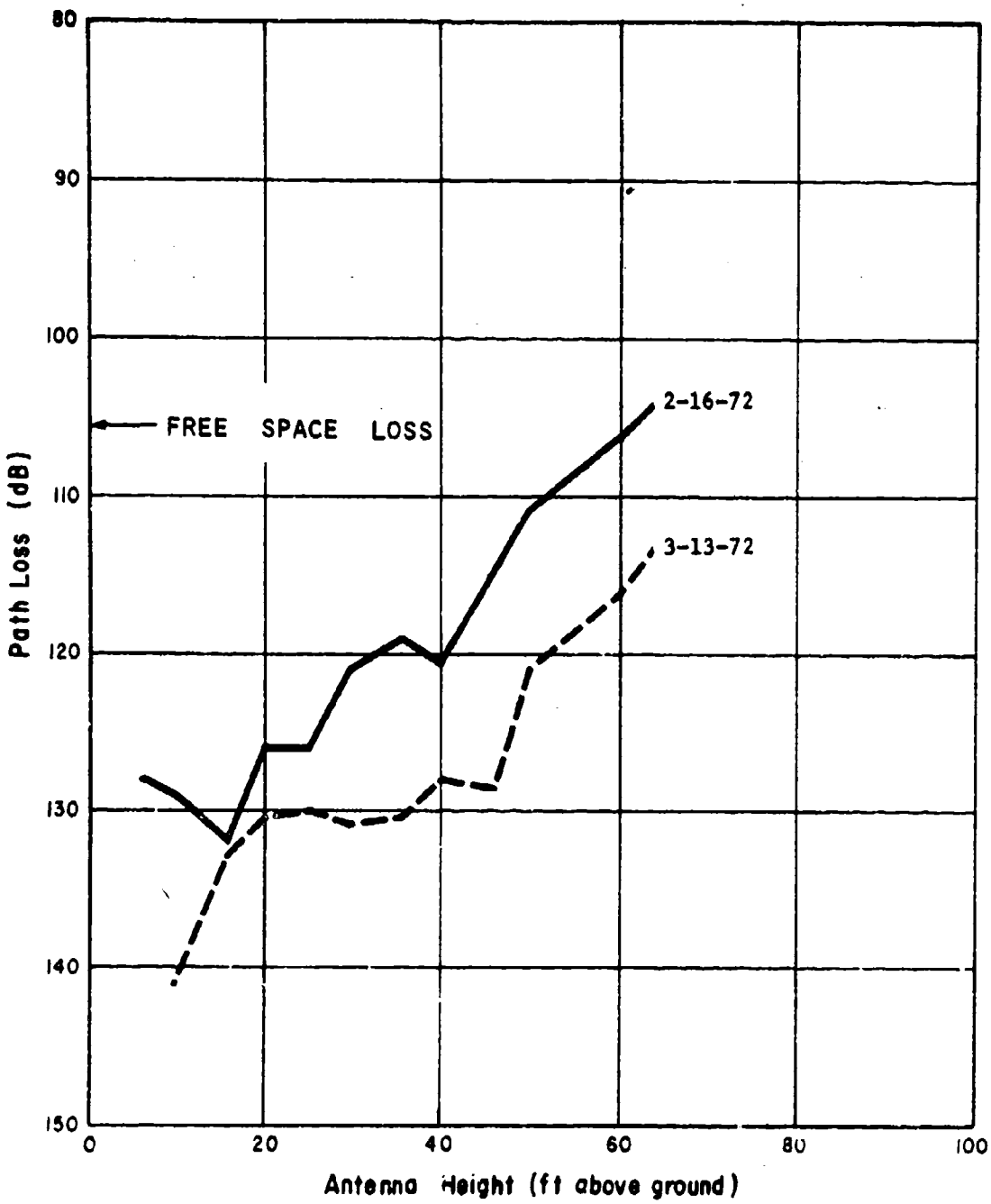


Figure 50. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,545 MHz, Antenna - EMCO 3102 (Circular))

(B) Path: Wheeler Site No. 19B to BCOM Hexagon - 1.86 miles.

Oper. Freq. 1,345 MHz Ant. Type (See Graph)

The advantages of circular polarisation demonstrated on this path for 229.5 and 371.4 MHz are similar at 1,345 MHz. At 1,345 MHz, performance with the AEL Horn antenna in vertical polarisation is 6 to 9 dB below that with the circularly polarised EMCO Model 3102 log spiral antenna for antenna heights above 10 feet. The path loss when using the AEL Horn in horizontal polarisation is from 8 to 20 dB more than with vertical polarisation.

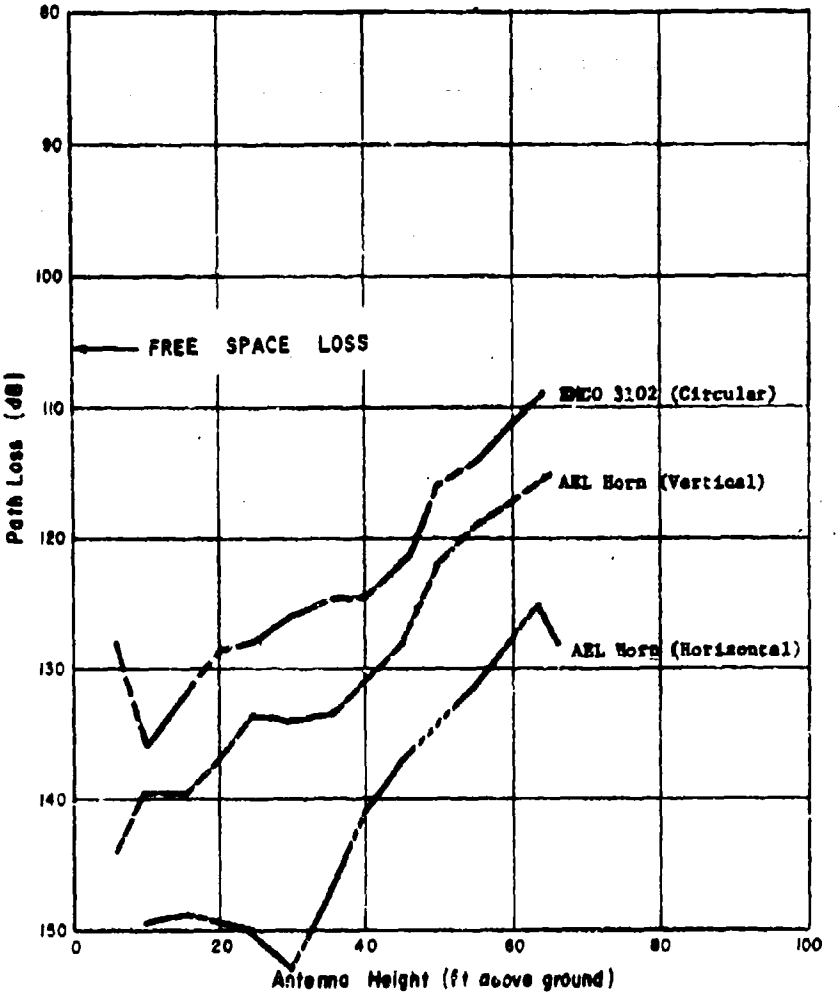


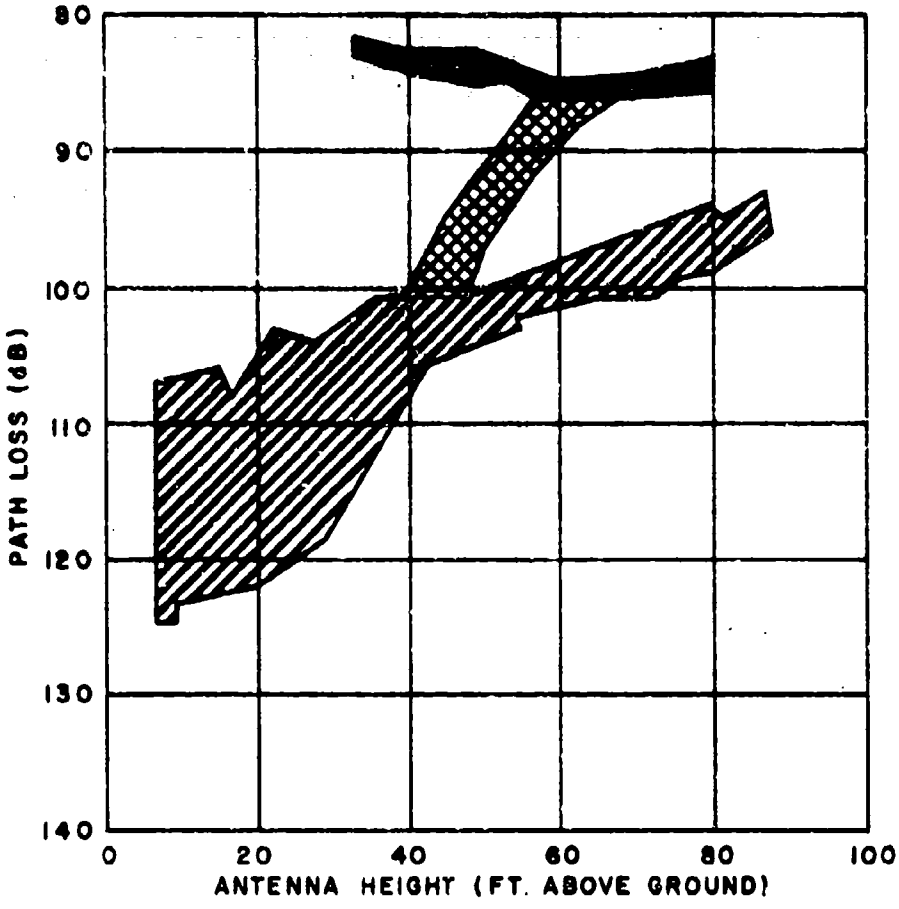
Figure 51. Propagation Path Loss (Site 19B to Hexagon, Frequency 1,345 MHz, Antenna (See Graph))

9. COMMENTS ON THE TEST RESULTS

The path loss tests were conducted in the vicinity of the Hexagon Building, Fort Monmouth, and within a radius of less than 10 miles from it. Propagation paths varied from line of sight to completely out of line of sight, through trees and brush. The maximum losses at 1,545 MHz were approximately 150 dB, and it was possible to receive the signal from all sites. At 229.5 and 371.4 MHz, the maximum losses were close to 135 dB under the same conditions.

The test included experiments with vertically polarized, horizontally polarized, and circularly polarized antennas. The results indicated that there is some signal depolarization, probably due to the obstructions in the signal path.

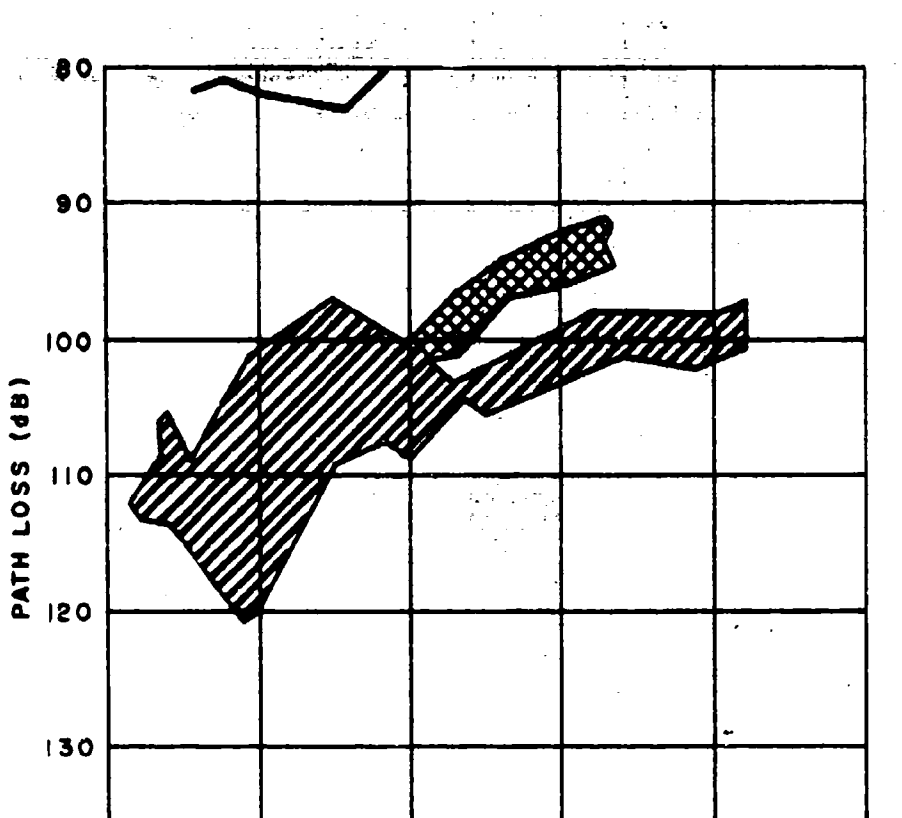
The free space loss for any path length can be calculated from the expression - Loss = $36.58 + 20 \log_{10} d + 20 \log_{10} f$, where d is in statute miles and f in MHz. To determine the path loss which is due to physical factors in the path other than free space loss, the free space loss is subtracted from the total loss. This was done for all tests covered in this report and the results plotted in Figures 52, 53, and 54 for 1,545, 371.4, and 229.5 MHz respectively. These plots show the range of path losses, in addition to the free space path losses, which we observed, as a function of antenna height, independent of distance between the transmitter and receiver, but within our less than 10-mile radius test area. The plots contain areas which are striped, crosshatched, and solid. The solid areas are the results of data obtained where there was definitely clear line of sight between the transmitting and receiving antennas. The striped areas are based on data obtained from paths where there was definitely no line of sight. The crosshatched areas are based upon results where there was marginal line of sight. Obviously, although the plot shows a clear border between these areas, these borders are only approximate and cannot be that sharply defined. These plots, however, do show the maximum losses that we experienced in our area in addition to the free space loss. With them, one can estimate the antenna height required for a system of known gains, transmitter power, and receiver sensitivity, or conversely the required transmitter power if the other parameters are fixed.



LOSS BELOW FREE SPACE LOSS

FREQ. 1545 MHz ANT. POLARIZATION VERTICAL

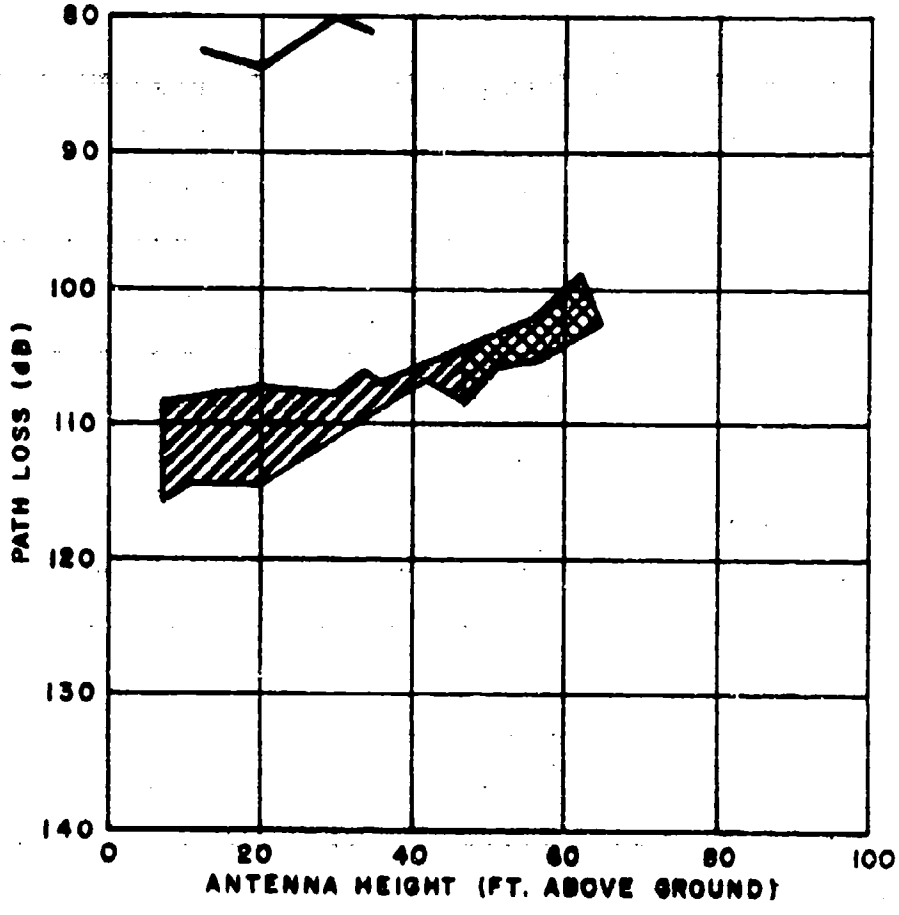
Figure 52. Propagation Path Loss - 1,545 MHz



LOSS BELOW FREE SPACE LOSS

FREQ. 371.4 MHz ANT. POLARIZATION VERTICAL

Figure 53. Propagation Path Loss - 371.4 MHz



LOSS BELOW FREE SPACE LOSS

FREQ. 229.5 MHz ANT. POLARIZATION VERTICAL

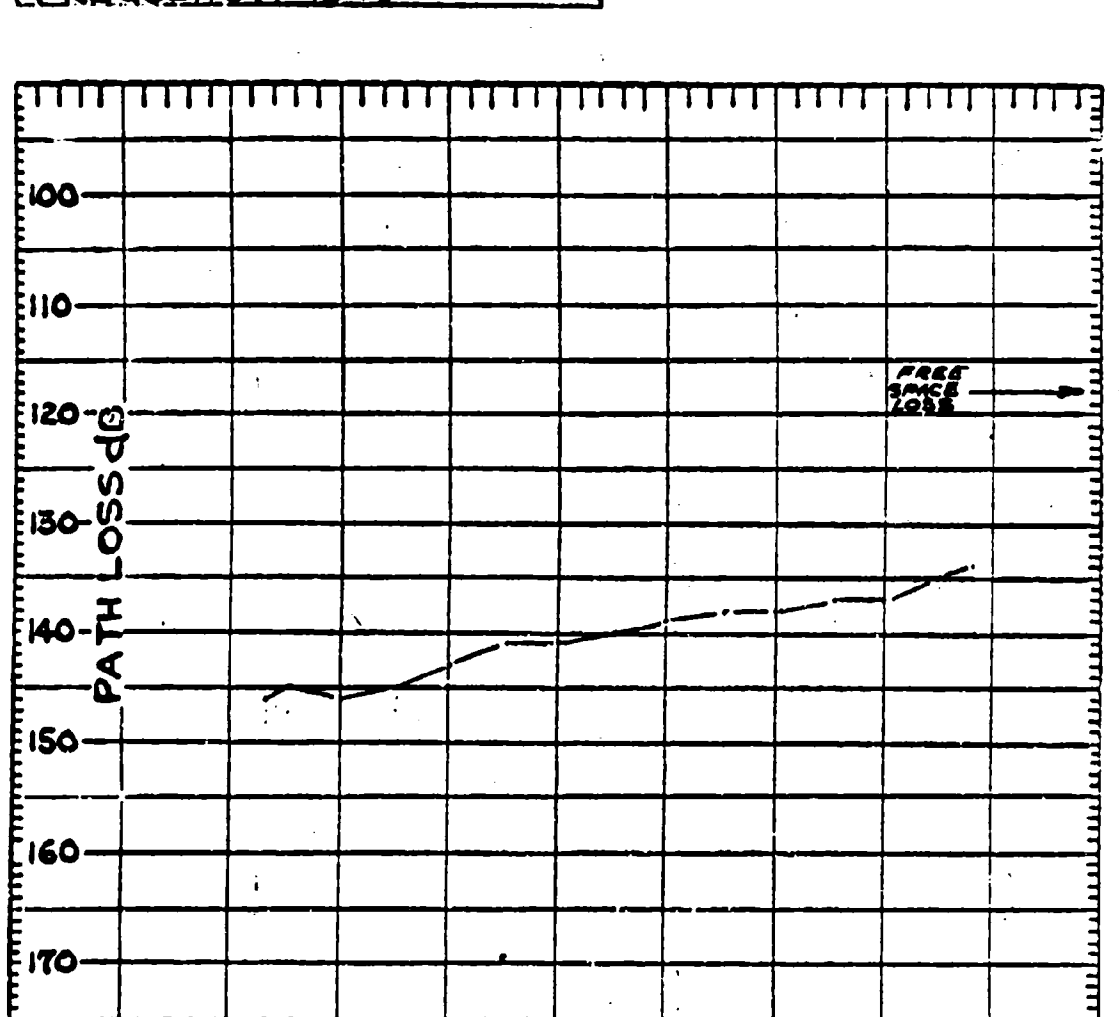
Figure 54. Propagation Path Loss - 229.5 MHz

APPENDIX

REDUCED DATA

TEST RUN S/N	AVERAGE PROPAGATION	24 JAN. 1972
T20124-05	PATH LOSS AEL MCA SITE	
	NO. 5 TO RCOM HEXAGON	

FREQUENCY: 1545 MHZ



TEST DATA SHEET

DATE: 24 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	AEL MCA No. 5	44 dBM	AEL HORN	14.4	6.5
RECEIVER	ECOM HEXAGON	[redacted]	ANDREW BICONICAL	0.3	HELIAX 1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 6.5 + 1.2 = 7.7 dB

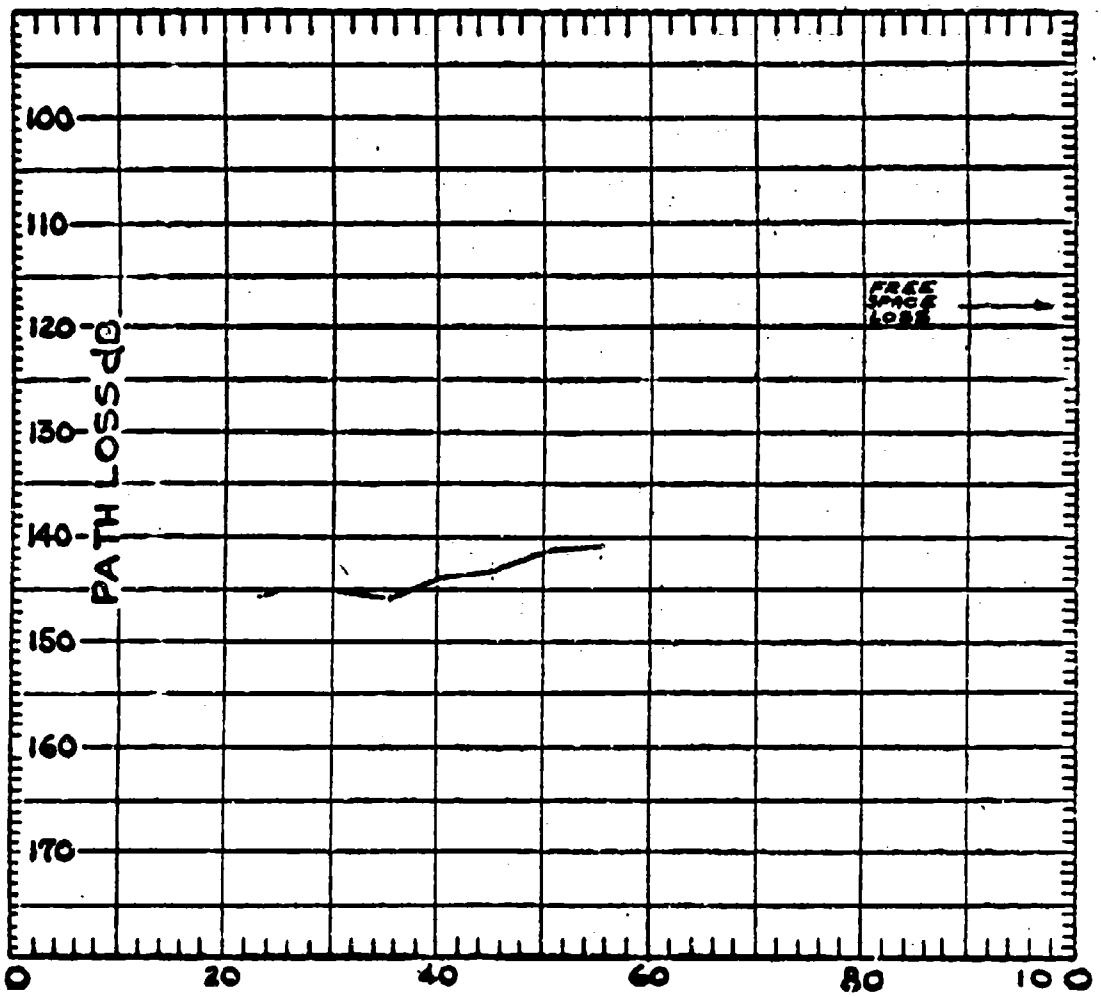
EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 14.7
-CABLE LOSSES 7.7
-ESP = 51.0

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720124-03	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720124-03			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
88	83			134			134	1	
85	84			135			135		
80	86			137			137		
75	86			137			137		
70	87			138			138		
65	87			138			138		
60	88			139			139		
55	89			140			140		
50	90			141			141		
45	90			141			141		
40	92			143			143		
35	94			145			145		
30	95			146			146		
25	94			145			145		
23	95			146			146	1	

TEST RUN S/N	AVERAGE PROPAGATION	25 JAN. 1972
720125-01	PATH LOSS ALL MCA SITES	
	NO 3 TO ECOM HEXAGON	

FREQUENCY: 1545 MHZ



TEST DATA SHEET

DATE: 25 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1100 HRS.

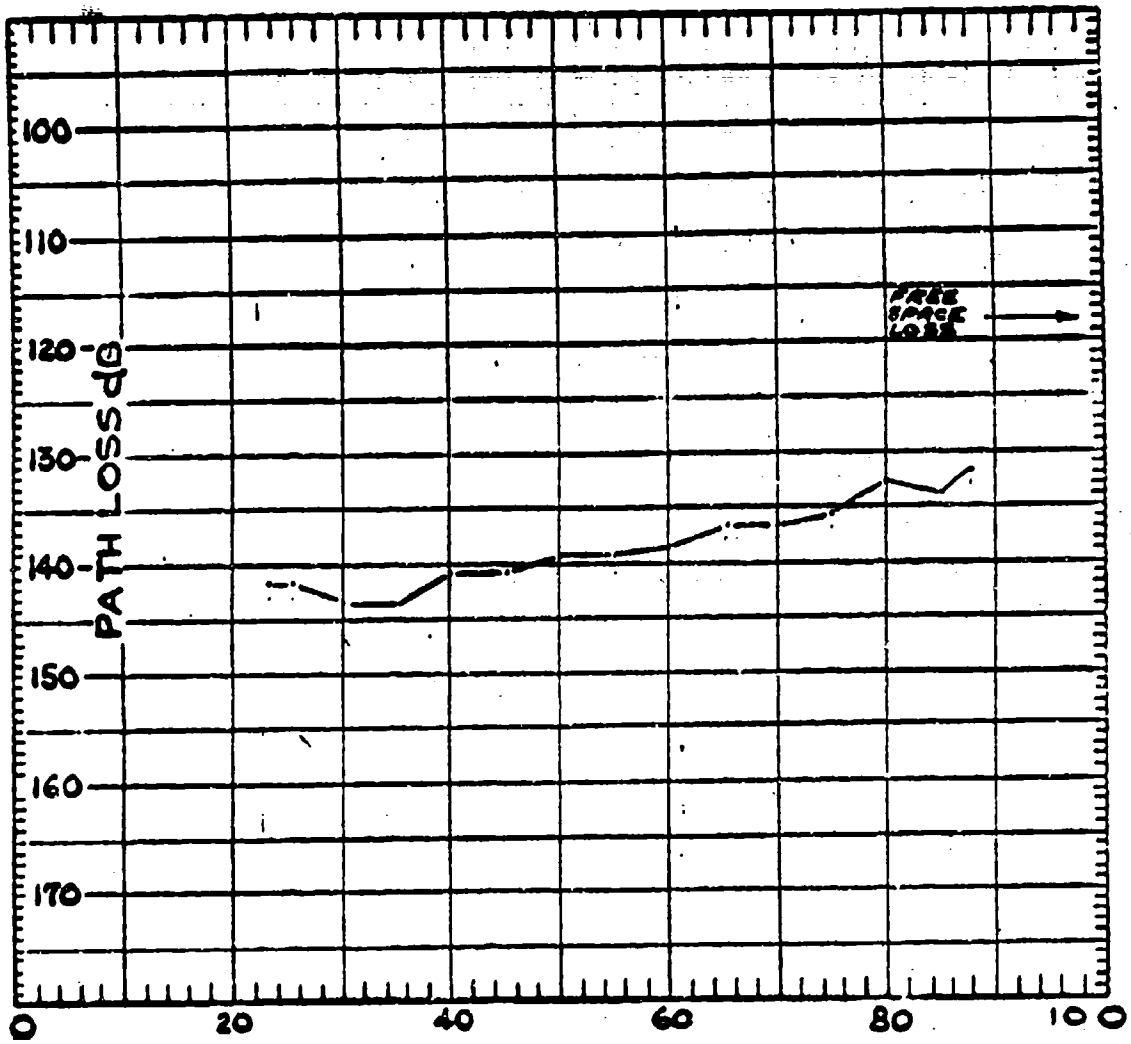
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA #5	44 dBM	AEL HORN	14.4	5.3	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON	[redacted]	ANDREW BICONICAL	0.3	HELIAX 1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.5
TOTAL CABLE LOSS (XMTR + REC.)		5.3 + 1.2 = 6.5 dB				=ESP = 52.2 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720125-01	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720125-01			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
23	93			145			145.5	2	VERY WINDY
25	93			145			145.0		
30	93			145			145.0		
35	93			145			145.5		
40	92			144			144.0		
45	90			142			143.0		
50	89			141			141.5	2	
55	89			141			141.0	1	
50	90			142					
45	92			144					
40	92			144					
35	94			146					
30	93			145					
25	93			145					
23	94			146					END 720125-01 — 1144 HRS.

TEST RUN NO	AVERAGE PROPAGATION	25 JAN 1972
760126-01	PATH LOSS APPLICATION	
	NOAA TO ECOM HEXAGON	

FREQUENCY: 1845 MHZ



TEST DATA SHEET

DATE: 26 JANUARY 1972

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1497 HRS.

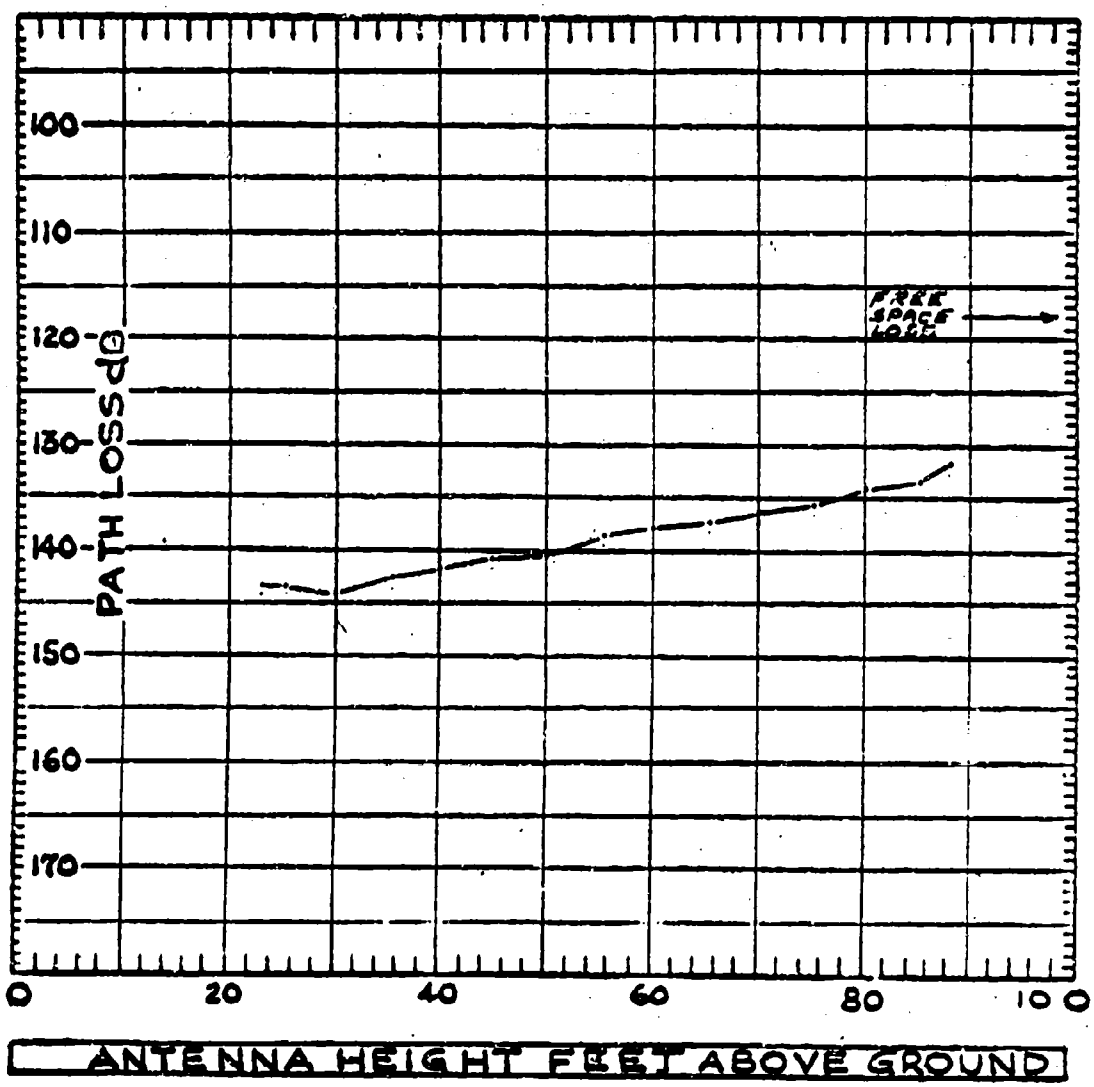
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA #5	44 dBM	AEL HORN	14.4	5.3	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		ANDREW ALCONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.5
TOTAL CABLE LOSS (XMTR + REC.)		5.3 + 1.2 = 6.5 dB				-ESP = √2.2 use 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720126-01	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720126-01			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
88	80			132			132	1	
85	82			134			134		
80	81			133			133		
75	84			136			136		
70	85			137			137		
65	85			137			137		
60	87			139			138		
55	88			140			140		
50	88			140			140		
45	89			141			141		
40	89			141			141		
35	92			144			144		
30	92			144			144		
25	90			142			142		
23	90			142			142	1	

TEST RUN S/N	AVERAGE PROPAGATION	27 JAN 1972
720127-01,02,	PATH LOSS AEL MCA SITE	
03 AND 04	NO 6 TO ECOM HEXAGON	

FREQUENCY: 1545 MHZ



TEST DATA SHEET

DATE: 27 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 09.20 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44 dBM	AEL HORN	14.4	5.3	XMTR. PWR. 1.1
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.5
TOTAL CABLE LOSS (XMTR + REC.)		5.3 + 1.2 = 6.5 dB				=ESP = √2,2 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720127-01	TEST 720127-02	TEST 720127-03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720127-01	720127-02	720127-03	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
23	90	92	92	142	144	144	143.3	4	END 720127-01 1015
25	90	92	92	142	144	144	143.3	1	START 720127-02 1045
30	90	93	93	142	145	145	144.0		END 720127-02 1120
35	89	91	92	141	143	144	142.5		START 720127-03 1340
40	89	90	90	141	142	142	141.8		END 720127-03 1407
45	88	89	89	140	141	141	140.8		
50	87	89	89	139	141	141	140.3		AVG. PATH
55	87	87	87	139	139	139	138.8		LOSS (dB)
60	85	87	86	137	139	138	138.0		INCLUDES
65	85	86	86	137	138	138	137.5		TEST RUN S/N 720127-01
70	83	85	85	135	137	137	136.3		720127-03
75	82	84	84	134	136	136	135.3		720127-02
80	81	82	83	133	134	135	134.0		720127-01
85	81	81	82	133	133	134	133.3		
88	79	80	80	131	132	132	131.8	4	

TEST DATA SHEET

DATE: 27 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1415 HRS.

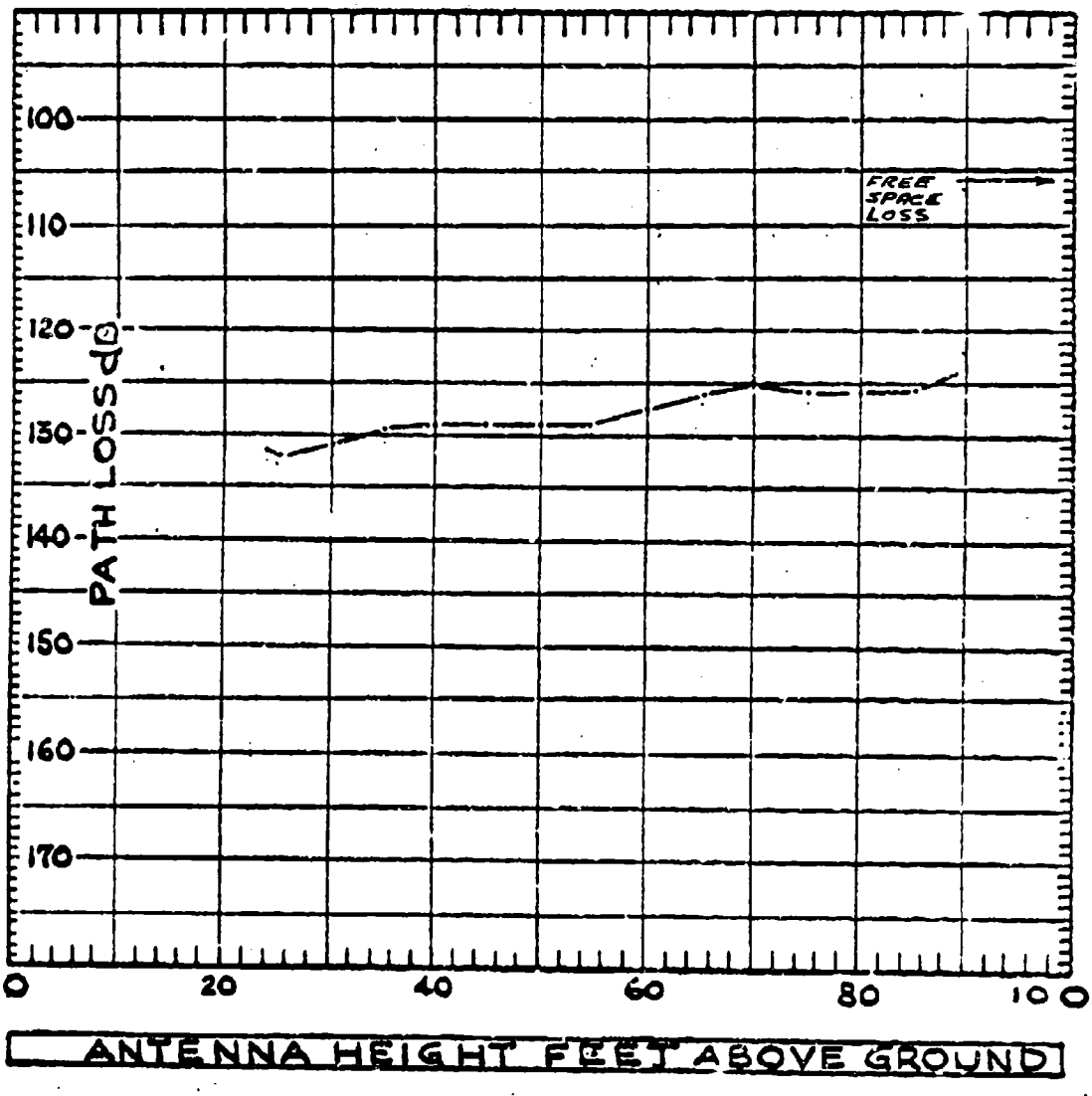
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44 dBM	AEL HORN	14.4	5.3	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.5
TOTAL CABLE LOSS (XMTR + REC.)		5.3 + 1.2 = 6.9 dB				=ESP = 52.2 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720127-04	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720127-04			AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
98	80			132					AVG PATH
85	81			133					LOSS (dB)
80	82			134					INCLUDED
75	83			135					TO COMPUTE
70	84			136					AVG PATH LOSS OF
65	85			137					TEST RUNS
60	86			138					720127-01, 02 AND 03
55	86			138					
50	88			140					
45	89			141					
40	90			142					
35	90			142					
30	92			144					
25	92			144					
23	91			143					

TEST RUN S/N	AVERAGE PROPAGATION	27 JAN 1972
720127-05	PATH LOSS AEL MCA SITE	
720127-06	NO 5 TO ECOM HEXAGON	

FREQUENCY: 371.4 MHZ



TEST DATA SHEET

DATE: 27 JANUARY 72

OPER. FREQ. 311.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1450 HRS.

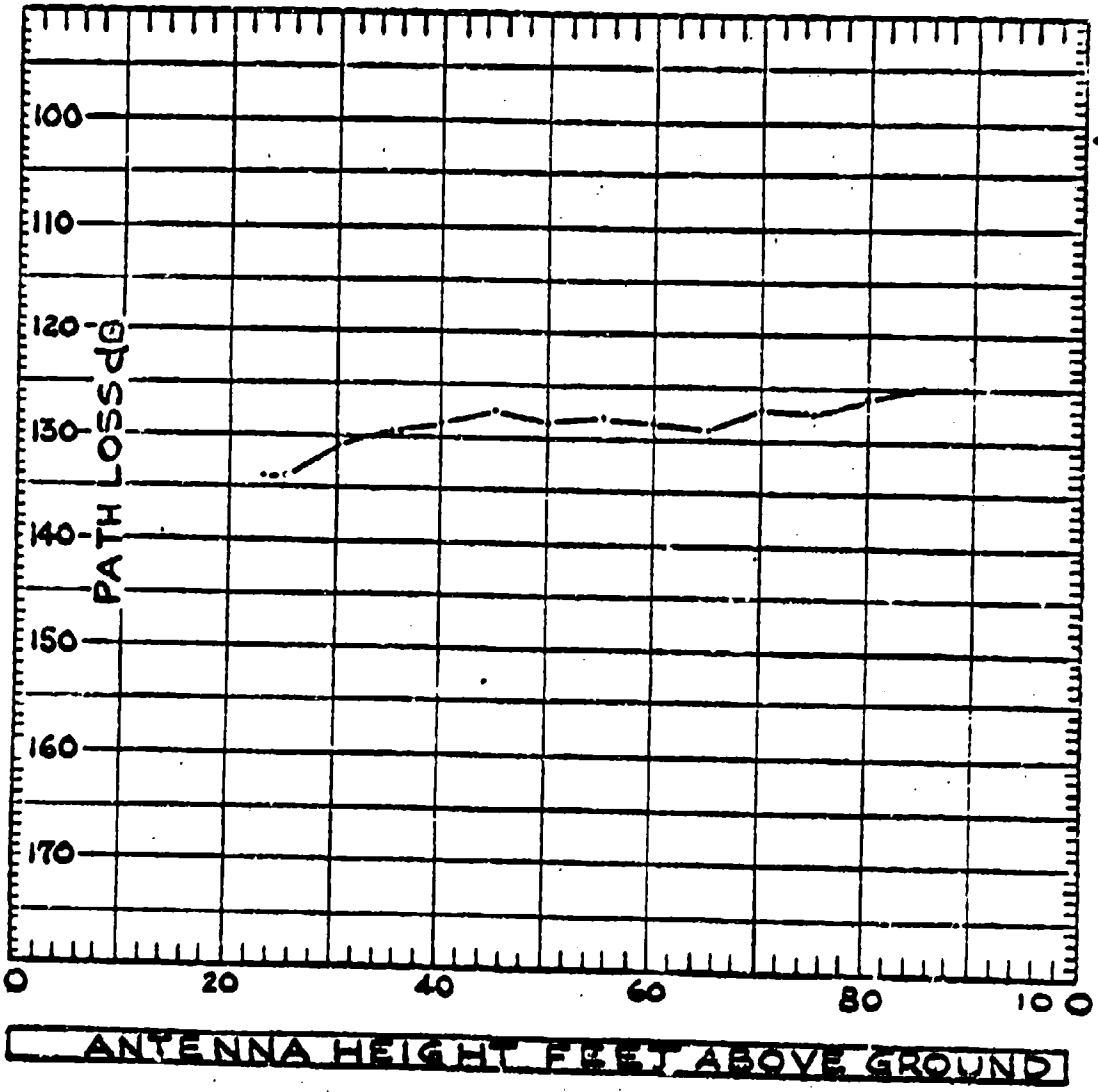
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44 dBM	AT 197	2.0	2.2	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		AT 197	2.0	2.3	+ANT. GAINS 4.0
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0 dB				-CABLE LOSSES 4.5
TOTAL CABLE LOSS (XMTR + REC.)		2.2 + 2.3 = 4.5 dB				=ESP = 43.5 USE 44

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT.)	RCVD. PWR. (dBM) TEST 720127-05	TEST 720127-06	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720127-05	720127-06		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
24	86	89		130	133		131.5	2	
25	87	89		131	133		132.0	↑	
30	86	88		130	132		131.0	|	
35	85	86		129	130		129.5	|	
40	85	85		129	129		129.0	|	
45	85	85		129	129		129.0	|	
50	85	85		129	129		129.0	|	
55	86	84		130	128		129.0	|	
60	84	83		128	127		127.5	|	
65	82	82		126	126		126.0	|	
70	81	81		125	125		125.0	|	
75	82	82		126	126		126.0	|	
80	82	82		126	126		126.0	|	END 720127-05 1N2S
85	81	82		125	126		125.5	↓	START 720127-06 N4S
89	80	80		124	124		124.0	7	END 720127-06 160S

TEST RUN S/N	AVERAGE PROPAGATION	25 JAN 1972
720125-05	PATH LOSS AS A FUNCTION	
	TO ECOM HERAGON	

FREQUENCY: 229.5 MHZ



TEST DATA SHEET

DATE: 28 JANUARY 72

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: 1437 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44 DBM	AT 197	1.2	2.√	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON	[redacted]	AT 197	1.2	1.8	+ANT. GAINS 2.4
TOTAL ANT. GAIN (XMTR + REC.)		1.2 + 1.2 = 2.4	dB			-CABLE LOSSES 4.3
TOTAL CABLE LOSS (XMTR + REC.)		2.5 + 1.8 = 4 3	dB			=ESP = 41.9 USE 42

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720128-03	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720128-03			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
23	92			134			134.0	2	WIND 270° 2 KTS
25	92			134			134.0	2	GUSTING TO 8 KTS
30	89			131			131.0	2	TEMP. 27° F
35	88			130			129 √	2	
40	87			129			128 √	2	
45	86			128			127.√	2	
50	87			129			128.√	2	
55	87			129			128.0	2	
60	87			129			128 √	2	
65	87			129			129 0	2	
70	85			127			127.0	2	
75	85			127			127.√	2	
80	84			126			126.0	2	
85	83			125			125.0	2	
89	83			125			125.0	1	
85	83			125					
80	84			126					
75	86			128					
70	85			127					
65	87			129					

TEST DATA SHEET

DATE: 28 JANUARY 72

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: 1437 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44dBM	AT 197	1.2	2.5	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		AT 197	1.2	1.8	+ANT. GAINS 2.3
TOTAL ANT. GAIN (XMTR + REC.)		1.2 + 1.2 = 2.2 dB				-CABLE LOSSES 1.3
TOTAL CABLE LOSS (XMTR + REC.)		2.5 + 1.8 = 4.3 dB				=ESP = 41.9 USE 42

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

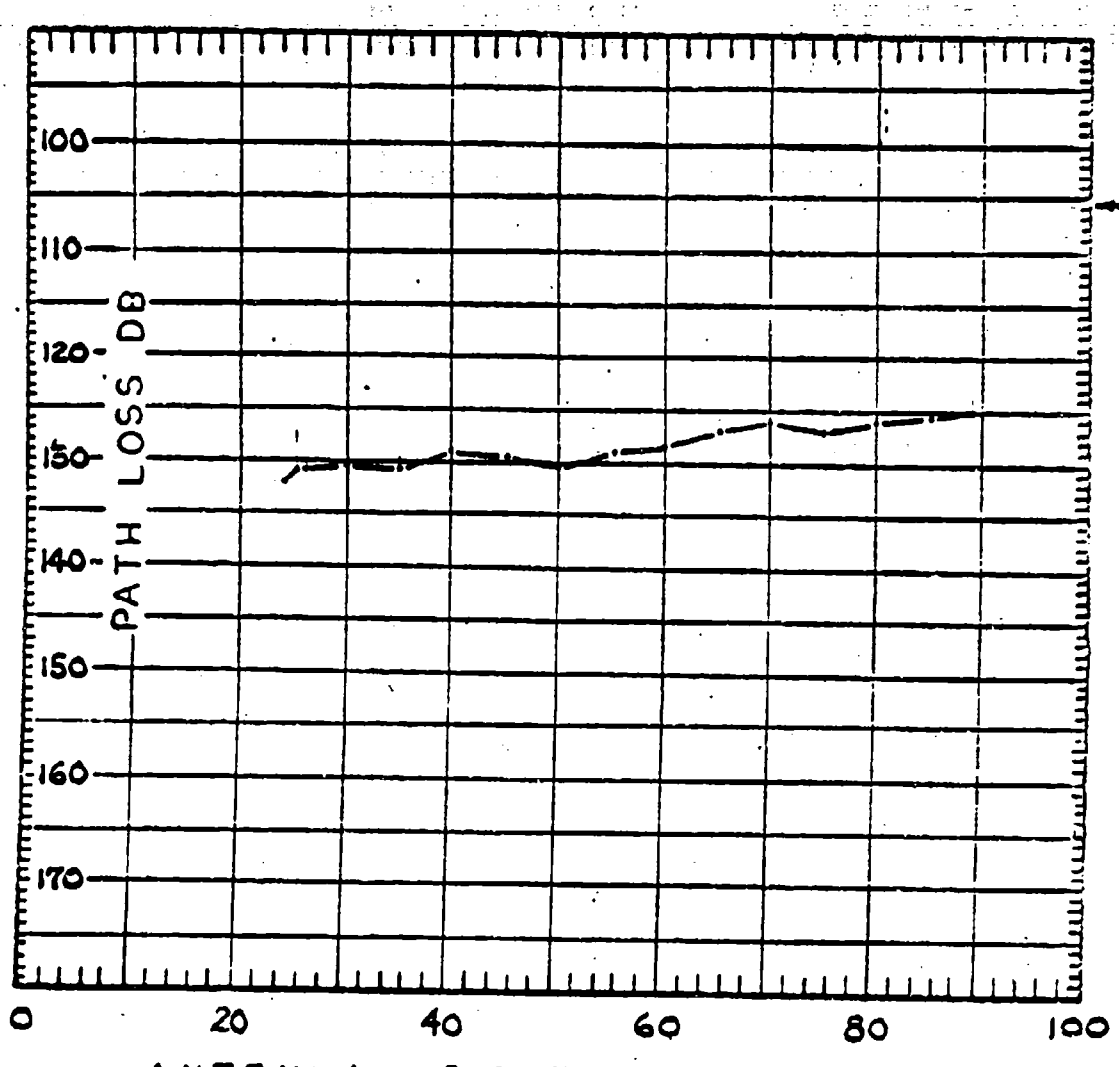
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720128-03	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720128-03			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
60	86			128					
55	85			127					
50	86			128					
45	85			127					
40	86			128					
35	87			129					
30	89			131					
25	92			134					
23	92			134					END 720128-03 1520

PROPAGATION PATH LOSS

DATE: 28 JANUARY 72 TEST RUN S/N: 720128-01

PATH: AEL MCA SITE No. 5 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 28 JANUARY 1972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1004 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44dBM	AT197	2.0	2.2	XMTR. PWR. 44
RECEIVER	ECOM HEXAGO		AT197	2.0	2.3	+ANT. GAINS 4.0
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0 dB				-CABLE LOSSES 4.√
TOTAL CABLE LOSS (XMTR + REC.)		2.2 + 2.3 = 4.5 dB				=ESP = 43.5 USE 44

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72012 9-01	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72012 8-01			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
24	88			132			132	2	WIND CALM - 1 KT.
25	87			131			131		
30	86			130			130.5		SOME ICE FORMATION
35	87			131			131		ON ANTENNA
40	84			128			129		
45	85			129			129.5		
50	86			130			130.5		
55	85			129			129.0		
60	85			129			128.√		
65	83			127			127.0		
70	82			126			126.0		
75	82			126			127.0		
80	81			125			126.0		
85	82			126			125.√	2	
89	81			125			125.0	1	
85	81			125					
80	83			127					
75	84			128					
70	82			126					
65	83			127					

TEST DATA SHEET

DATE: 28 JANUARY 1972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1004 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	AEL MCA 5	44dBM	AT 197	2.0	2.2
RECEIVER	ECOM HEXAGON		AT 197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.2 + 2.3 = 4.1 dB

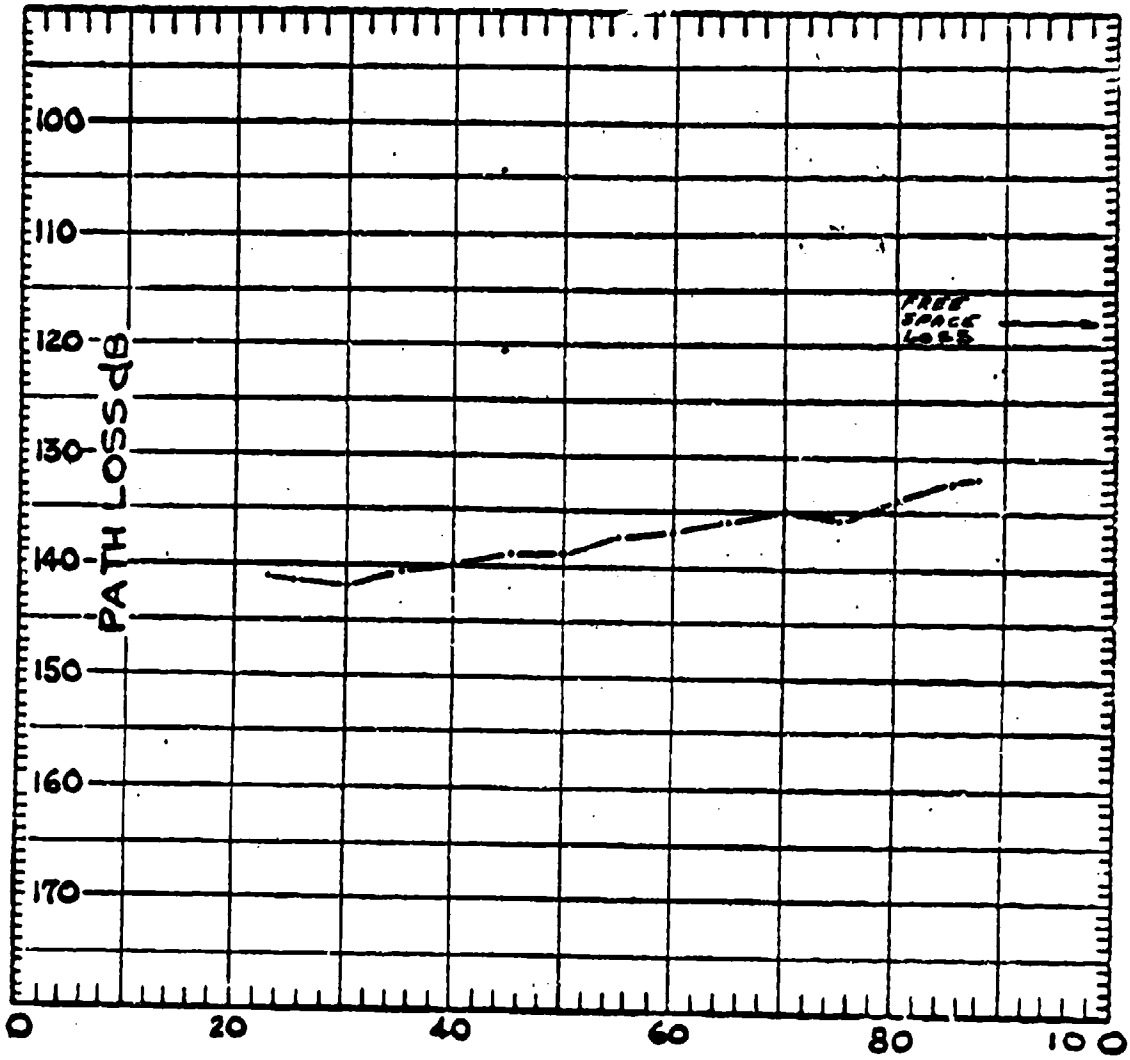
EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 4.0
-CABLE LOSSES 4.1
=ESP = 43.5 USE 44

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
	720128-01			720128-01					
60	84			128					
55	85			129					
50	87			131					
45	86			130					
40	86			130					
35	87			131					
30	87			131					
25	87			131					
24	88			132					END 720128-01 - 1102

TEST RUN S/N	AVERAGE PROPAGATION	25 JAN 1972
720125-02	PATH LOSS ALL MCA SITES	
	NO. 8 TO ECOM HEXAGON	

FREQUENCY: 1645 MHZ



TEST DATA SHEET

DATE: 28 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1310 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	AEL MCA 5	44 dBM	AEL HORN	14.4	7.9
RECEIVER	ECOM HEXAGON	[redacted]	ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 7.9 + 1.2 = 9.1 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44

+ANT. GAINS 14.7

-CABLE LOSSES 9.1

=ESP = 49.6 USE 50

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720128-02	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720128-02			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
23	91			141			141.0	2	WIND CALM 270° 1KT
25	91			141			141.√		TEMP. 27° F
30	92			142			142.0		2.5 IN. SNOW ON GROUND
35	90			140			140.√		
40	90			140			140.0		
45	89			139			139.0		
50	89			139			139.0		
55	87			137			137.√		
60	87			137			137.0		
65	86			136			136.0		
70	85			135			135.0		
75	84			134			134.√		
80	84			134			134.0		
85	82			132			132.√	2	
88	82			132			132.0	1	
85	83			133					
80	84			134					
75	85			135					
70	85			135					
65	86			136					

TEST DATA SHEET

DATE: 28 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1315 HRS.

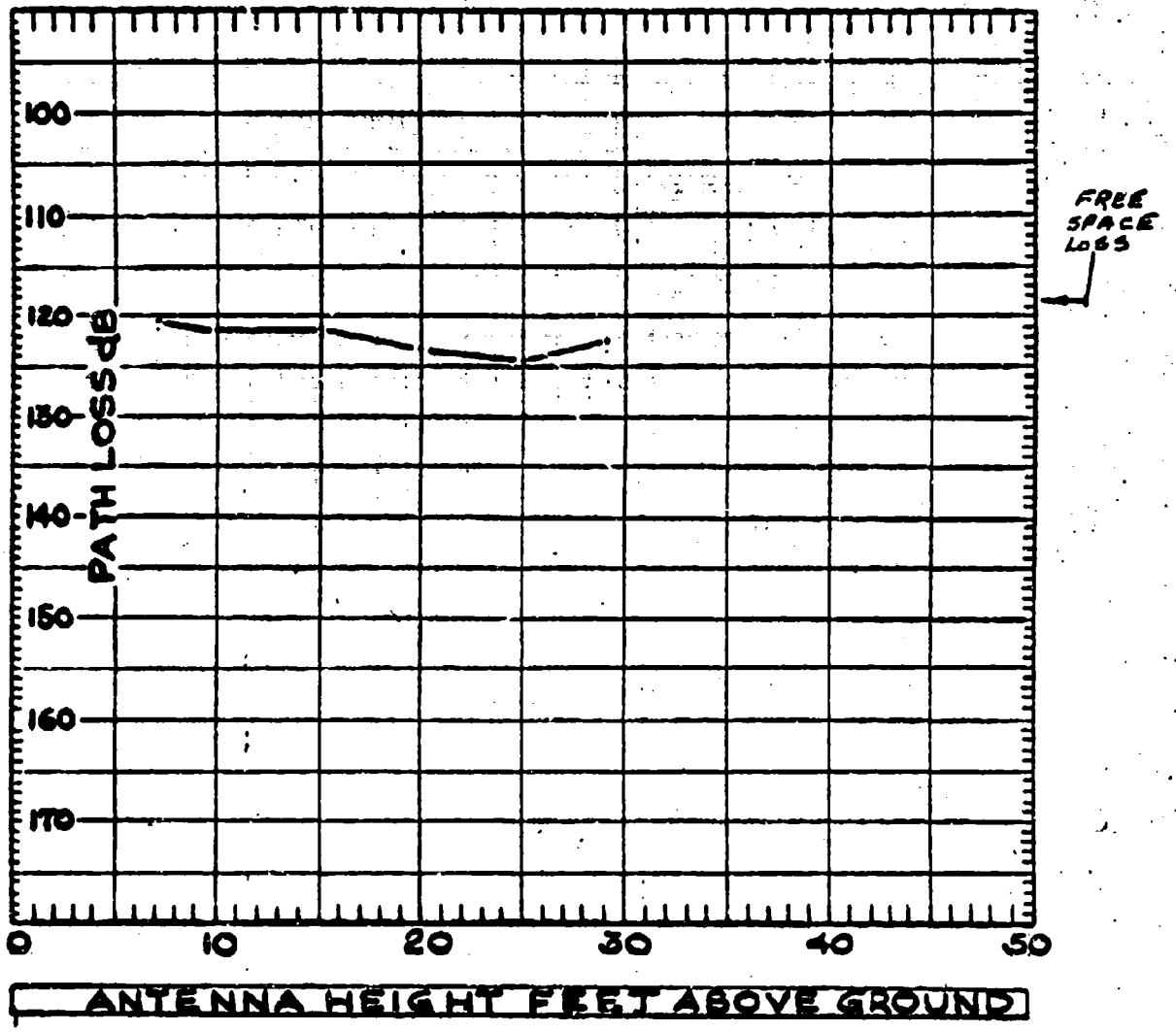
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	AEL MCA 5	44dBM	AEL HORN	14.4	7.9	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		ANDREW BICONKAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 9.1
TOTAL CABLE LOSS (XMTR + REC.)		7.9 + 1.2 = 9.1 dB				=ESP = 49.6 USE 50

XMTR. SITE HEIGHT ABOVE SEA LEVEL 155 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720128-02	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720128-02			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
60	87			137					
55	88			138					
50	89			139					
45	89			139					
40	90			140					
35	91			141					
30	92			142					
25	92			142					
23	91			141					END 720128-02 1345

TEST RUN S/N	AVERAGE PROPAGATION	31 JAN 1972
7201 31-01, 02	PATH LOSS HIGHLANDS	
AND 03.	SITE NO. 21 TO ECOM HEXAGON	

FREQUENCY: 1545 MHZ



TEST DATA SHEET

DATE: 31 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1350 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	HIGHLANDS 21	44 dBM	AEL HORN	14.4	6.8	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 8.0
TOTAL CABLE LOSS (XMTR + REC.)		6.8 + 1.2 8.0 dB				-ESP = 52.7 USE 51

XMTR. SITE HEIGHT ABOVE SEA LEVEL 200 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

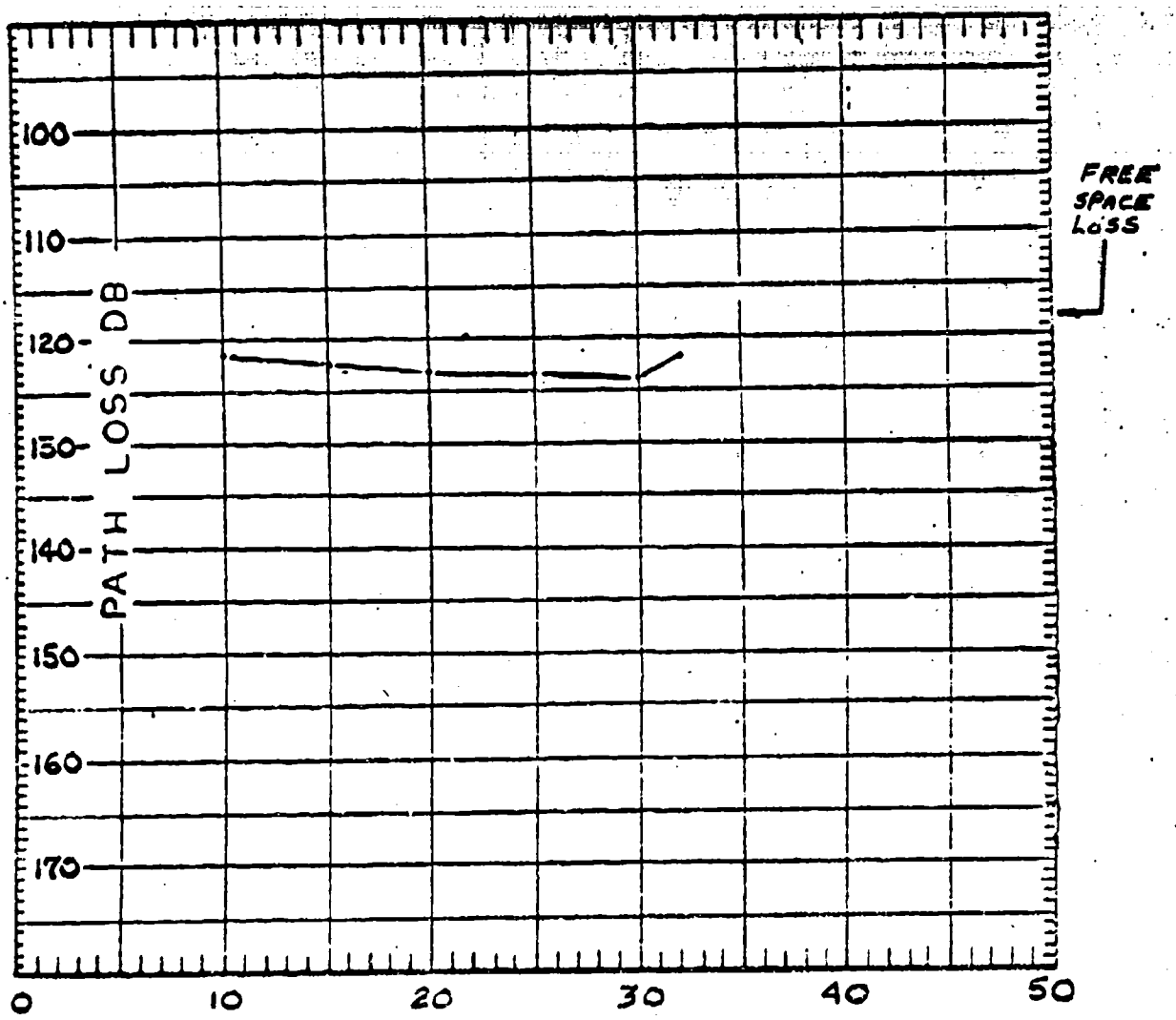
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720131-01	TEST 720131-02	TEST 720131-03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720131-01	720131-02	720131-03	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
7	69	69	69	120	120	120	120 2	6	WIND 4 KTS - 5 KTS
10	70	71	71	121	122	122	121 4	6	GUSTING TO 9 KTS
15	69	70	70	120	121	121	121.3	6	TEMP. -1°C.
20	72	71	72	123	122	123	123.7	6	
25	74	74	72	125	125	123	124.7	6	
29	71	71	72	122	122	123	122.3	3	
25	74	74	74	125	125	125			
20	72	73	73	123	124	124			
15	70	71	70	121	122	121			
10	71	71	71	122	122	122			
7	69	70	69	120	121	120			END 720131-01 - 1410
									START 720131-02 - 1420
									END 720131-02 - 1435
									START 720131-03 - 1450
									END 720131-03 - 1520

PROPAGATION PATH LOSS

DATE: 31 JANUARY 72 TEST RUN S/N: 720131-0405

PATH: HIGHLANDS SITE NO. 21 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHZ



TEST DATA SHEET

DATE: 31 JANUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1520 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	HIGHLANDS 21	44 KW	ANDREWS DISCONE	2.5	6.8
RECEIVER	ECOM HEXAGON	[redacted]	ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 2.5 + 0.3 = 2.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 6.8 + 1.2 = 8.0 dB

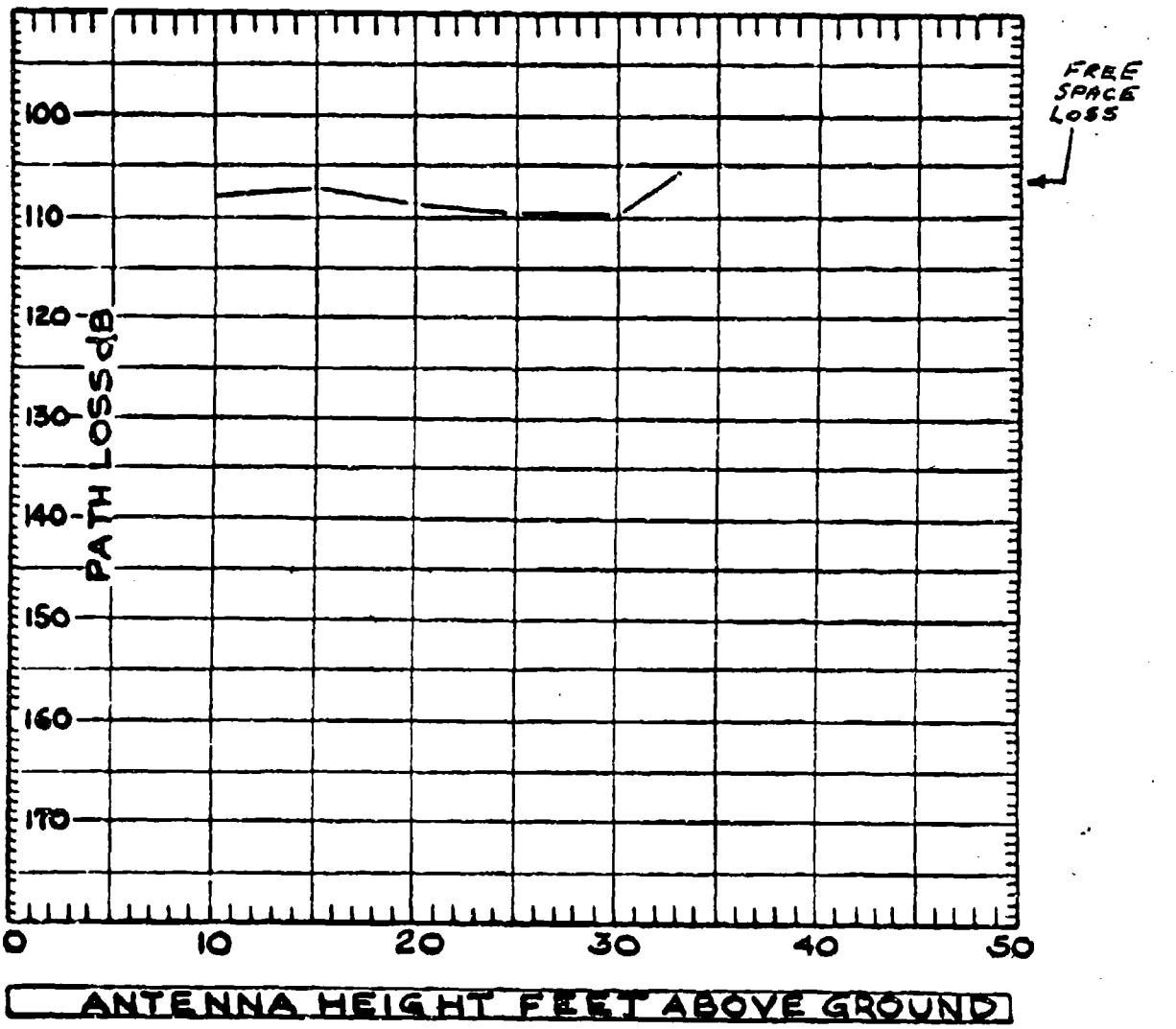
EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ ANT. GAINS 2.8
- CABLE LOSSES 8.0
= ESP = 38.8 USE 39

XMTR. SITE HEIGHT ABOVE SEA LEVEL 200 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720131-04	TEST 720131-05	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720131-04	720131-05		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	81	83		120	122		121.5	4	WIND 2 KTS
15	83	83		122	122		122.3	4	GUSTING TO 7 KTS
20	84	84		123	123		123.3	4	1.5 IN. SNOW ON GROUND
25	84	85		123	124		123.5	4	
30	84	86		123	125		123.8	4	
32	82	84		121	123		122.0	2	
30	84	85		123	124				
25	83	86		122	125				
20	84	85		123	124				
15	84	83		123	122				
10	81	81		120	120				END 720131-04 - 1535
									START 720131-05 - 1544
									END 720131-05 1600

TEST RUN S/N	AVERAGE PROPAGATION	FEB. 1972
720201-01	PATH LOSS HIGHLANDS	
-02 AND -03	SITE NO. 21 TO ECOM HEXAGON	

FREQUENCY: 371.4 MHZ



TEST DATA SHEET

DATE: 1 FEB. 1972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 0[illegible] HRS.

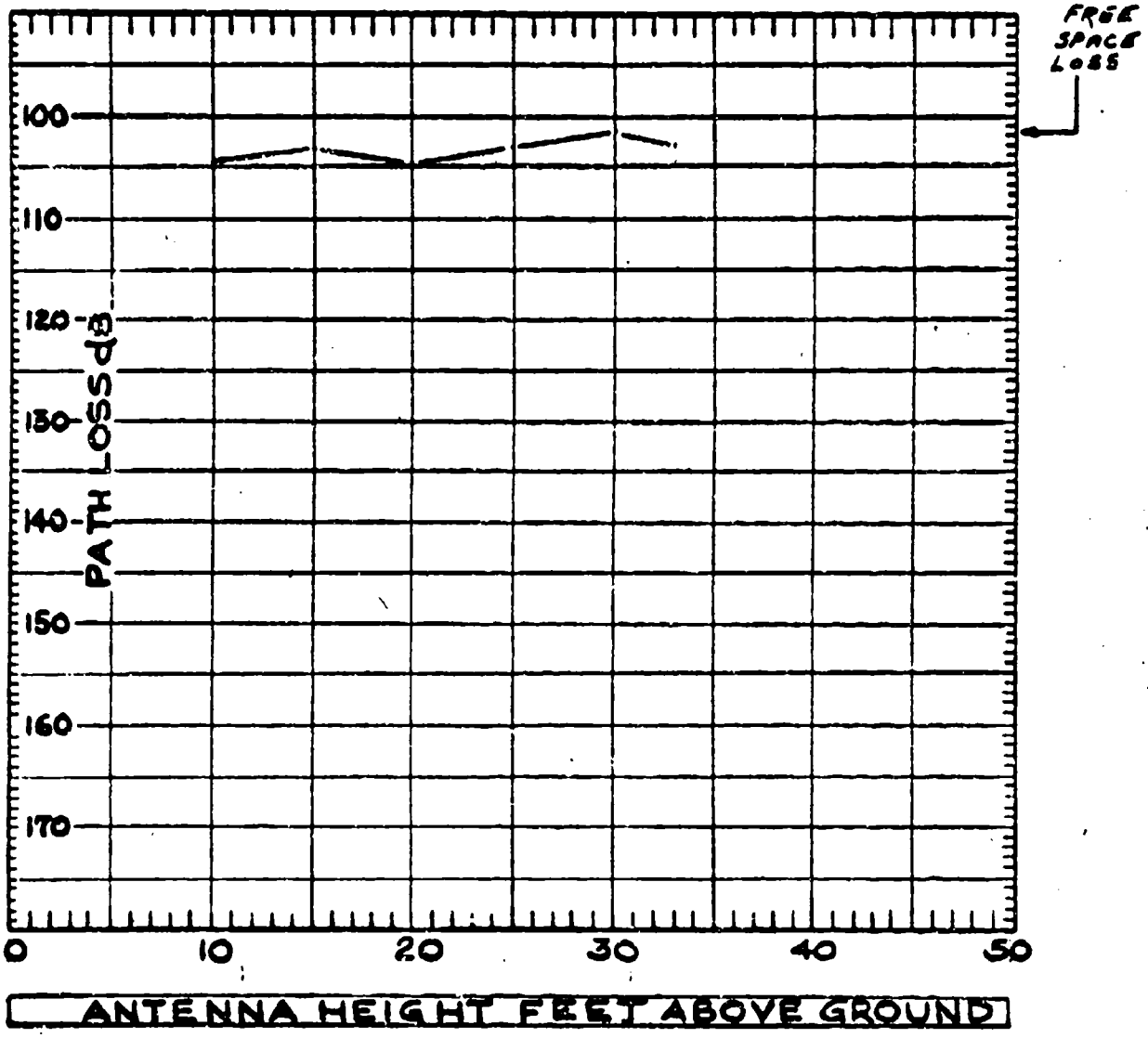
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	HIGHLANDS 21	44	AT-197	2.0	2.6	XMTR. PWR. 44
RECEIVER	ECOM H. XAGON	[illegible]	AT-197	2.0	2.3	+ANT. GAINS 4.0
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0		dB		-CABLE LOSSES 4.9
TOTAL CABLE LOSS (XMTR + REC.)		2.6 + 2.3 = 4.9		dB		=ESP = 43.1 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 200 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720201-01	TEST 720201-02	TEST 720201-03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720201-01	720201-02	720201-03	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10'3"	65	64	65	108	107	108	108	6	. WIND 3 KTS. 240°
15	64	64	64	107	107	107	107	6	GUSTING TO 4 KTS.
20	65	65	66	108	108	109	108.5	6	TEMP. 26°F.
25	66	67	67	109	110	110	109.5	6	
30	66	67	66	109	110	109	109.7	6	
32'7"	62	63	63	105	106	106	105.7	3	
30	66	69	66	109	112	109			
25	65	68	67	108	110	110			
20	65	67	65	108	110	108			
15	64	64	64	107	107	107			
10'3"	64	67	65	107	110	108			END 720201-01 — 1000
									START 720201-02 1005
									END 720201-02 — 1035
									START 720201-03 — 1052
									END 720201-03 — 1057

TEST RUN S/N	AVERAGE PROPAGATION	FEB. 1972
720201-04	PATH LOSS HIGHLANDS	
AND 05	SITE NO. 21 TO ECOM HEXAGON	

FREQUENCY: 229.5 MHZ



TEST DATA SHEET

DATE: 1 FEB 1972

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: 1115 HRS.

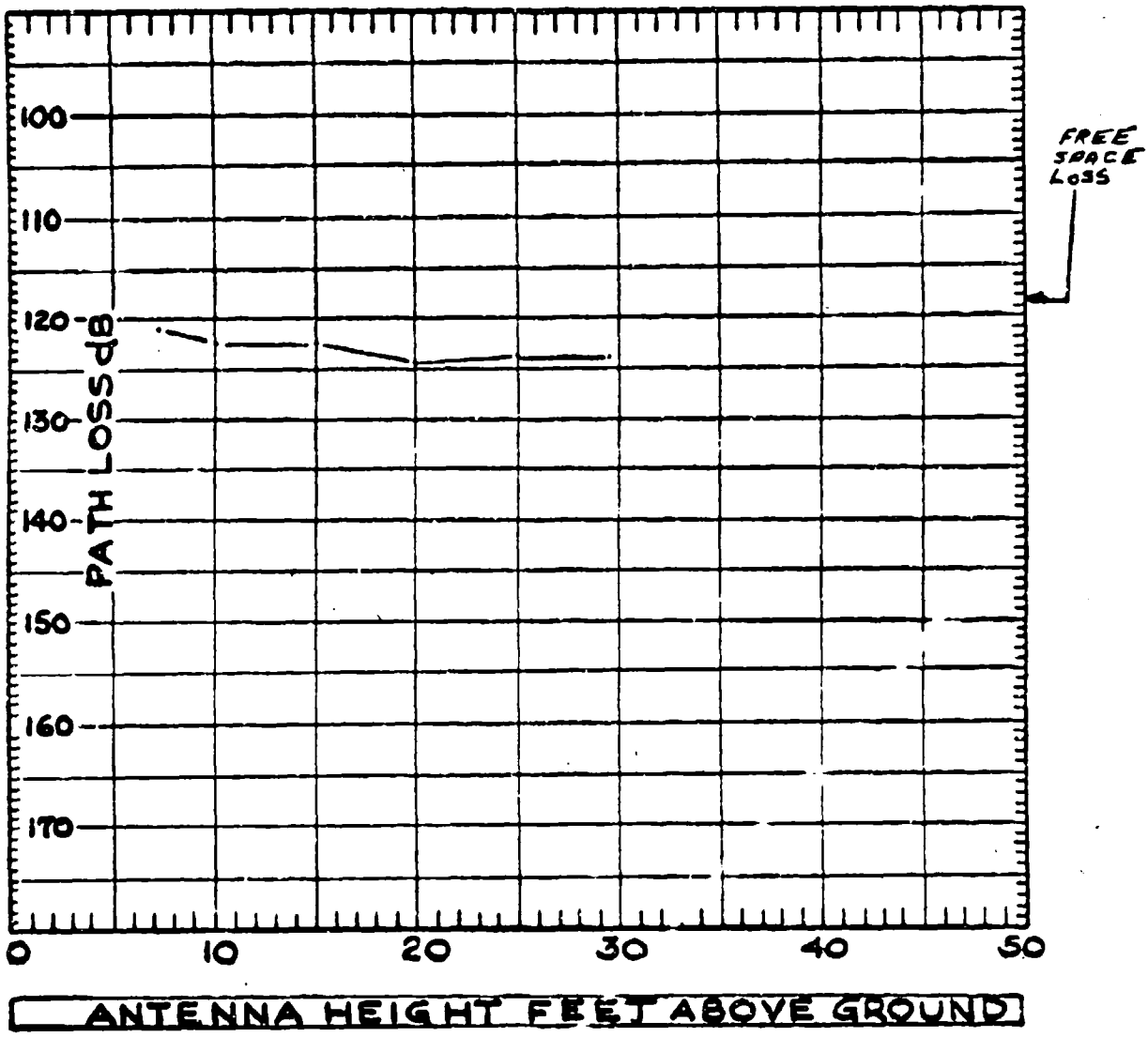
SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	HIGHLANDS 21	44 dBM	AT-197	1.2	2.0	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON	[redacted]	AT-197	1.2	1.8	+ANT. GAINS 2.4
TOTAL ANT. GAIN (XMTR + REC.)		1.2 + 1.2 = 2.4 dB				-CABLE LOSSES 3.8
TOTAL CABLE LOSS (XMTR + REC.)		2.0 + 1.8 = 3.8 dB				=ESP = 42.6 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 200 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720201-04	TEST 720201-05	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720201-04	720201-05		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10'3"	62	61		105	104		104.3	4	WIND 3 KTS 240°
15	60	60		103	103		103.0	4	TEMP. 33°F.
20	62	62		105	105		105.0	4	WIND GUSTING
25	60	60		103	103		103.0	4	TO 12 KTS.
30	59	58		102	101		101.5	4	
32'7"	60	60		103	103		103.0	2	
30	59	58		102	101				
25	60	60		103	103				
20	62	62		105	105				
15	60	60		103	103				
10'3"	61	61		104	104				END 720201-04 - 1127
									START 720201-05 - 1130
									END 720201-05 - 1142

TEST RUN S/N	AVERAGE PROPAGATION	FEB 72
720201-06	PATH LOSS HIGHLANDS	
	SITE NO. 21 TO ECOM HEXAGON	

FREQUENCY: 1545 MHZ



TEST DATA SHEET

DATE: 1 FEBRUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1330 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	HIGHLANDS 21	44 dBM	AEL HORN	14.4	6.5
RECEIVER	ECOM HEXAGON	[illegible]	ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 6.5 + 1.2 = 7.7 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 200 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 165 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. +41.0
+ANT. GAINS 14.7
-CABLE LOSSES 7.7
=ESP = √1.0

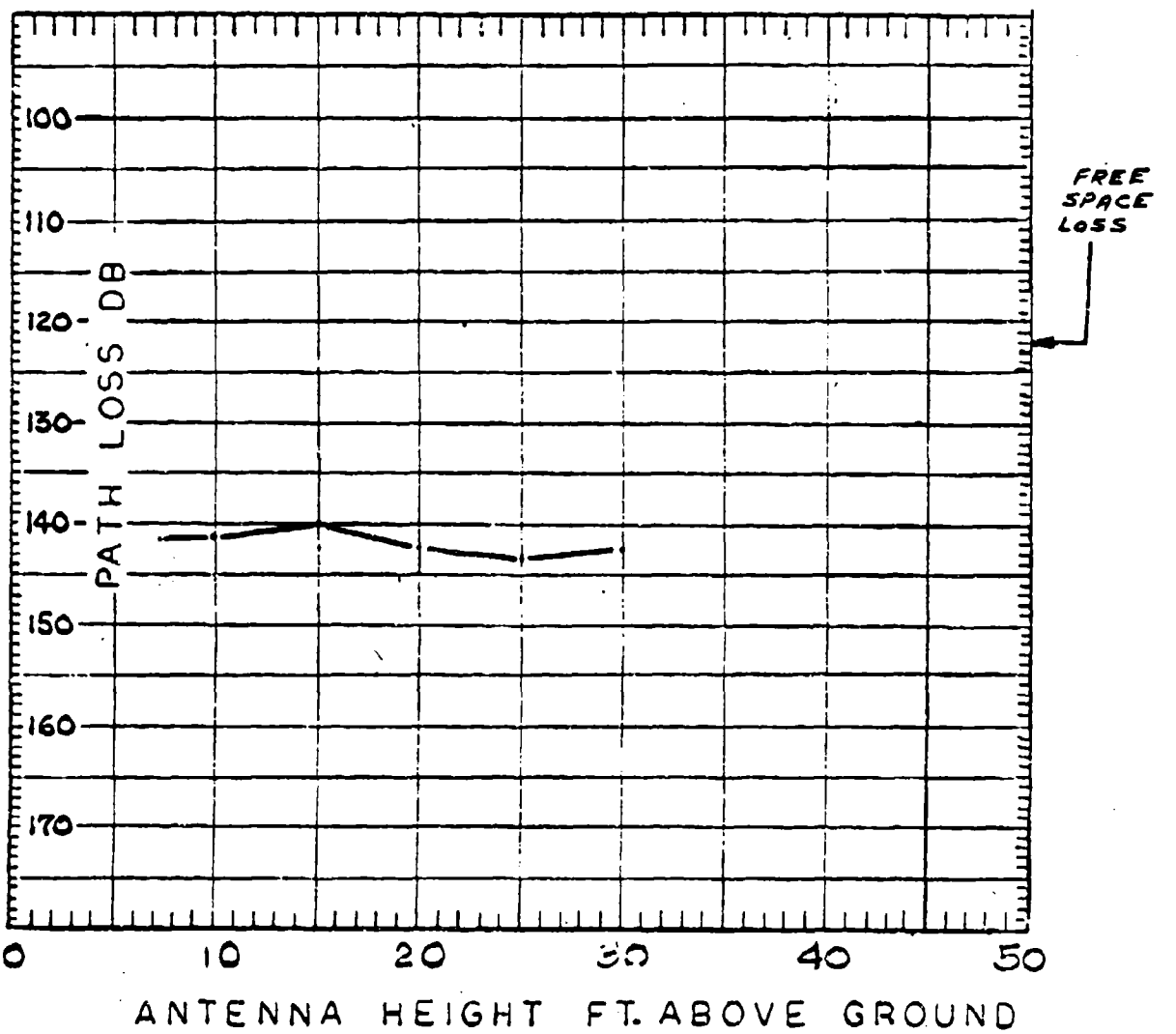
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720201-06	TEST —	TEST —	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720201-06	—	—	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
7	70			121			121.0	2	WIND 2 KTS 270°
10	71			122			122.5	2	GUSTING TO 7-20 KTS
15	72			123			122.5	2	
20	74			125			124.5	2	
25	73			124			124.0	2	
29'4"	73			124			124.0	1	
25	73			124					
20	73			124					
15	71			122					
10	72			123					
7	70			121					END 720201-06 - 1350

PROPAGATION PATH LOSS

DATE: 1 FEBRUARY 72 TEST RUN S/N: 720201-07-08

PATH: HIGHLANDS SITE No. 21 TO ECOM HEXAGON

OPER. FREQ.: 2290 MHz



TEST DATA SHEET

DATE: 1 FEBRUARY 72

OPER. FREQ. 2290 MHZ REC. SITE ANT. HT. _____ FT. START: 1410 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	HIGHLANDS 21	44 dBm	AEL HORN	16.7	8.5	XMTR. PWR. 44
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.7	1.6	+ANT. GAINS 17.4
TOTAL ANT. GAIN (XMTR + REC.)		16.7 + 0.7 = 17.4 dB				-CABLE LOSSES 10.4
TOTAL CABLE LOSS (XMTR + REC.)		8.5 + 1.6 = 10.1 dB				=ESP = 51.0

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 14√ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720201-07	TEST 720201-08	TEST ———	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720201-07	720201-08	———	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
7	91	91		142	142		141.8	4	WIND 2 KTS 270°
10	90	91		141	142		141.3	4	GUSTING TO 20 KTS
15	89	89		140	140		140.0	4	
20	89	89		140	140		142.3	4	
25	89	94		140	145		143.8	4	
29	89	94		140	145		142.√	2	
25	94	94		145	145				
20	94	93		145	144				
15	89	89		140	140				
10	90	90		141	141				
7	90	91		141	142				END 720201-07 - 1435
									START 720201-08 - 1440
									END 720201-08 - 1500

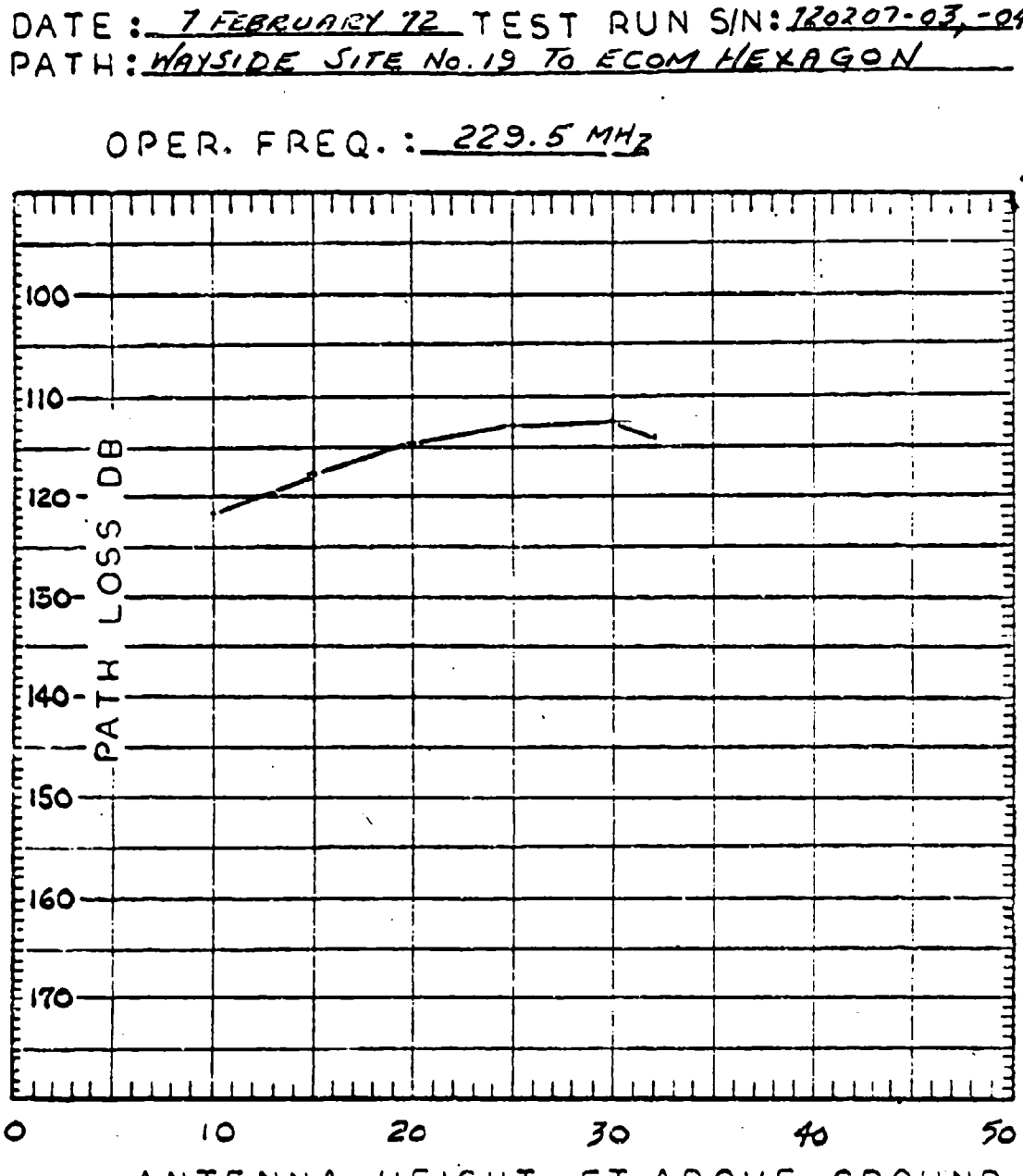
97

PROPAGATION PATH LOSS

DATE: 7 FEBRUARY 72 TEST RUN S/N: 720207-03, -04

PATH: WAYSIDE SITE No. 19 TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



TEST DATA SHEET

DATE: 7 FEBRUARY 72

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: 1040 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19	44 dBM	AT-197	1.2	1.8
RECEIVER	ECOM HEX.		AT-197	1.2	1.8

TOTAL ANT. GAIN (XMTR + REC.) 1.2 + 1.2 = 2.4 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 2.4
-CABLE LOSSES 3.6
=ESP = 42.8 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

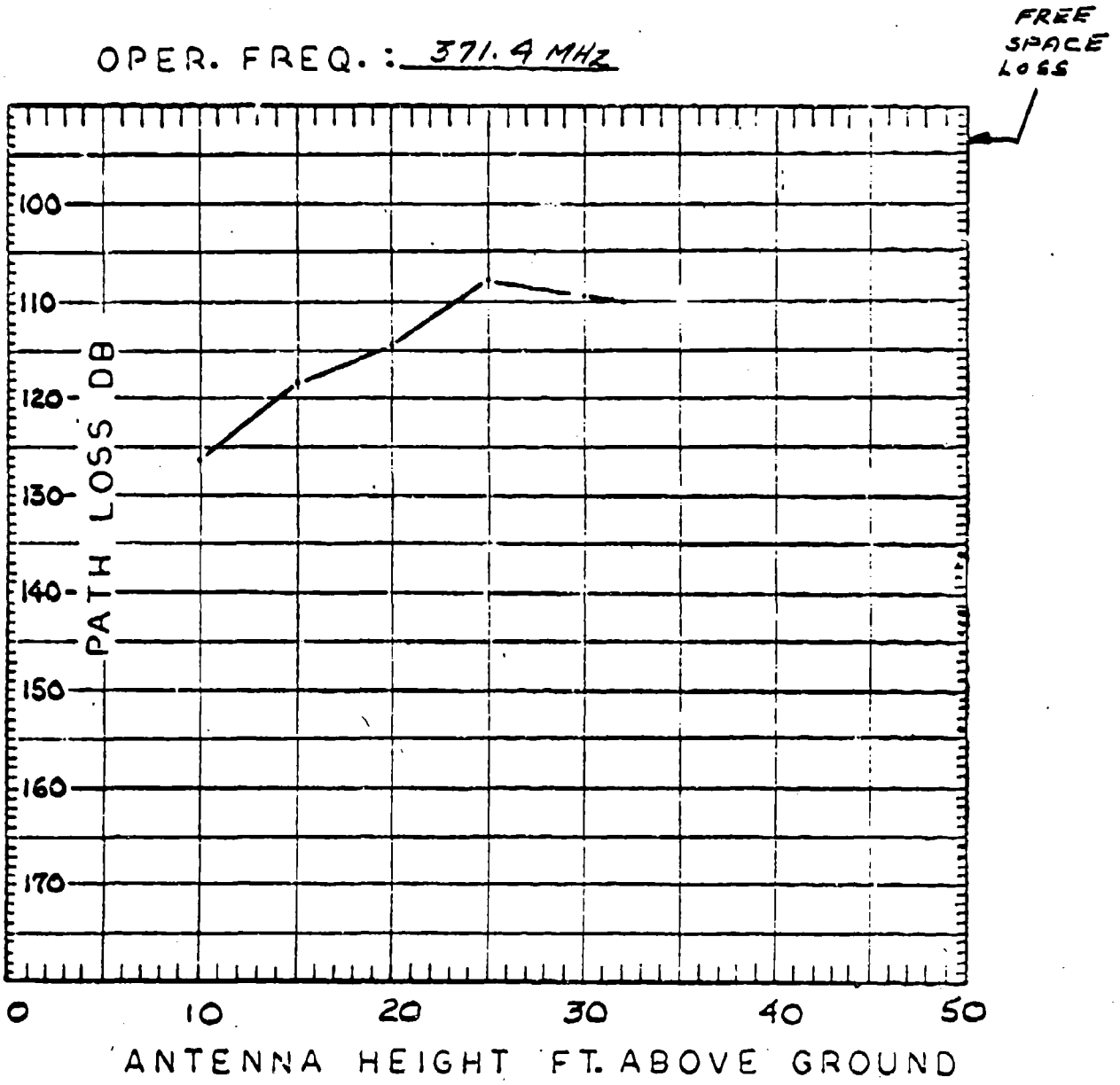
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720207-03	TEST 720207-04	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720207-03	720207-04		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	79	77		122	120		121.3	4	
15	75	74		118	117		117.5	4	
20	71	72		114	115		114.5	4	
25	69	70		112	113		113.0	4	
30	68	70		111	113		112.5	4	
32	71	71		114	114		114.0	2	
30	69	70		112	113				
25	71	70		114	113				
20	71	72		114	115				
15	75	74		118	117				
10	77	80		120	123				END 720207-03 - 1057
									START 720207-04 - 1105
									END 720207-04 - 1120

PROPAGATION PATH LOSS

DATE: FEBRUARY 72 TEST RUN S/N: 720207-01, -02

PATH: WAYSIDE SITE NO. 19 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 7 FEBRUARY 72

OPER. FREQ. 371.4 REC. SITE ANT. HT. _____ FT. START: 1000 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAISIDE 19	44 dBM	AT 197	2.0	2.3
RECEIVER	ECOM HEX.		AT 197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 4.0
-CABLE LOSSES 4.6
=ESP = 43.4 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

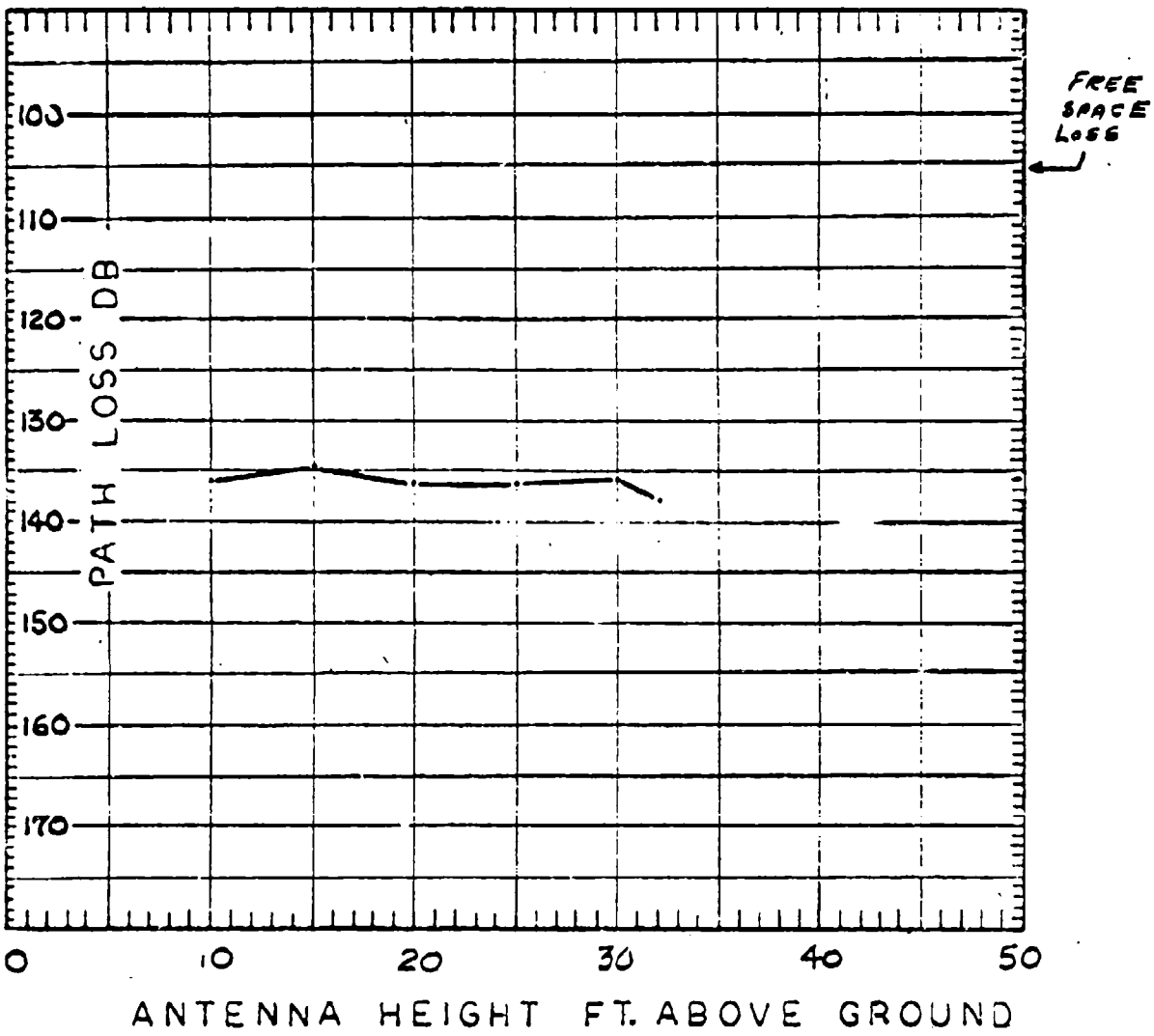
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720207-01	TEST 720207-02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720207-01	720207-02		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	83	85		126	128		126.3	4	
15	77	73		120	116		118.3	4	
20	70	73		113	116		114.8	4	
25	65	65		108	108		108.0	4	
30	66	66		109	109		109.5	4	
32	67	67		110	110		110.0	2	
30	67	67		110	110				
25	65	65		108	108				
20	70	74		113	117				
15	76	75		119	118				
10	83	82		126	125				END 720207-01 - 101
									START 720207-02 - 1020
									END 720207-02 - 105

PROPAGATION PATH LOSS

DATE: 7 FEBRUARY 72 TEST RUN S/N: 720207-05,-06 & 08

PATH: WAYSIDE SITE No. 19 To ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 7 FEBRUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1315 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19	43 dBM	ANDREW DISCONE	2.5	5.7
RECEIVER	ECOM HEX.		ANDREW Biconical	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 2.5 + 0.3 = 2.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 43
+ ANT. GAINS 2.8
- CABLE LOSSES 6.9
= ESP = 38.9 USE 39

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720207-05	TEST 720207-06	TEST 720207-07	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720207-05	720207-06	720207-07	AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
10	97	104		196	143		136.1	6	RUN 720207-07 CONDUCTED
15	93	97		132	136		134.8	6	WITH ANTENNA AT 75'
20	100	100		139	139		136.5	6	IN BRUCE'S TOWER TO
25	100	100		139	139		136.5	6	CHECK PREVIOUS RUNS
30	100	97		139	136		136.0	6	NO MEASUREMENTS TAKEN
32	102	100		141	139		138.0	3	
30	100	95		139	134				AVG. PATH LOSS INCLUDES
25	98	97		137	136				RUNS 720207-05, 720207-06
20	97	99		136	138				AND 720207-08
15	96	97		135	136				
10	96	95		135	134				END 720207-05 - 1330
									START 720207-06 - 1400
									END 720207-06 - 1420
									START 720207-07 - 1445
									END 720207-07 - 1500

TEST DATA SHEET

DATE: 7 FEBRUARY 72

OPER. FREQ. 154.5 MHz REC. SITE ANT. HT. _____ FT. START: 1520 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19	43 dBM	ANDREWS DISCONE	2.5	5.7	XMTR. PWR. 43
RECEIVER	ECOM HEX.		ANDREWS BIQUAD	0.3	1.2	+ANT. GAINS 2.8
TOTAL ANT. GAIN (XMTR + REC.)	2.5 + 0.3 = 2.8 dB					-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)	5.7 + 1.2 = 6.9 dB					=ESP = 38.9 USE 39

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720207-08	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720207-08			AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
10	96			135					AVG. PATHLOSS
15	95			134					INCLUDED WITH
20	94			133					RUNS 720207-05
25	95			134					AND 720207-06
30	95			134					
32	95			134					
30	95			134					
25	95			134					
20	95			134					
15	97			136					
10	95			134					

TEST DATA SHEET

DATE: 7 FEBRUARY 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1545 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19	43 dBM	AEL HORN	14.4	5.7
RECEIVER	ECOM HEX.		ANDREW Biconical	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 43.0
+ANT. GAINS 14.7
-CABLE LOSSES 6.9
=ESP = 50.8 USE 51

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 1-15 FT.

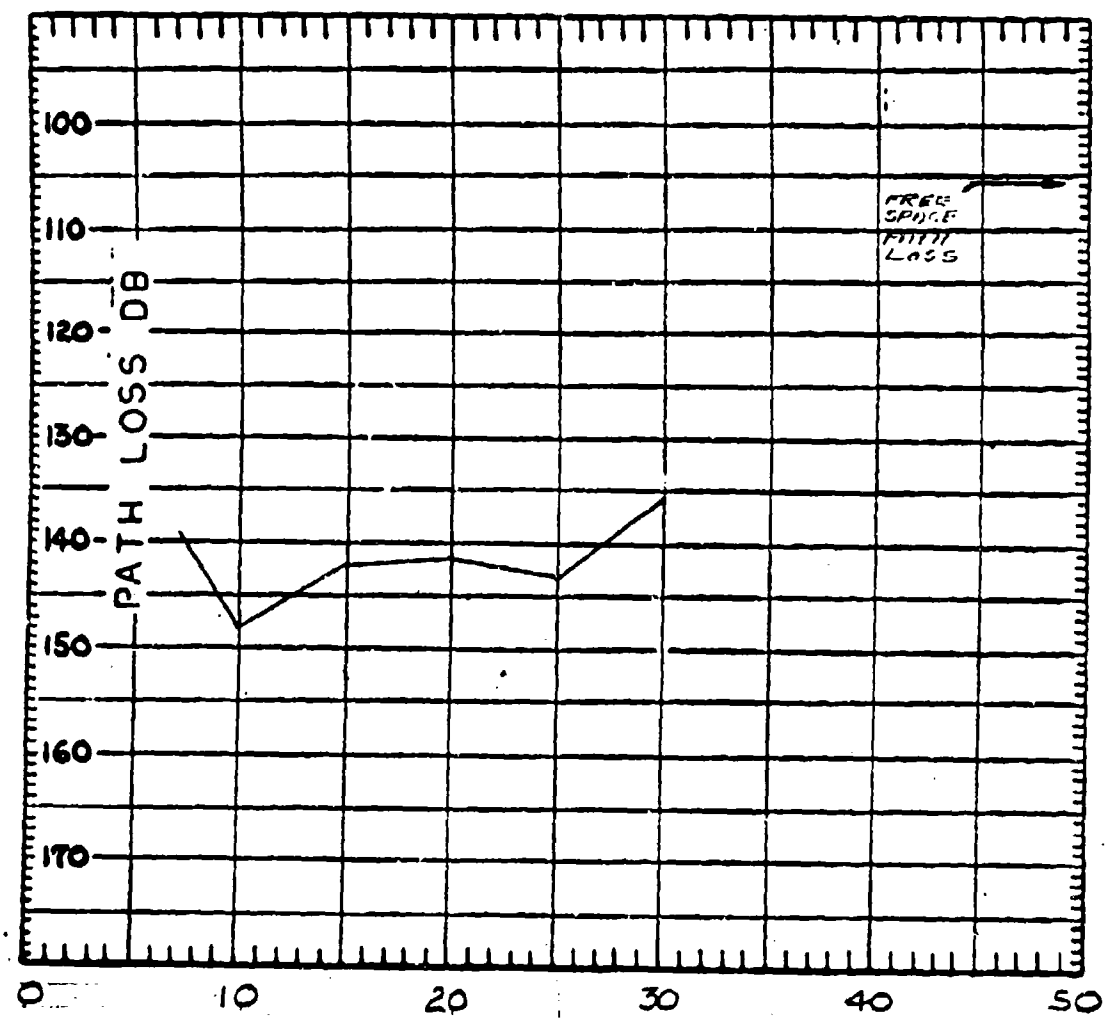
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72 02 07-07			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
	72 02 07-09			72 02 07-07					
10	*			*					* 15 MINUTE RUN ENDING 1548 RCVD POWER WAS A LOW OF 90dB AND A HIGH OF 95dB NO. AVG. PATH LOSS CALCULATED

PROPAGATION PATH LOSS

DATE: 8 FEB 72 TEST RUN S/N: 720208.01&02

PATH: WAYSIDE 19 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 8 FEB 72

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19	44 dBM	AEL HORN	14.4	5.7	XMTR. PWR. 44
RECEIVER	ECOM HEX	[redacted]	ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)	14.4 + 0.3 = 14.7 dB					-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)	5.7 + 1.2 = 6.9 dB					=ESP = 51.8 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

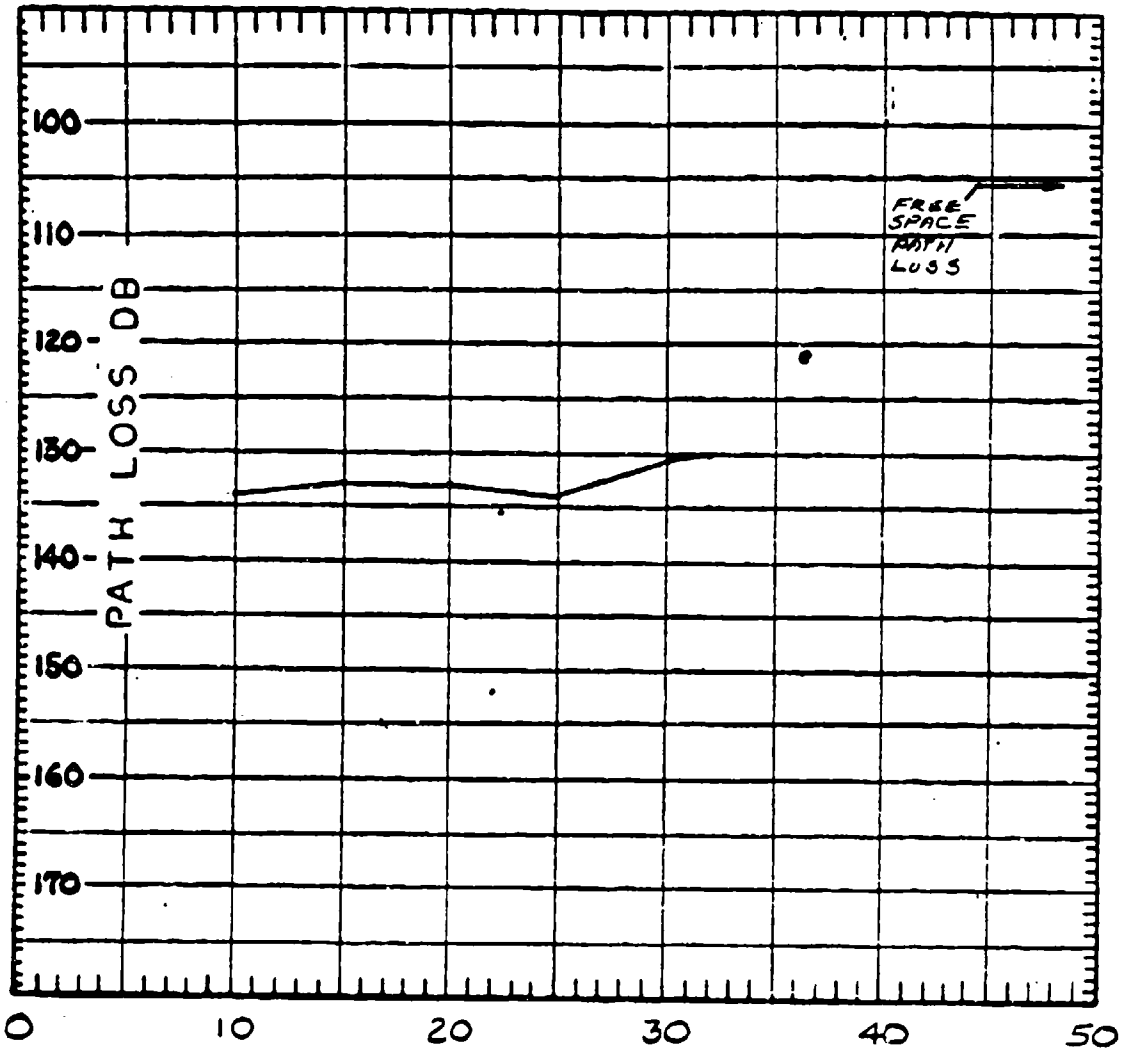
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720208.01	TEST 720208.02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720208.01	720208.02		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
7'3"	88	87		140	139		139.5	4	
10	99	95		151	147		148	4	
15	84	84		136	136		137	4	
20	84	85		136	137		136.5	4	
25	85	86		137	138		138	4	
30	84	83		136	135		135.5	2	
25	85	87		137	139				
20	84	85		136	137				
15	84	86		136	138				
10	95	95		147	147				
7'3"	87	88		139	140				
									POS. PEAK AVERAGING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 8 FEB. 72 TEST RUN S/N: 720208.03 #04

PATH: WAYSIDE 19 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 8 FEB 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19	44dBM	ANDREW DISCONE	2.5	5.7	XMTR. PWR. 44
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2	+ ANT. GAINS 2.8
TOTAL ANT. GAIN (XMTR + REC.)		2.5 + 0.3 = 2.8 dB				- CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				= ESP = 39.9 use 40

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

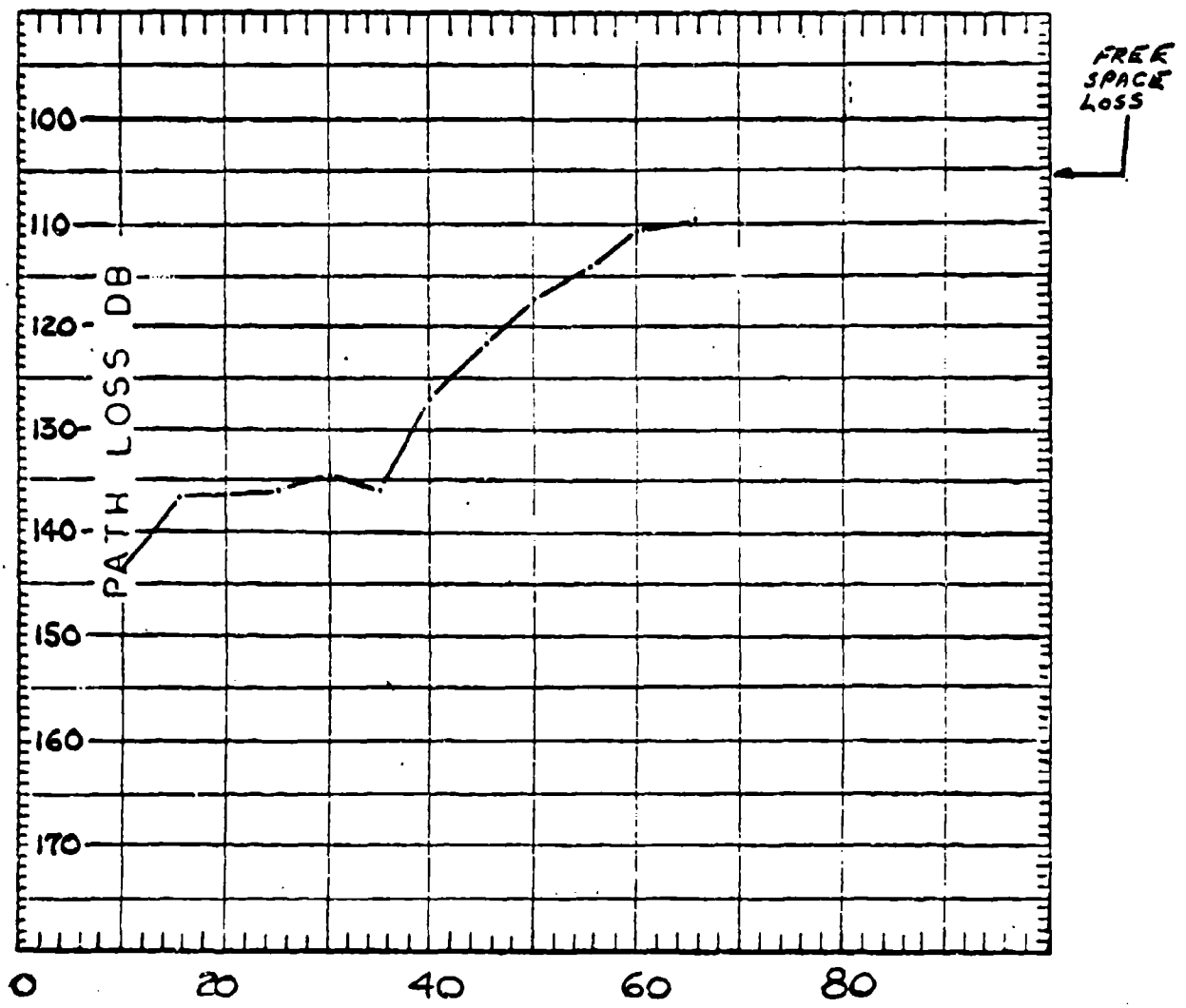
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{02_{08.03}}$	RCVD. PWR. (dBM) TEST $72_{02_{08.04}}$	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{02_{08.03}}$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{02_{08.04}}$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	95.7	91.3		135.7	131.3		134	4	
15	96.3	89.8		136.3	129.8		133	4	
20	94.8	93.5		134.8	133.5		133	4	
25	91.6	92.3		131.6	132.3		134	4	
30	91.4	91.5		131.4	131.5		131	4	
92	91.6	87.3		131.6	127.3		130	2	
30	89.9	91.4		129.9	131.4				
25	94.3	95.9		134.3	135.9				
20	91.3	93.0		131.3	133.0				
15	94.1	93.3		134.1	133.3				
10	92.4	97.0		132.4	137.0				
									POS. PEAK AVERAGING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 8 FEBRUARY 72 TEST RUN S/N: 720208-06,07,08

PATH: WAYSIDE SITE No. 19B TO ECOM LEXINGTON

OPER. FREQ.: 154 MHz



TEST DATA SHEET

DATE: 8 FEBRUARY 72

OPER. FREQ. 1745 MHZ REC. SITE ANT. HT. _____ FT. START: 1405 H

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 198	44 dBM	PEL HORN	14.4	5.7
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ ANT. GAINS 14.7
- CABLE LOSSES 6.9
= ESP = √1.8 USE √2

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720208-06	TEST 720208-07	TEST 720208-08	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720208-06	720208-07	720208-08	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	93	89	91	145	141	143	143.3	4	TRACKING TESTS
15	87	83	87	139	135	139	136.8	4	WITH ANT. IN BRUNES
20	87	85	82	139	137	134	136.8	4	TOWER
25	82	79	77	134	131	129	131.0	4	
30	79	78	76	131	130	128	129.8	4	
35	79	79	79	129	131	131	131.0	4	
40	76	74	74	128	126	126	127.0	4	
45	70	70	69	122	122	121	121.8	4	
50	65	—	65	117	—	117	117.3	3	
55	62	63	64	114	115	116	114.0	4	CABLE PROBLEMS RUN 720208-08
60	59	59	59	111	111	111	110.8	4	
65	57	58	58	109	110	110	109.7	3	
60	58			110					
55	63			115					
50	66			118					
45	70			122					
40	76			128					
35	79			131					
30	78			130					MEAN READING OF STRIP CHART RECORDING
25	78			130					

TEST DATA SHEET

DATE: 8 FEBRUARY 74

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: 1425 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE NB	44dBM	PYL HORN	14.4	.7	XMTR. PWR. 41.3
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		.7 + 1.2 6.9 dB				=ESP = 51.8 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

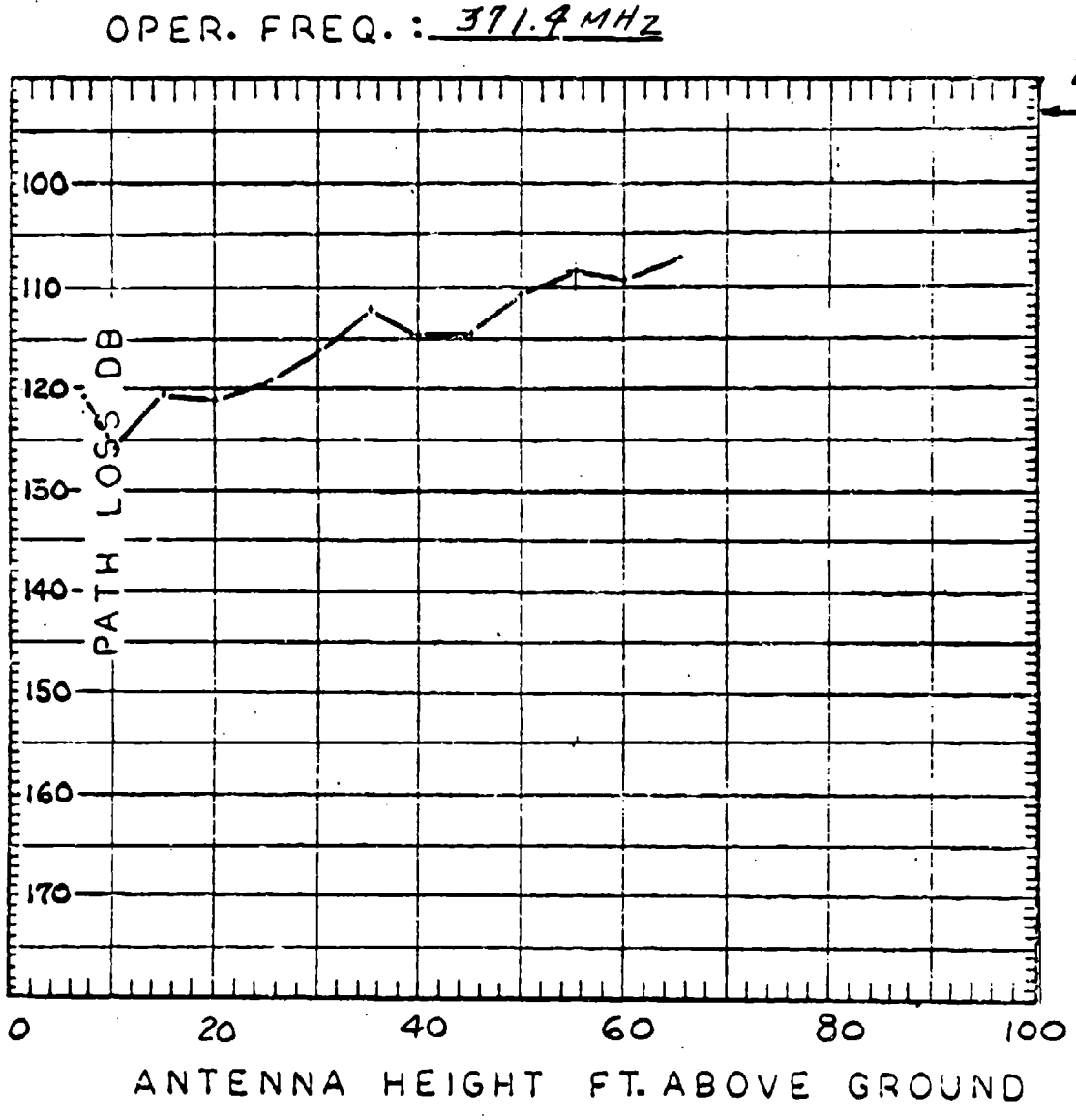
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720208-06	TEST 720208-07	TEST 720208-08	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720208-06	720208-07	720208-08	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
20	83			135					
15	82			134					
10	92			144					
9'7"	92			144					
									END 720208-06 – 1450
									START 720208-07 – 1455
									END 720208-07 – 1500
									START 720208-08 – 1507
									END 720208-08 – 1515
									MEAN READING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 9 FEBRUARY 72 TEST RUN S/N: 720209-07-08

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 9 FEBRUARY 72

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1538 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44dBM	AT-197	2.0	2.3	XMTR. PWR. 44.0
RECEIVER	ECOM HEX.		AT-197	2.0	2.3	+ANT. GAINS 4.0
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				=ESP = 43.4 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

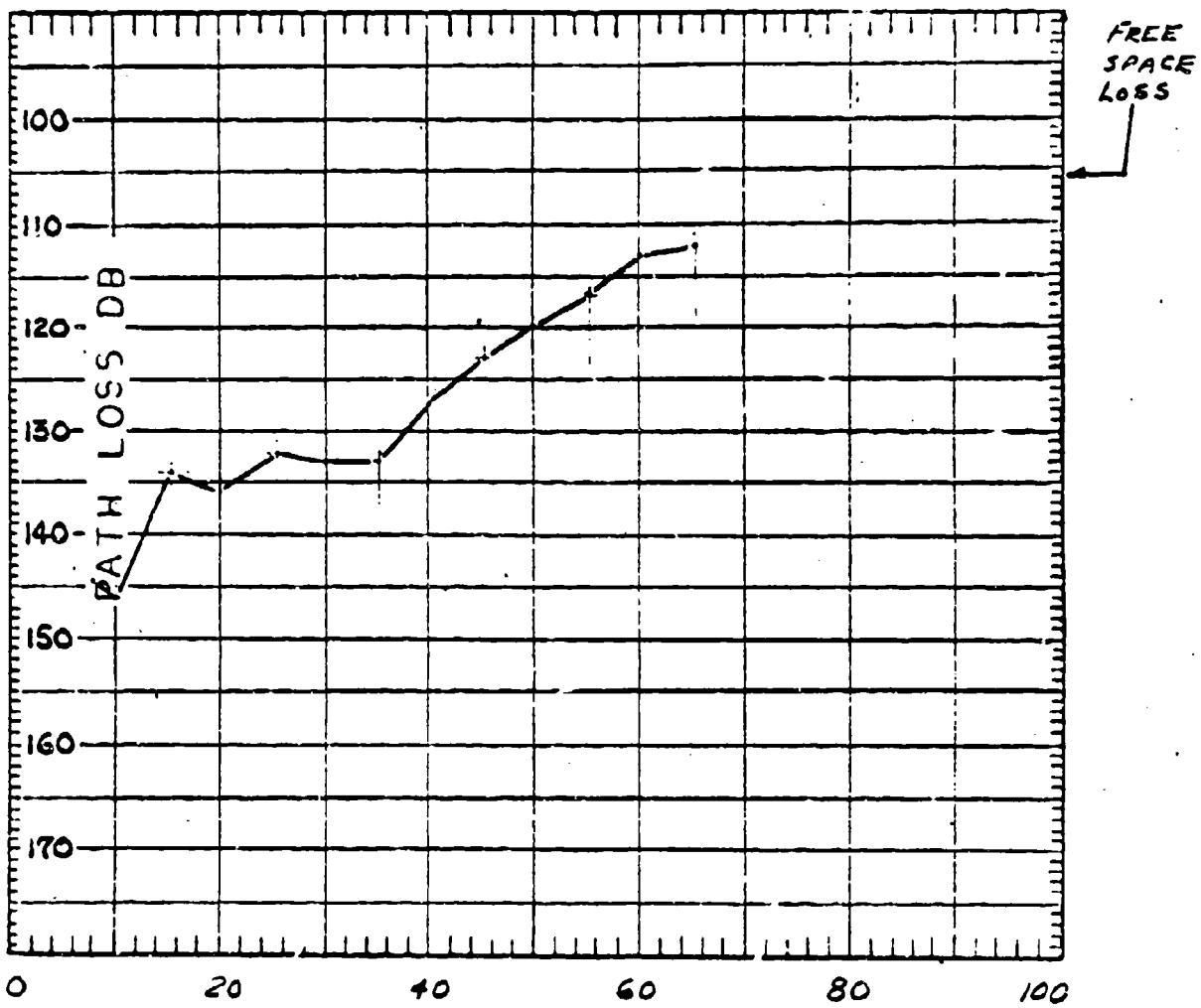
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720209-07	TEST 720209-08	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720209-07	720209-08		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
10	82	83		125	126		125.5	2	
15	77	78		120	121		120.5	2	
20	78	78		121	121		121.0	2	
25	76	76		119	119		119.0	2	
30	74	72		117	115		116.0	2	
35	69	69		112	112		112.0	2	
40	73	70		116	113		114.5	2	
45	75	68		118	111		114.5	2	
50	68	67		111	110		110.5	2	
55	66	65		109	108		108.5	2	
60	67	66		110	109		109.5	2	
65	65	64		108	107		107.5	2	END 720209-07 - 1545
									START 720209-08 - 1550
									END 720209-08 - 1555
7	-	78		-	121		121	1	

PROPAGATION PATH LOSS

DATE: 9 FEBRUARY 72 TEST RUN S/N: 720209-01-02

PATH: WAYSIDE SITE No. 19B TO ECOM HEXAGON

OPER. FREQ.: 154 MHz



TEST DATA SHEET

DATE: 9 FEBRUARY 7[illegible]

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: 1325 [illegible]

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19B	44 dBM	RFL HORN	14.4	√.7
RECEIVER	ECOM H/EX.		ANDREW BICONICAL	0.3	1.2

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ ANT. GAINS 14.7
- CABLE LOSSES 6.9
= ESP = √1.8 USE -2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

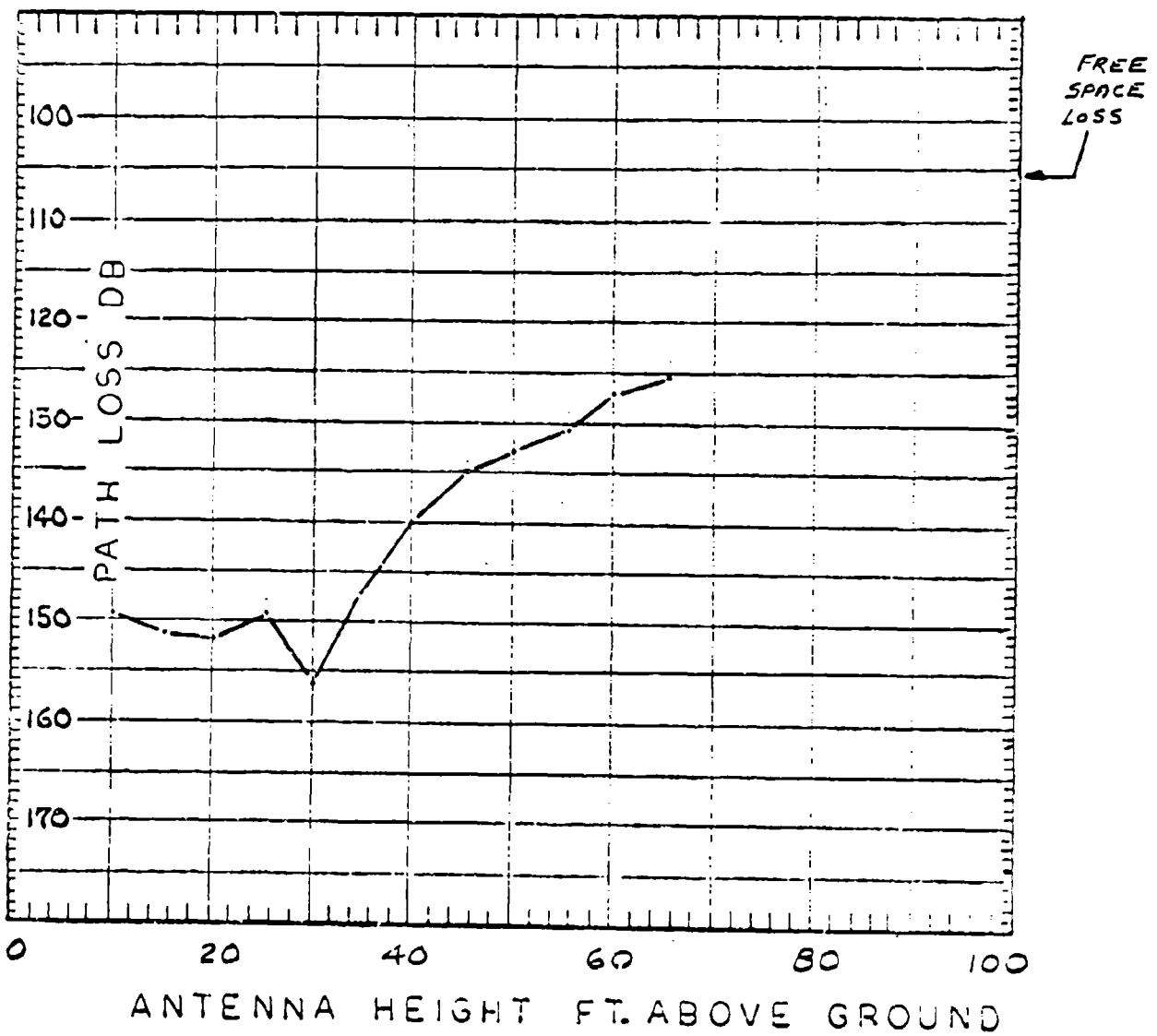
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720209-01	TEST 720209-02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720209-01	720209-02	AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
8	97	88		149	140	144.5	2	
10	96	92		148	144	146.0	2	
15	82	82		134	134	134.0	2	
20	85	83		137	135	136.0	2	
25	80	80		132	132	132.0	2	
30	81	81		133	133	133.0	2	
35	81	81		133	133	133.0	2	
40	76	75		128	127	127.5	2	
45	72	70		124	122	123.0	2	
50	68	68		120	120	120.0	2	
55	65	65		117	117	117.0	2	
60	—	62		—	114	114.0	1	END 720209-01 — 13[illegible]
65	—	60		—	112	112.0	1	START 720209-02 — 1350
								END 720209-02 — 1400
								MEAN READING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 9 FEBRUARY 72 TEST RUN S/N: 720201-03, 04, & 05

PATH: WAYSIDE SITE No 19E TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 9 FEBRUARY 72

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: 1420 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19B	44 dBM	AEL HORN	14.4	√.7
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 14.7
-CABLE LOSSES 6.9
=ESP = √1.8 USE √2

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720209-03	TEST 720209-04	TEST 720209-05	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720209-03	720209-04	720209-05	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	98	97	97	150	149	149	149.3	3	ANTENNA HORIZONTALLY
15	102	98	99	154	150	151	151.7	3	POLARIZED
20	101	102	97	153	154	149	152.0	3	
25	97	98	97	149	150	149	149.3	3	
30	107	105	102	159	157	154	156.7	3	
35	97	93	95	149	145	147	147.0	3	
40	88	88	88	140	140	140	140.0	3	
45	84	82	83	136	134	135	135.0	3	
50	82	81	80	134	133	132	133.0	3	
55	79	78	78	131	130	130	130.3	3	
60	77	74	74	129	126	126	127.0	3	
65	74	73	73	127	125	125	125.2	6	
65	72	—	—	124	-	-			ADDED 20dB ATTENUATION FOR 720209-03 CHK. @ 65'
65	72	—	—	124	-	-			
65	73	—	—	125	-	-			

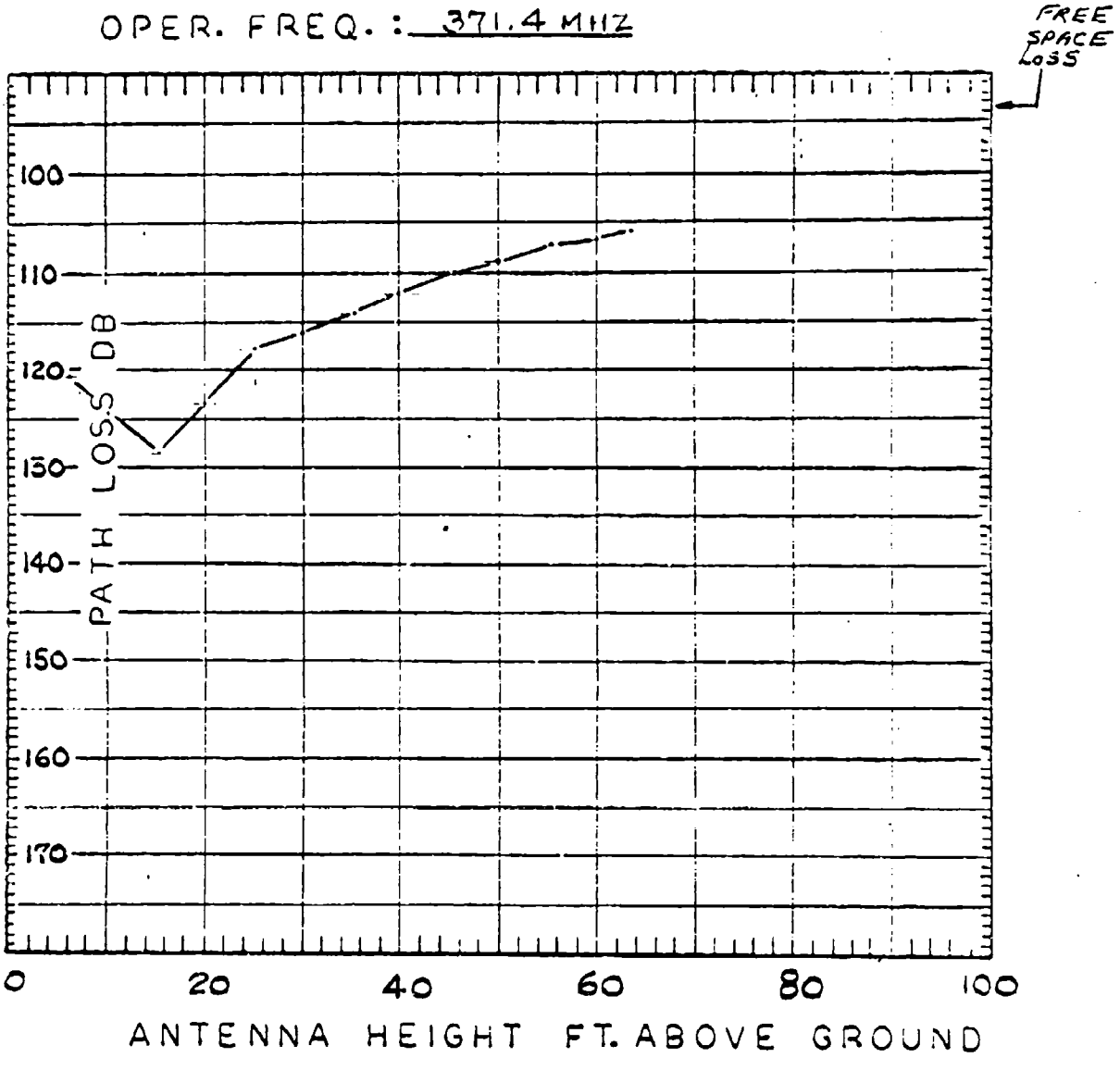
END 720209-03 - ?
START 720209-04 - 1435
END 720209-04 - 1441
START 720209-05 - 1447
END 720209-05 - 1451

PROPAGATION PATH LOSS

DATE: 14 FEBRUARY 72 TEST RUN S/N: 72021-01,02,03

PATH: WAYSIDE SITE NO. 19H TO ECOM HEXAGON 1

OPER. FREQ.: 371.4 MHZ



TEST DATA SHEET

DATE: 14 FEBRUARY 972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1104

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 193	44 dBM	T29	8.0	2.3
RECEIVER	ECOM 1/2 WAVE		AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 8.0 + 2.0 = 10.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ANT. GAINS 10.0
-CABLE LOSSES 4.6
=ESP = 49.4 USE 49

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

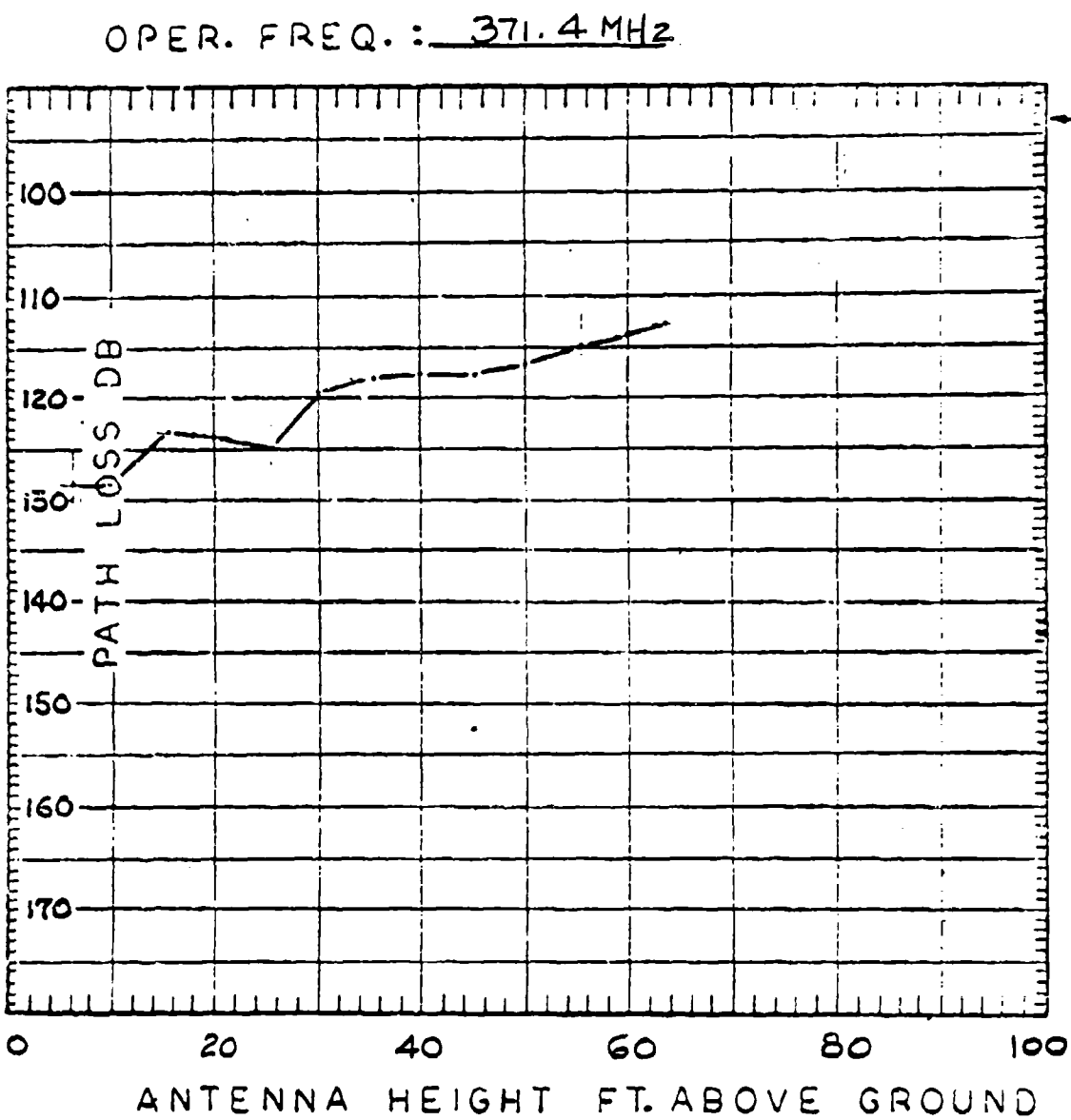
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720214-01	TEST 720214-02	TEST 720214-03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720214-01	720214-02	720214-03	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	72	71	72	121	120	121	120.7	3	TRANSMITTING ANTENNA
10	75	76	76	124	125	125	124.7	3	VERTICALLY
15	79	80	79	128	129	128	128.3	3	POLARIZED
20	74	77	73	123	126	122	123.7	3	
25	70	69	68	119	118	117	118.0	3	
30	68	67	67	117	116	116	116.3	3	
35	65	66	64	114	115	113	114.0	3	
40	63	-	63	112	-	112	112.0	2	
45	61	-	61	110	-	110	110.0	2	
50	60	-	60	109	-	109	109.0	2	
55	59	-	58	108	-	107	107.5	2	
60	58	-	58	107	-	107	107.0	2	
63	57	-	57	106	-	106	106.0	2	END 720214.01 → 1110
									START 720214.02 → 1119
									END 720214.02 → ?
									START 720214.03 → 1127
									END 720214.03 → 1132

PROPAGATION PATH LOSS

DATE: 14 FEBRUARY 72 TEST RUN S/N: 720214-0405

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 14 FEBRUARY 1972

OPER. FREQ. 371.4 REC. SITE ANT. HT. _____ FT. START: 1145 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19B	44 dBM	T-29	8.0	2.3
RECEIVER	ECOM HEXAGON		AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 8.0 + 2.0 = 10.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ANT. GAINS 10.0
-CABLE LOSSES 4.6
=ESP = 49.4 USE 49

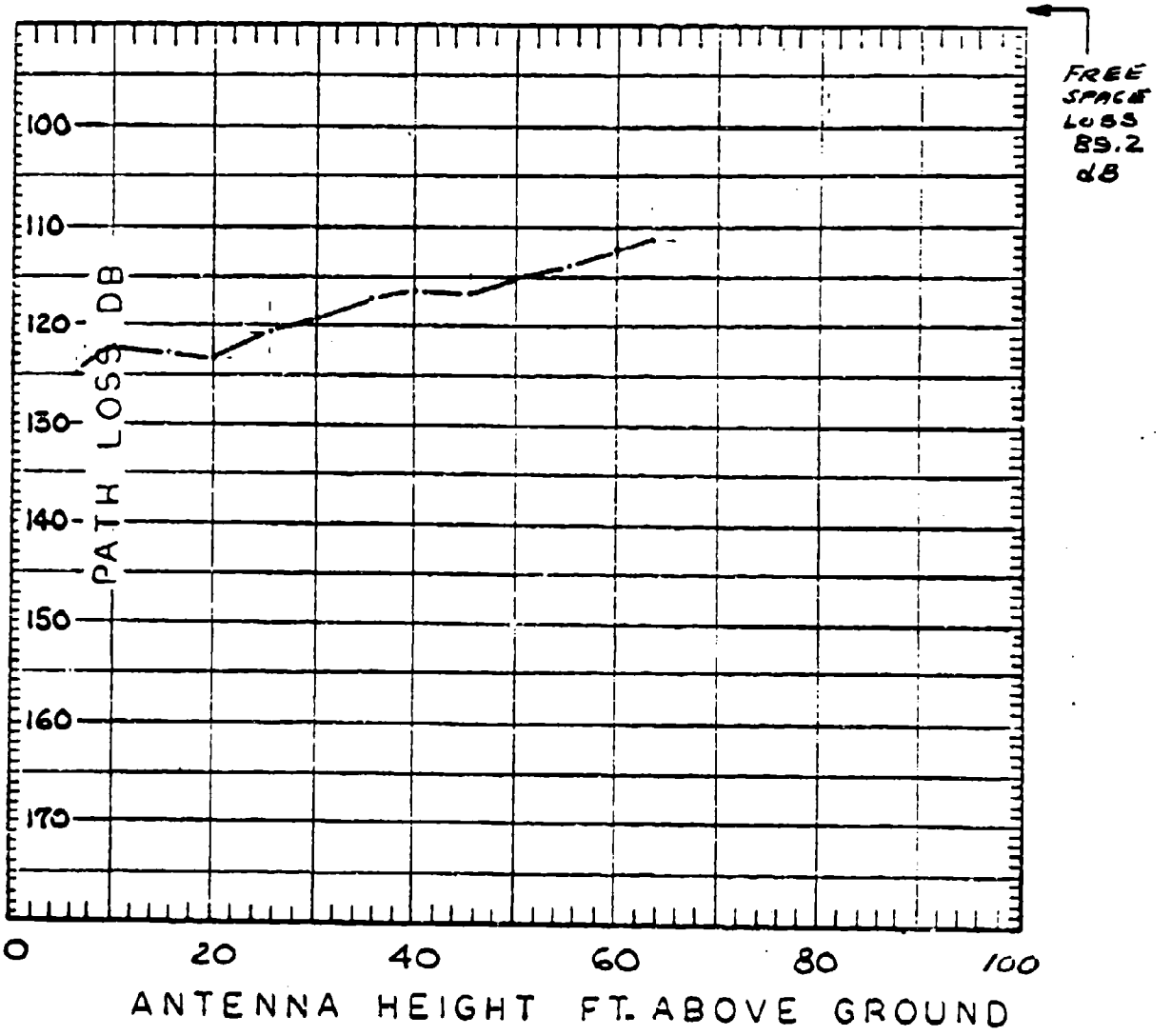
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720214-04	TEST 720214-05	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720214-04	720214-05		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	80	79		129	128		128.5	2	TRANSMITTING
10	80	79		129	128		128.5	2	ANTENNA HORIZONTALLY
15	74	75		123	124		123.5	2	POLARIZED
20	71	76		123	125		124.0	2	
25	75	77		124	126		125.0	2	
30	70	71		119	120		119.5	2	
35	69	70		118	119		118.5	2	
40	69	69		118	118		118.0	2	
45	68	70		117	119		118.0	2	
50	67	69		116	118		117.0	2	
55	65	67		114	116		115.0	2	
60	65	65		114	114		114.0	2	
63	64	65		113	114		113.5	2	END 720214-04 — 1150
									START 720214-05 — 1152
									END 720214-05 — 1158

PROPAGATION PATH LOSS

DATE: 14 FEBRUARY 72 TEST RUN S/N: 720214-08&09

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



TEST DATA SHEET

DATE: 14 FEB 72

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: 1350 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 198	44 dBM	T-29	8.0	1.8
RECEIVER	ECOM/HEXAGON		FIT-197	1.2	1.8

TOTAL ANT. GAIN (XMTR + REC.) 8.0 + 1.2 = 9.2 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.
+ANT. GAINS 9.2
-CABLE LOSSES 3.6
=ESP = 49.6 USE √6

RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

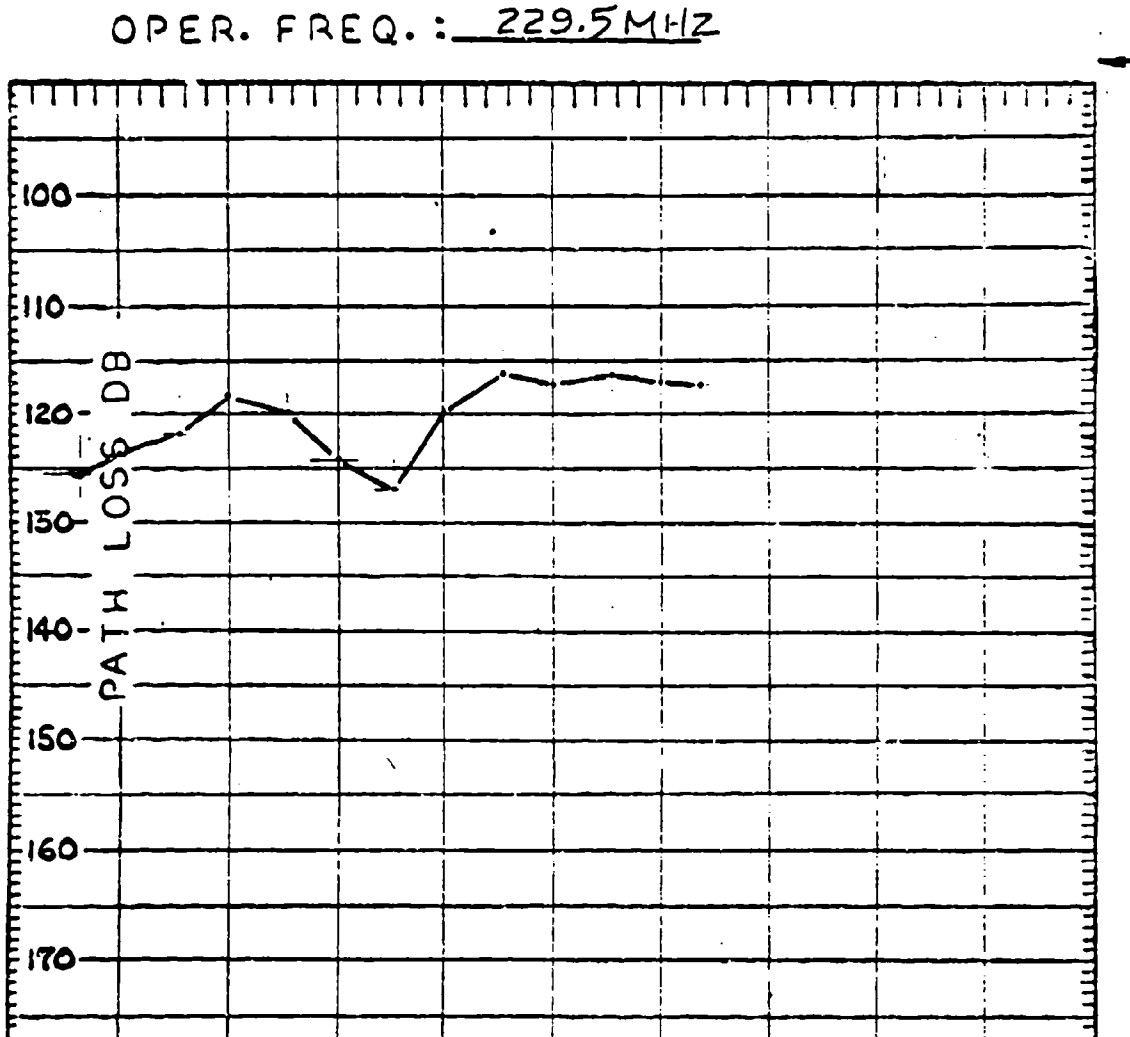
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720214.08	TEST 720214.09	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720214-08	720214.09		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	75	75		125	125		125.0	2	TRANSMITTING ANT-
10	72	73		122	123		122.5	2	ENNA VERTICALLY
15	73	73		123	123		123.0	2	POLARIZED
20	74	73		124	123		123.5	2	
25	70	71		120	121		120.5	2	
30	69	70		119	120		119.5	2	
35	68	67		118	117		117.5	2	
40	66	67		116	117		116.5	2	
45	67	67		117	117		117.0	2	
50	64	66		114	116		115.0	2	
55	63	65		113	115		114.0	2	
60	62	63		112	113		112.5	2	
68	61	62		111	112		111.5	2	END 720214-08 — 1354
									START 720214-09 — 1400
									END 720214-09 — 1406

PROPAGATION PATH LOSS

DATE : 14 FEBRUARY 72 TEST RUN S/N: 720214-06/07

PATH : WAYSIDE SITE No. 19B TO ECOM HEXAGON

OPER. FREQ. : 229.5 MHZ



TEST DATA SHEET

DATE: 14 FEBRUARY 1972

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: 1327 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19B	44 dBM	T-29	8.0	1.8
RECEIVER	Ecom HEXAGON		AT-197	1.2	1.8

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ANT. GAINS 9.2
-CABLE LOSSES 3.6
=ESP = 49.6 USE √0

TOTAL ANT. GAIN (XMTR + REC.) 8.0 + 1.2 = 9.2 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

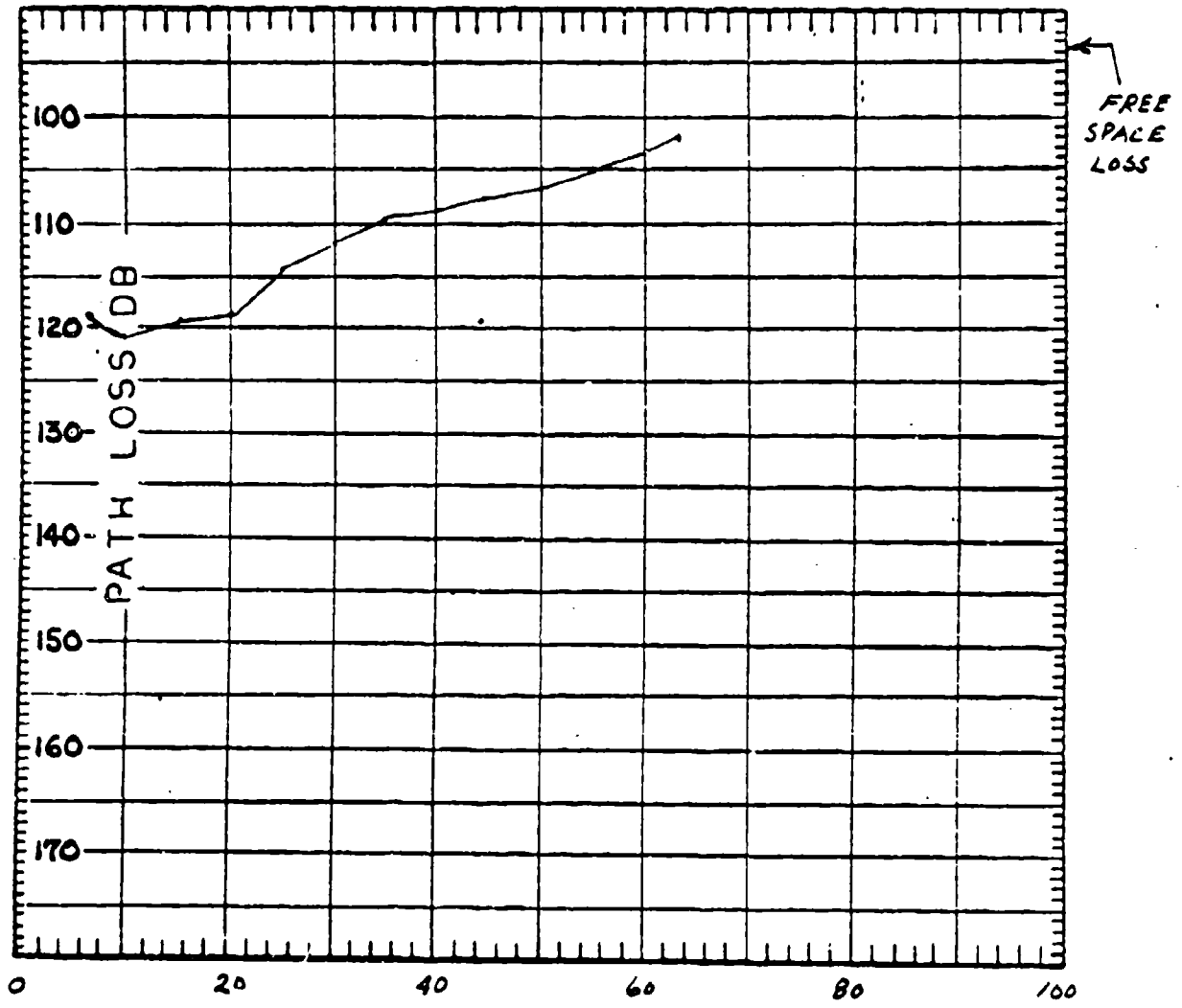
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720214-06	TEST 720214-07	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720214-06	720214-07		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	75	76		125	126		125.5	2	TRANSMITTING ANTENNA
10	74	74		124	124		124.0	2	HORIZONTALLY POLARIZED
15	72	72		122	122		122.0	2	
20	67	70		117	120		118.5	2	
25	70	70		120	120		120.0	2	
30	74	75		124	125		124.5	2	
35	77	77		127	127		127.0	2	
40	70	70		120	120		120.0	2	
45	67	66		117	116		116.5	2	
50	67	68		117	118		117.5	2	
55	66	67		116	117		116.5	2	
60	67	67		117	117		117.0	2	
63	67	68		117	118		117.5	2	END 720214-06 - 1332
									START 720214-07 - 1338
									END 720214-07 - 1344

PROPAGATION PATH LOSS

DATE: 16 FEBRUARY 72 TEST RUN S/N: 720216-01 & -02

PATH: WAYSIDE SITE NO. 198 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 16 FEBRUARY 1972

OPER. FREQ. 371.4 MHz REC. SITE ANT. HT. _____ FT. START: 0940 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 198	44 dBM	EMCO 3101	6.10	2.3
RECEIVER	ECOM HEXAGON		AT-197	2.00	2.3

TOTAL ANT. GAIN (XMTR + REC.) 6.10 + 2.00 = 8.10 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 9.60 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR.	44.00
+ANT. GAINS	8.10
-CABLE LOSSES	4.60
=ESP = 47.5 USE	48

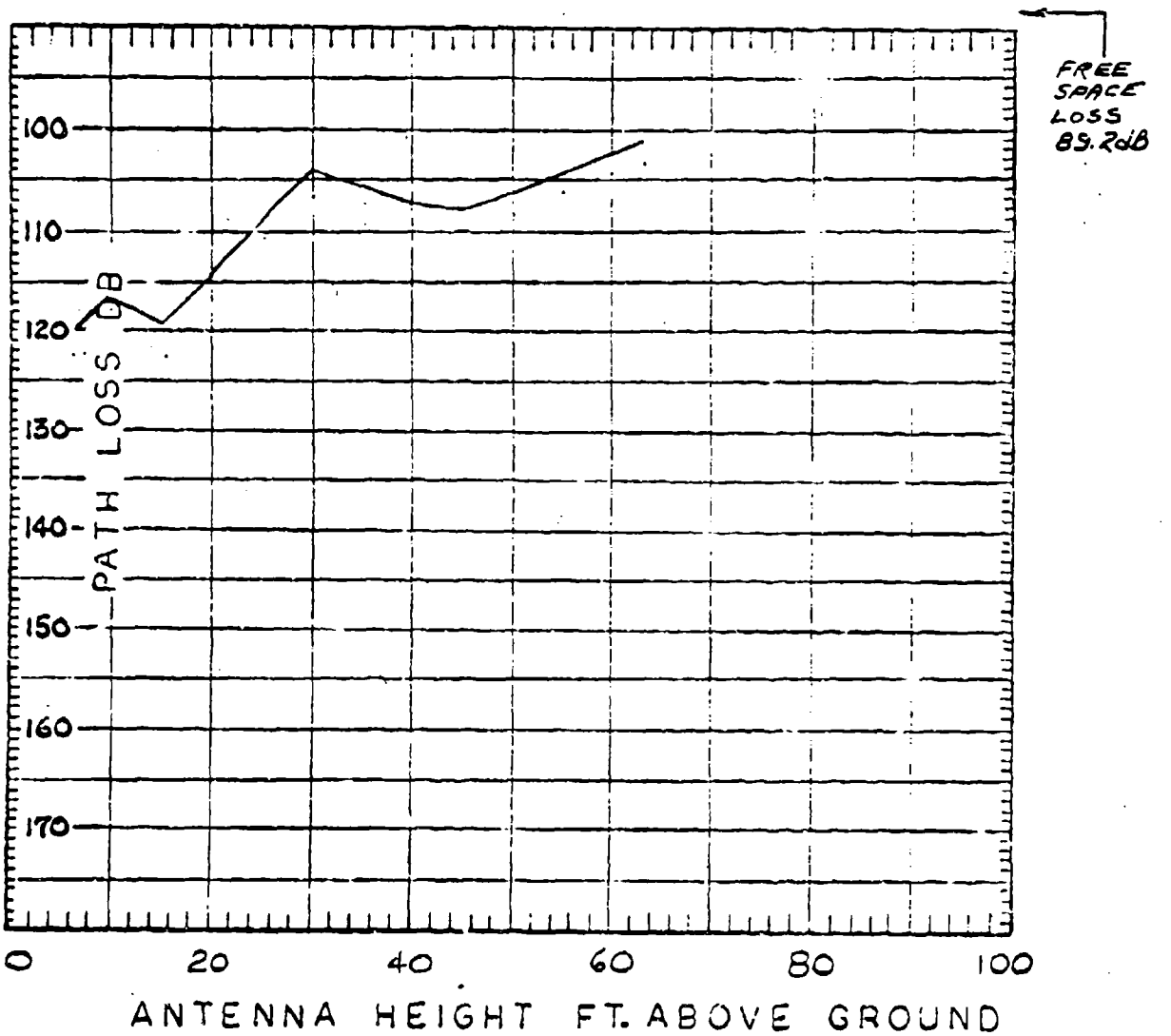
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720216-01	TEST 720216-02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720216-01	720216-02		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	71	70		119	118		118.5	2	
10	74	73		122	121		121.6	2	
15	70	72		118	120		119.0	2	
20	69	71		117	119		118.0	2	
25	66	67		114	115		114.5	2	
30	64	64		112	112		112.0	2	
35	61	62		109	110		109.5	2	
40	60	61		108	109		108.5	2	
45	59	60		107	108		107.5	2	
50	58	58		106	106		106.5	2	
55	57	57		105	105		105.0	2	
60	55	55		103	103		103.0	2	
63	54	54		102	102		102.0	2	END 720216-01 - 0943
									START 720216-02 - 0950
									END 720216-02 - 0954

PROPAGATION PATH LOSS

DATE : 16 FEBRUARY 72 TEST RUN S/N: 720216-03,04&05

PATH : WAYSIDE SITE NO 198 TO ECOM HEXAGON

OPER. FREQ. : 229.5 MHz



TEST DATA SHEET

DATE: 16 FEBRUARY 1972

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: 1000 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44 dBM	EMCO 3101	-3.80	1.8	XMTR. PWR. 44.0
RECEIVER	ECOM HEXAGON		AT-197	1.20	1.8	+ANT. GAINS -2.6

TOTAL ANT. GAIN (XMTR + REC.) -3.80 + 1.20 = -2.6 dB -CABLE LOSSES 3.6

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB =ESP = 38

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

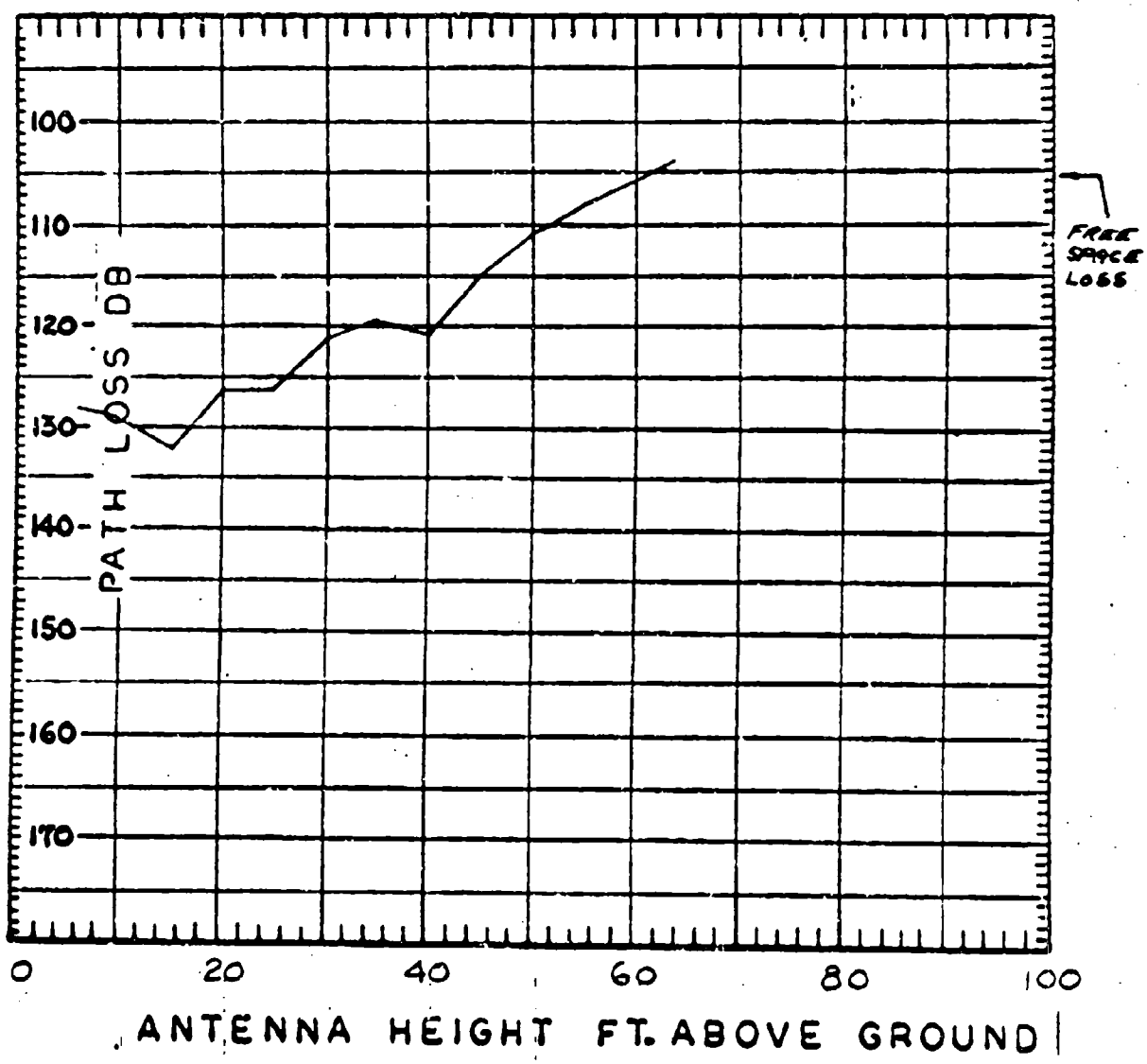
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72o216-03	TEST 72o216-04	TEST 72o216-05	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72o216-03	72o216-04	72o216-05	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
6	81	82	82	119	120	120	119.7	3	
10	77	79	78	115	117	116	116.7	3	
15	80	82	82	118	120	120	119.3	3	
20	75	80	75	113	118	113	114.7	3	
25	70	70	71	108	108	109	108.3	3	
30	67	67	69	105	104	107	104.7	3	
35	67	67	68	105	105	106	105.3	3	
40	70	70	68	108	108	106	107.3	3	
45	69	70	71	107	108	109	108.0	3	
50	67	69	69	105	107	107	106.3	3	
55	66	67	66	104	105	104	104.7	3	
60	63	66	65	101	104	103	102.7	3	
63	62	63	63	100	103	101	101.3	3	END 72o216-03 - 1015 START 72o216-04 - 1020 END 72o216-04 - 1035 START 72o216-05 - 1030 END 72o216-05 - 1035

PROPAGATION PATH LOSS

DATE: 16 FEBRUARY 72 TEST RUN S/N: 720216.06, 07 & 08

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 16 FEB. 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1125 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 198	44dBm	EMCO 3103	-0.4	5.7
RECEIVER	ECOM HEX.	[illegible]	[illegible]	+0.3	1.2

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS -0.1
-CABLE LOSSES 6.9
=ESP = 37.0

TOTAL ANT. GAIN (XMTR + REC.) -0.4 + 0.3 = -0.1 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

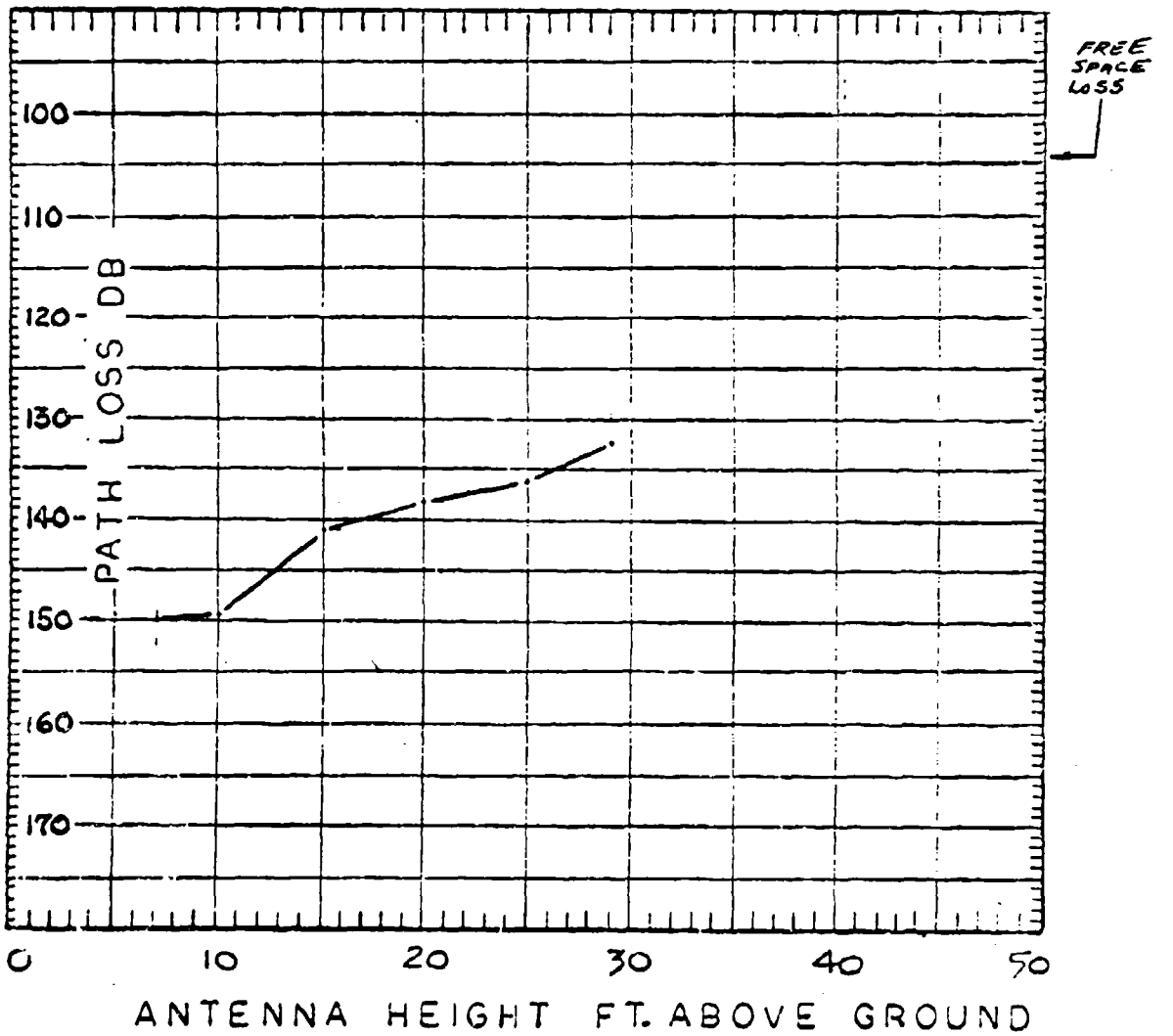
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720216.06	TEST 720216.07	TEST 720216.08	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720216.06	720216.07	720216.08	AVG. PATH. LOSS (dB)	NO. OF SAMR	REMARKS
6	90	92	91	127	129	128	128.0	3	
10	93	93	90	130	130	127	129.0	3	
15	97	97	92	134	134	129	132.3	3	
20	87	90	90	124	127	127	126.0	3	
25	92	87	88	129	124	125	126.0	3	
30	83	85	84	120	122	121	121.0	3	
35	82	83	82	119	120	119	119.3	3	
40	85	83	83	122	120	120	120.7	3	
45	80	76	78	117	113	115	115.0	3	
50	75	74	73	112	111	110	111.0	3	
55	73	70	71	110	107	108	108.3	3	
60	70	67	69	107	106	106	106.3	3	
63	68	67	67	105	104	104	104.3	3	END 720216.06 - 1137
									START 720216.07 - 1137
									END 720216.07 - 1137
									START 720216.08 - 1143
									END 720216.08 - 1147

PROPAGATION PATH LOSS

DATE: 17 FEBRUARY 72 TEST RUN S/N: 720217-02, 03 & 04

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 17 FEBRUARY 1972

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: 1115 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44 dBM	AEL HORN	14.4	5.7
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44.0

+ANT. GAINS 14.7

-CABLE LOSSES 6.9

=ESP = 51.8 USE 52

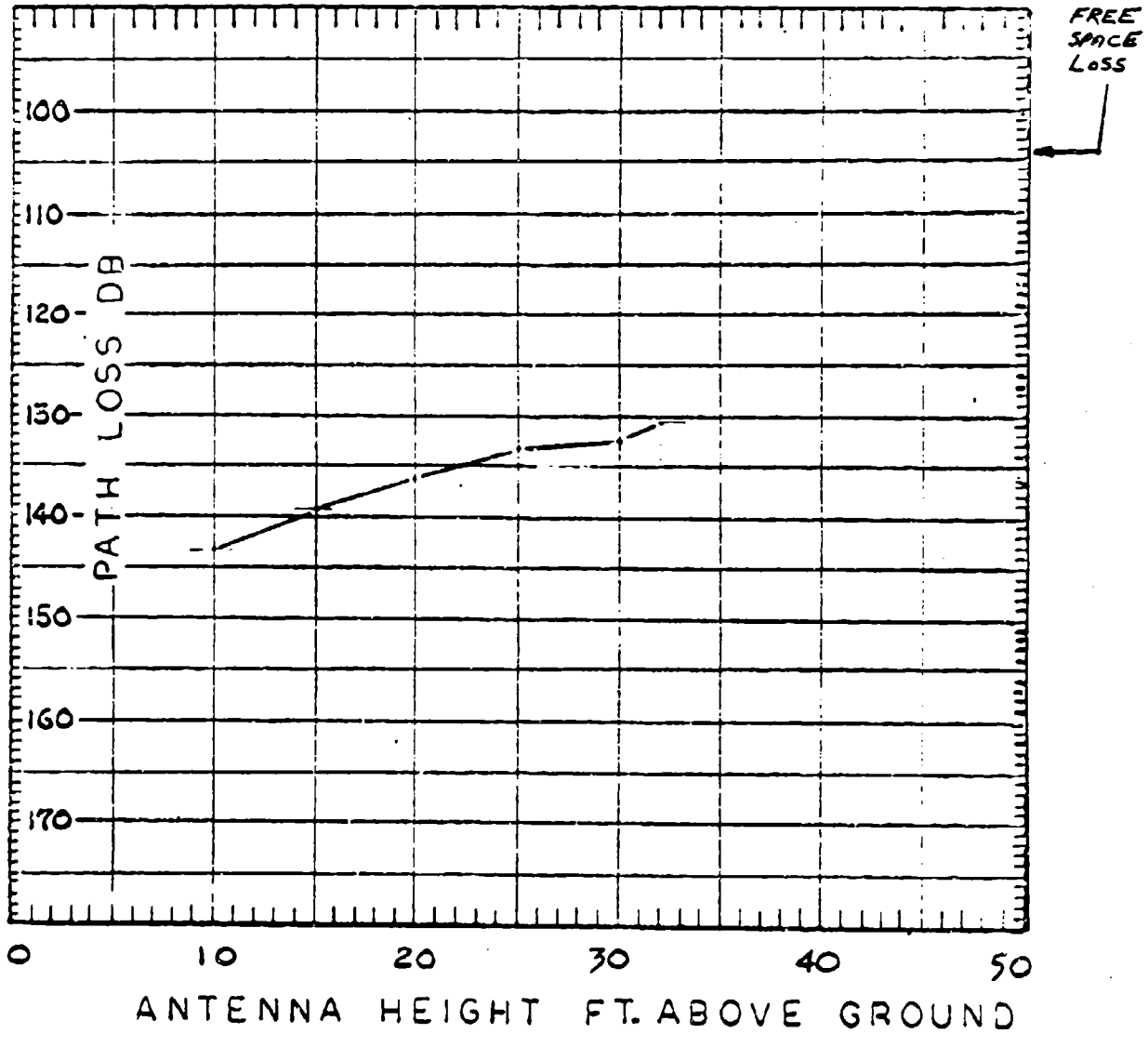
XMTR. ANT. HT ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $T_{720217-02}$	TEST $T_{720217-03}$	TEST $T_{720217-04}$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $T_{720217-02}$	$T_{720217-03}$	$T_{720217-04}$	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
29	81	80	80	133	132	132	132.3	6	RUN 720217-01 DISCARDED
25	84	84	85	136	136	137	136.3	6	
20	88	87	87	140	139	139	138.5	6	
15	92	92	90	142	142	140	141.0	6	
10	98	97	97	150	149	149	149.7	6	
7	97	99	98	149	151	150	150.0	3	
10	93	94	97	145	146	149			
15	85	88	90	140	140	142			
20	84	87	86	136	139	138			
25	83	86	84	135	138	136			
29	80	81	80	132	133	132			END 720217-02 - 1125
									START 720217-03 - 1129
									END 720217-03 - 1137
									START 720217-04 - 1347
									END 720217-01 - 1357

PROPAGATION PATH LOSS

DATE: 17 FEBRUARY 72 TEST RUN S/N: 720217-0506

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 17 FEBRUARY 1972

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1430 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	14 dBM	ANDREW DISCONE	2.5	5.7
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 2.5 + 0.3 = 2.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. -11.0
+ANT. GAINS 2.8
-CABLE LOSSES 6.9
=ESP = 39.7 (35 10

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

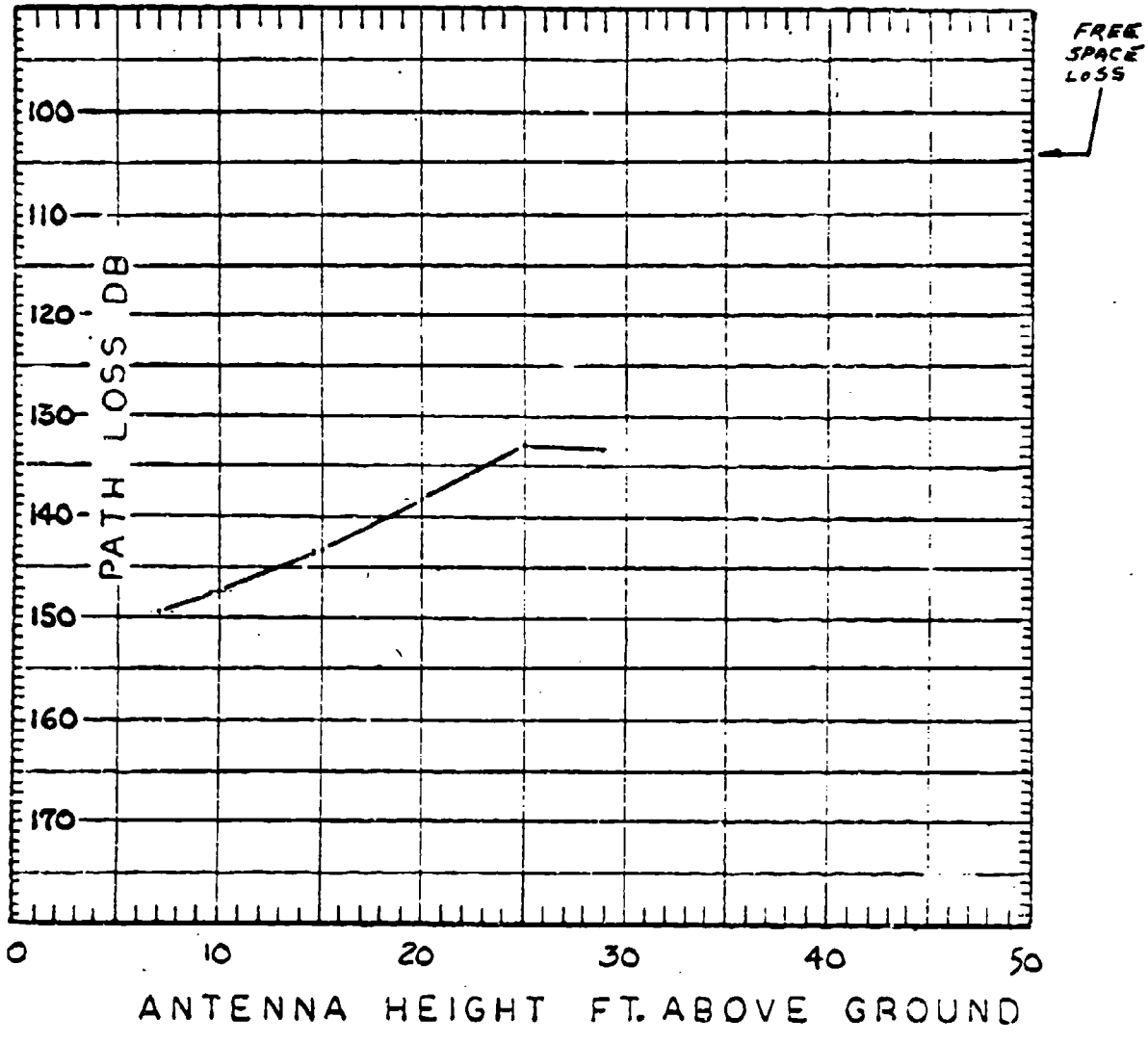
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{02_{17-05}}$	TEST $72_{02_{17-06}}$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{02_{17-05}}$	$72_{02_{17-06}}$		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	103	102		143	142		143.3	4	
15	98	101		138	141		139.3	4	
20	97	97		137	137		136.3	4	
25	94	95		134	135		133.3	4	
30	93	92		133	132		132.8	4	
32	91	90		131	130		130.5	2	
30	93	93		133	133				
25	92	92		132	132				
20	97	95		137	135				
15	100	99		140	139				
10	103	105		143	145				END 720217-05 - 1439
									START 720217-06 - 1444
									END 720217-06 - 1452

PROPAGATION PATH LOSS

DATE : 18 FEBRUARY 72 TEST RUN S/N: 720218-01&02

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ. : 1545 MHz



TEST DATA SHEET

DATE: 18 FEBRUARY 1972

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 0955 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44 dBM	AEL HORN	14.4	5.7
RECEIVER	ECOM HEXAGON		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ANT. GAINS 14.7
-CABLE LOSSES 6.9
=ESP = 51.8 OR 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

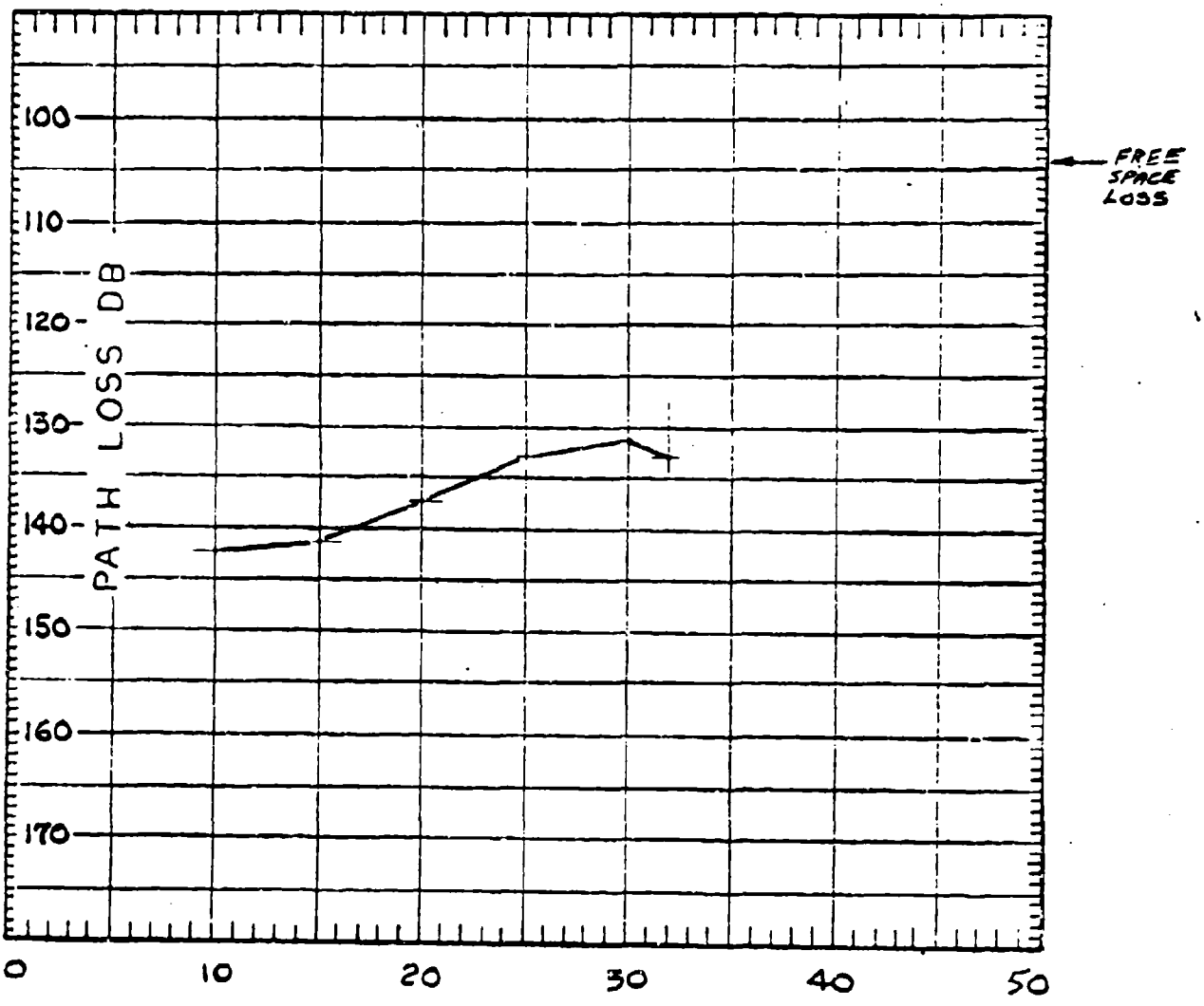
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $T_{20218-01}$	TEST $T_{20218-02}$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $T_{20218-01}$	$T_{20218-02}$		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
7	96	99		148	151		149.8	4	
10	93	98		145	150		147.5	4	
15	89	93		141	145		143.3	4	
20	86	87		138	139		138.5	4	
25	81	81		133	133		133.0	4	
29	81	82		133	134		133.5	4	
25	81	81		133	133				
20	86	87		138	139				
15	91	92		143	144				
10	95	96		147	148				
7	98	98		150	150				END 720218-01 — 1009
									START 720218-02 — 1014
									END 720218-02 — 1022

PROPAGATION PATH LOSS

DATE: 18 FEBRUARY 72 TEST RUN S/N: 720218-03&04

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 18 FEBRUARY 1972

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: 1035 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44dBM	ANDREWS DISCONE	2.5	5.7
RECEIVER	ECOM HEXAGON		ANDREWS BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 2.5 + 0.3 = 2.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44.0
+ANT. GAINS 2.8
-CABLE LOSSES 6.9
=ESP = 34.9 USE 40

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

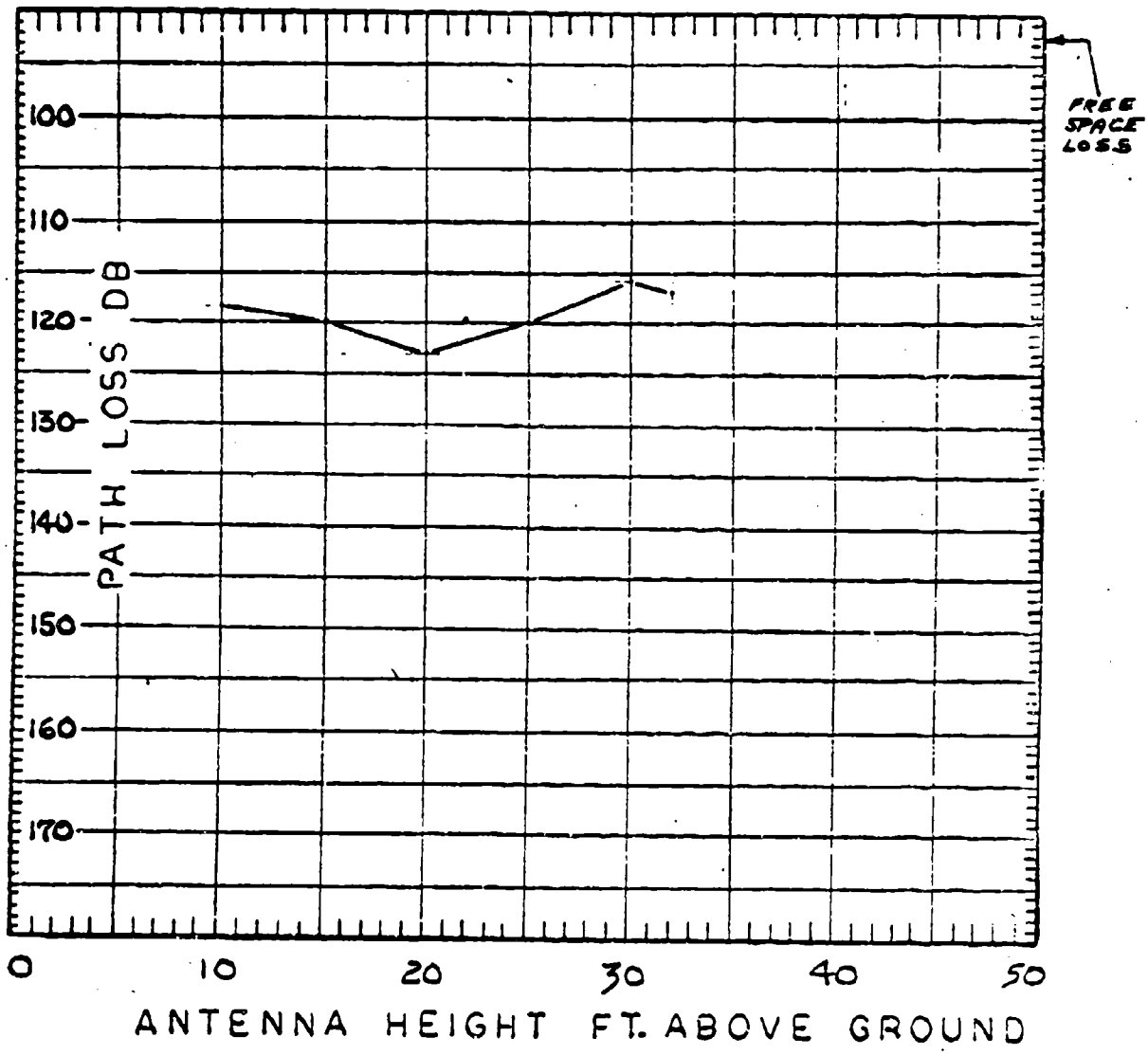
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720218-03	RCVD. PWR. (dBM) TEST 720218-04	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720218-03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720218-04		AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
10	104	102		144	142		142.3	4	
15	102	100		142	140		141.3	4	
20	97	97		137	137		137.5	4	
25	94	93		134	133		133.0	4	
30	93	92		133	132		131.5	4	
32	93	93		133	133		133.0	2	
30	90	90		130	130				
25	92	93		132	133				
20	98	98		138	138				
15	97	106		137	146				
10	100	103		140	143				END 720218-03 — 1043
									START 720218-04 — 1047
									END 720218-04 — 1055

PROPAGATION PATH LOSS

DATE: 18 FEBRUARY 72 TEST RUN S/N: 720218-05606

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 18 FEBRUARY 1972

OPER. FREQ. 371.4 MHz REC. SITE ANT. HT. _____ FT. START: 1129 HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44 dBM	AT-197	2.0	2.3
RECEIVER	ECOM HEXAGON		AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 14.0
+ANT. GAINS 4.0
-CABLE LOSSES 4.6
=ESP = 43.4 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

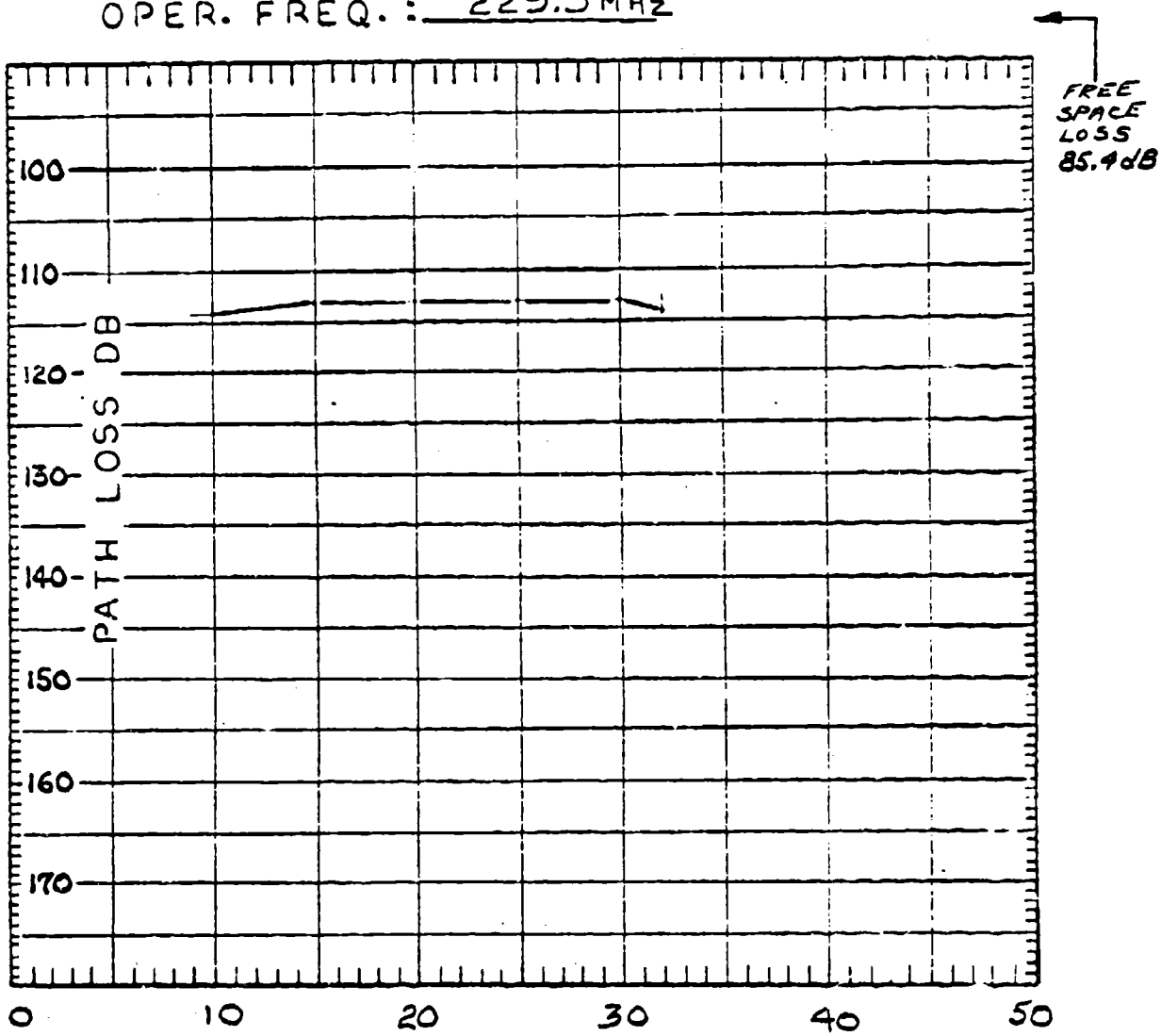
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720218-05	RCVD. PWR. (dBM) TEST 720218-06	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720218-05	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720218-06	AVG. PATH LOSS (dB)	NO. OF SAMP.	REMARKS
10	77	76		120	119	118.5	4	
15	77	78		120	121	120.0	4	
20	80	81		123	124	123.0	4	
25	77	77		120	120	120.0	4	
30	73	73		116	116	115.8	4	
32	75	73		118	116	117.0	2	
30	73	72		116	115			
25	77	77		120	120			
20	79	80		122	123			
15	77	76		120	119			
10	74	75		117	118			END 720218-05 — 1135
								START 720218-06 — 1139
								END 720218-06 — 1146

PROPAGATION PATH LOSS

DATE: 18 FEBRUARY 72 TEST RUN S/N: 720218-07,08&09

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



TEST DATA SHEET

DATE: 18 FEBRUARY 1972

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: 1308 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44 dBM	AT-197	1.2	1.8
RECEIVER	ECOM HEXAGON		AT-197	1.2	1.8

TOTAL ANT. GAIN (XMTR + REC.) 1.2 + 1.2 = 2.4 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44.0

+ANT. GAINS 2.4

-CABLE LOSSES 3.6

=ESP = 42.8 USE 43

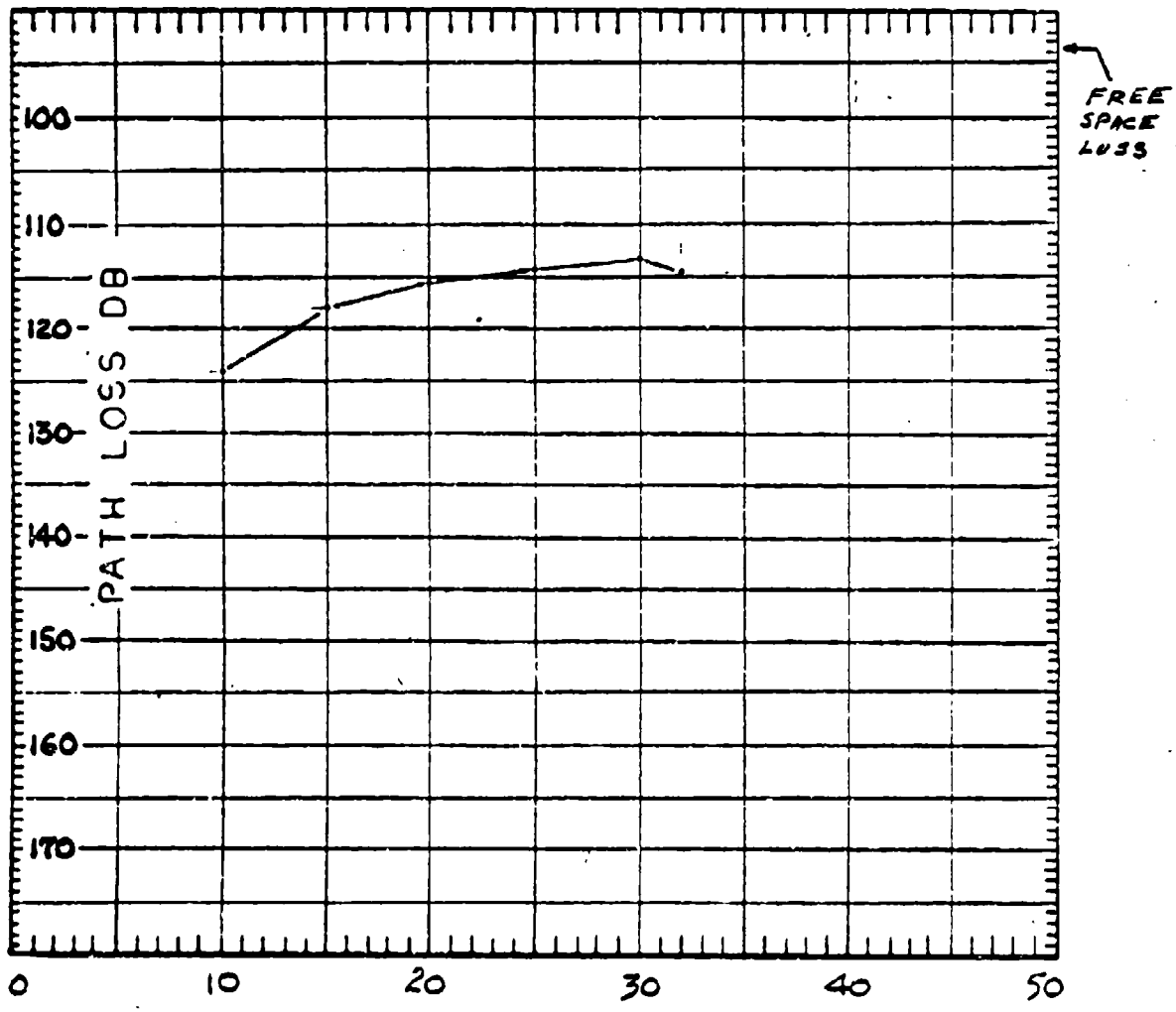
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72021 8-07	TEST 72021 8-08	TEST 72021 8-09	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72021 8-07	72021 8-08	72021 8-09	AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
10	72	70	71	115	113	114	114.0	6	
15	71	70	70	114	113	113	113.1	6	
20	71	70	70	114	113	113	113.1	6	
25	71	70	70	114	113	113	113.1	6	
30	71	70	70	114	113	113	113.1	6	
32	72	71	70	115	114	113	114.0	3	
30	70	70	70	113	113	113			
25	70	70	70	113	113	113			
20	70	70	70	113	113	113			
15	70	70	70	113	113	113			
10	71	71	71	114	114	114			END 720218-07 — 1313
									START 720218-08 — 1320
									END 720218-08 — 1325
									START 720218-09 — ?
									END 720218-09 —

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.01+02

PATH: WAYSIDE SITE NO. 19 TO ECOM HEXAGON

OPER. FREQ.: 371.4MHz



NOTE: AT-197 ANTENNA

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19	44 dBM	AT-197	2.0	2.3
RECEIVER	ECOM H/I Y.	[redacted]	AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44

+ANT. GAINS 4

-CABLE LOSSES 4.6

=ESP = 43.4 USE 42

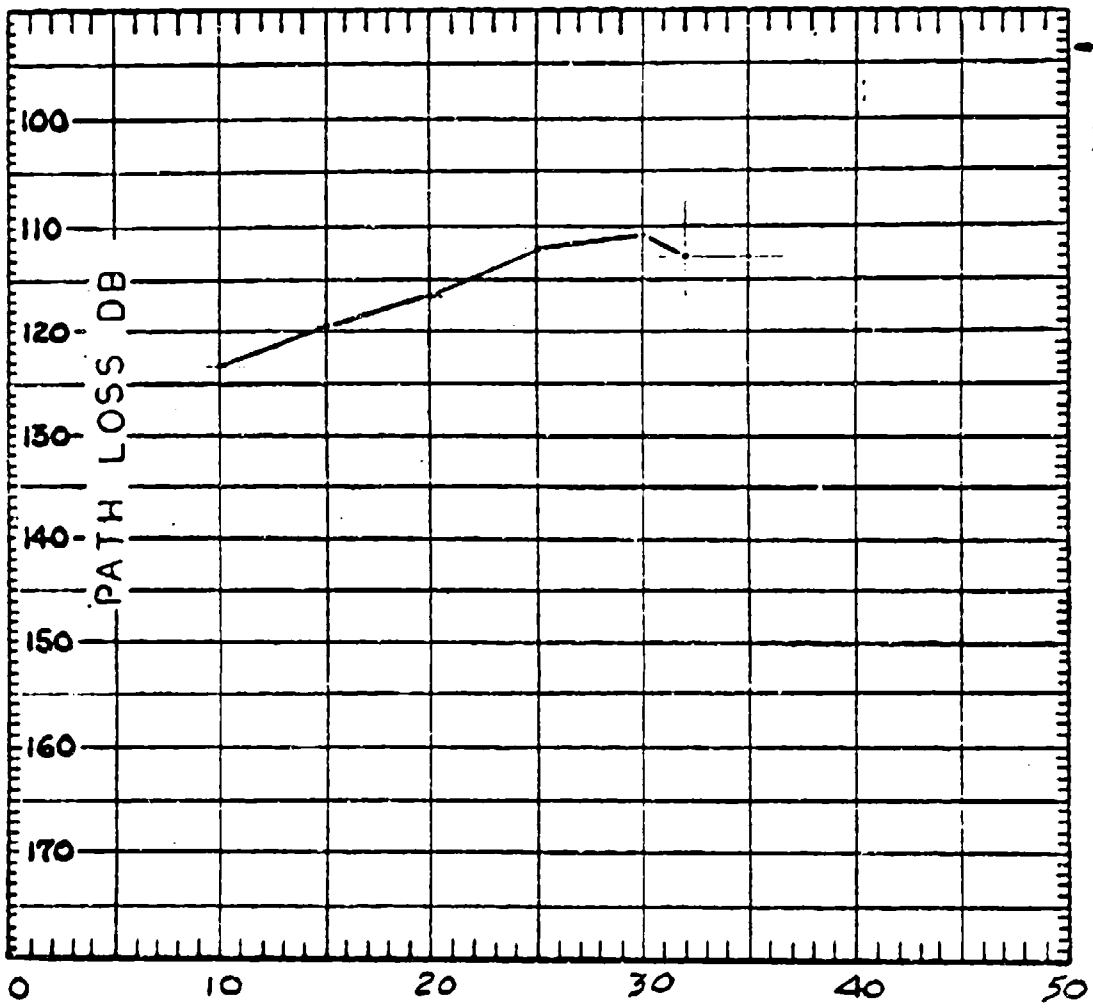
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03}10.01$	TEST $72_{03}10.02$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}10.01$	$72_{03}10.02$		AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
40	81	81		124	124		124.2✓	4	
35	75	75		118	118		118.0	4	
30	74	73		117	116		116.5	4	
25	71	71		114	114		114.3	4	
20	70	69		113	112		113.5✓	4	
17	68	75✓		111	118		114.5✓	2	
30	70	73		113	116				
25	70	73		113	116				
20	73	70		116	113				
15	76	72		119	115				
10	83	80		126	123				

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.03, 04

PATH: WAYSIDE SITE NO. 19 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



NOTE: AT-197 ANTENNA

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19	44dBM	AT-197	2.0	2.3	XMTR. PWR. 44
RECEIVER	ECOM HEX.	[redacted]	AT-197	2.0	2.3	+ANT. GAINS 4
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				=ESP = 43.4 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

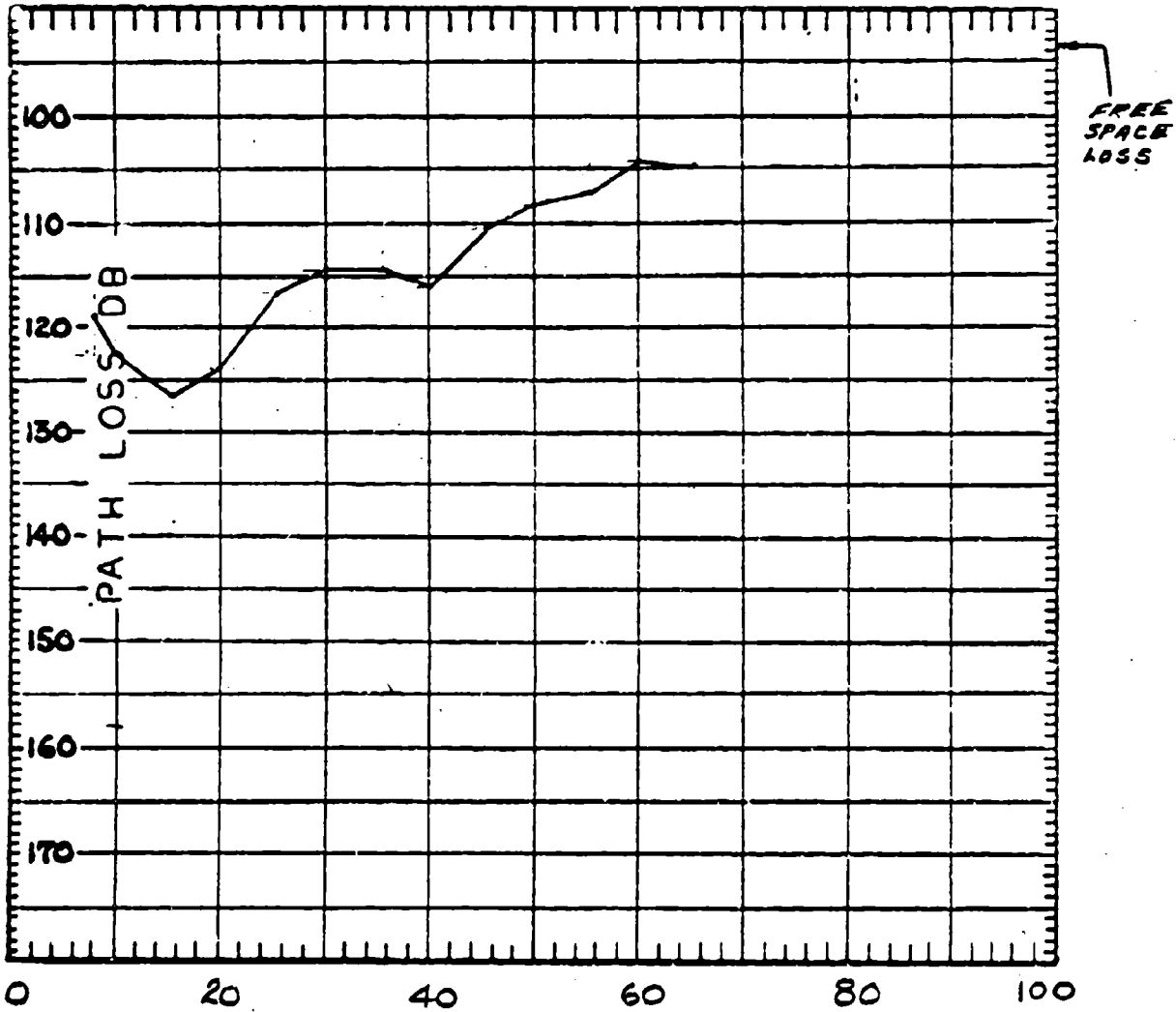
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03_{10.03}}$	RCVD. PWR. (dBM) TEST $72_{03_{10.04}}$	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03_{10.03}}$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03_{10.04}}$		AVG. PATH LOSS (dB)	NO. OF SAMP	REMARKS
10	80	79		123	122		123.5	4	
15	78	76		121	119		119.3	4	
20	75	73		118	116		116.7	4	
25	73	69		116	112		112.0	4	
30	68	68		111	111		111.0	4	
32	69	71		112	114		113.0	2	
30	68	68		111	111				
25	70	70		113	113				
20	74	73		117	116				
15	76	75		119	118				
10	82	81		125	124				

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.0506

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



NOTE: AT-197 ANTENNA

TEST DATA SHEET

DATE: 10 MARCH 1972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: 1120 HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WINDSOR 198	44 dBM	AT-197	2.0	2.3
RECEIVER	ECOM H/E.		AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

EQUIV. SYS. PWR. (ESP)	
XMTR. PWR.	44
+ANT. GAINS	4.0
-CABLE LOSSES	4.6
=ESP = 43.4 USE 43	

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72o3 10.05	TEST 72o3 10.06	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72o3 10.05	72o3 10.06		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
8	78	75		121	118		119.0	4	
10	80	79		123	122		122.75	4	
15	84	83		127	126		126.75	4	
20	81	81		124	124		124.0	4	
25	74	73		117	116		116.5	4	
30	73	72		116	115		114.75	4	
35	72	70		115	113		114.75	4	
40	76	75		119	117		116.0	4	
15	68	69		111	112		110.25	4	
50	66	66		109	109		108.5	4	
55	64	65		107	108		107.75	4	
60	61	62		104	105		104.75	4	
65	62	62		105	105		105.00	2	
60	62	62		105	105				
55	65	65		108	108				
50	65	65		108	108				
45	65	67		108	110				
40	67	74		110	117				
35	75	70		118	113				
30	71	71		114	114				

TEST DATA SHEET

DATE: 10 MARCH 1972

OPER. FREQ. 371.4 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44dBM	AT-197	2.0	2.3	XMTR. PWR. 44
RECEIVER	ECOM HFY.	[redacted]	AT-197	2.0	2.3	+ANT. GAINS 4.0
TOTAL ANT. GAIN (XMTR + REC.)		2.0 + 2.0 = 4.0 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				-ESP = 43.4 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

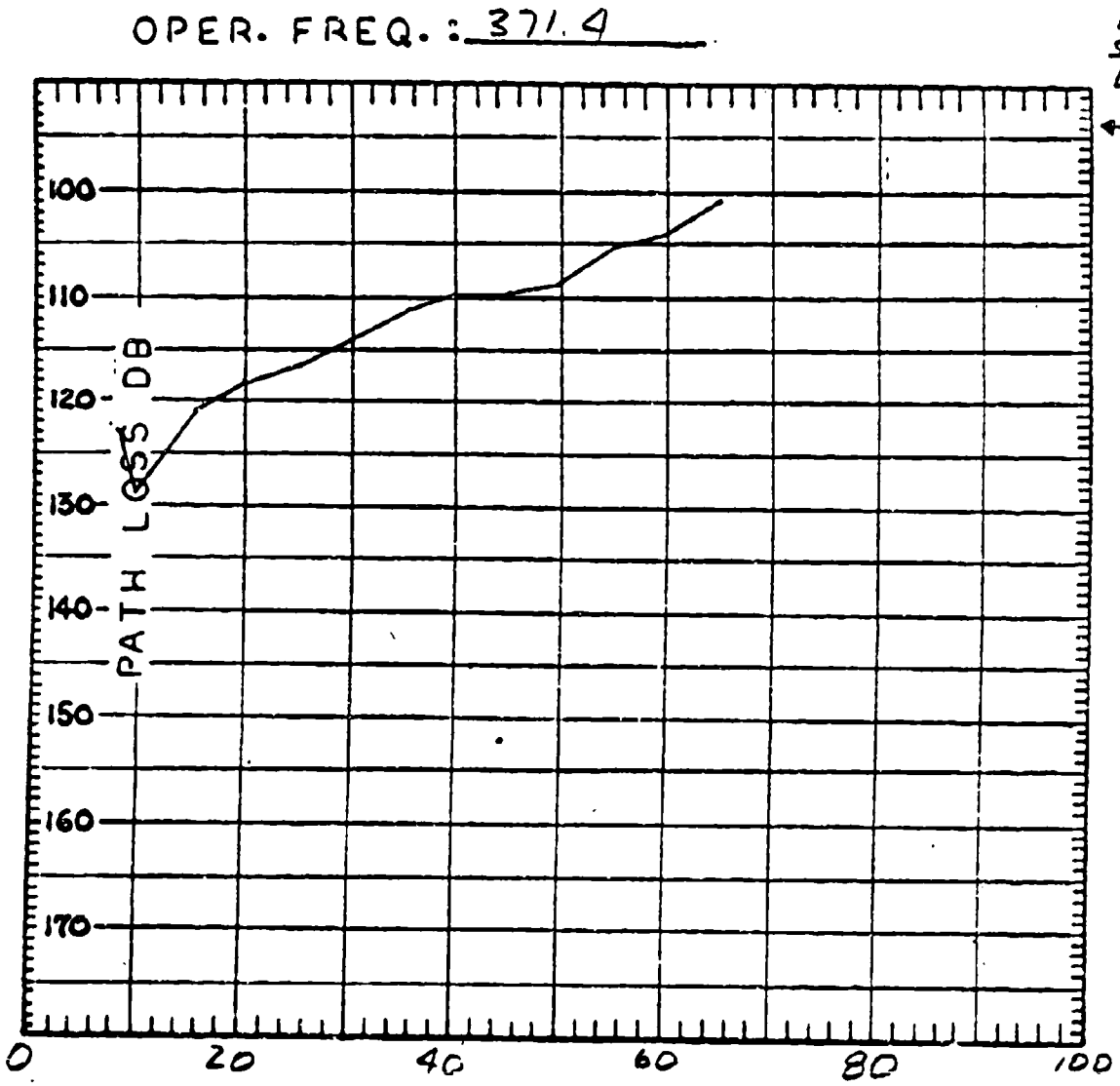
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72v3_{10.05}$	TEST $72o3_{10.06}$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72o3_{10.05}$	$72o3_{10.06}$		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
35	73	74		116	117				
20	80	82		123	125				
15	84	83		127	126				
10	80	80		123	123				
8	75	76		118	119				

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.07108

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 371.4



TEST DATA SHEET — DATE: 10 MARCH 1972

OPER. FREQ. 321.4 MHZ — REC. SITE ANT. HT. _____ FT. — START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE MC	44dBM	Emco 3101	6.1	2.3
RECEIVER	ECOM HEx	[redacted]	AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 6.1 + 2.0 = 8.1 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. — RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44

+ANT. GAINS 8.1

-CABLE LOSSES 4.6

=ESP = 47.5 USE 48

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 720310.07	TEST 720310.08	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 720310.07	720310.08		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	75	76		123	124		123.75	4	
10	81	80		129	128		128.00	4	
15	77	73		125	121		121.75	4	
20	70	72		118	120		118.75	4	
25	68	69		116	117		116.50	4	
30	66	66		119	119		119.00	4	
35	63	63		111	111		111.25	4	
40	62	62		110	110		109.75	4	
45	62	61		110	109		109.75	4	
50	60	60		108	108		108.25	4	
55	59	58		107	106		105.25	4	
60	58	57		106	105		104.25	4	
65	57	56		99	104		101.50	2	
60	58	57		101	105				
55	59	58		102	106				
50	61	60		109	108				
45	62	60		110	108				
40	62	61		110	109				
35	64	63		112	111				
30	66	66		114	114				

TEST DATA SHEET DATE: 10 MARCH 1972

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44dBM	EMCO 3101	6.1	2.3	XMTR. PWR. 44
RECEIVER	ECOM IICX		A7-197	2.0	2.3	+ANT. GAINS 8.1
TOTAL ANT. GAIN (XMTR + REC.)		6.1 + 2.0 = 8.1 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				=ESP = 47.5 USE 46

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

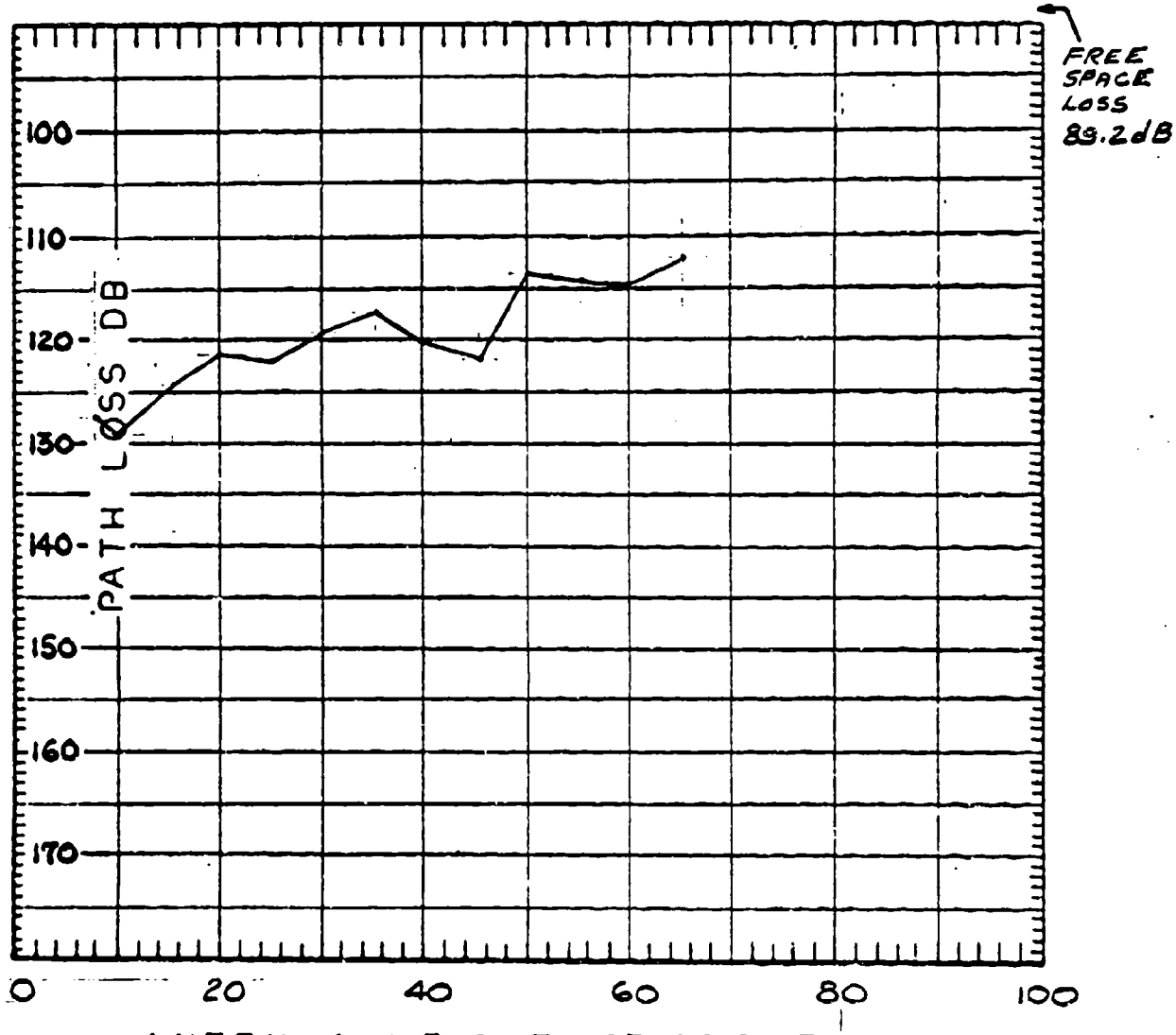
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 7203;10,07	TEST 7203;10,08	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 7203;10,07	7203;10,08		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
25	68	69		116	117				
20	70	71		118	119				
15	72	73		120	121				
10	81	78		129	126				
8	77	75		125	123				

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.09:10

PATH: WAYSIDE SITE 198 TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



NOTE: EMCO 3101 ANT.
CIRCULAR POLARIZED

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19R	44dBM	EMCO 3101	-3.8	1.8	XMTR. PWR. 44
RECEIVER	ECOM HEX.	[redacted]	AT-197	2.0	1.8	+ANT. GAINS -1.8
TOTAL ANT. GAIN (XMTR + REC.)	-3.8 + 2.0 = -1.8 dB					-CABLE LOSSES 3.6
TOTAL CABLE LOSS (XMTR + REC.)	1.8 + 1.8 = 3.6 dB					=ESP = 38.6 USE 39

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72033 10.09	TEST 72033 10.10	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72033 10.09	72033 10.10		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
5	84	93		123	132		127.25	4	
10	91	95		130	124		129.00	4	
15	87	80		123	119		124.50	4	
20	85	[illegible]		124	122		121.75	4	
25	85	81		124	123		122.25	4	
[illegible]	80	81		119	120		119.75	4	
[illegible]	79	77		118	116		117.25	4	
40	81	80		120	119		120.50	4	
[illegible]	85	83		124	121		122.00	4	
[illegible]	75	75		114	114		113.75	4	
[illegible]	75	75		114	114		114.00	4	
[illegible]	76	75		115	114		114.75	4	
[illegible]	73	73		112	112		112.00	2	
60	76	76		115	115				
[illegible]	75	75		114	114				
[illegible]	75	74		114	113				
[illegible]	81	81		123	120				
[illegible]	81	81		123	120				
[illegible]	82	77		121	116				
[illegible]	82	80		121	119				

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 229.✓ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 198	44dBM	EMCO 3101	-3.8	1.8
RECEIVER	ECOM HEY.	[redacted]	AT-197	2.0	1.8

TOTAL ANT. GAIN (XMTR + REC.) -3.8 + 2.0 = -1.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS -1.8
-CABLE LOSSES 3.6
=ESP = 38.6 USE 39

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

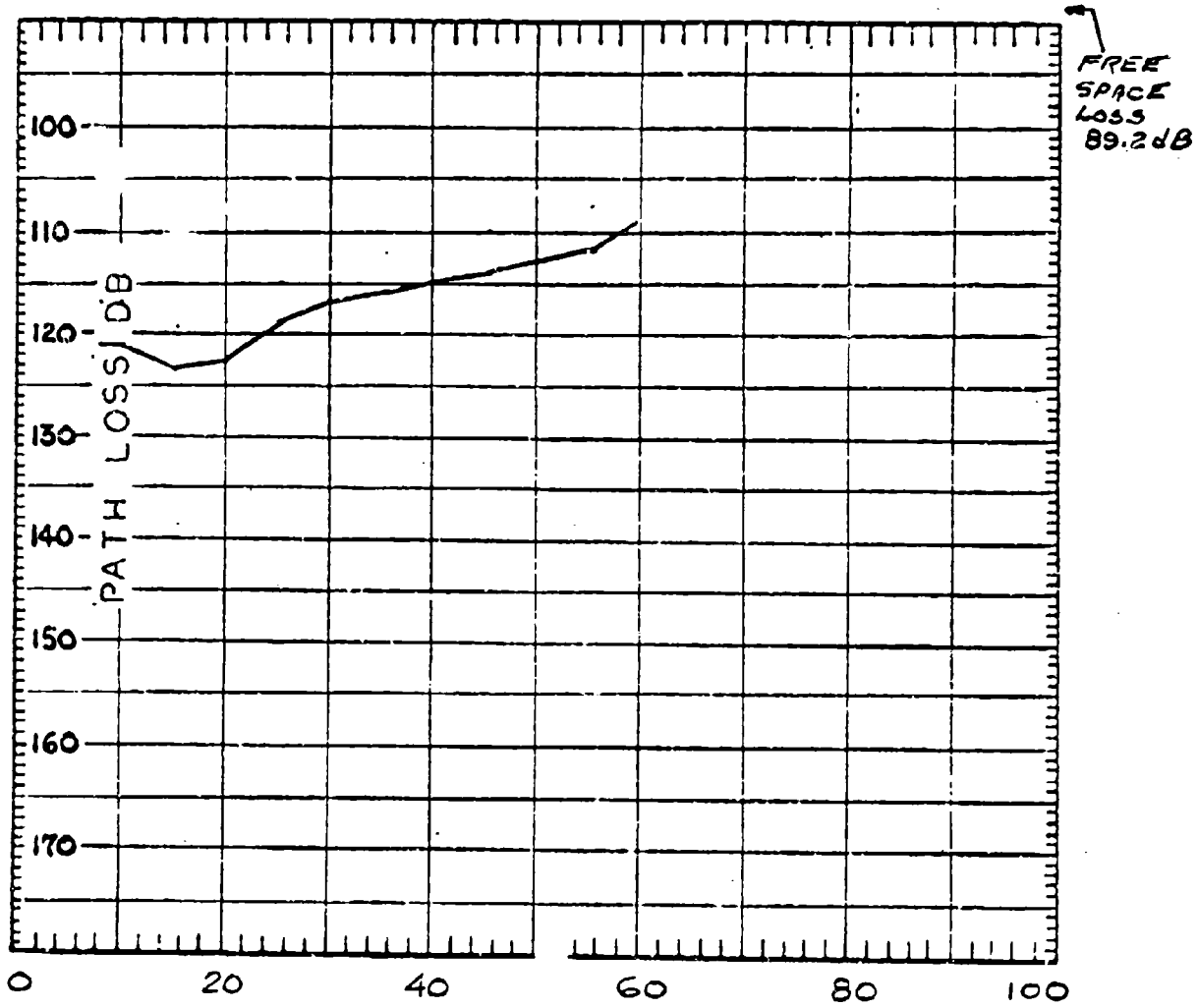
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03}10.09$	RCVD. PWR. (dBM) TEST $72_{03}10.10$	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}10.09$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}10.10$		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
25	82	82		121	121				
20	80	80		119	122				
15	92	86		131	125				
10	89	85		128	124				
8	89	87		128	126				

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.11

PATH: WAYSIDE SITE NO 19B TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



NOTE: T-29 ANT.
VERT. POLARIZED

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 229.√ MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44dBM	T-29 VERT.	8.0	1.8	XMTR. PWR. 44
RECEIVER	ECOM HEX.	[redacted]	AT-197	1.2	1.8	+ANT. GAINS 9.2
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 1.2 = 9.2 dB				-CABLE LOSSES 3.6
TOTAL CABLE LOSS (XMTR + REC.)		1.8 + 1.8 = 3.6 dB				=ESP = 19.6 USE √0

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
	72 03 10.11			72 03 10.11					
8	71			12.1			121.0	2	
10	71			12.1			121.0	2	
1√	73			123			123.√	2	
20	73			123			123.0	2	
2√	69			119			119.0	2	
30	67			117			117.0	2	
3√	66			116			116.0	2	
40	6√			115			115.0	2	
4√	64			114			114.0	2	
√0	63			113			113.0	2	
√√	62			112			112.0	2	
60	√9			109			109.0	1	
√√	62			112					
√0	63			113					
4√	64			114					
40	6√			115					
3√	66			116					
30	67			117					
2√	69			119					
20	73			123					

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WHYSIDE 19B	44dBM	T-29 VERT.	8.0	1.8	XMTR. PWR. 44
RECEIVER	ECOM HEX.		AT-197	1.2	1.8	+ANT. GAINS 9.2
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 1.2 = 9.2 dB				-CABLE LOSSES 3.6
TOTAL CABLE LOSS (XMTR + REC.)		1.8 + 1.8 = 3.6 dB				=ESP = 49.6 USE 50

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $7_{20}3_{10.11}$	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $7_{20}3_{10.11}$			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
15	74			124					
10	71			121					
8	71			121					

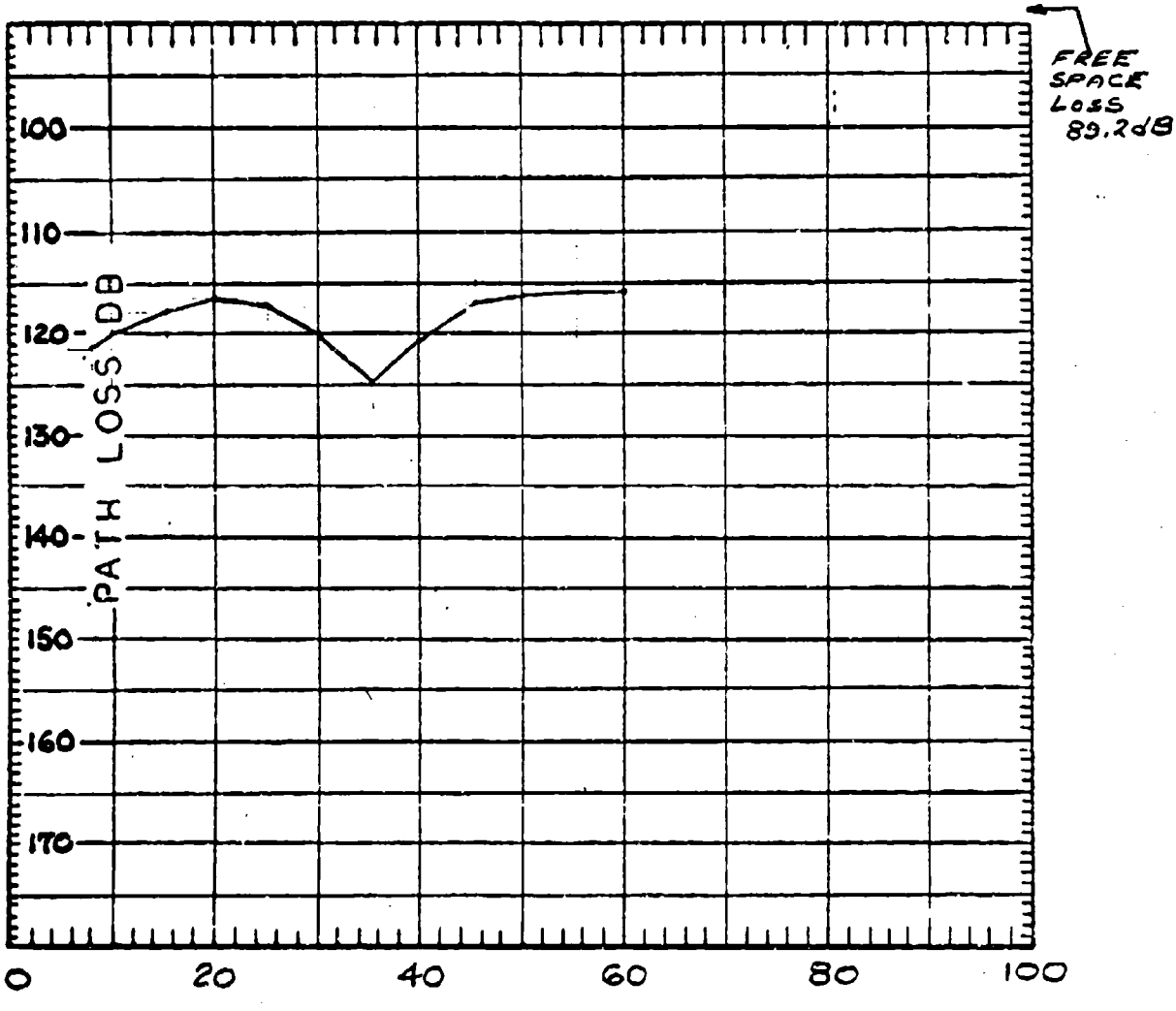
160

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.12

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



NOTE: T-29 ANT.
HORIZ. POLARIZED

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 229.5 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE AB	44 dBM	T-29 HORIZ	8.0	1.8	XMTR. PWR. 44
RECEIVER	ECOM HEX.	[redacted]	AT-197	1.2	1.8	+ANT. GAINS 9.2
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 1.2 = 9.2 dB				-CABLE LOSSES 3.6
TOTAL CABLE LOSS (XMTR + REC.)		1.8 + 1.8 = 3.6 dB				=ESP = 45.6 USE 46

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $T_{2_{03}10.12}$	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $T_{2_{03}10.12}$			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	75			121			121.50	2	
10	77			120			120.0	2	
15	72			118			118.0	2	
20	70			116			116.5	2	
25	71			117			117.5	2	
30	74			120			120.0	2	
35	79			125			125.0	2	
40	74			120			120.5	2	
45	71			117			117.0	2	
50	70			116			116.5	2	
55	70			116			116.0	2	
60	70			116			116.0	1	
55	70			116					
50	71			117					
45	71			117					
40	75			121					
35	79			125					
30	74			120					
25	72			118					
20	71			117					

TEST DATA SHEET DATE: 10 MAR 11 72

OPER. FREQ. 229.7 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WHYSIDE 19B	44dBM	T-29 HORN	8.0	1.8	XMTR. PWR. 44
RECEIVER	ECOM HE...	[redacted]	AT-197	1.2	1.8	+ANT. GAINS 9.2
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 1.2 = 9.2 dB				-CABLE LOSSES 3.6
TOTAL CABLE LOSS (XMTR + REC.)		1.8 + 1.8 = 3.6 dB				=ESP = 45.6 USE 16

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

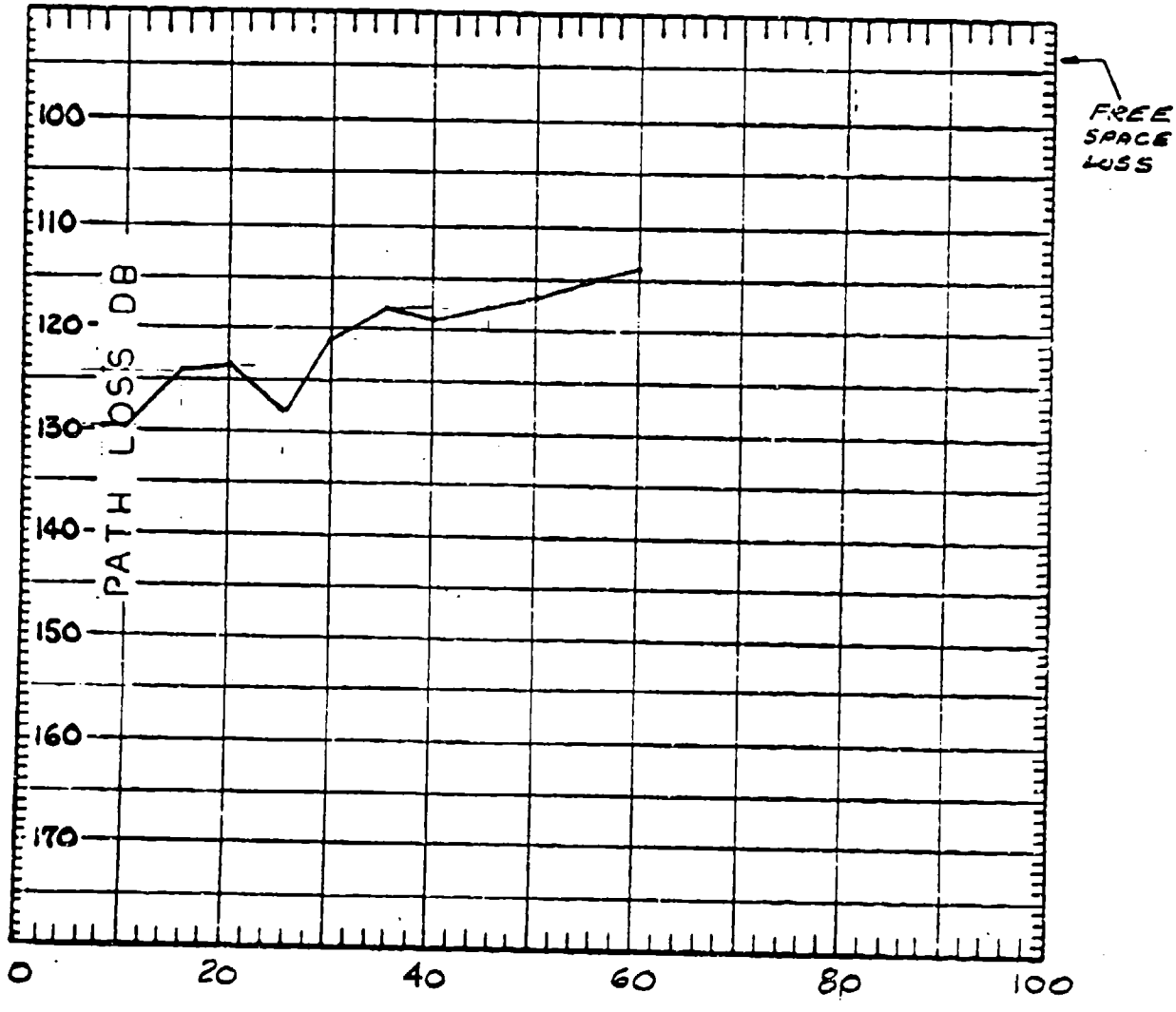
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72052012	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72032012			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
15	72			118					
10	74			120					
8	76			122					

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 720310.13

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXACOM

OPER. FREQ.: 371.4 MHz



NOTE: T-29 ANT.
HORIZ. POLARIZED

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 198	44dBM	T-29 HORIZ	8.0	2.3	XMTR. PWR. 44
RECEIVER	ECOM HEX.	[redacted]	AT-197	2.0	2.3	+ANT. GAINS 10
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 2.0 = 10.0 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				=ESP = 49.4 USE 49

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03_{10.13}}$	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03_{10.13}}$			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	81			130			129.√	2	
10	81			130			129.√	2	
15	76			125			124.5	2	
20	75			124			124.0	2	
25	79			128			128.0	2	
30	72			121			121.0	2	
35	69			118			118.0	2	
40	70			119			119.0	2	
35	69			118			118.0	2	
50	68			117			117.0	2	
55	66			115			115.0	2	
60	65			114			114.0	1	
55	66			115					
50	68			117					
45	69			118					
40	70			119					
35	69			118					
30	72			121					
25	79			128					
20	75			124					

TEST DATA SHEET

DATE: 10 MARCH 72.

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 198	44 dBM	T-29 Horiz	8.0	2.3	XMTR. PWR. 44
RECEIVER	ECOM HEX.		AT-197	2.0	2.3	+ANT. GAINS 10
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 2.0 = 10.0 dB				-CABLE LOSSES 1.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 1.6 dB				=ESP = 49.4 USE 49

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

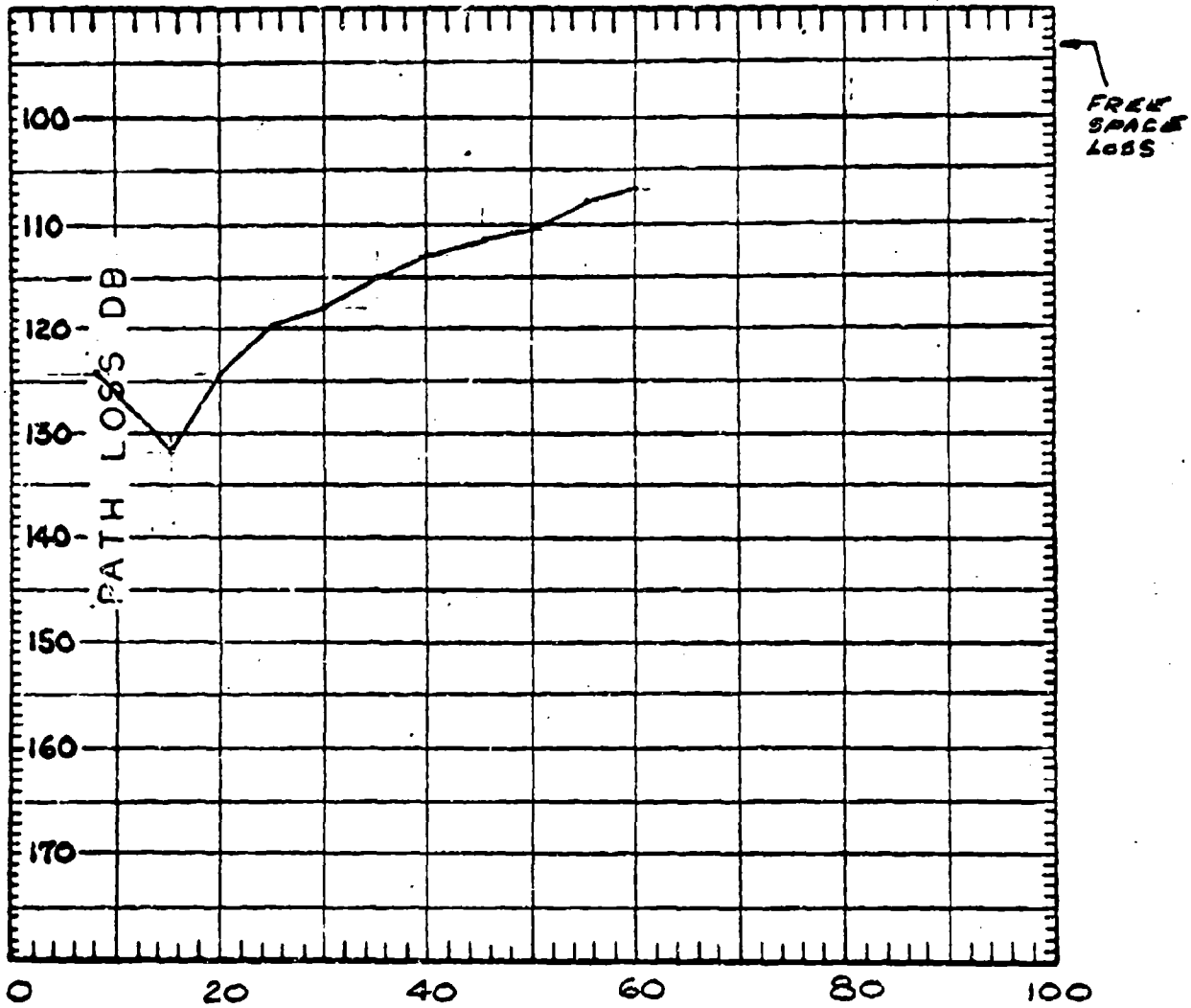
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
	$72_{03_{10.13}}$			$72_{03_{10.15}}$					
15	75			124					
10	80			129					
8	80			129					

PROPAGATION PATH LOSS

DATE: 10 MARCH 72 TEST RUN S/N: 7203 10. 14-

PATH: WAYSIDE SITE No. 103 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



NOTE: T-29 ANT.
VERT. POLARIZED

TEST DATA SHEET

DATE: 10 MARCH 72.

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	W/ SIDE 198	44 dBM	T-29 Vert	8.0	2.3
RECEIVER	ECOM HEX.		AT-197	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 8.0 + 2.0 = 10.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 14

+ANT. GAINS 10

-CABLE LOSSES 4.6

=ESP = 19.4 dBM

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72 03 10.14	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72 03 10.14			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
8	75			124			124.5	2	
10	77			126			126.0	2	
15	83			132			132.0	2	
20	75			124			124.5	2	
25	71			120			120.0	2	
30	69			118			118.0	2	
35	66			115			115.0	2	
40	64			113			113.0	2	
45	62			111			111.5	2	
50	61			110			110.5	2	
55	55			108			108.0	2	
60	56			107			107.0	1	
55	59			108					
50	62			111					
45	64			112					
40	67			113					
35	66			115					
30	64			118					
25	71			120					
20	76			125					

168

TEST DATA SHEET

DATE: 10 MARCH 72

OPER. FREQ. 371.4 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44 dBM	T-29 VERT.	8.0	2.3	XMTR. PWR. 44
RECEIVER	ECOM HEX.		AT-197	2.0	2.3	+ANT. GAINS 10
TOTAL ANT. GAIN (XMTR + REC.)		8.0 + 2.0 = 10.0 dB				-CABLE LOSSES 4.6
TOTAL CABLE LOSS (XMTR + REC.)		2.3 + 2.3 = 4.6 dB				=ESP = 49.4 USE 49

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

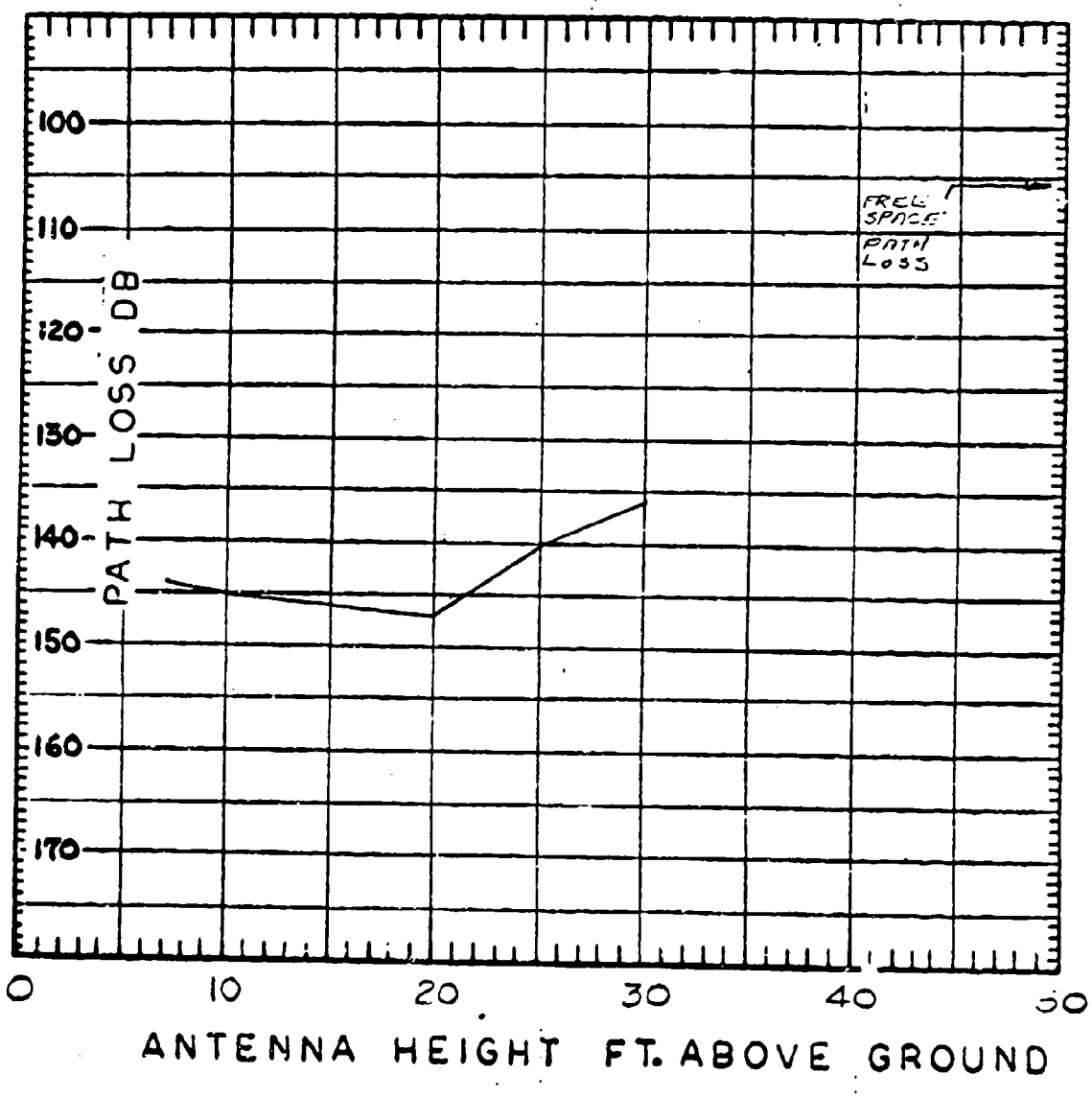
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
	72 03 10.14			72 03 10.14					
15	83			132					
10	77			126					
8	75			124					

PROPAGATION PATH LOSS

DATE: 13 MARCH 72 TEST RUN S/N: 720313.01 & 02

PATH: WAYSIDE SITE No. 19 TO ECOM HEXAGON

OPER. FREQ.: [illegible]



TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1574 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19	14dBM	4EL HORN	14.4	5.7	XMTR. PWR. 44
RECEIVER	ECOM H/EX.		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				=ESP = 51.8 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

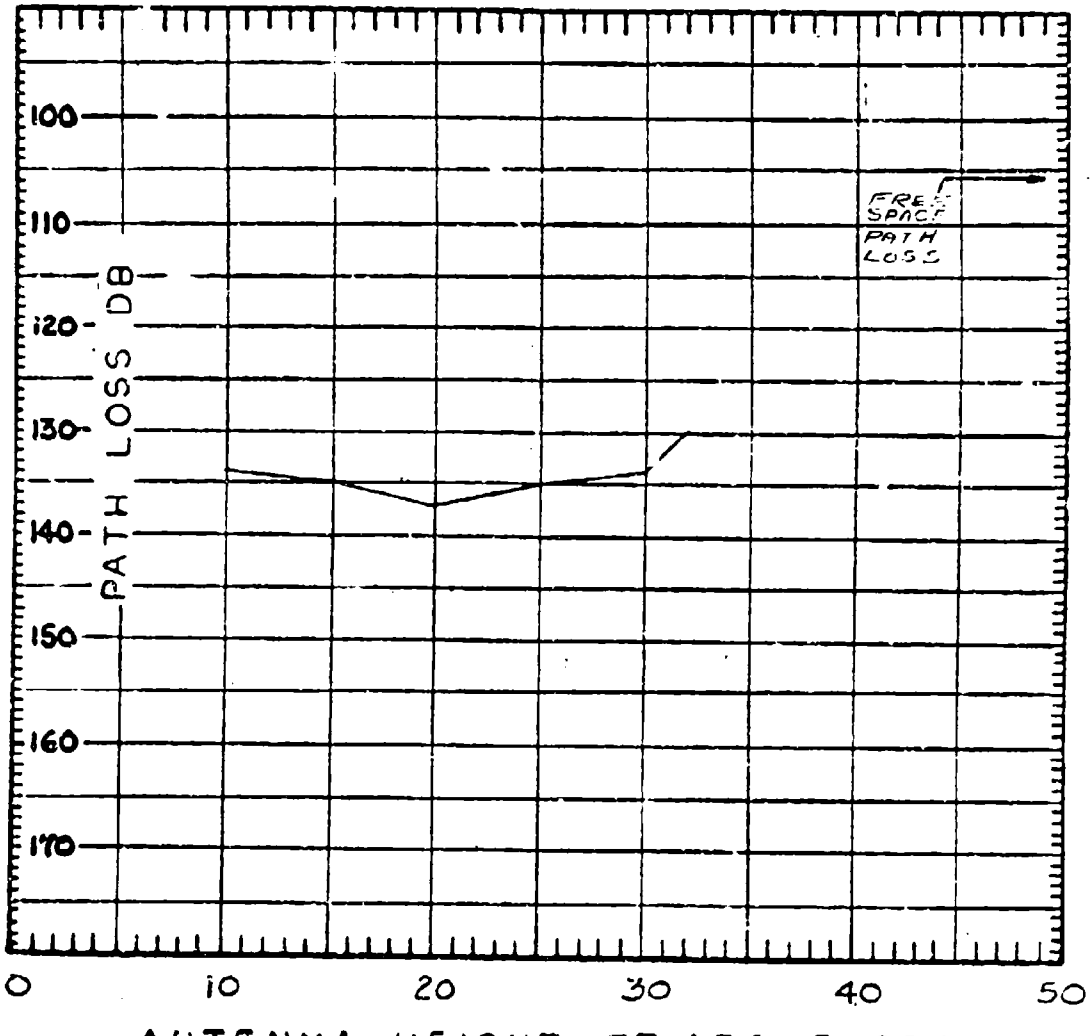
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03_{13.01}}$	TEST $72_{03_{13.02}}$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03_{13.01}}$	$72_{03_{13.02}}$		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
7	90.3	92.3		142.3	144.3		141.0	4	
10	91.2	92.9		143.2	144.9		145.0	4	
15	97.0	89.8		149.0	141.8		146.0	4	
20	94.1	95.8		146.1	147.8		147.0	4	
25	88.1	89.4		140.8	141.4		140.0	4	
30	83.8	87.8		135.8	136.8		136.0	2	
25	88.3	89.5		135.3	141.5				
20	93.4	93.4		147.4	145.4				
15	95.0	94.4		147.0	146.4				
10	93.4	94.2		145.4	146.2				
7	91.1	92.9		143.1	144.9				
									POS. PEAK AVERAGE OF STRIP CHART RECORDINGS.

PROPAGATION PATH LOSS

DATE: 13 MARCH 72 TEST RUN S/N: 720313.03 & 04

PATH: WAYSIDE SITE NO. 19 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19	44 dBM	ANDREW DISCONE	2.5	5.7
RECEIVER	ECOM HEX.		ANDREW PARABOLIC	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 2.5 + 0.3 = 2.8 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 2.8
-CABLE LOSSES 6.9
=ESP = 37.9 USE 40

XMTR. SITE HEIGHT ABOVE SEA LEVEL _____ FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL _____ FT.

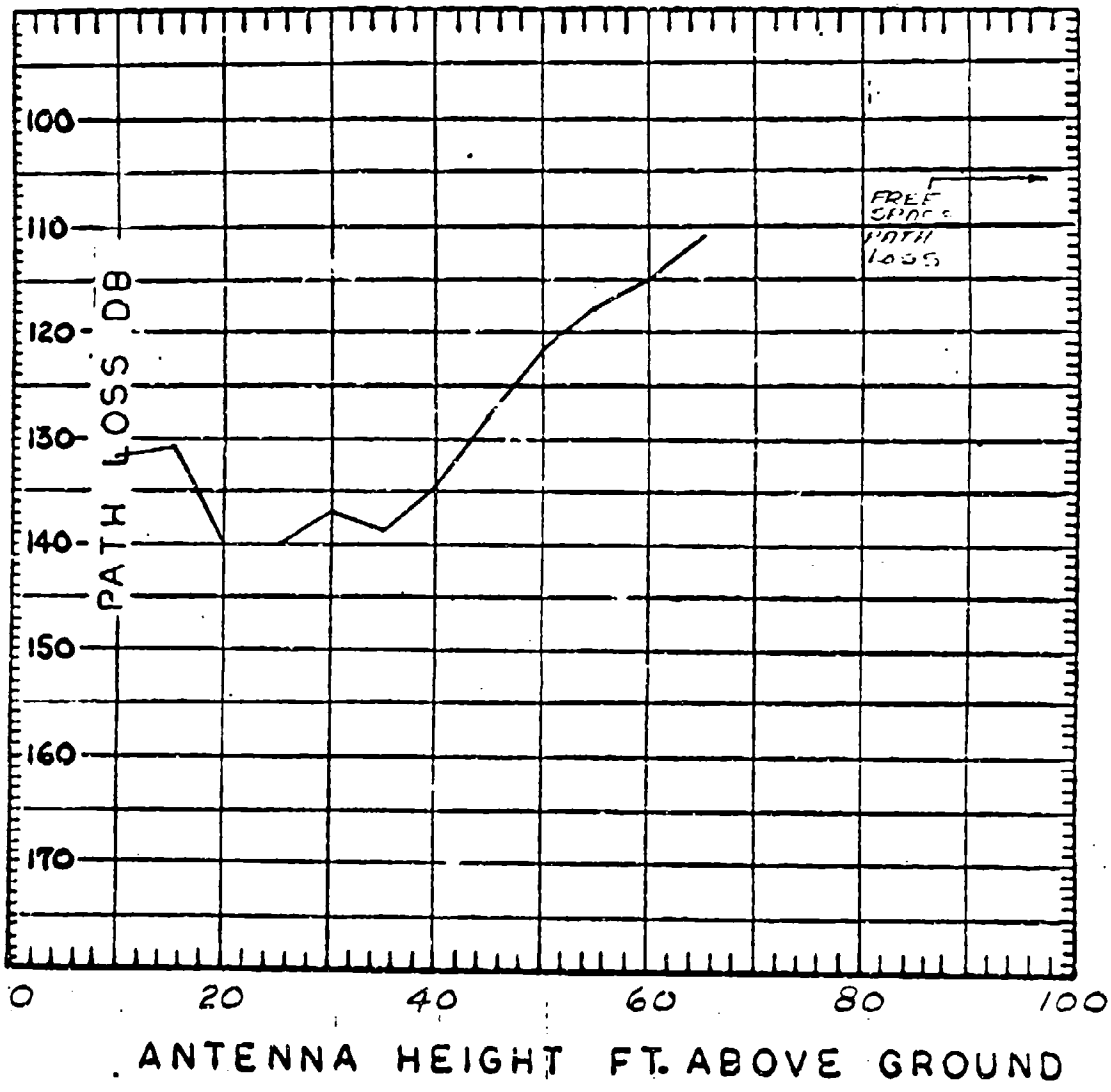
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $T2_{03}$ 13.03	RCVD. PWR. (dBM) TEST $T2_{03}$ 13.04	RCVD. PWR. (dBM) TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $T2_{03}$ 13.03	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $T2_{03}$ 13.04	AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
40	101	98		141	138	139	4	
35	97	94		137	134	135	4	
30	98	97		138	137	137	4	
25	92	93		132	133	133	4	
30	95	98		135	138	134	4	
32	93	88		133	128	130	2	
30	91	92		131	132			
25	97	96		137	136			
20	96	97		136	137			
15	95	94		135	134			
10	91	101		137	131			
								POS. PEAK AVERAGE OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 13 MARCH 72 TEST RUN S/N: 720313.06107

PATH: WAYSIDE SITE NO. 19B TO ECOM HEAVAGOU

OPER. FREQ.: 1545 MHz



TEST DATA SHEET — DATE: 13 MARCH 72

OPER. FREQ. 1545 MHz — REC. SITE ANT. HT. _____ FT. — START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE NB	44 dBM	AEL HORN	14.4	5.7	XMTR. PWR. 44
RECEIVER	ECOM HEX	[redacted]	ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL. ANT. GAIN (XMTR + REC.)	14.4 + 0.3 = 14.7 dB					-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)	5.7 + 1.2 = 6.9 dB					=ESP = 51.8 USE 52

XMTR. SITE HEIGHT ABOVE SEA LEVEL 110 FT. — RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72031306	TEST 72031307	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72031306	72031307		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	90	93		142	142		132	4	
15	90	92		142	141		131	4	
20	86	90		138	139		140	4	
25	87	88		139	137		140	4	
30	84	90		136	139		137	4	
35	87	90		136	139		139	4	
40	83	85		135	134		135	4	
45	77	78		129	127		128	4	
50	69	74		121	123		122	4	
55	65	69		117	118		118	4	
60	62	65		114	114		115	4	
65	59	63		111	111		111	2	
70	64	65		116	114				
75	61	62		119	117				
80	72	72		124	121				
85	71	78		129	127				
90	85	86		131	135				
95	90	91		142	140				
100	82	87		134	136				MEAN READING CHARTS
105	90	91		142	140				

TEST DATA SHEET

DATE: 13 MARCH 71

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	44 dBM	4EL HORN	14.4	5.7	XMTR. PWR. 44
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 14.7
TOTAL ANT. GAIN (XMTR + REC.)		14.4 + 0.3 = 14.7 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				=ESP = 51.8 USE 52
XMTR. SITE HEIGHT ABOVE SEA LEVEL 1[illegible] FT.				RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.		

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03}13.06$	TEST $72_{03}13.07$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}13.06$	$72_{03}13.07$		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
20	91	92		147	141				
15	90	90		142	139				
10	90	92		142	140				

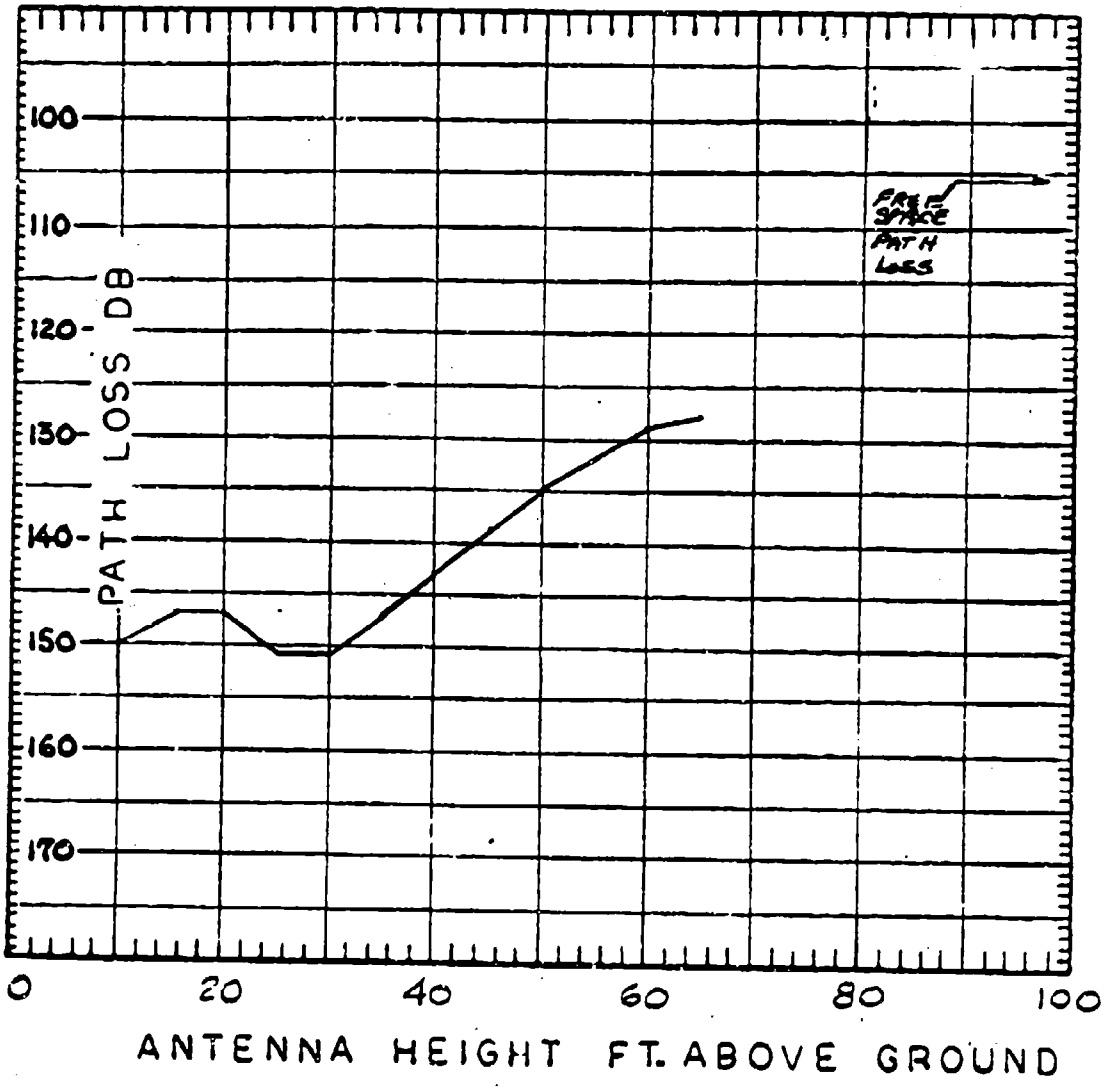
176

PROPAGATION PATH LOSS

DATE: 13 MARCH 72 TEST RUN S/N: 720313.28509

PATH: WAYSIDE SITE NO. 19B TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	41 dBM	EMCO 2102	-0.4	5.7	XMTR. PWR. 41
RECEIVER	ECOM HEY.	[redacted]	ANDREW BICONICAL	0.3	1.2	+ANT. GAINS -0.1
						-CABLE LOSSES 6.9
						=ESP = 34.0

TOTAL ANT. GAIN (XMTR + REC.) -0.4 + 0.3 = -0.1 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03}13.10$	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}13.10$			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	106			140			141	2	
15	97			131			133	2	
20	96			130			130.5	2	
25	96			130			130.0	2	
30	98			132			131.0	2	
35	97			131			130.5	2	
40	95			129			128.0	2	
45	96			130			128.5	2	
50	87			121			121.5	2	
55	83			117			118.0	2	
60	81			115			116.0	2	
65	80			114			114.0	1	
60	83			117					
55	85			119					
50	88			122					
45	93			127					
40	93			127					
35	94			130					
30	96			130					
25	96			130					

TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1545 MHz REC. SITE ANT. HT. _____ FT. START: – HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WHYSIDE 198	41dBM	AEL HORN	14.4	5.7
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0.3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 41
+ANT. GAINS 14.7
-CABLE LOSSES 6.9
=ESP = 48.8 USE 49

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST $T_{20}3_{13.08}$	TEST $T_{20}B_{13.09}$	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)	$T_{20}3_{13.08}$	$T_{20}3_{13.09}$	AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
10		98	100		147	149	150	4	ANT HORIZ POL.
15		97	97		146	146	147	4	
20		95	98		144	147	147	4	
25		102	103		151	152	151	4	
30		97	105		146	154	151	4	
35		97	97		146	146	147	4	
40		94	95		143	144	143	4	
45		90	90		139	139	139	4	
50		86	86		135	135	135	4	
55		83	82		132	131	132	4	
60		80	80		129	129	129	4	
65		78	79		127	128	128	2	
60		78	80		127	129			
55		83	82		132	131			
50		87	83		136	132			
45		90	90		139	139			
40		95	93		144	142			
35		97	98		146	147			
30		100	106		149	155			MEAN READING OF
25		103	100		152	149			STRIP CHART RECORDINGS

TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: — HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 19B	41 dBM	ASL HORN	14.4	5.7
RECEIVER	ECOM HEX.		ANDREW BICONICAL	0 3	1.2

TOTAL ANT. GAIN (XMTR + REC.) 14.4 + 0.3 = 14.7 dB

TOTAL CABLE LOSS (XMTR + REC.) 5.7 + 1.2 = 6.9 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 41
+ANT. GAINS 14.7
-CABLE LOSSES 6.9
=ESP = 48.8 USE 49

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST	TEST 72o313.08	TEST 72o313.09	PATH LOSS (dB) = (ESP) - (RCVD. PWR.)	72o313.08	72o313.09	AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
20		105	95		154	144			
15		100	99		149	148			
10		105	99		154	148			
									MEAN READING OF STRIP CHART RECORDINGS

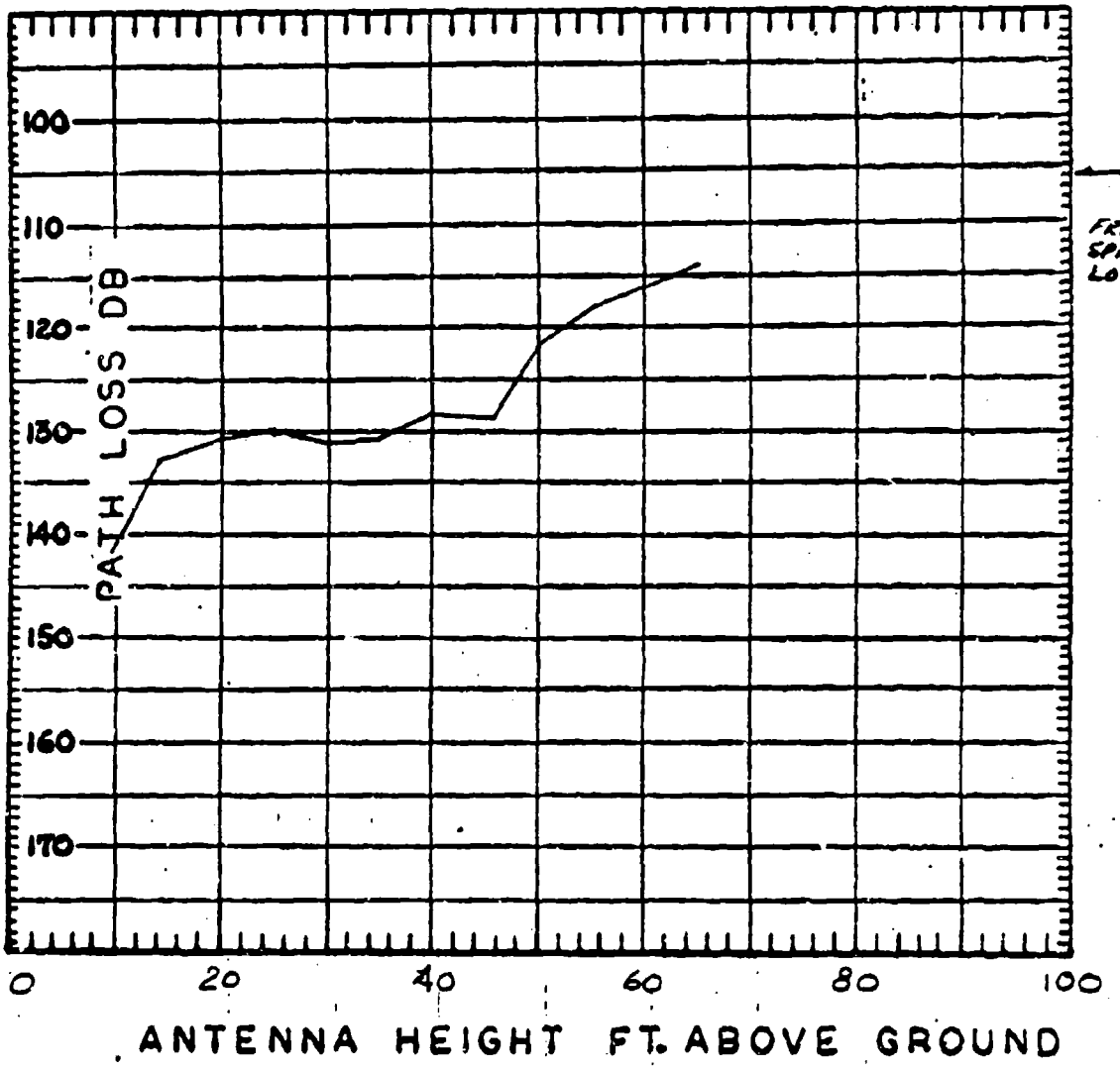
180

PROPAGATION PATH LOSS

DATE: 13 MARCH 72 TEST RUN S/N: 720313.10

PATH: WAYSIDE SITE No. 19B TO ECOM HEXAGON

OPER. FREQ.: 1545 MHZ



TEST DATA SHEET

DATE: 13 MARCH 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 19B	41 dBM	EMCO 3102	-0.4	5.7	XMTR. PWR. 41
RECEIVER	ECOM HEX		ANDREW BICONICAL	+0.3	1.2	+ANT. GAINS -0.1
TOTAL ANT. GAIN (XMTR + REC.)		-0.4 + 0.3 = -0.1 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				=ESP = 34.0

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03_{13.10}}$	TEST	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03_{13.10}}$			AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
2	97			131					
5	101			135					
10	108			142					

TEST DATA SHEET

DATE: 14 MARCH 72

OPER. FREQ. 971.4 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44dBM	AT-197	2.0	2.3
RECEIVER	ECOM HEX.	[redacted]	AT-177	2.0	2.3

TOTAL ANT. GAIN (XMTR + REC.) 2.0 + 2.0 = 4.0 dB

TOTAL CABLE LOSS (XMTR + REC.) 2.3 + 2.3 = 4.6 dB

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

EQUIV. SYS. PWR. (ESP)

XMTR. PWR. 44

+ANT. GAINS 4

-CABLE LOSSES 4.6

=ESP = 43.4 USE 43

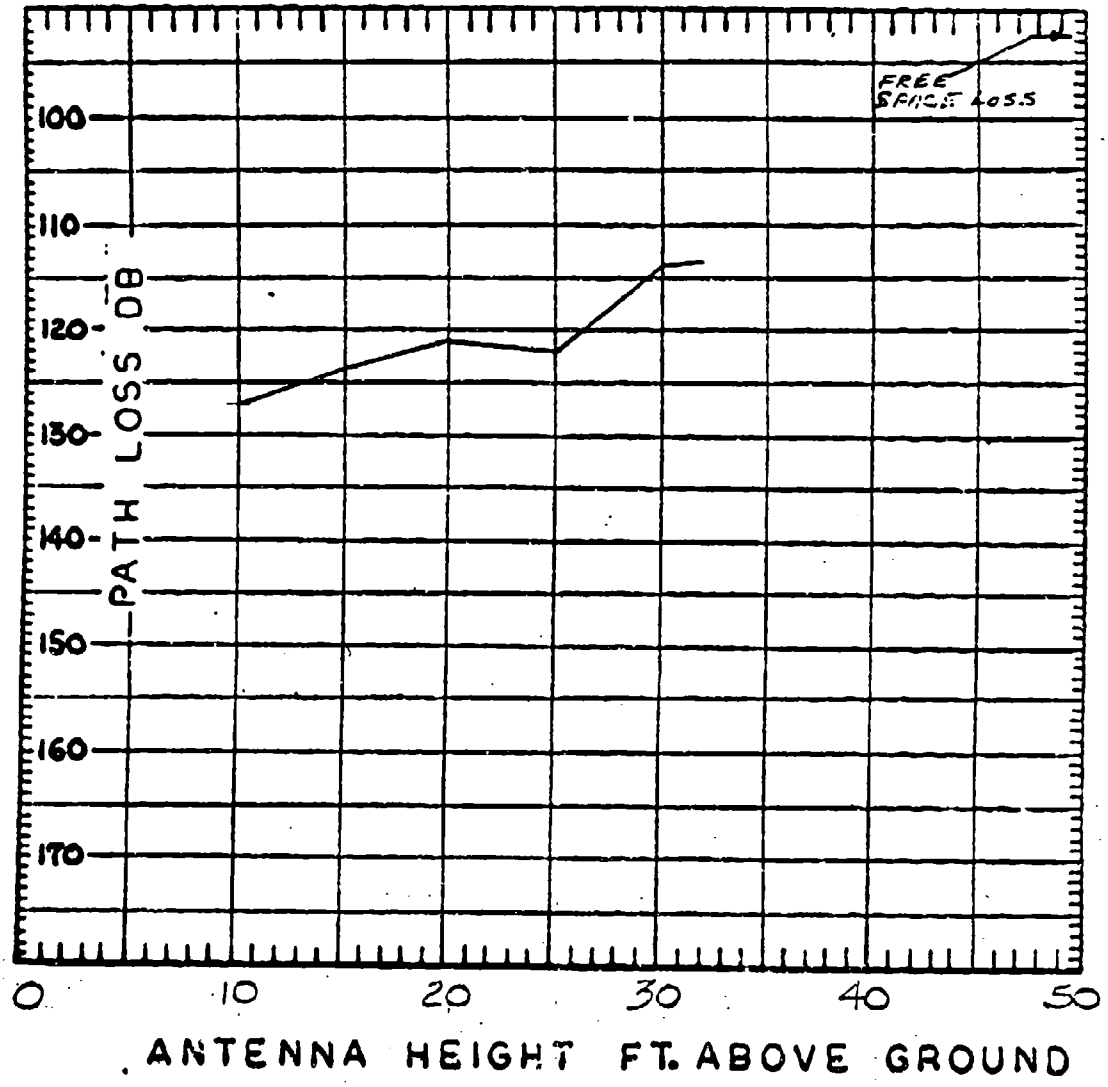
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72_{02} 14.01	TEST 72_{03} 14.02	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72_{03} 14.01	72_{03} 14.02		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
10	88	93		131	136		127	4	
15	84	79		127	122		124	4	
20	82	79		125	122		121	4	
25	80	80		123	123		122	4	
30	70	72		113	115		114	4	
32	70	71		113	114		113.5		
30	70	72		113	115				
25	79	78		122	121				
20	79	72		122	115				
15	78	82		121	125				
10	87	78		120	121				
									POS. PEAK AVERAGING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 14 MARCH 72 TEST RUN S/N: 720314.01402

PATH: WAYSIDE SITE 9 TO ECOM HEXAGON

OPER. FREQ.: 371.4 MHz



TEST DATA SHEET

DATE: 14 MARCH 72

OPER. FREQ. 1545 MHZ REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR. [redacted]	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)	EQUIV. SYS. PWR. (ESP)
TRANSMITTER	WAYSIDE 9	40 dBM	ANDREW DISCONE	2.5	5.7	XMTR. PWR. 40
RECEIVER	ECOM HEY.	[redacted]	ANDREW BICONICAL	0.3	1.2	+ANT. GAINS 2.8
TOTAL ANT. GAIN (XMTR + REC.)		2.5 + 0.3 = 2.8 dB				-CABLE LOSSES 6.9
TOTAL CABLE LOSS (XMTR + REC.)		5.7 + 1.2 = 6.9 dB				=ESP = 35.9 USE 36

XMTR. SITE HEIGHT ABOVE SEA LEVEL 140 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 140 FT.

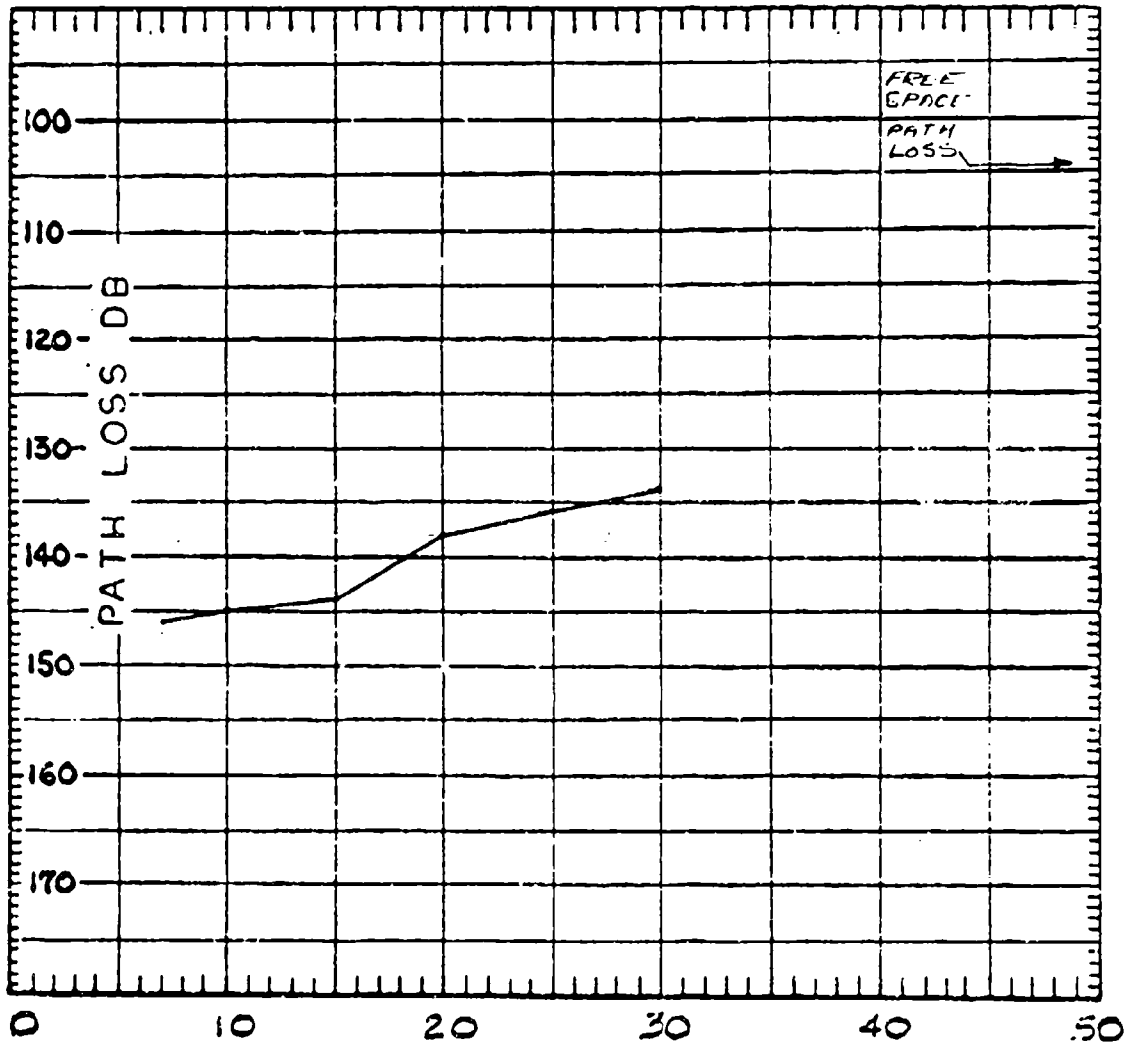
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST $72_{03}14.05$	TEST $72_{03}14.06$	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) $72_{03}14.05$	$72_{03}14.06$		AVG. PATH. LOSS (dB)	NO. OF SAMP.	REMARKS
10	106	105		142	141		141	4	
15	102	101		138	137		138	4	
20	102	102		138	138		138	4	
25	100	100		136	136		136	4	
30	98	97		134	133		134	4	
32	97	95		133	131		132	2	
30	98	97		134	133				
25	100	99		136	135				
20	101	102		137	138				
15	101	103		137	139				
10	103	104		139	140				
									POSITIVE PEAK AVERAGING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 14 MARCH 72 TEST RUN S/N: 720314.075[illegible]

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 1545 MHz

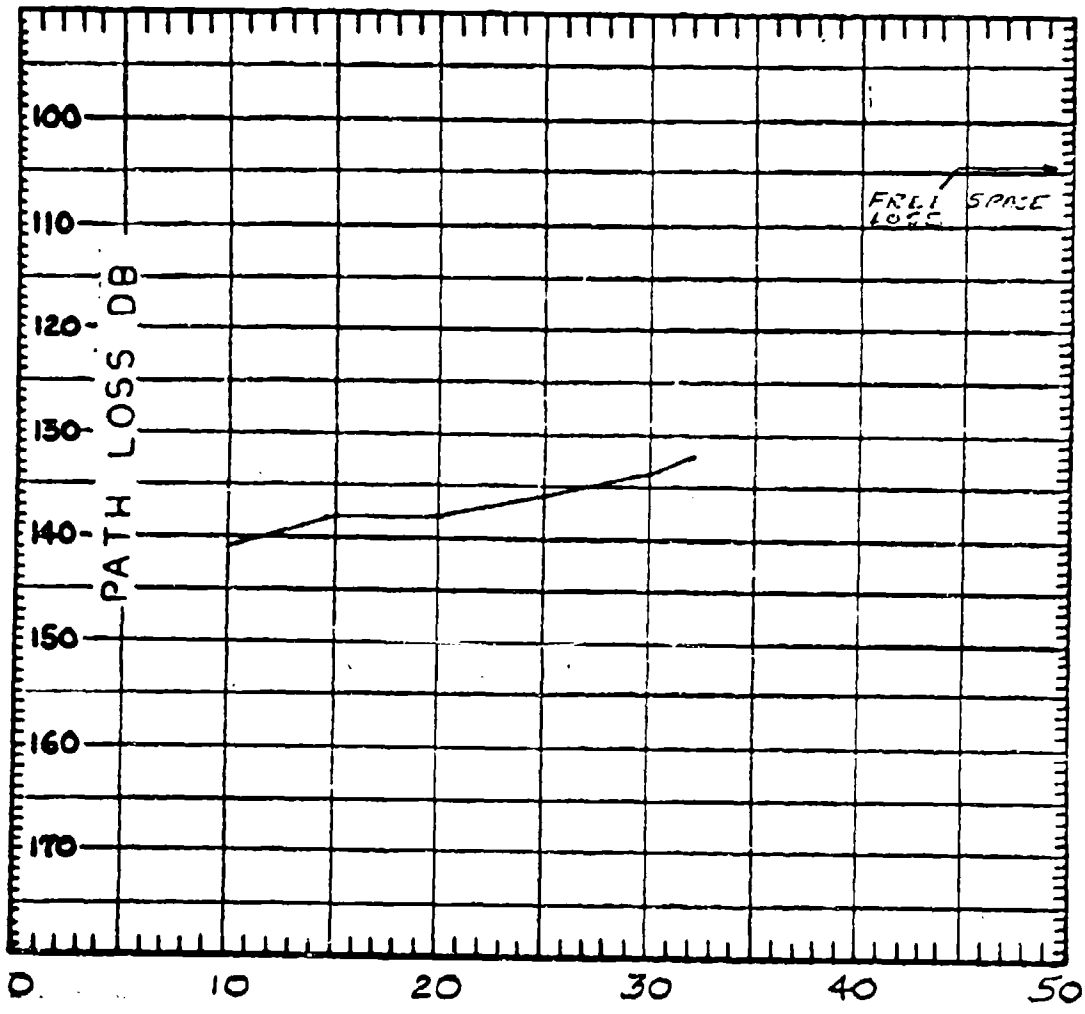


PROPAGATION PATH LOSS

DATE: 14 MARCH 72 TEST RUN S/N: 720314.0506

PATH: WAYSIDE SITE 9 TO ECOM HEXACON

OPER. FREQ.: 1545 MHz



TEST DATA SHEET

DATE: 14 MARCH 72

OPER. FREQ. 229.5 MHz REC. SITE ANT. HT. _____ FT. START: _____ HRS.

SITE	LOCATION	XMTR PWR.	TYPE ANTENNA	ANT. GAIN (dB)	CABLE LOSSES (dB)
TRANSMITTER	WAYSIDE 9	44 dBM	AT-197	1.2	1.8
RECEIVER	ECOM HEX.	[redacted]	AT-197	1.2	1.8

TOTAL ANT. GAIN (XMTR + REC.) 1.2 + 1.2 = 2.4 dB

TOTAL CABLE LOSS (XMTR + REC.) 1.8 + 1.8 = 3.6 dB

EQUIV. SYS. PWR. (ESP)
XMTR. PWR. 44
+ANT. GAINS 2.4
-CABLE LOSSES 3.6
=ESP = 42.8 USE 43

XMTR. SITE HEIGHT ABOVE SEA LEVEL 145 FT. RCVR. ANT. HEIGHT ABOVE SEA LEVEL 145 FT.

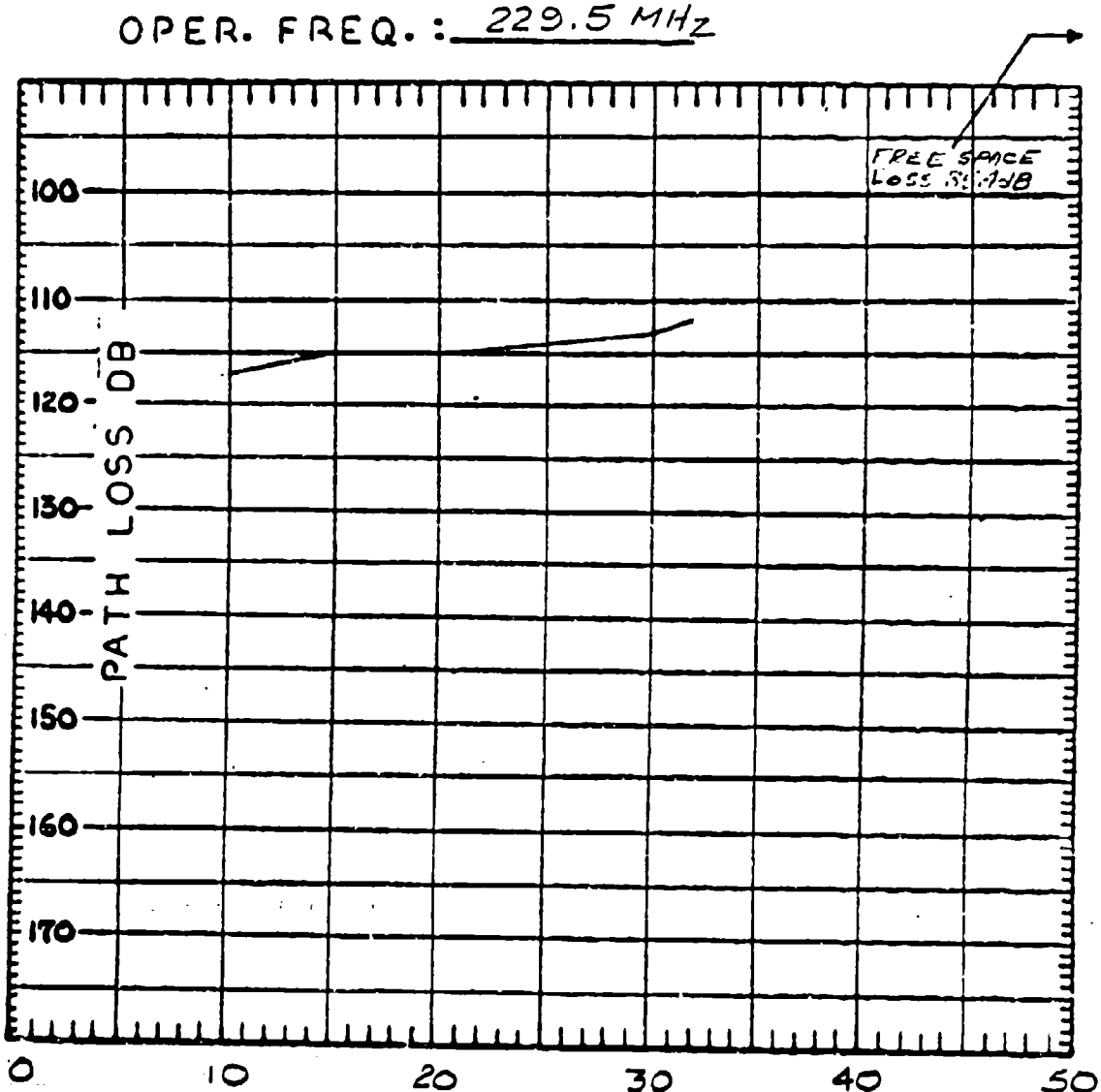
XMTR. ANT. HT. ABOVE GND (FT)	RCVD. PWR. (dBM) TEST 72_{03} 14.03	TEST 72_{03} 14.04	TEST	PATH LOSS (dB) = (ESP) - (RCVD. PWR.) 72_{03} 14.03	72_{03} 14.04		AVG. PATH. LOSS (dB)	NO. OF SAMP	REMARKS
10	75	73		118	116		117	4	
15	73	72		116	115		115	4	
20	72	72		115	115		115	4	
25	71	70		114	113		114	4	
30	70	70		113	113		113	4	
32	69	69		112	112		112	2	
30	69	69		112	112				
25	71	70		114	113				
20	71	73		114	114				
15	72	73		115	114				
10	75	75		118	114				
									POSITIVE PEAK AVERAGING OF STRIP CHART RECORDINGS

PROPAGATION PATH LOSS

DATE: 14 MARCH 72 TEST RUN S/N: 720314.03 & 0.4

PATH: WAYSIDE SITE NO. 9 TO ECOM HEXAGON

OPER. FREQ.: 229.5 MHz



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13. ABSTRACT

This report covers RF path loss measurements near Fort Monmouth, N. J., over distances of up to 10 miles and at low grazing angles. Four frequencies were used during these tests, three in the UHF region and one just below it. Measurements were made with antennas vertically, horizontally, and circularly polarized. Paths were varied from non-line-of-sight to definitely line-of-sight. Comparison of losses under varying conditions were made and graphs for estimating losses in the area covered by these tests are included.

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UHF Propagation losses RF transmissions at low grazing angles						