MMERCE/Environmental Science Services Administration

Technical Report

RESEARCH LABORATORIES

ERL 65-ITS 58-2

Tabulations of Propagation Data Over Irregular Terrain in the 230-to 9200-MHz Frequency Range

Part II: Fritz Peak Receiver Site

P.L. McQUATE
J.M. HARMAN
M.E. JOHNSON
A. P. BARSIS

DECEMBER 1968

Boulder, Colorado

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Tabulations of Propagation Data Over Irregular Terrain in the 230- to 9200- MHz Frequency Range

Part II: Fritz Peak Receiver Site

by

P. L. McQuate, J. M. Harman, M. E. Johnson, and A. P. Barsis

This is the second part of a four-part report containing tabulations and graphs of transmission loss data resulting from propagation experiments in the 230- to 9200- MHz frequency range conducted over irregular terrain in Colorado. This part describes data obtained at a single common receiver site at Fritz Peak, Colorado, over propagation paths varying in length from 3.0 to 120 km.

1. Introduction

The purpose of this report series is to present transmission loss data resulting from propagation experiments over irregular terrain in Colorado, with path lengths ranging from 0.5 to 120 km at seven frequencies in the 230- to 9200- MHz range. This measurement program was sponsored by the U. S. Army Electronics Command and by the U. S. Army Security Agency as part of a study of propagation characteristics and communication systems performance under conditions similar to those encountered by an army in the field.

Descriptions of the equipment used, of measurement procedures, and of initial data presentation and analysis are contained in Part I of this report (McQuate et al., 1968). The presentation of the data in Part II differs from that in Part I only in the following:

1. No individual photographs of the transmission path from the common receiver site toward the transmitter location were obtained. The panoramic photographs, figures 2 and 3, provide an indication of the foreground in the various directions and include bearing indications for comparison with the detailed path data in the subsequent sections.

2. The principal results, consisting of graphs of basic transmission loss versus receiving antenna height for each frequency, were obtained directly from computer outputs with the use of a microfilm plotter. Computer operations and additional data analysis, which will be reported on separately, were supported by the U. S. Air Force Space and Missile System Organization (SAMSO).

3. Part I of the report contained a number of comparisons of basic transmission loss values obtained over the same paths on different dates. Since only very few paths pertaining to the R-2 site were rerun, the comparison graphs are omitted here.

The Fritz Peak receiver site (designated R-2) shown in figure 5, is located in the mountainous terrain west of Boulder at the foot of Fritz Peak, which shields the site from the eastern plains, about 20 km

distant, Consequently, the majority of the transmitter sites (36 of 44) associated with this receiver site are located in the mountains, and the data represent propagation conditions in extremely rough terrain to the northwest. An estimated 90 percent of the foliage in this test area is coniferous. Figure 1 is a map of the area, showing the common receiver site R-2 and most of the transmitting locations, which were arranged in concentric circles around it. A large building approximately 50 m from the receiving antenna, as seen in figures 2 and 3, prevented the establishment of transmitting sites in the sector from 125^{o} to 160^{o} measured east of true north. Figure 2 is a panoramic view of the immediate foreground taken from the top of the 13 m tower, and figure 3 is the same panoramic view taken from a height of approximately 1 m above ground.

As already noted, further details regarding measurement techniques, equipment, and data presentation can be found in Part I of this report (McQuate et al., 1968).

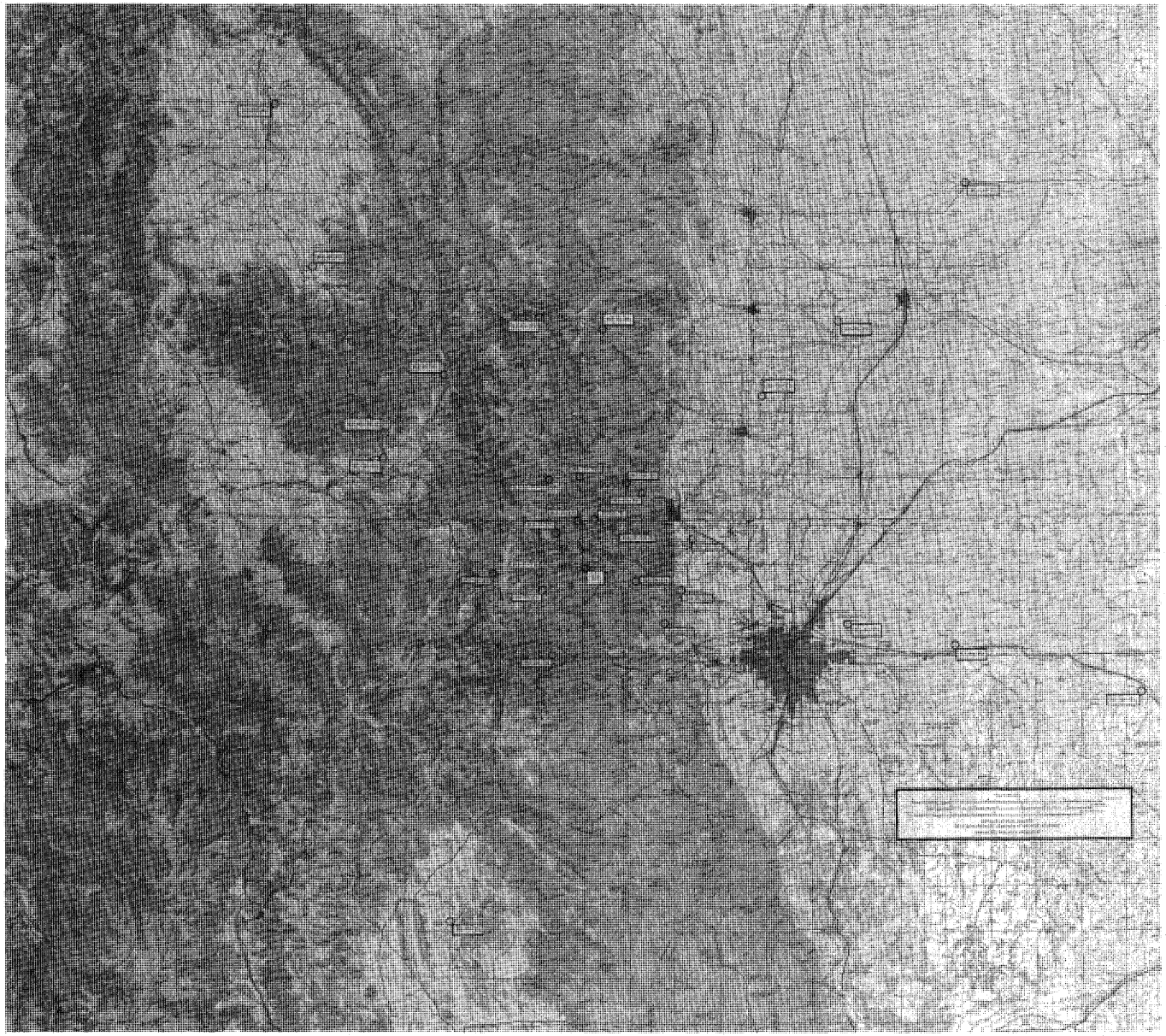


FIGURE I. LAYOUT OF MEASUREMENT POINTS

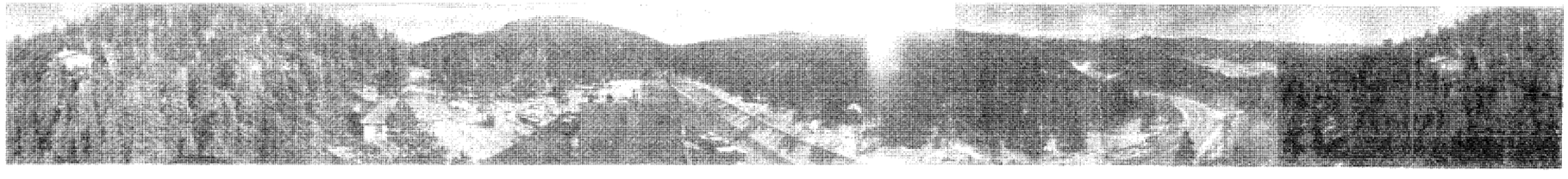


FIGURE 2. PANORAMIC VIEW FROM 13 METERS

FIGURE 3. PANORAMIC VIEW FROM 1 METER

PANORAMIC VIEWS FROM THE COMMON RECEIVER SITE

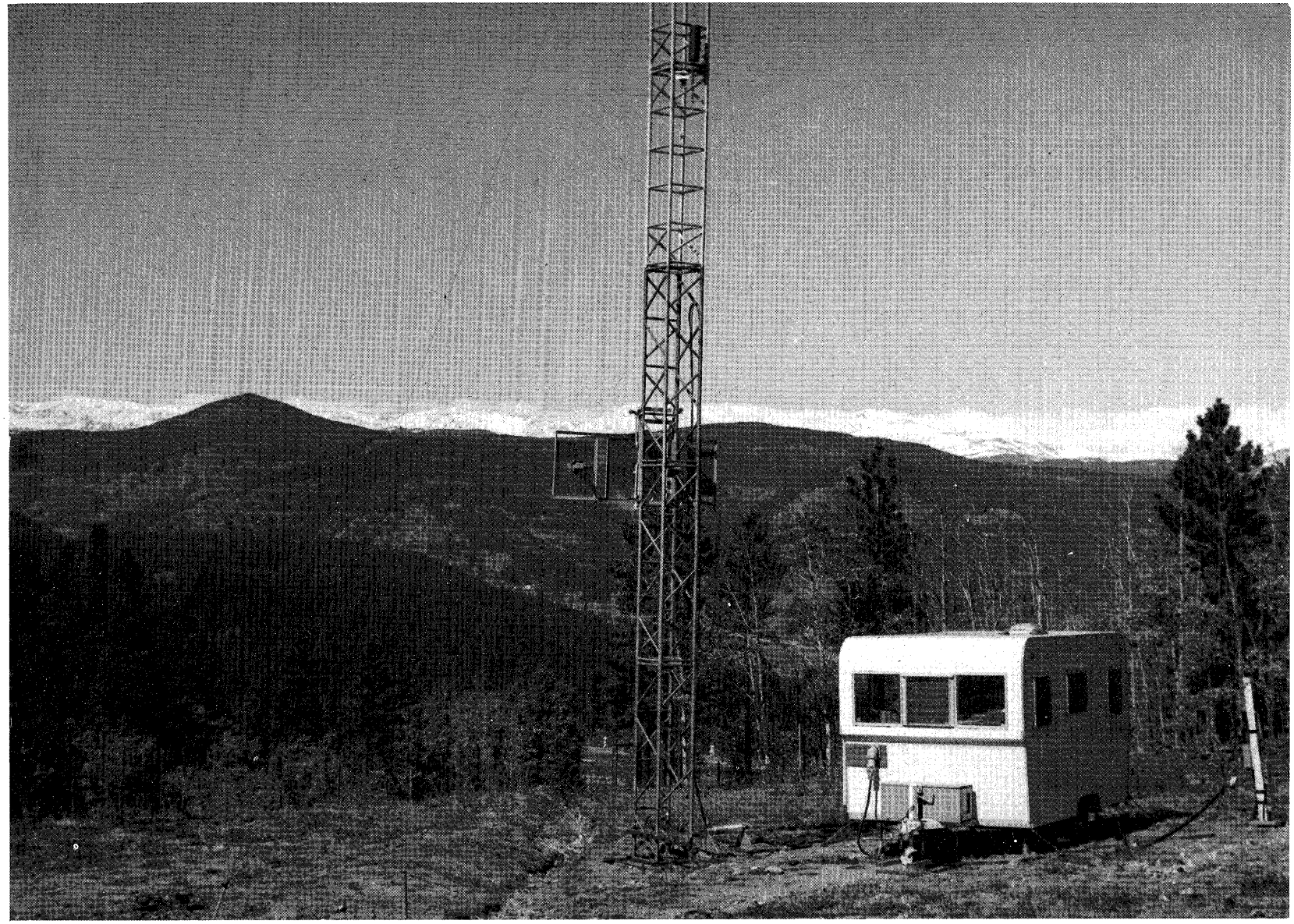


Figure 4. Fritz Peak Receiver Site Looking West

Figure 5. Fritz Peak Receiver Site Looking East

2. Acknowledgements

Nearly all personnel within the Spectrum Utilization Task Area of the Tropospheric Telecommunication Laboratory participated in the collection, analysis, and evaluation of the data.

3. Reference

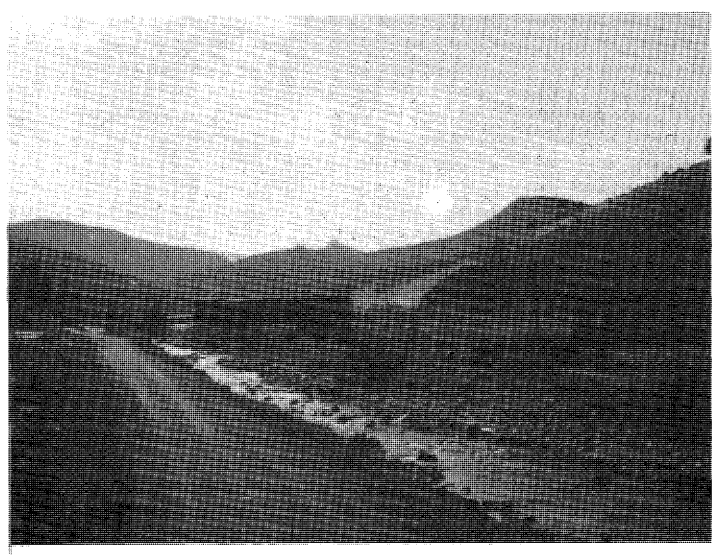
McQuate, P. L., J. M. Harman, and A. P. Barsis (1968), "Tabulations of propagation data over irregular terrain in the 230- to 9200-MHz frequency range, Part I: Gunbarrel Hill receiver site," ESSA Tech. Rept. ERL 65 - ITS 58.

4. Data Tabulations

Propagation data tabulations are presented on pages 9 through 158. Meteorological data obtained during daylight hours concurrently with the transmission loss measurements at each site are tabulated on pages 159 through 171.

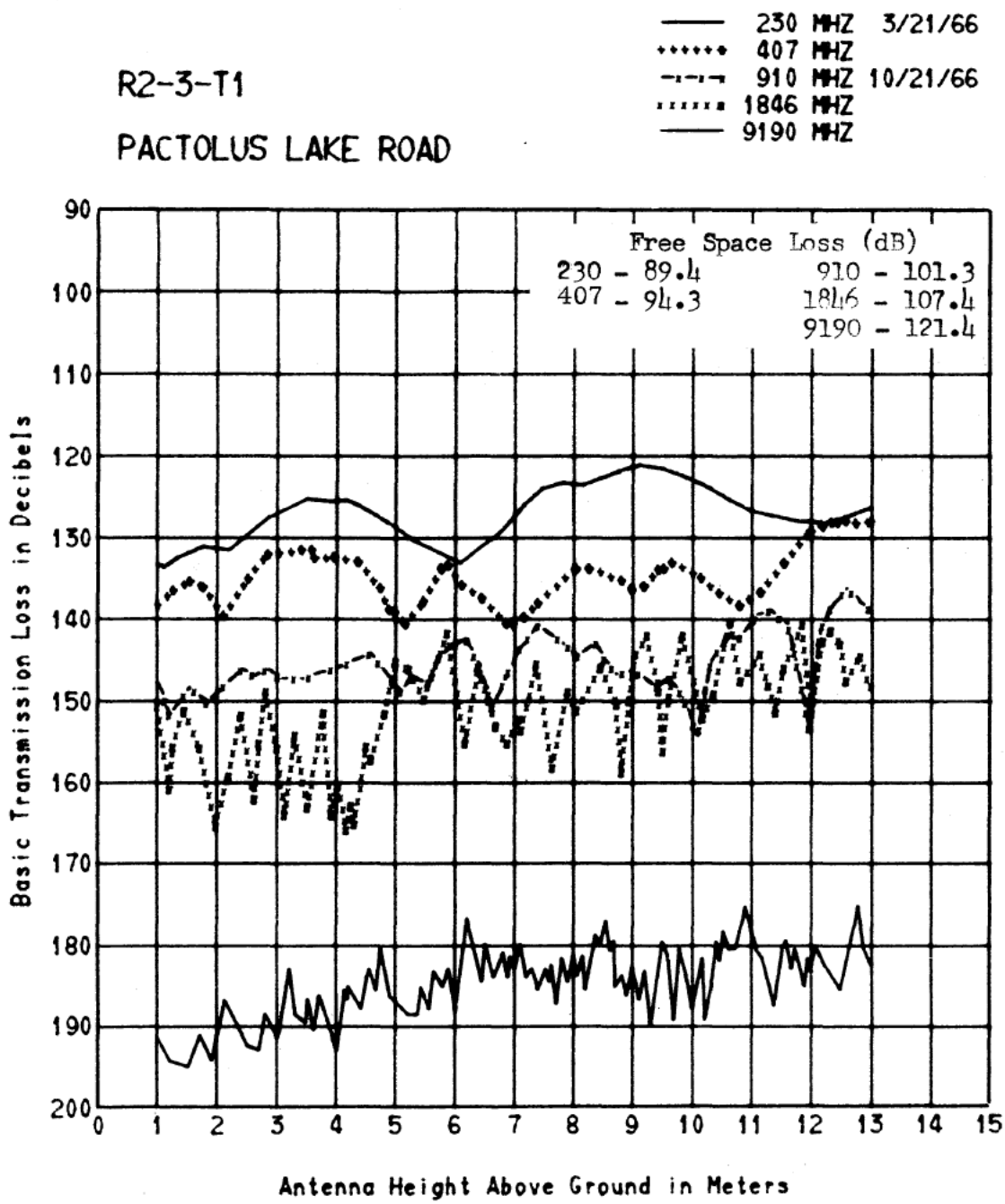
In addition, USGS quadrangle information, helpful in checking terrain profiles, is provided on pages 172 through 185. For each path, intercepts of the great-circle path with the edges of the listed quadrangles are given, together with the distance from the common receiver site R-2.

R2-3-T1
PACTOLUS LAKE ROAD



PATH VIEW FROM TRANSMITTER

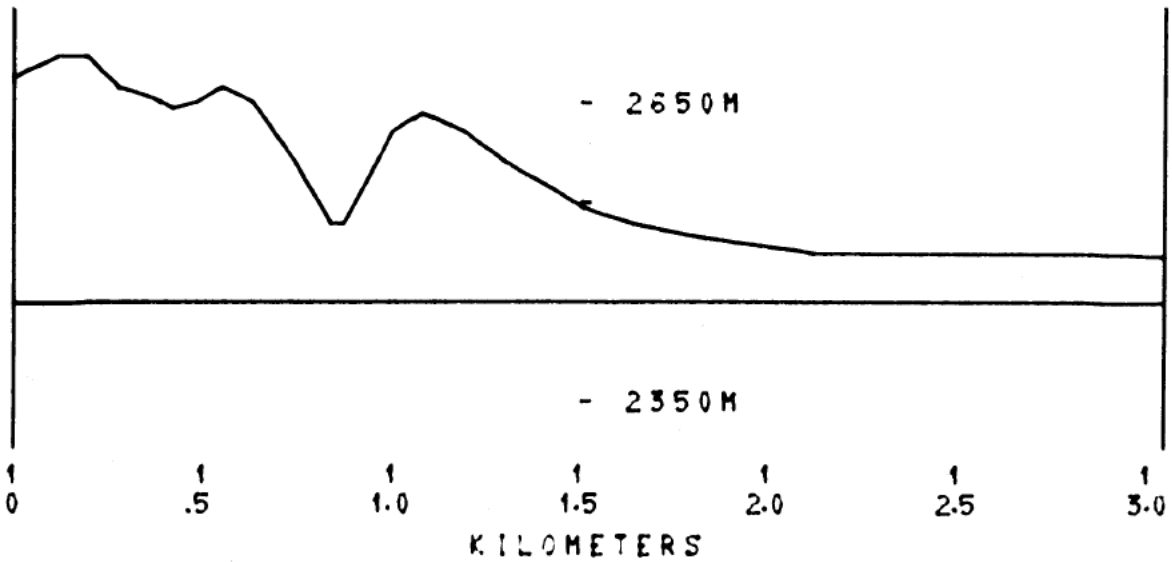
Bearing from common receiver site to transmitter site is 69° 54' 56" T.


230 MHZ 3/21/66
407 MHZ
910 MHZ 10/21/66
1846 MHZ
9190 MHZ
R2-3-T1
PACTOLUS LAKE ROAD
Free Space Loss (dB)
230 - 89.4
407 - 94.3
910 - 101.3
1846 - 107.4
9190 - 121.4
Basic Transmission Loss in Decibels
90
100
110
120
130
140
150
160
170
180
190
200
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-3-T1
PATH LENGTH 3.045 km

XMTR. ELEV. 2496 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

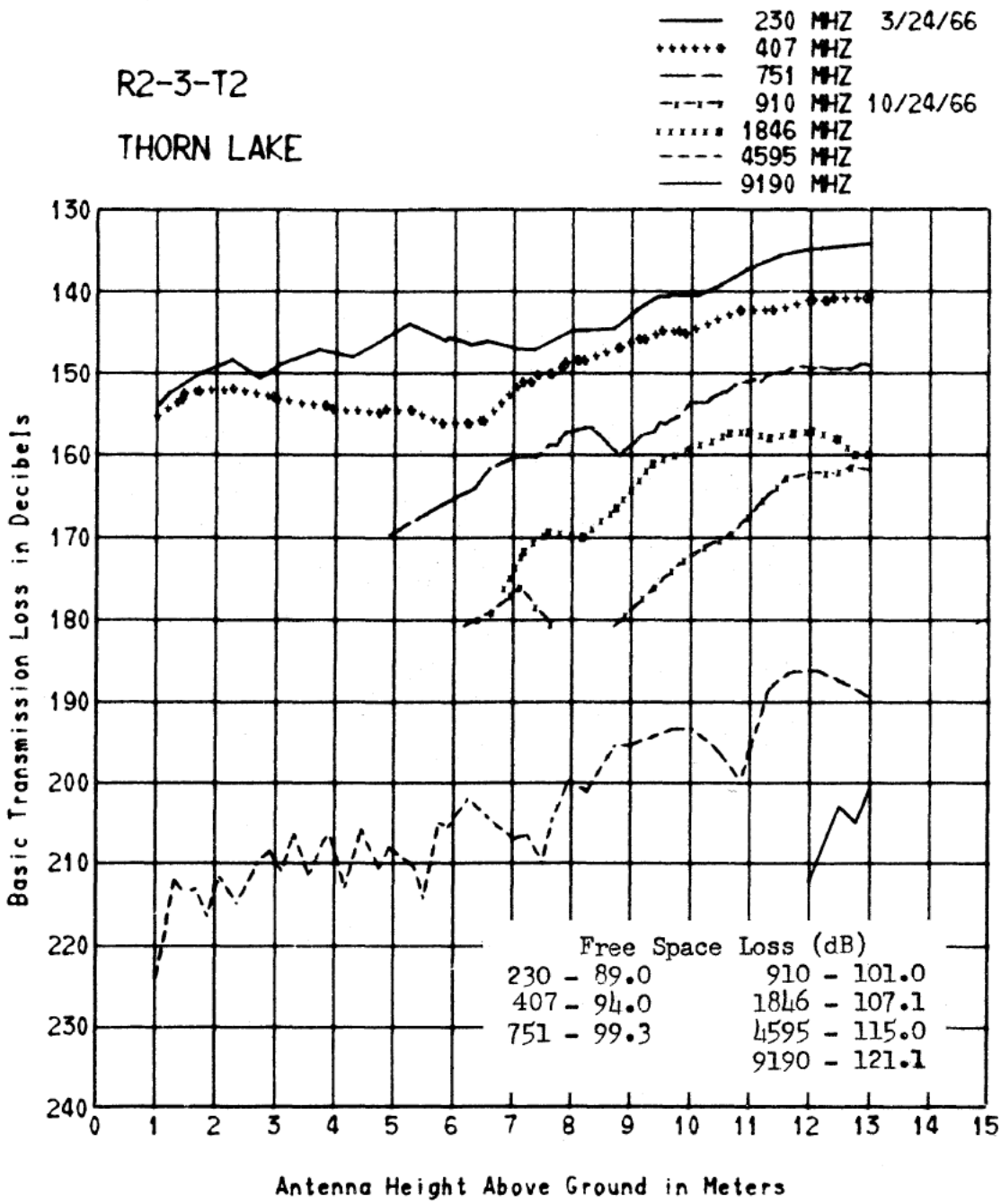
Freq (MHz)	230	407	910	1846	9190
	3-21-66 at 13 M		10-21-66 at 13 M		
50%	125.8	127.9	138.8	154.5	180.2
Δ10%-90%	< 3	<3	< 3	10.6	7.8
			10-21-66 at 7.3 M		
			140.8	147.1	181.8
			< 3	3.3	6.6
			10-21-66 at 1 M		
			146.0	151.5	192.5
			< 3	3.6	4.6

The path near the transmitter crosses a dirt road and then follows a narrow mountain valley for 800 m. The horizon is formed by ridges 1800 m away, covered with coniferous trees. Power and telephone lines parallel both sides of the dirt road, which runs at 20^{o} to the path.

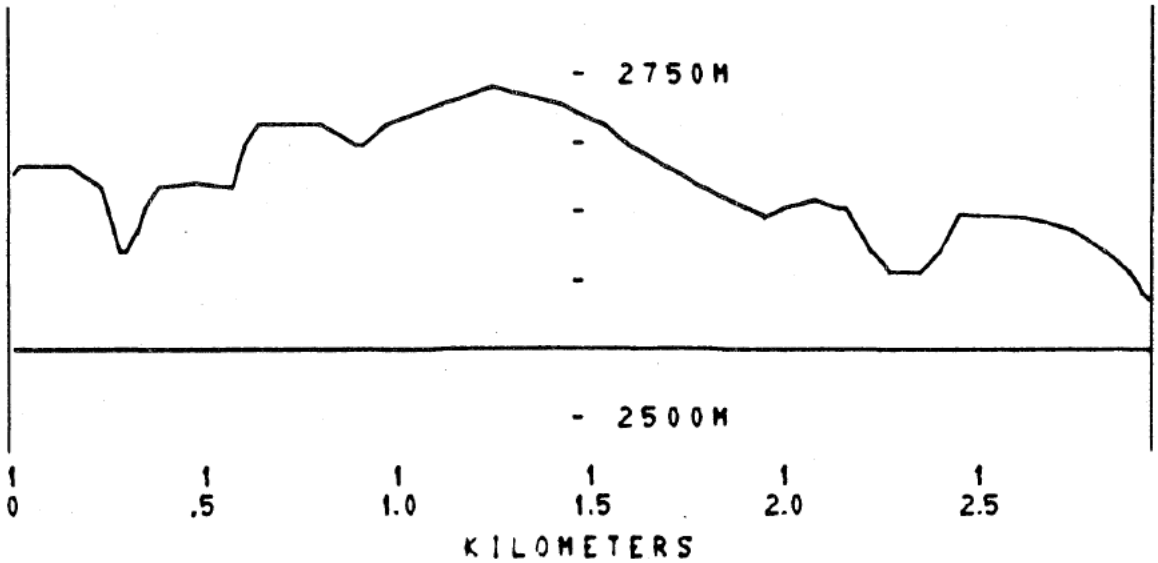
R2-3-T2
THORN LAKE

PATH VIEW FROM TRANSMITTER

Bearing from common receiver site to transmitter site is
106° 08' 15" T.


R2-3-T2
THORN LAKE
230 MHZ 3/24/66
407 MHZ
751 MHZ
910 MHZ 10/24/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss (dB)
230 - 89.0
407 - 94.0
751 - 99.3
910 - 101.0
1846 - 107.1
4595 - 115.0
9190 - 121.1

RCVR. ELEV. 2676 M | R2-3-T2 PATH LENGTH 2.934 km | XMTR. ELEV. 2586 M

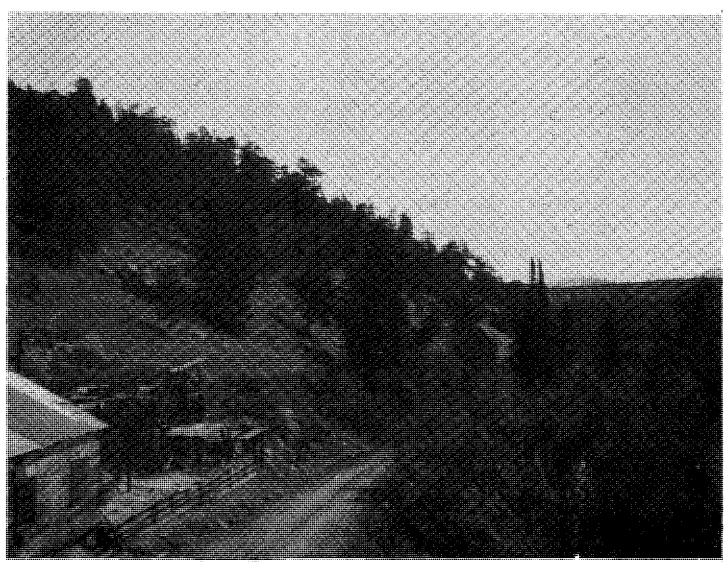


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-24-66 at 13 M				10-24-66 at 13 M		
50%	134.4	141.4	148.3	163.1	156.5	187.7	206.3
Δ10%-90%	< 3	< 3	< 3	< 3	3.6	4.0	15.3
					10-24-66 at 7.3 M		
50%				179.1	170.7	207.0	
Δ10%-90%				< 3	< 3	3.9	
					10-24-66 at 1 M		
50%						218.6	
Δ 10%-90%						5.4	

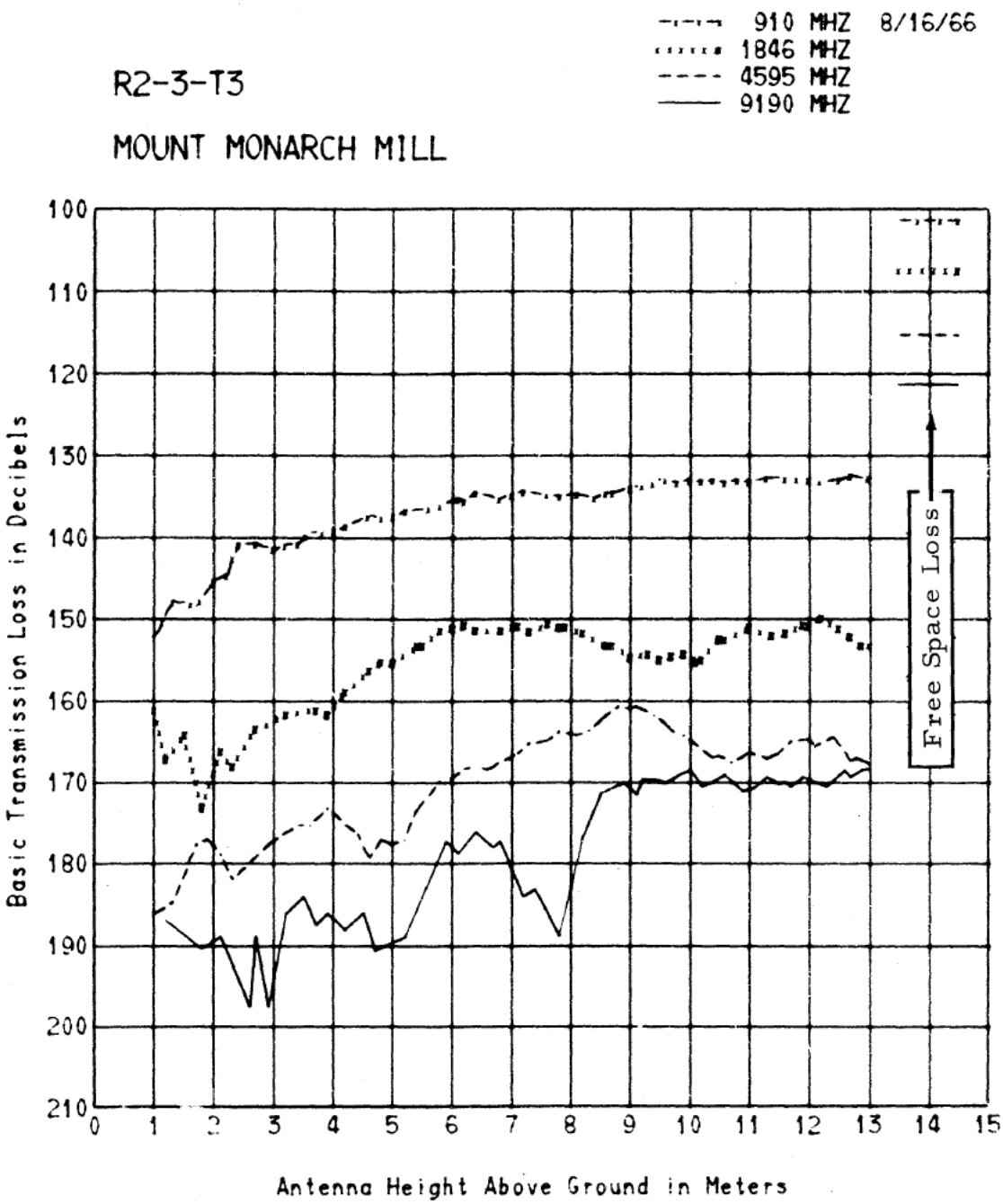
The path is directly into a hillside about 30 m away from the antennas. The hillside is covered with aspen trees. Telephone lines, 10 m to the south, parallel the path for about 25 m, then lead away from it at 90°. The hill rises about 50 m above the antennas.

R2-3-T3
MOUNT MONARCH MILL



PATH VIEW FROM TRANSMITTER

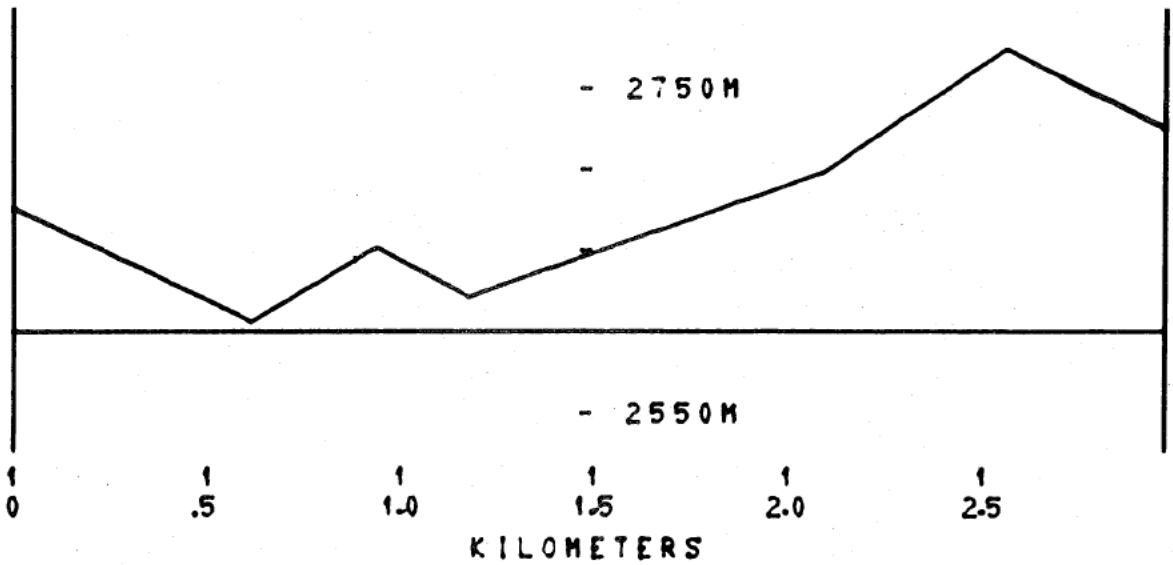
Bearing from common receiver site to transmitter site is
236° 44' 18" T.


910 MHZ 8/16/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-3-T3
MOUNT MONARCH MILL
Basic Transmission Loss in Decibels
100
110
120
130
140
150
160
170
180
190
200
210
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-3-T3
PATH LENGTH 2.886 km

XMTR. ELEV. 2725 M

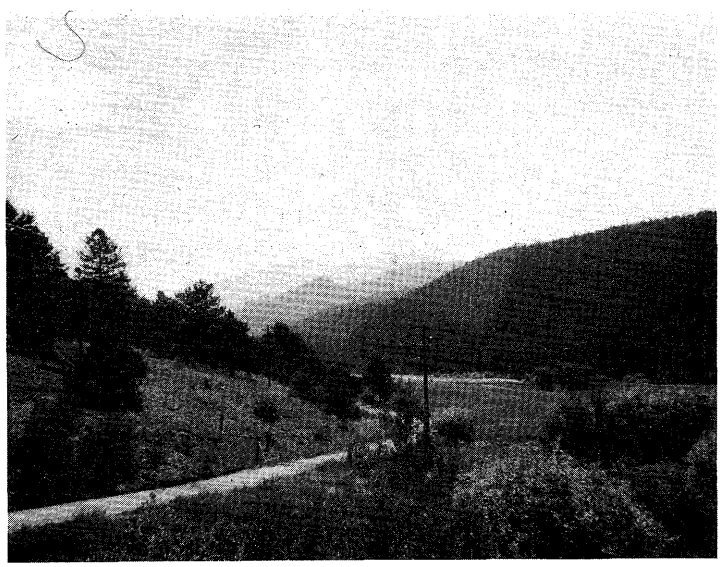


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	910	1846	4595	9190
		8-16-66 at 13 M		
50%	132.0	154.1	165.3	165.5
Δ10%-90%	< 3	< 3	3.9	< 3
		8-16-66 at 7.3 M		
50%	134.6	151.4	165.0	179.0
Δ10%-90%	< 3	< 3	< 3	6.8
		8-16-66 at 1 M		
50%	154.7	163.4	184.4	
Δ10%-90%	< 3	< 3	< 3	

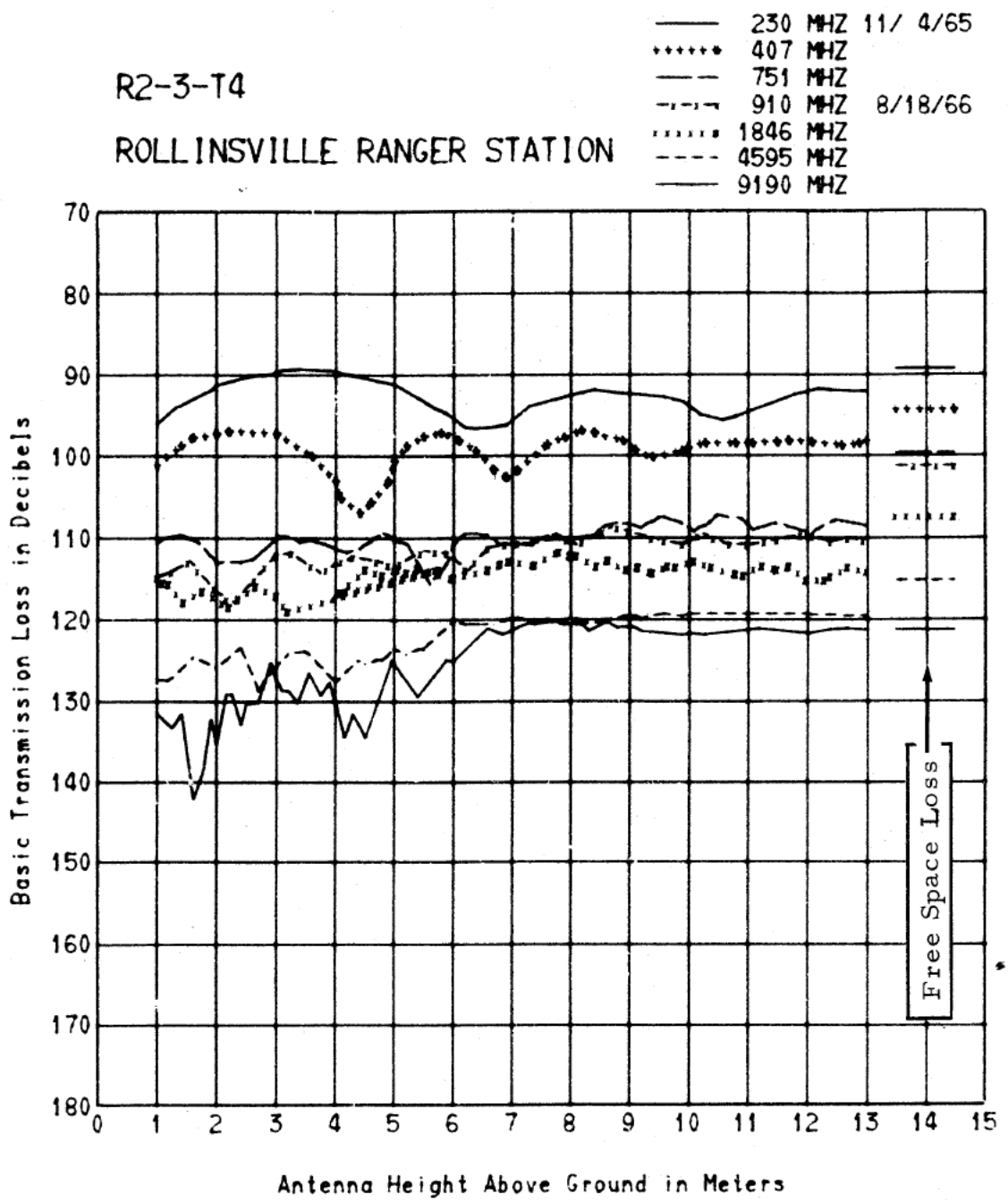
The transmitter is located on a mound of waste material from a mine approximately 10 m above the surrounding terrain. A few trees and brush grow about 100 m away. A metal building is to the left of the path and 46 m from the antennas. No power or telephone lines are in the area. Dense pines fill the area to the left of the path 180 m away.

R 2-3-T4
ROLLINSVILLE RANGER STATION



PATH VIEW FROM TRANSMITTER

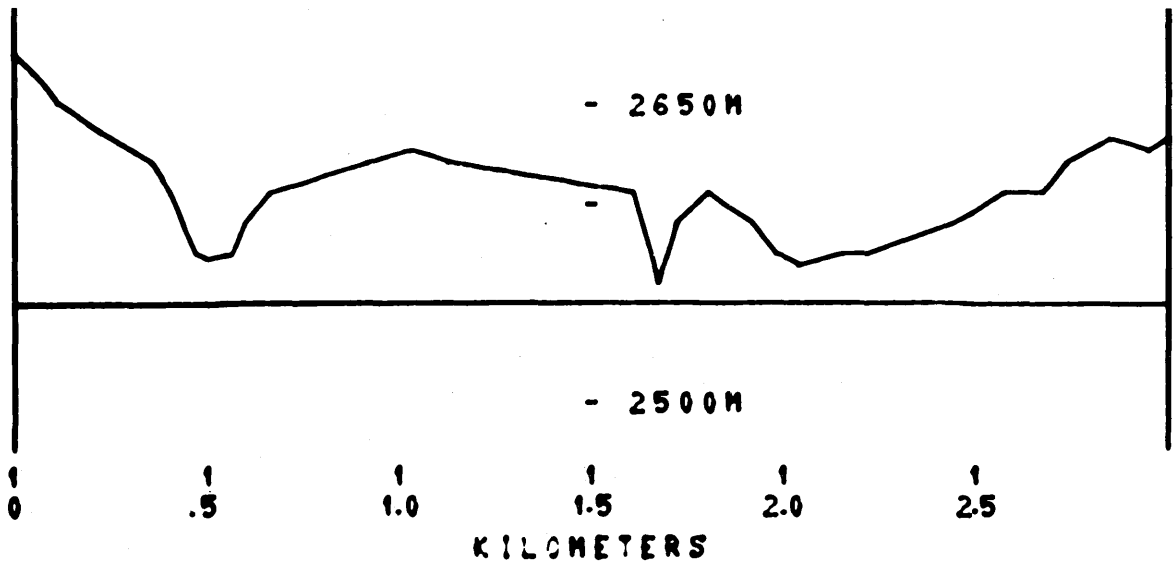
Bearing from common receiver site to transmitter site is
290° 11' 39" T.


R2-3-T4
ROLLINSVILLE RANGER STATION
230 MHZ 11/ 4/65
407 MHZ
751 MHZ
910 MHZ 8/18/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
70
80
90
100
110
120
130
140
150
160
170
180
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-3-T4
PATH LENGTH 2.992 km

XMTR. ELEV. 2633 M

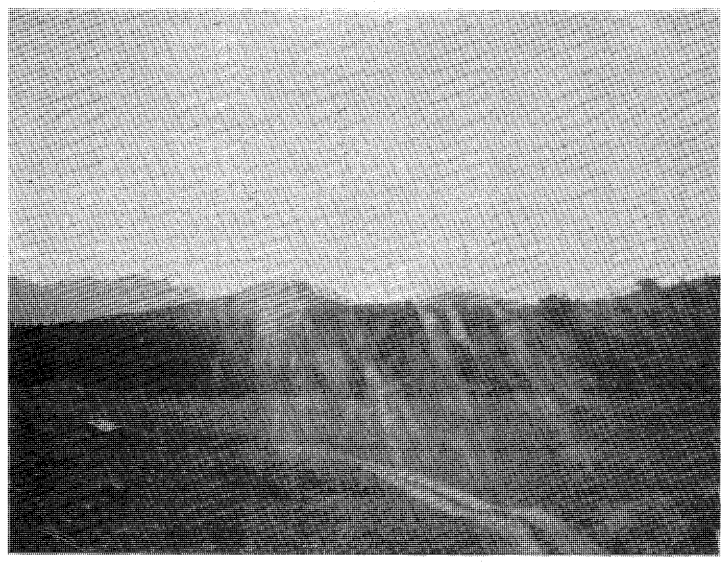


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	11-4-65 at 13 M				8-18-66 at 7.3 M		
50%	93.9	98.7	107.8	111.5	113.8	119.6	120.5
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	< 3

The path is over 30 m of small trees and brush, all below the line of sight, toward a 2-wire power line crossing the path at 45°. Beyond are sloping hills covered with dense pine trees.

R2-3-T5 OPEN AND CONCEALED
LOS LAGOS RANCH

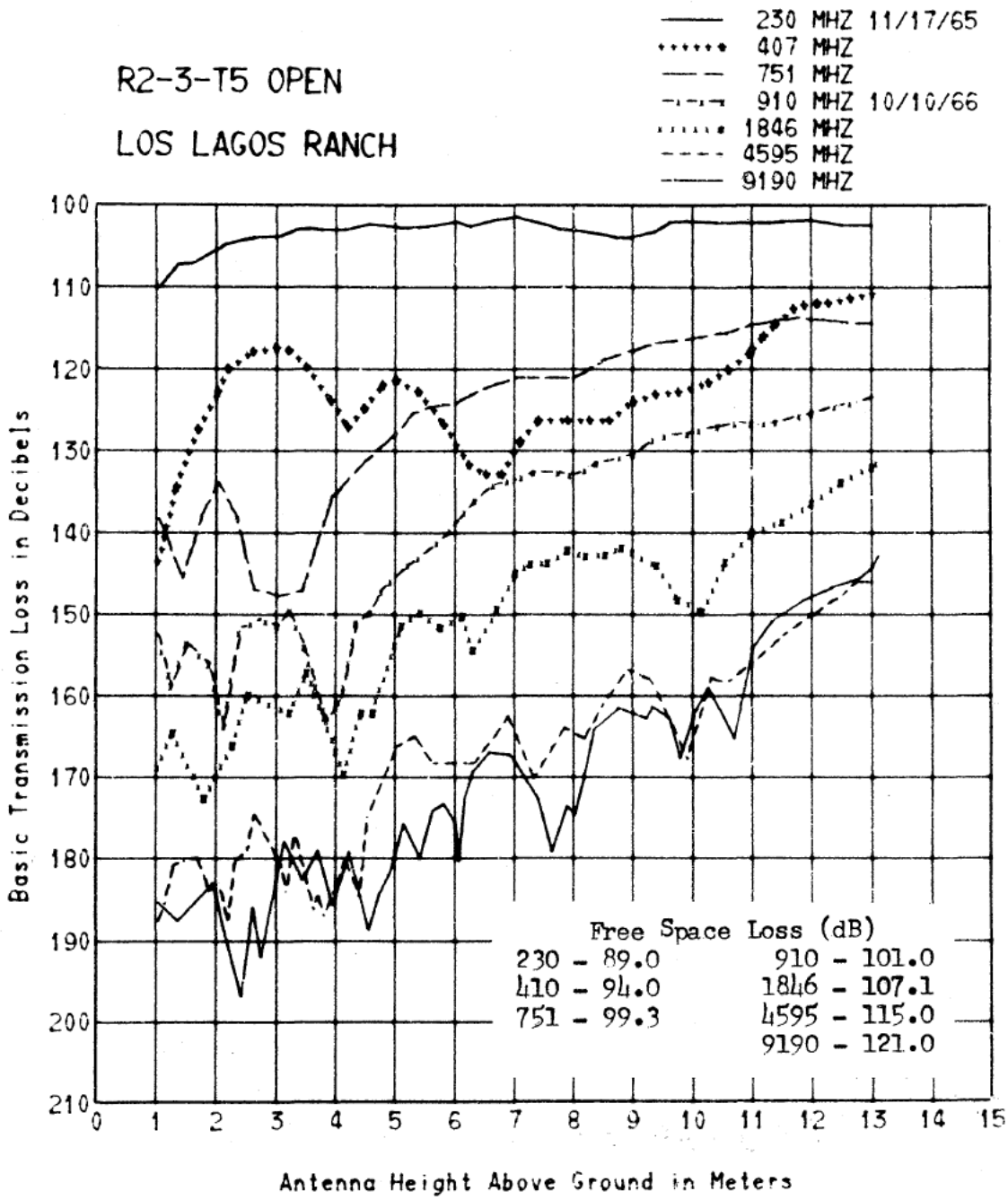


PATH VIEW FROM OPEN SITE

Bearing from common receiver site to transmitter site is 334° 55' 37" T.

PATH VIEW FROM CONCEALED SITE

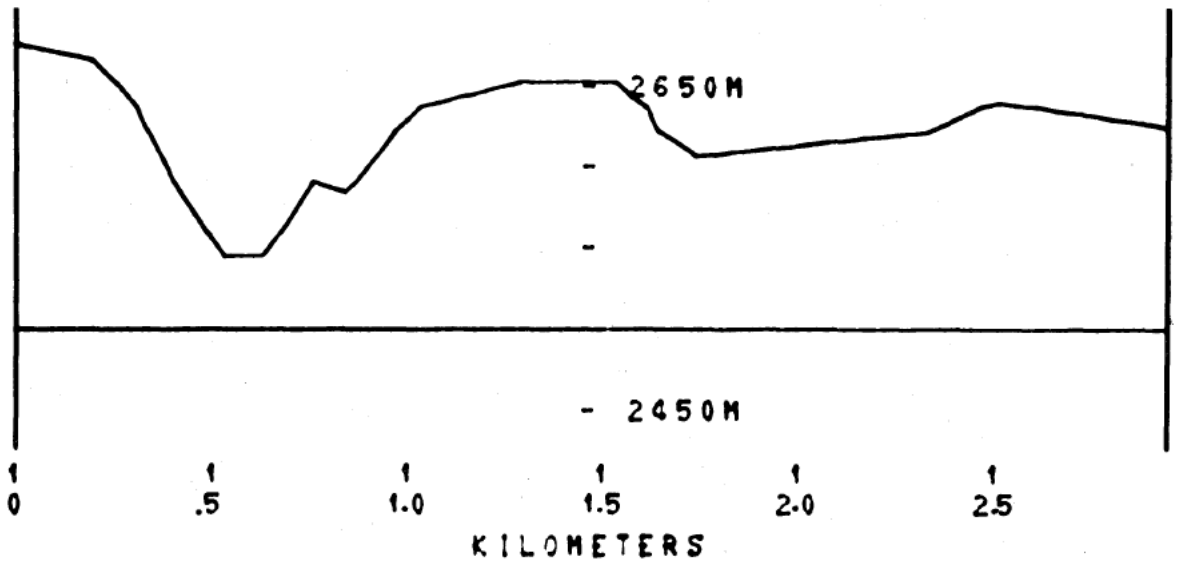
Bearing from common receiver site to transmitter site is 337° 32' 28" T.


R2-3-T5 OPEN
LOS LAGOS RANCH
230 MHZ 11/17/65
407 MHZ
751 MHZ
910 MHZ 10/10/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
100
110
120
130
140
150
160
170
180
190
200
210
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss (dB)
230 - 89.0
410 - 94.0
751 - 99.3
910 - 101.0
1846 - 107.1
4595 - 115.0
9190 - 121.0
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-3-T5 OPEN
PATH LENGTH 2.927 km

XMTR. ELEV.
2624 M



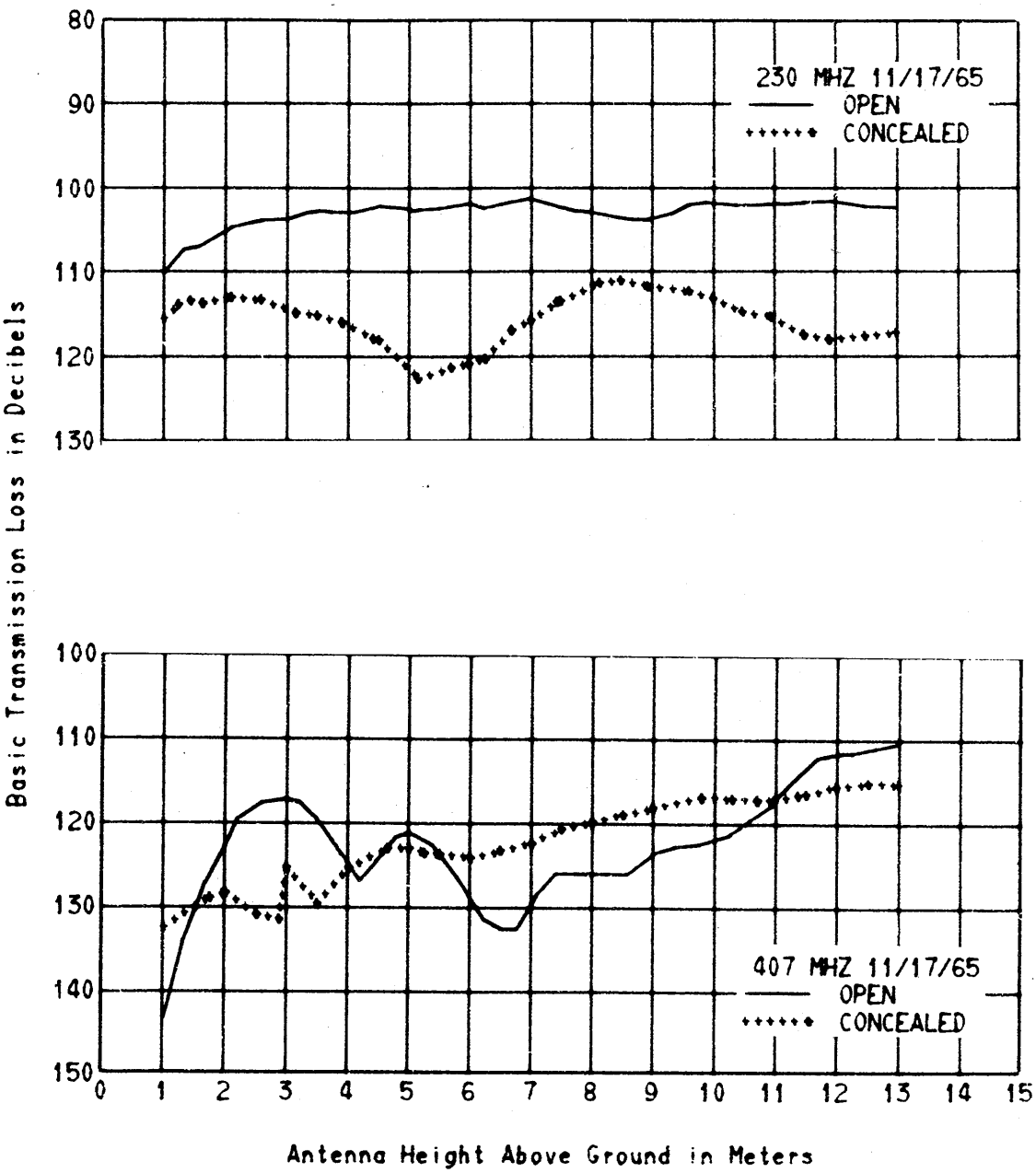
L_b (dB) SHORT TERM SIGNAL VARIABILITY

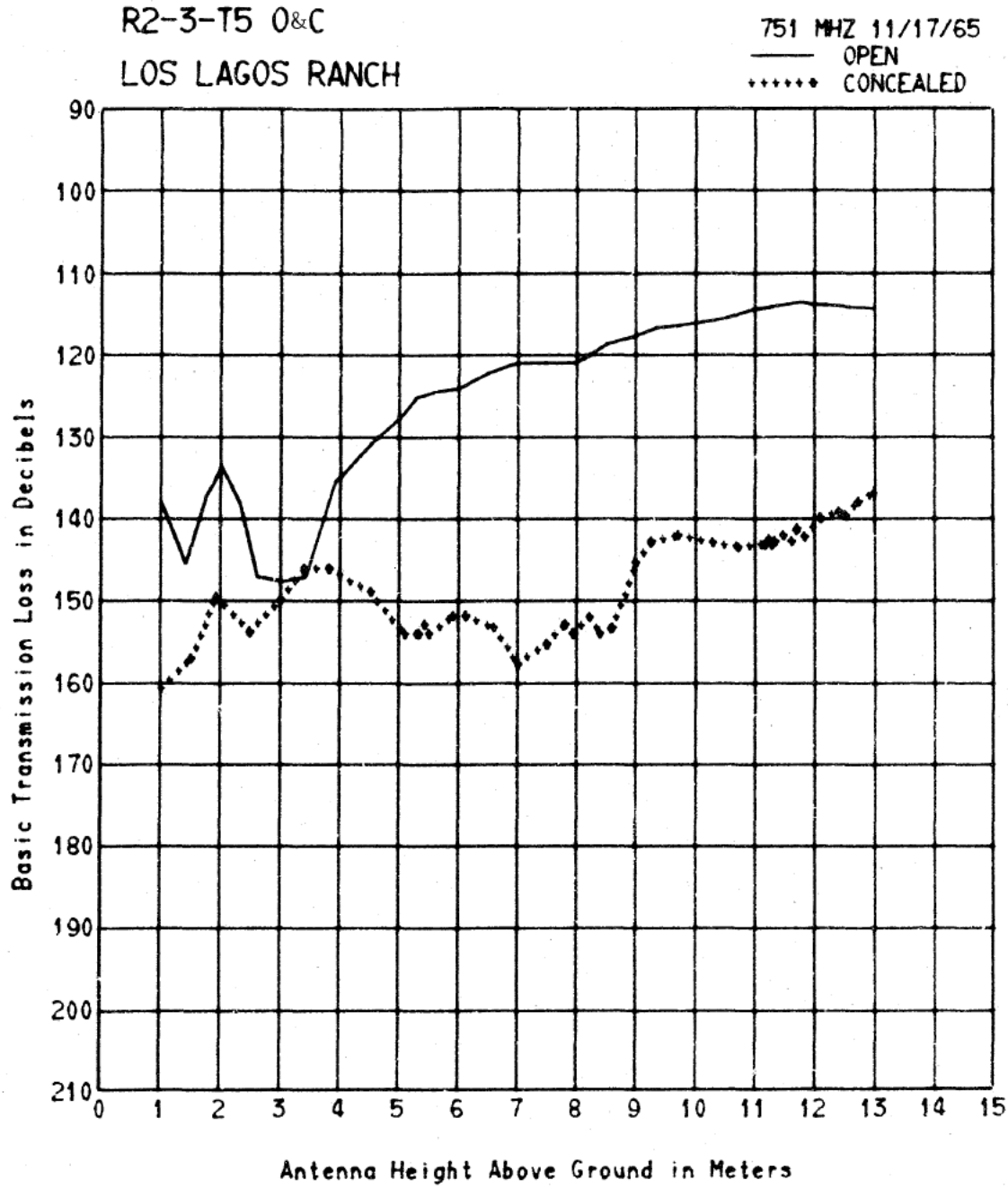
Freq (MHz)	230	407	751	910	1846	4595	9190
	11-17-65 at 13 M				10-10-66 at 13 M		
50%	103.4	109.0	114.5	122.6	129.0	146.0	141.0
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	< 3
					10-10-66 at 7.3 M		
50%				130.1	140.4	177.0	172.0
Δ10%-90%				< 3	< 3	8.5	< 3
					10-10-66 at 1 M		
50%				150.1	166.4	195.6	186.0
Δ10%-90%				< 3	< 3	9.5	< 3

The foreground is a clear meadow for the first 180 m. Dense pines then cover the terrain to the horizon, which is 1.5 km away.

R2-3-T5 O&C

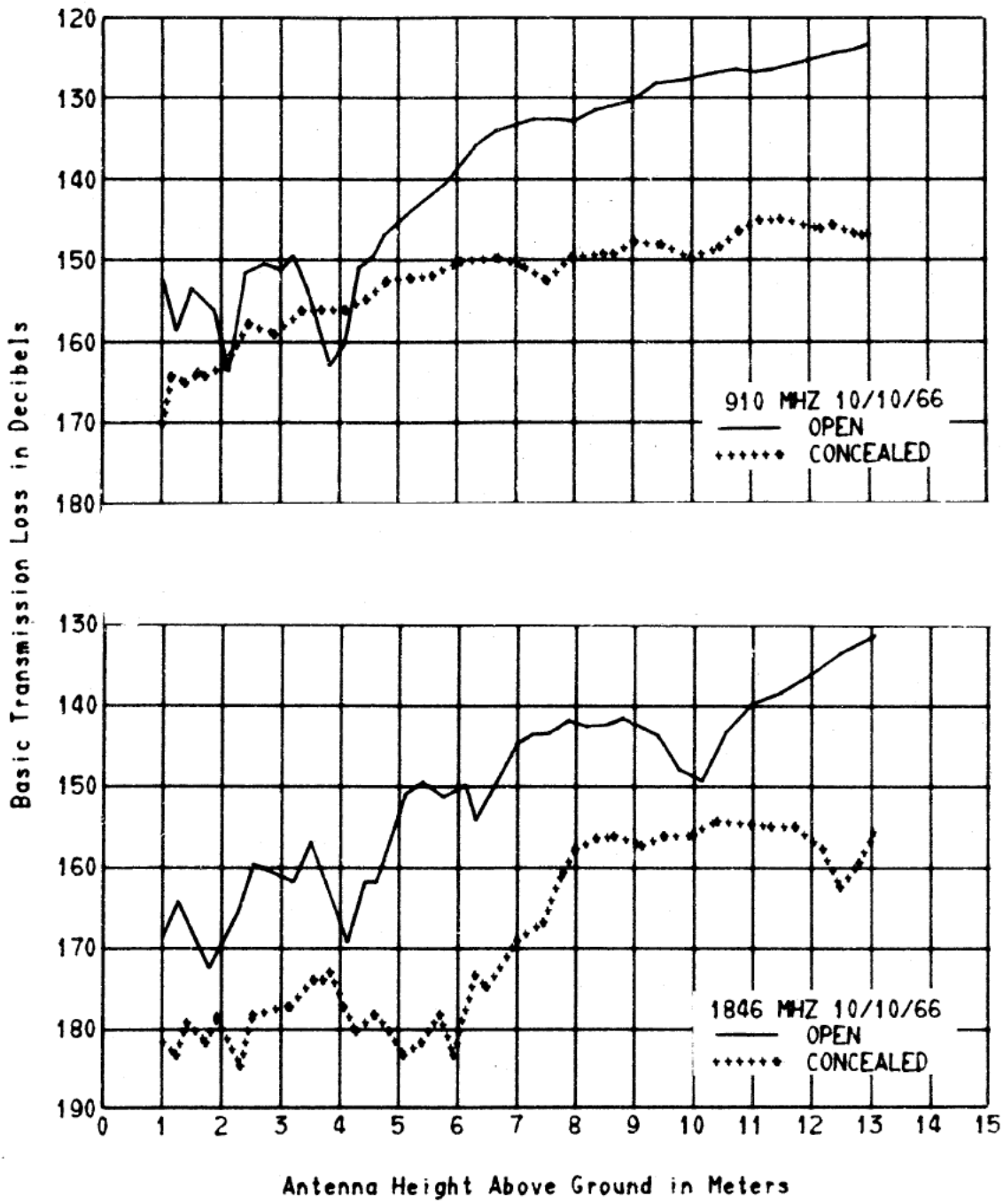
LOS LAGOS RANCH

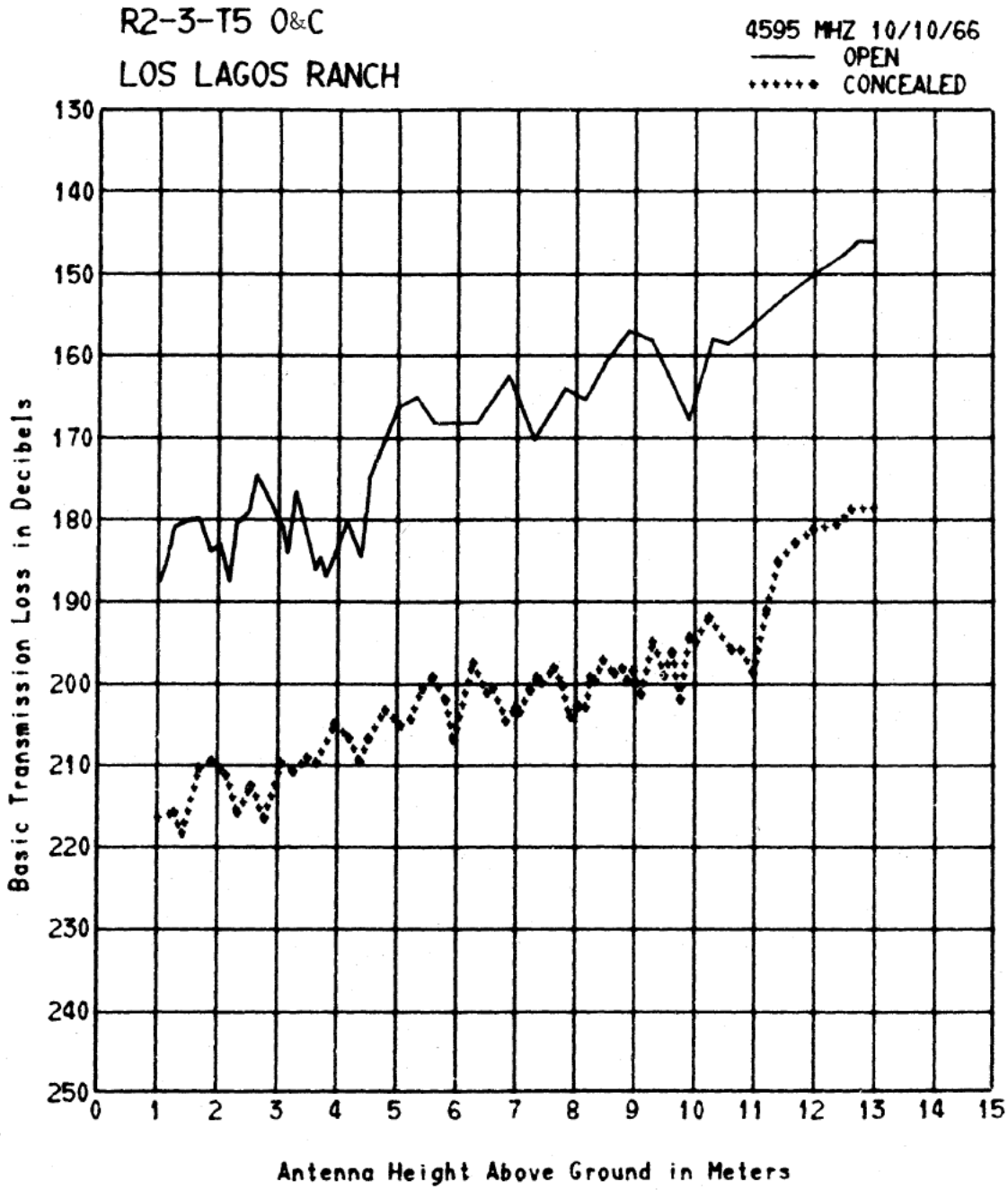


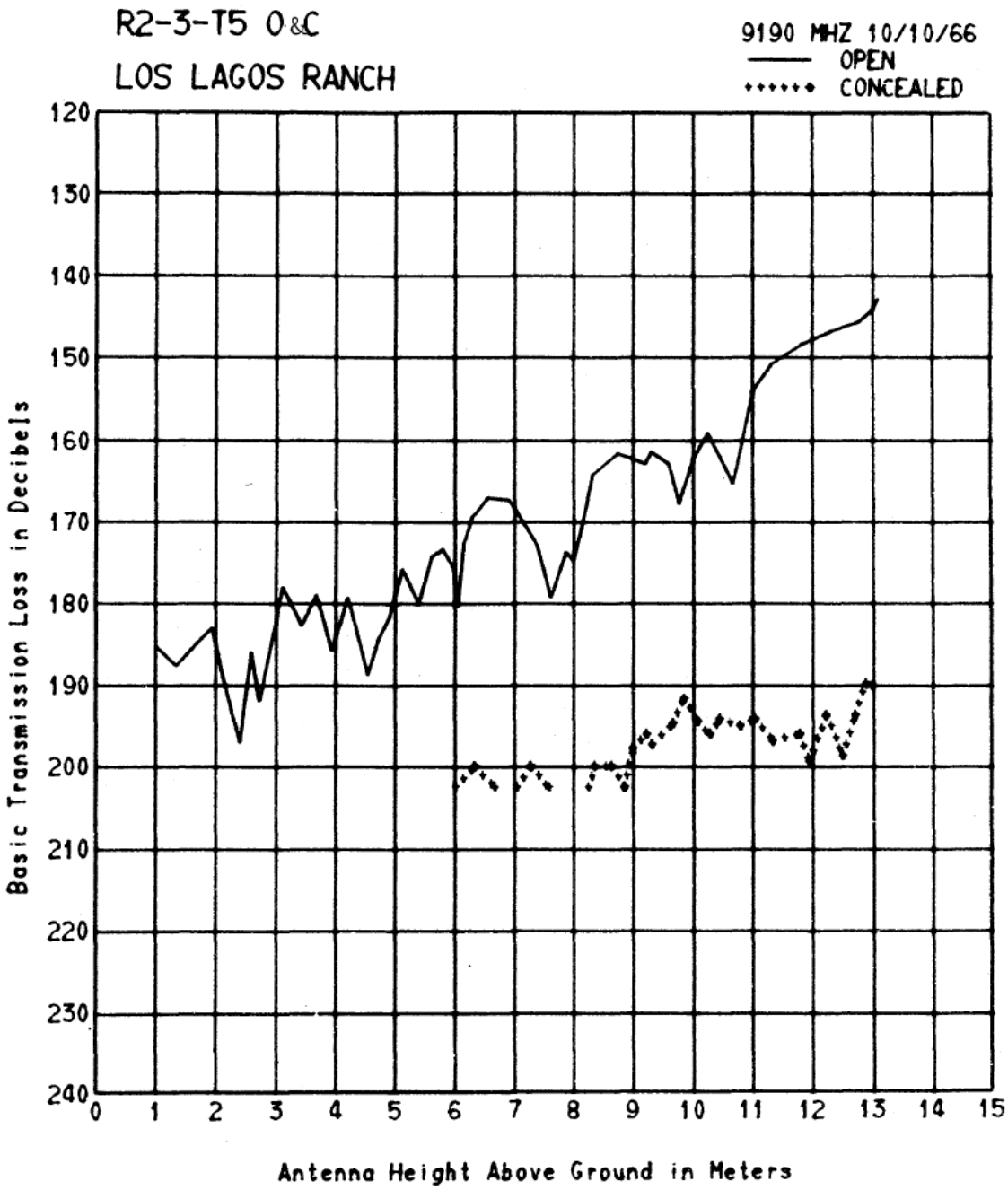

R2-3-T5 O&C
LOS LAGOS RANCH
751 MHZ 11/17/65
OPEN
CONCEALED
Basic Transmission Loss in Decibels
90
100
110
120
130
140
150
160
170
180
190
200
210
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

R2-3-T5 O&C

LOS LAGOS RANCH



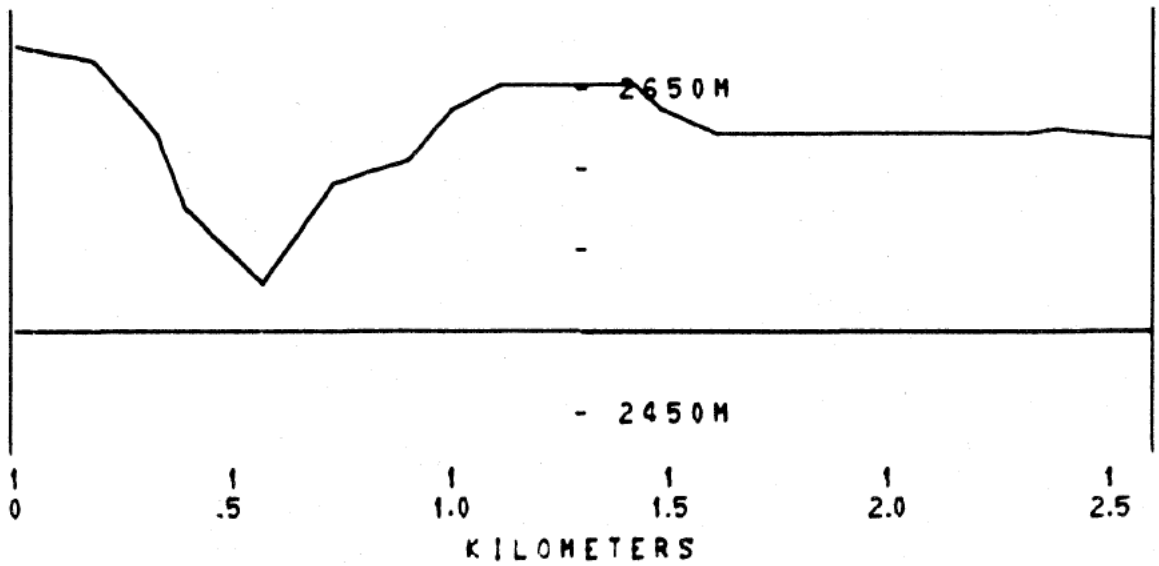

R2-3-T5 O&C
LOS LAGOS RANCH
4595 MHZ 10/10/66
OPEN
CONCEALED
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
250
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters


R2-3-T5 O&C
LOS LAGOS RANCH
9190 MHZ 10/10/66
OPEN
CONCEALED
Basic Transmission Loss in Decibels
120
130
140
150
160
170
180
190
200
210
220
230
240
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-3-T5 CONCEALED
PATH LENGTH 2.593 km

XMTR. ELEV.
2618 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

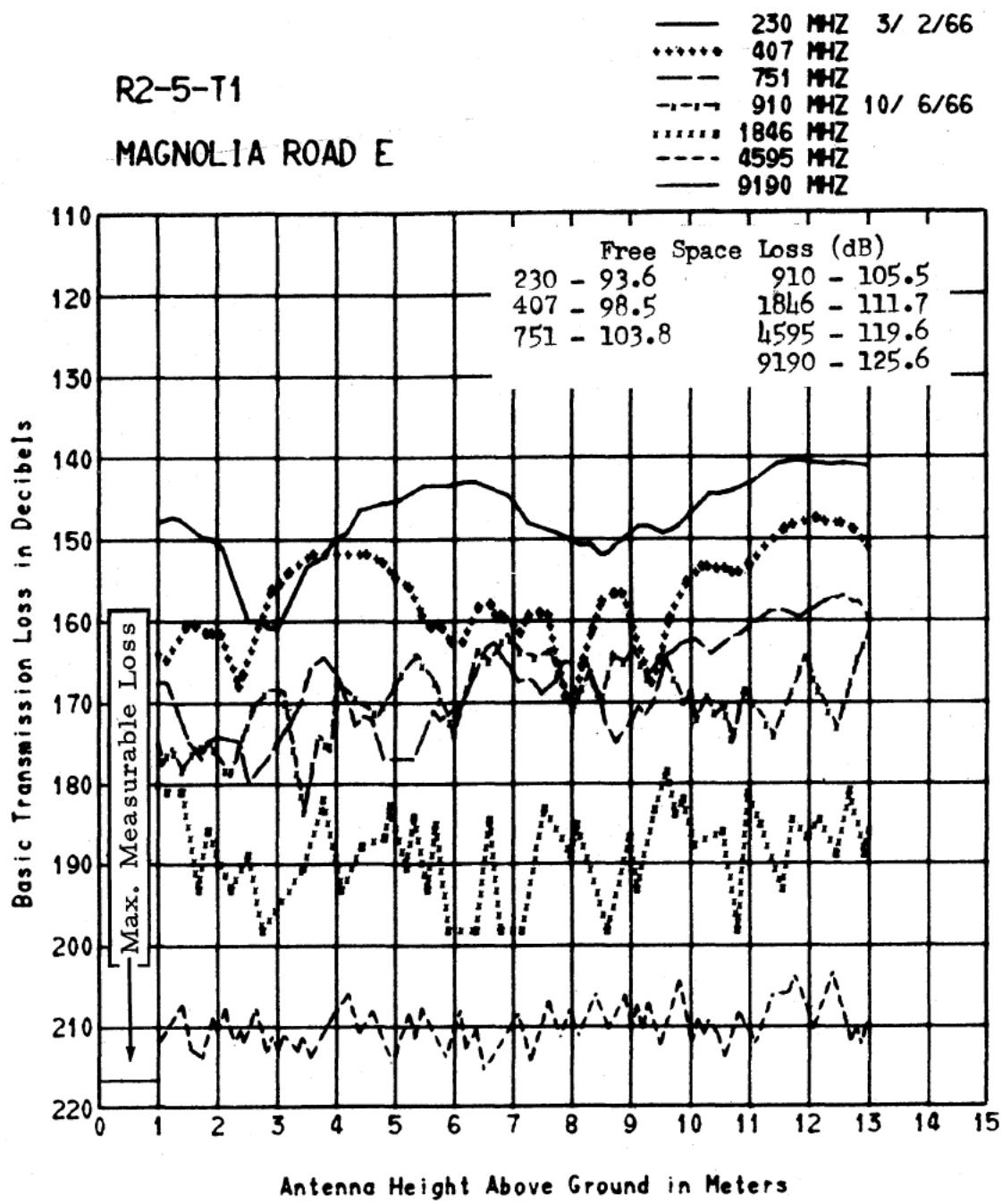
Freq (MHz)	230	407	751	910	1846	4595	9190
	11-17-65 at 13 M				10-10-66 at 13 M		
50%	116.8	115.2	135.0	146.8	153.6	176.6	190.6
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	< 3
					10-10-66 at 7.3 M		
50%				149.8	166.6	202.1	200.6
Δ10%-90%				< 3	8.0	10.0	< 3
					10-10-66 at 1 M		
50%				171.3	182.6	215.1	
Δ10%-90%				3.5	5.0	< 3	

This site is located within a dense grove of pine trees, which are 6 to 9 m tall. This tree cover continues to the horizon 1.5 km away.

R2-5-T1
MAGNOLIA ROAD E

PATH VIEW FROM TRANSMITTER

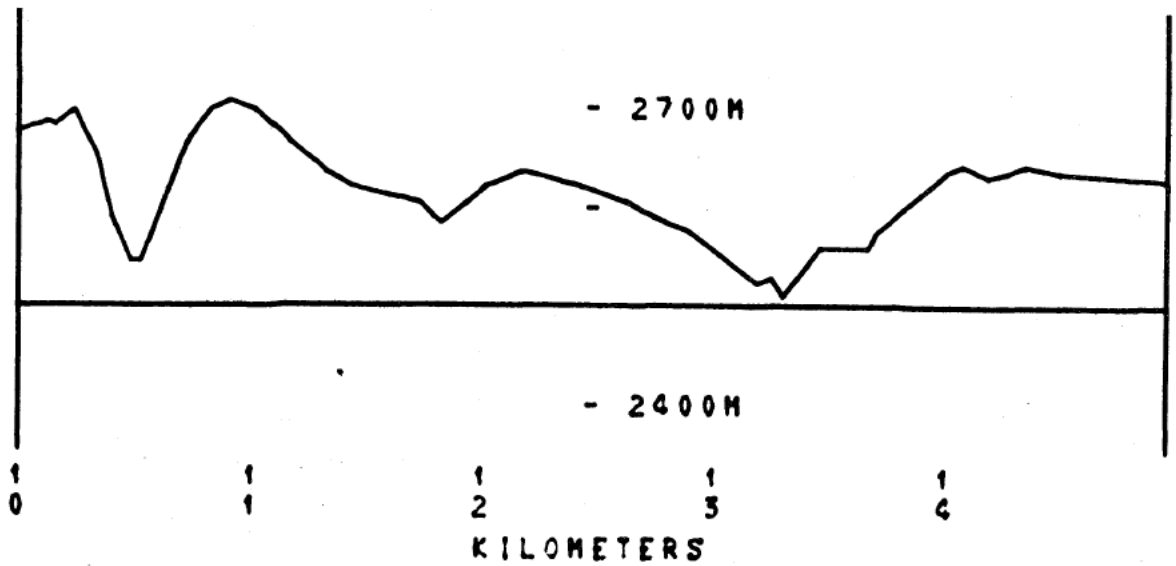
Bearing from common receiver site to transmitter site is
12^{o} 59' 22" T.


R2-5-T1
MAGNOLIA ROAD E
230 MHZ 3/ 2/66
407 MHZ
751 MHZ
910 MHZ 10/ 6/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 93.6
407 - 98.5
751 - 103.8
910 - 105.5
1846 - 111.7
4595 - 119.6
9190 - 125.6
Max. Measurable Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-5-T1
PATH LENGTH 4.946 km

XMTR. ELEV. 2629 M

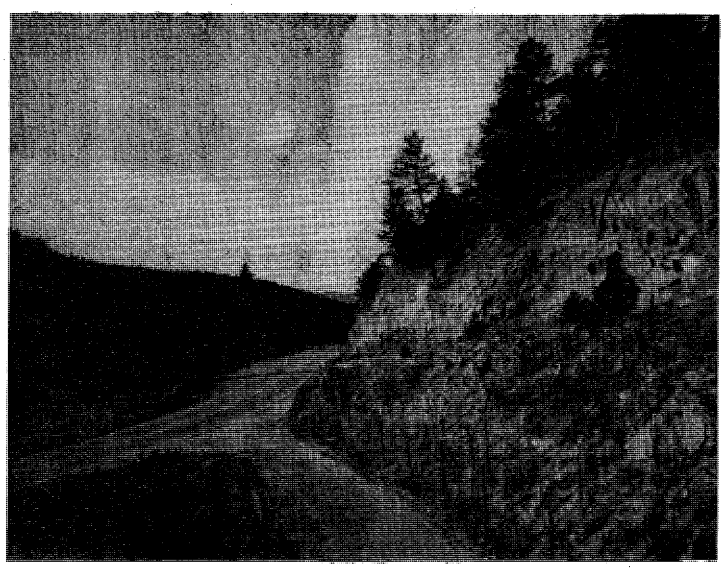


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	2-28-66 at 13 M				10-6-66 at 13 M		
50%	141.8	151.6	162.2	162.3	185.0	207.9	
Δ10%-90%	< 3	3.6	< 3	< 3	14.2	5.8	
					10-6-66 at 7.3 M		
50%				164.7	186.3	210.0	
Δ10%-90%				3.4	17.4	5.5	
					10-6-66 at 1 M		
50%				172.5	180.0	213.4	
Δ10%-90%				6.6	3.7	4.0	

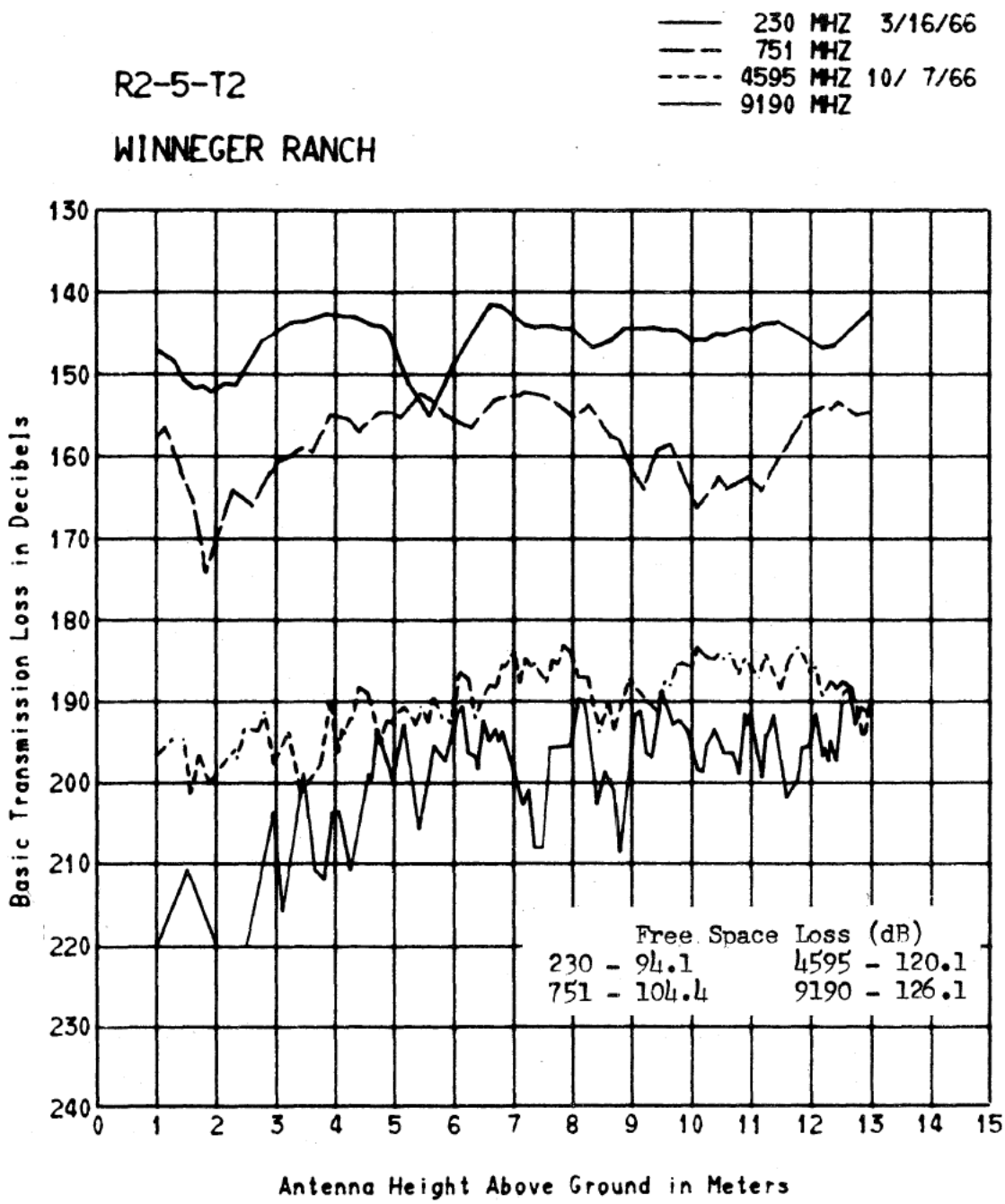
The radio path looks directly into a stand of young pine trees, which extends for 400 to 800 m. Beyond are scattered pines over rolling hills.

R2-5-T2
WINNEGER RANCH



PATH VIEW FROM TRANSMITTER

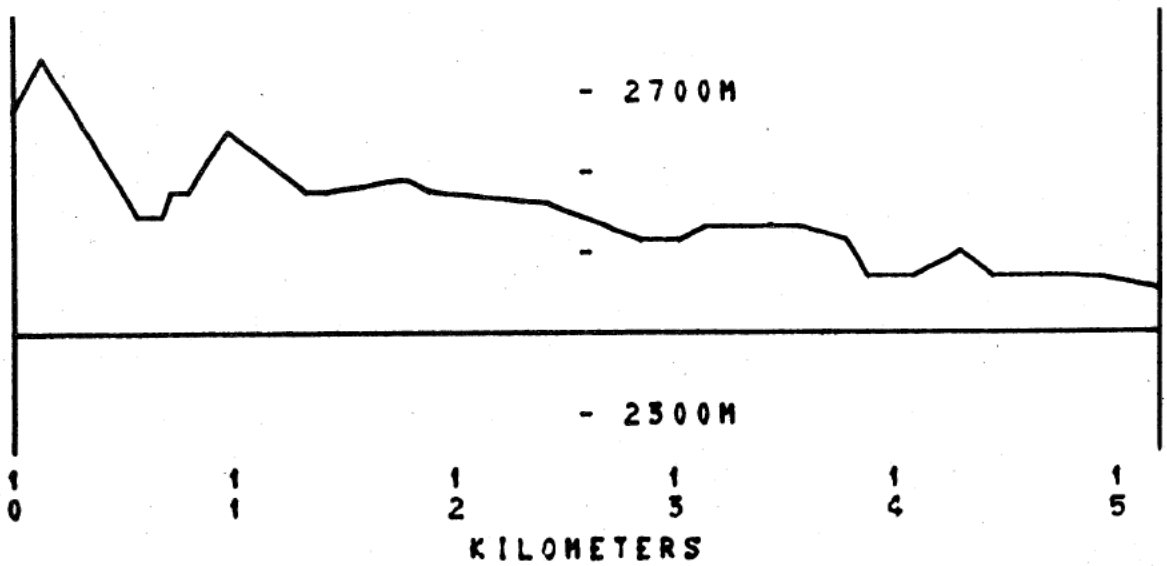
Bearing from common receiver site to transmitter site is 54^{o} 43' 10" T.


230 MHZ 3/16/66
751 MHZ
4595 MHZ 10/ 7/66
9190 MHZ
R2-5-T2
WINNEGER RANCH
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss (dB)
230 - 94.1
751 - 104.4
4595 - 120.1
9190 - 126.1

RCVR. ELEV. 2676 M

R2-5-T2
PATH LENGTH 5.267 km

XMTR. ELEV. 2454 M

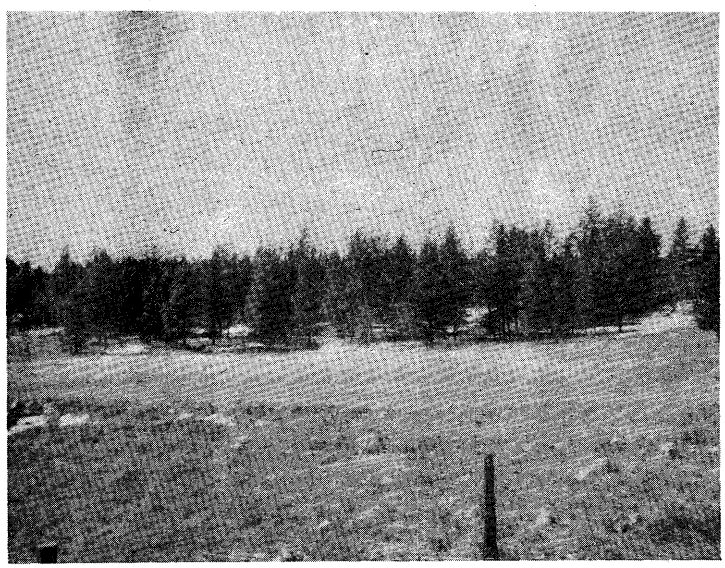


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	751	4595	9190
	3-16-66 at 13 M		10-7-66 at 13 M	
50%	142.4	155.4	188.0	202.8
Δ10%-90%	< 3	< 3	3.5	13.6
			10-7-66 at 7.3 M	
50%			186.0	205.8
Δ10%-90%			< 3	15.7
			10-7-66 at 1 M	
50%			200.0	
Δ10%-90%			< 3	

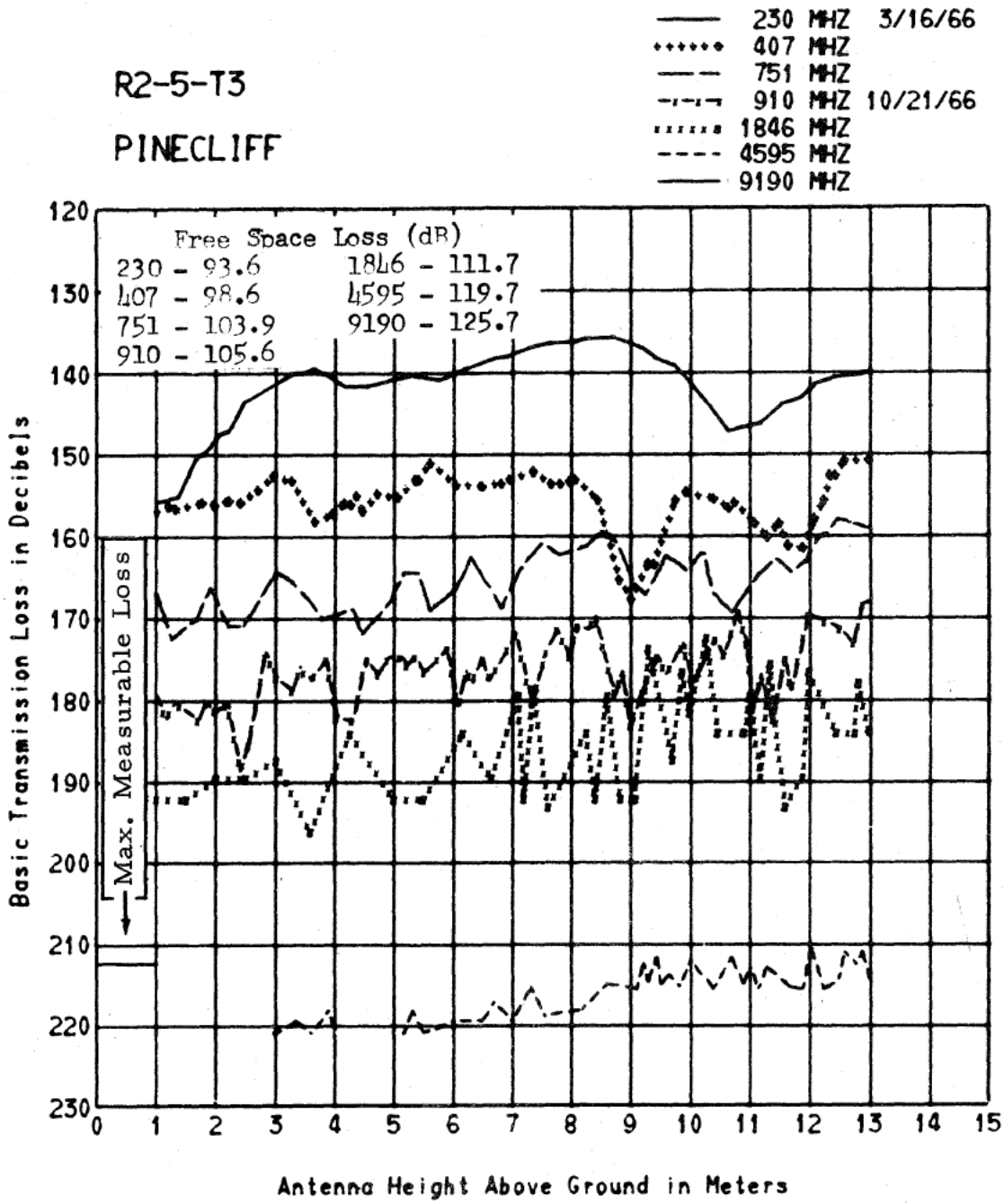
One hundred and fifty meters from the antennas, the radio path is obstructed by a cliff rising sharply to the right. In the immediate foreground, a short fence runs at 10^{o} to the path up to the cliff. Beyond are rolling hills covered with dense pines.

R2-5-T3
PINECLIFF



PATH VIEW FROM TRANSMITTER

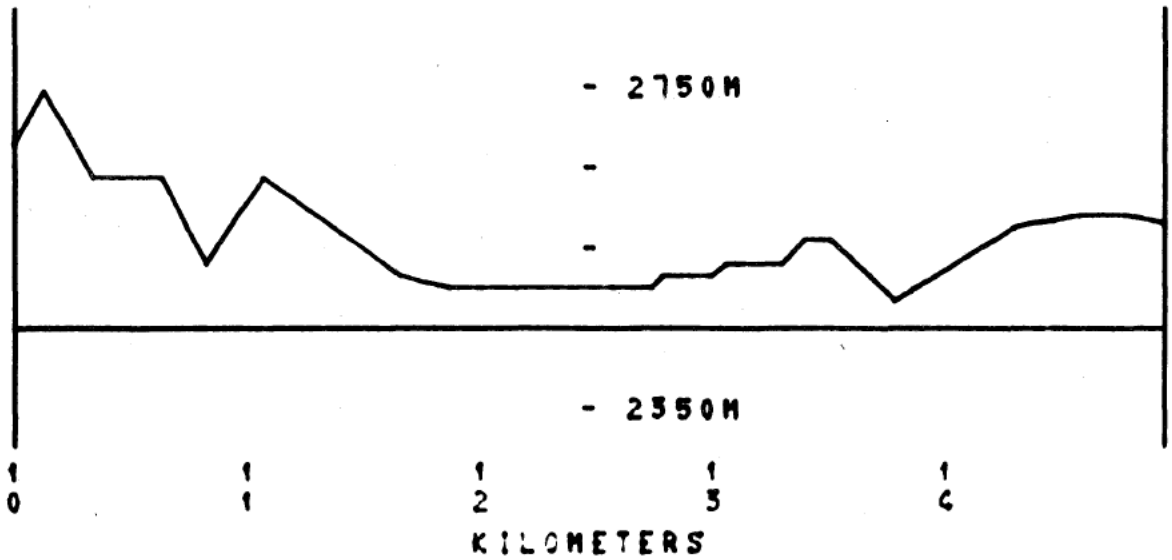
Bearing from common receiver site to transmitter site is 67^{o} 03' 45" T.


230 MHZ 3/16/66
407 MHZ
751 MHZ
910 MHZ 10/21/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-5-T3
PINECLIFF
Free Space Loss (dB)
230 - 93.6
407 - 98.6
751 - 103.9
910 - 105.6
1846 - 111.7
4595 - 119.7
9190 - 125.7
Max. Measurable Loss
Basic Transmission Loss in Decibels
120
130
140
150
160
170
180
190
200
210
220
230
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-5-T3
PATH LENGTH 4.987 km

XMTR. ELEV. 2580 M

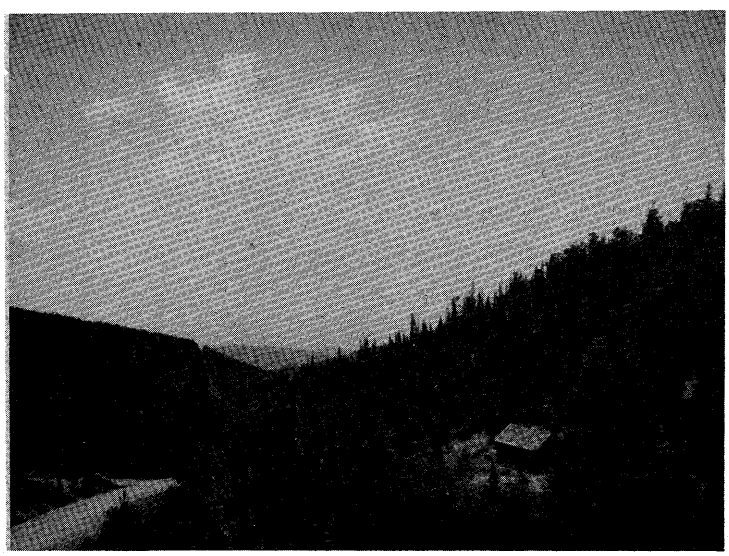


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-16-66 at 7.3 M			10-21-66 at 13 M			
50%	137.1	152.4	161.7	170.2	174.4	212.6	
Δ10%-90%	< 3	< 3	< 3	5.5	11.9	6.0	
				10-21-66 at 7.3 M			
50%				172.7	179.4	216.6	
Δ10%-90%				5.5	< 3	< 3	
				10-21-66 at 1 M			
50%				181.2	189.4		
Δ10%-90%				6.5	< 3		

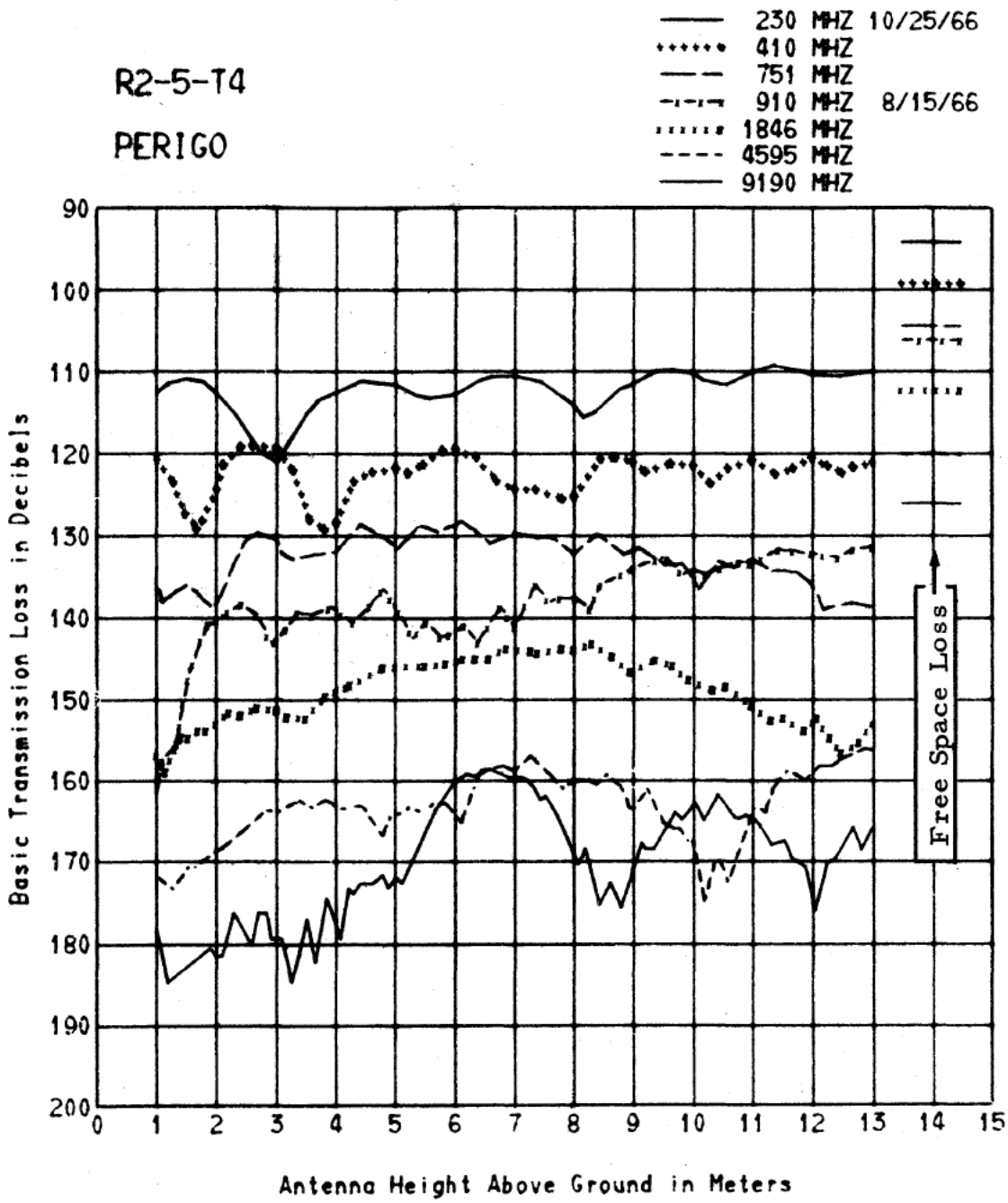
This path is over open grassy fields for 90 m to a dense grove of 15 m tall spruce trees, which continue to the horizon 400 m away.

R2-5-T4
PERIGO



PATH VIEW FROM TRANSMITTER

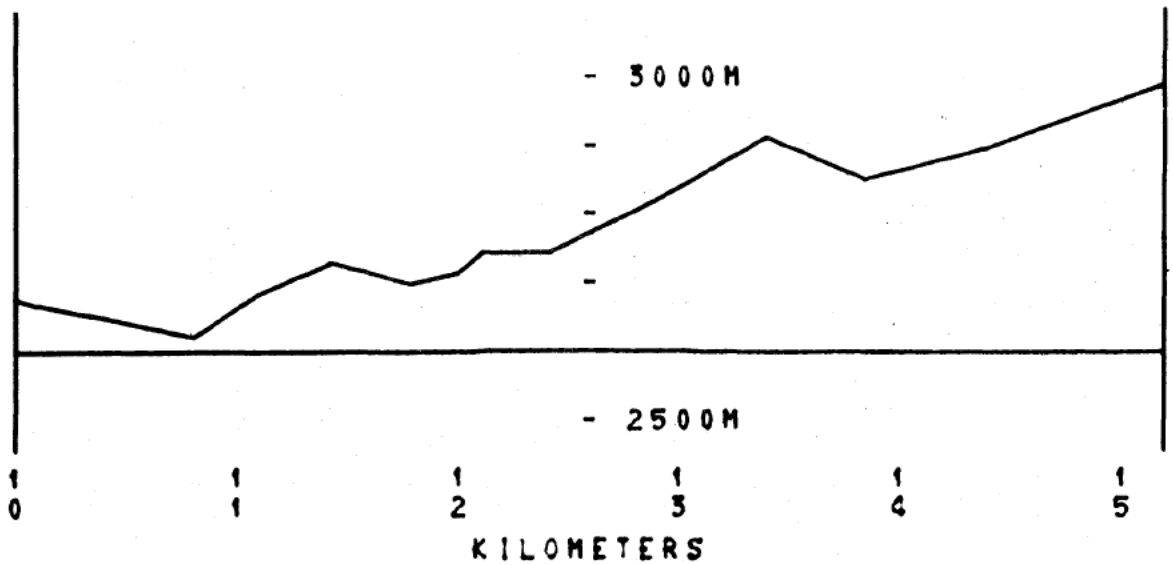
Bearing from common receiver site to transmitter site is
222^{o} 33' 37" T.


R2-5-T4
PERIGO
230 MHZ 10/25/66
410 MHZ
751 MHZ
910 MHZ 8/15/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss
Basic Transmission Loss in Decibels
90
100
110
120
130
140
150
160
170
180
190
200
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-5-T4
PATH LENGTH 5.097 km

XMTR. ELEV. 2987 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

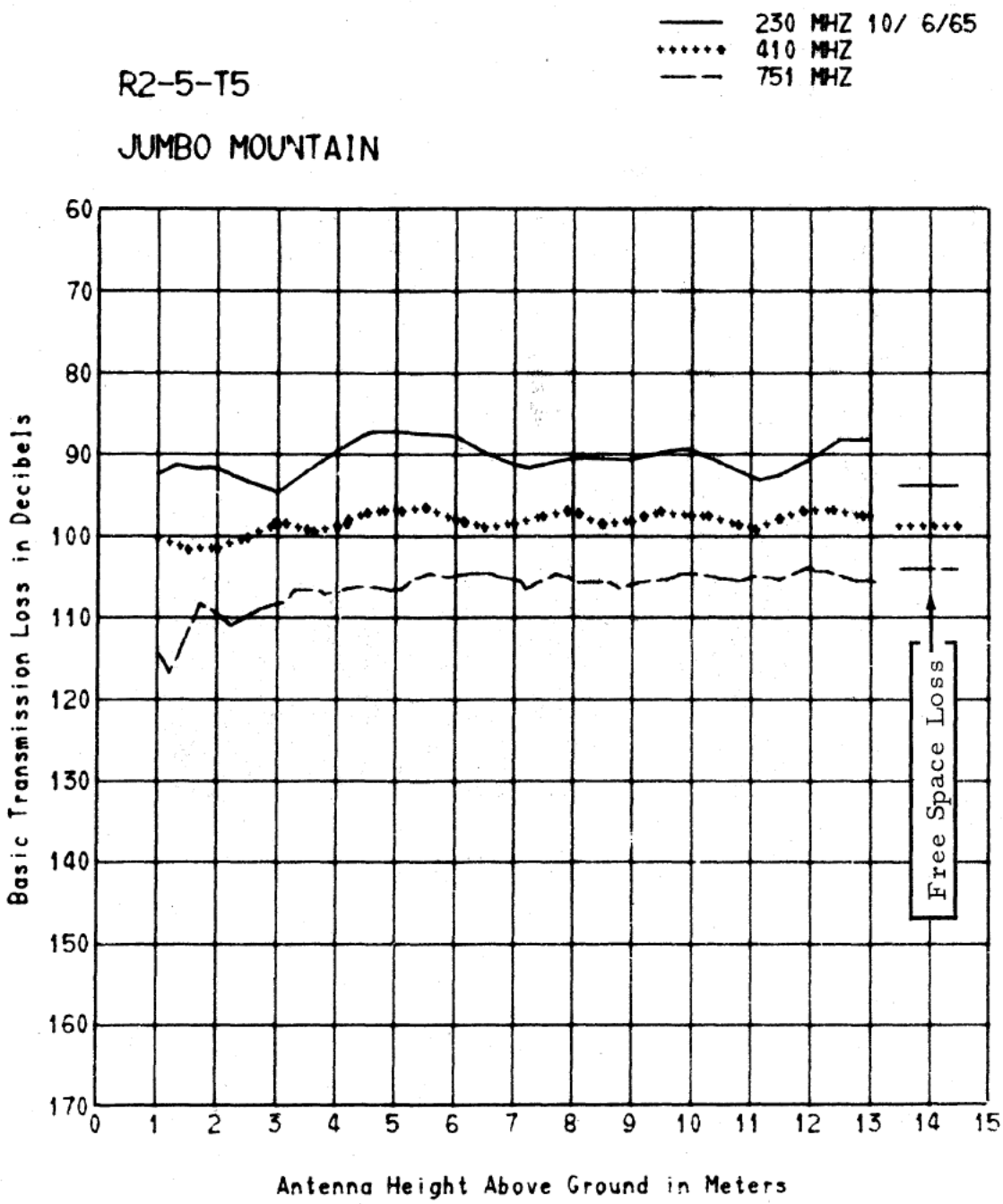
Freq (MHz)	230	410	751	910	1846	4595	9190
	10-6-65 at 13 M			8-15-66 at 13 M			
50%	109.9	120.9	137.0	131.6	150.2	157.5	165.7
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	3.7
				8-15-66 at 7.3 M			
50%				136.6	142.8	157.7	159.7
Δ10%-90%				< 3	< 3	4.0	< 3
				8-15-66 at 1 M			
50%				162.6	156.5	171.7	178.0
Δ10%-90%				<3	< 3	3.7	4.8

The immediate foreground drops quickly away from the transmitter. The terrain is covered with scrub pine and field grass for 60 m to a small stream. Beyond the stream the path extends over rolling hills covered with pines. A deserted cabin sits just to the right of the path, about 350 m away. No other obstructions exist.

R2-5-T5
JUMBO MOUNTAIN

PATH VIEW FROM TRANSMITTER

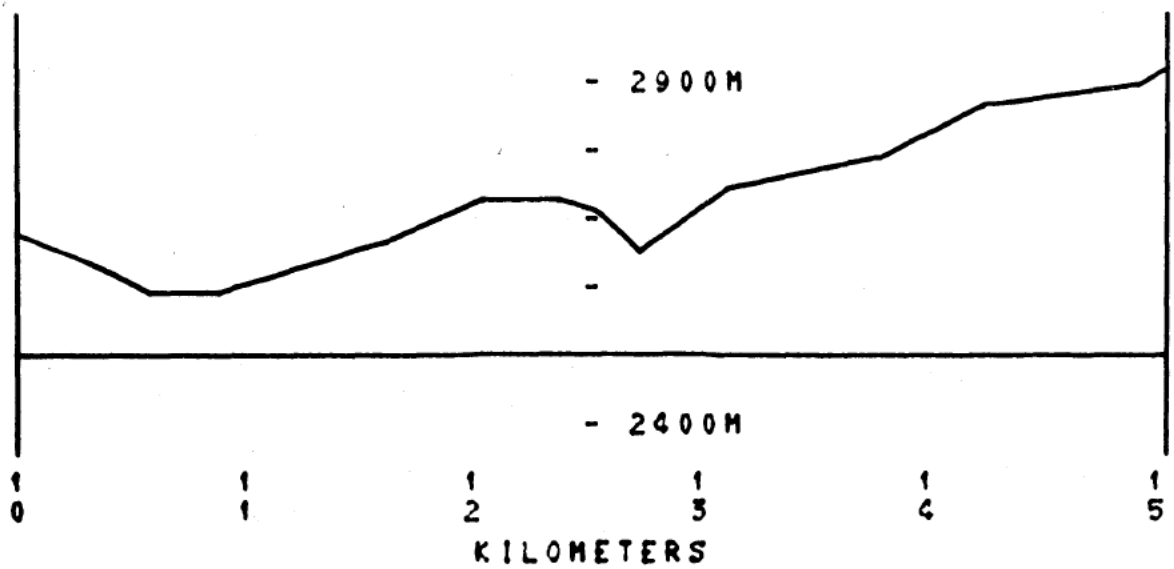
Bearing from common receiver site to transmitter site
257° 27' 49" T.


230 MHZ 10/ 6/65
410 MHZ
751 MHZ
R2-5-T5
JUMBO MOUNTAIN
Basic Transmission Loss in Decibels
60
70
80
90
100
110
120
130
140
150
160
170
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-5-T5
PATH LENGTH 5.014 km

XMTR. ELEV. 2917 M

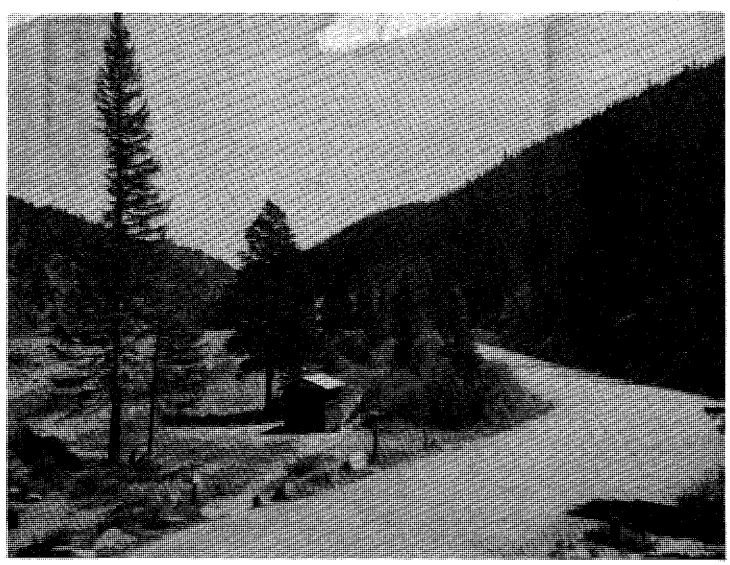


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)		410	751
	10-6-65 at 13 M		
50%	86.9	97.3	104.5
Δ10%-90%	< 3	< 3	< 3

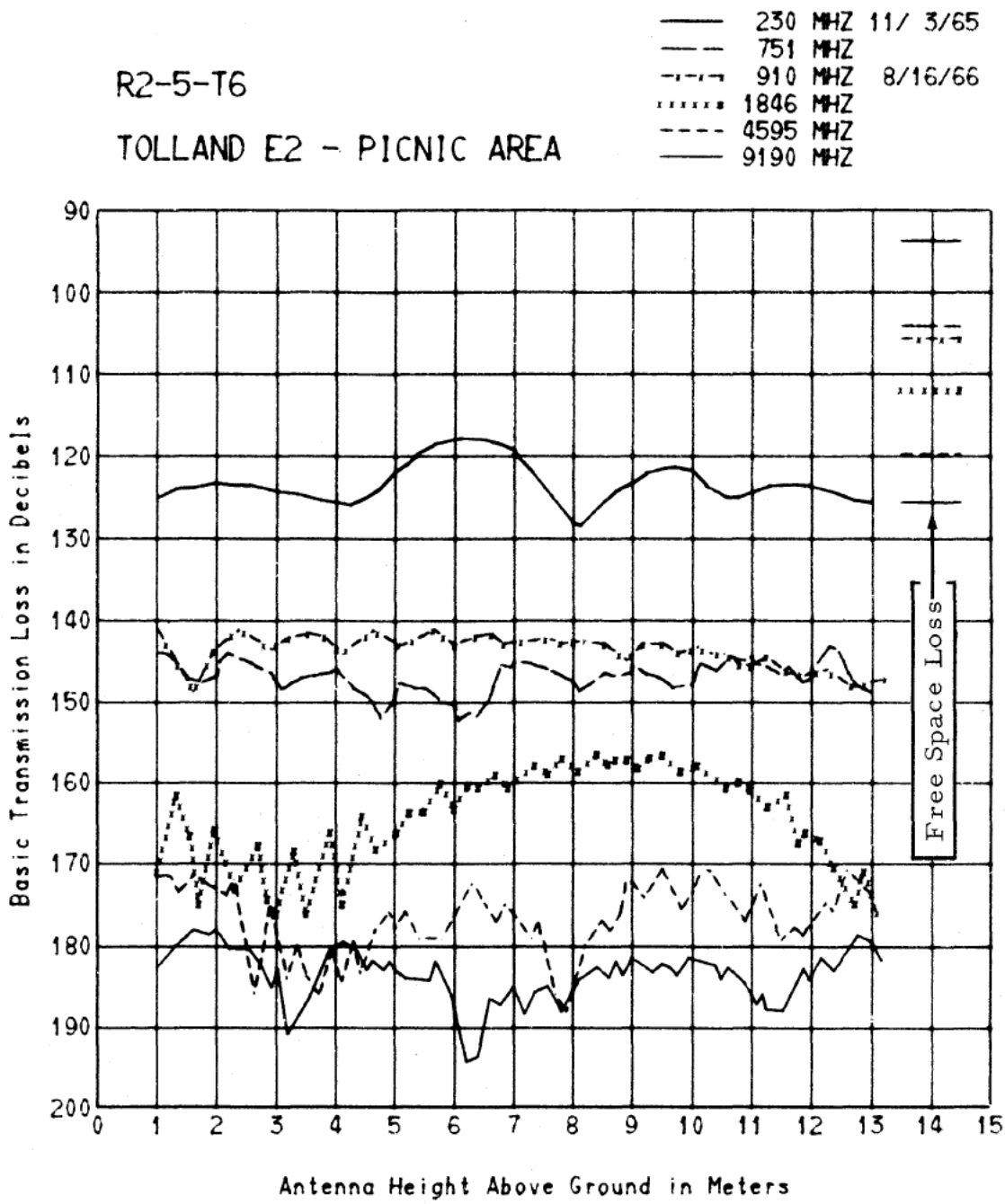
The foreground is free of all obstructions. Below the line-of-sight, dense pines cover rolling hills to the receiver site.

R2-5-T6
TOLLAND E2 - PICNIC AREA



PATH VIEW FROM TRANSMITTER

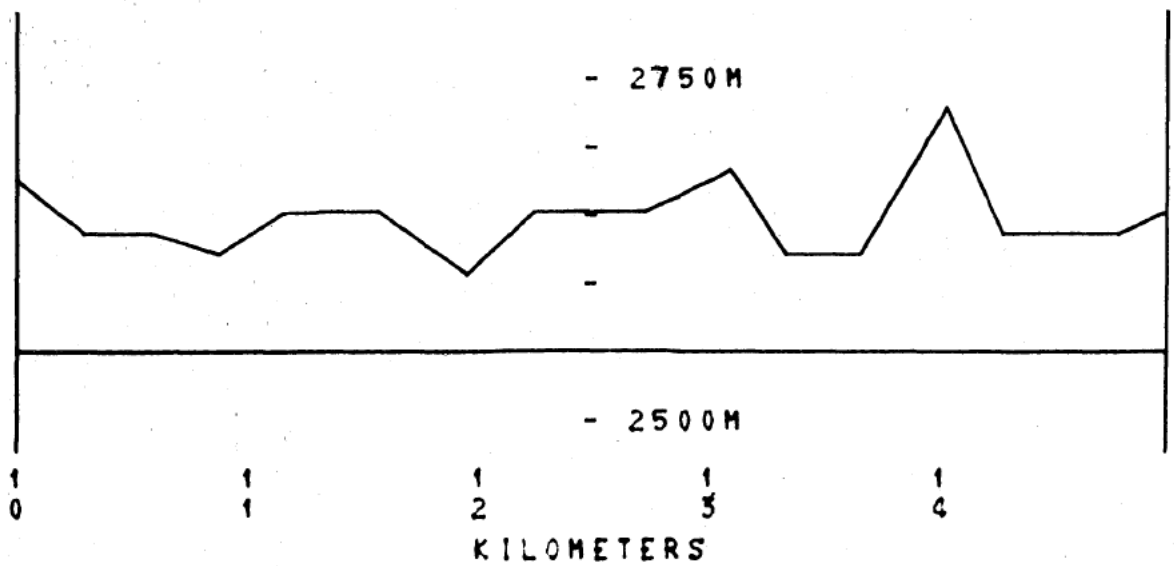
Bearing from common receiver site to transmitter site is 274° 53' 27" T.


R2-5-T6
TOLLAND E2 - PICNIC AREA
230 MHZ 11/ 3/65
751 MHZ
910 MHZ 8/16/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
90
100
110
120
130
140
150
160
170
180
190
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-5-T6
PATH LENGTH 4.953 km

XMTR. ELEV. 2652 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	751	910	1846	4595	9190
	11-3-65 at 13 M			8-16-66 at 13 M		
50%	126.7	149.8	151.4	169.6	170.9	180.3
Δ10%-90%	< 3	< 3	8.0	9.3	3.4	4.2
				8-16-66 at 7.3 M		
50%			143.9	156.9	177.7	186.6
Δ10%-90%			< 3	< 3	7.8	9.6
				8-16-66 at 1 M		
50%			141.9	167.8	169.3	183.8
Δ10%-90%			< 3	7.4	3.0	5.9

The only obstructions at this site are widely separated pine trees for 800 m from the transmitter. Beyond, dense pine trees cover rolling hills to the horizon.

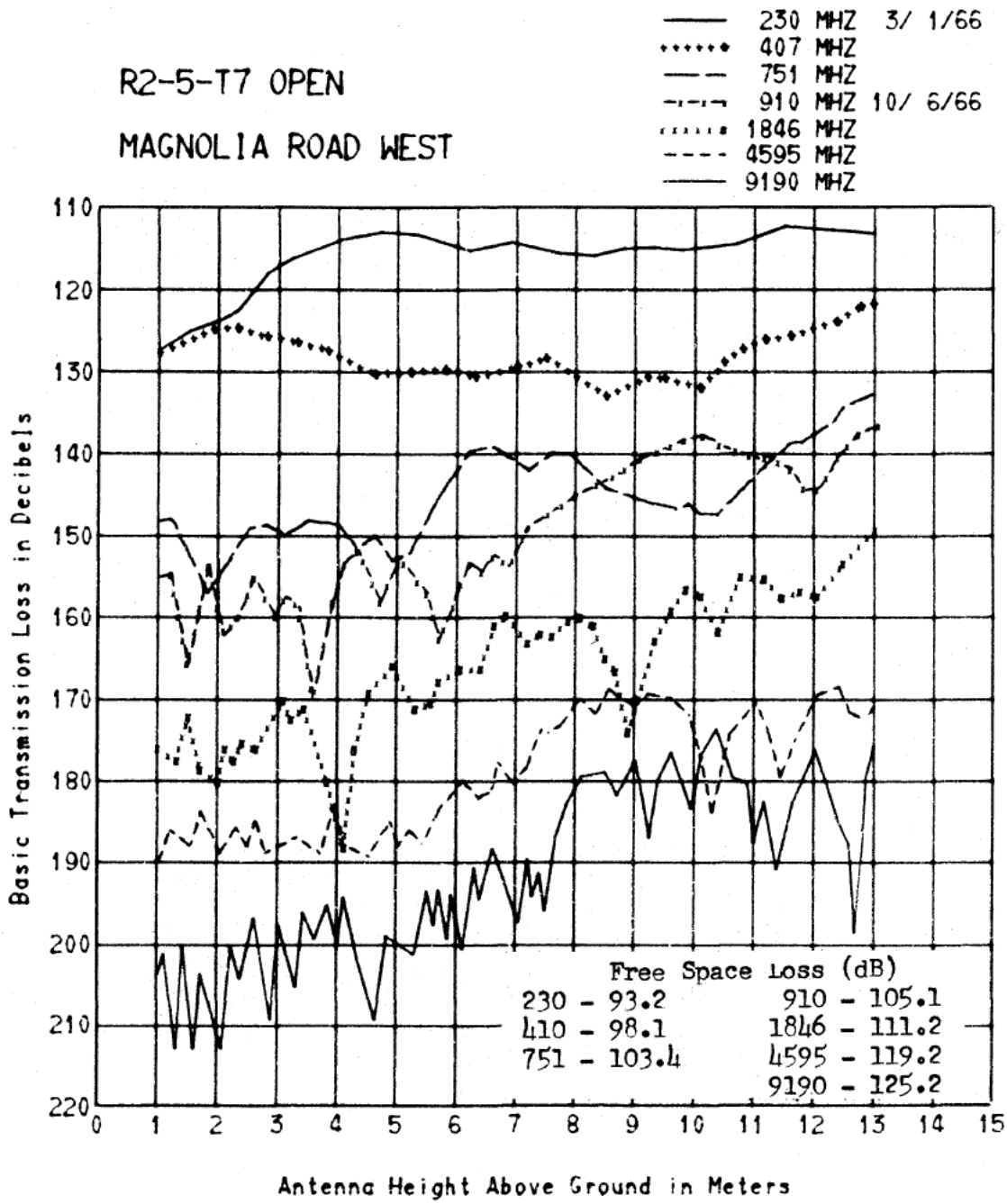
R2-5-T7 OPEN AND CONCEALED
MAGNOLIA ROAD WEST

PATH VIEW FROM OPEN SITE

Bearing from common receiver site to transmitter site is
346° 17' 09" T.

PATH VIEW FROM CONCEALED SITE

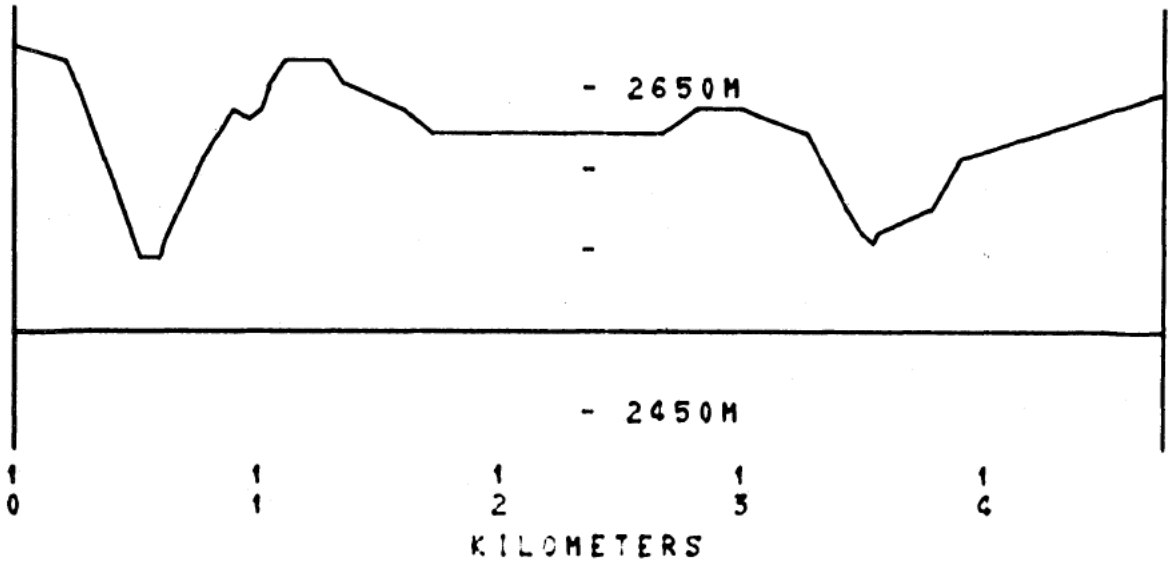
Bearing from common receiver site to transmitter site is
347° 53' 53" T.


230 MHZ 3/ 1/66
407 MHZ
751 MHZ
910 MHZ 10/ 6/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-5-T7 OPEN
MAGNOLIA ROAD WEST
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss (dB)
230 - 93.2
410 - 98.1
751 - 103.4
910 - 105.1
1846 - 111.2
4595 - 119.2
9190 - 125.2

RCVR. ELEV.
2676 M

R2-5-T7 OPEN
PATH LENGTH 4.713 km

XMTR. ELEV.
2646 M



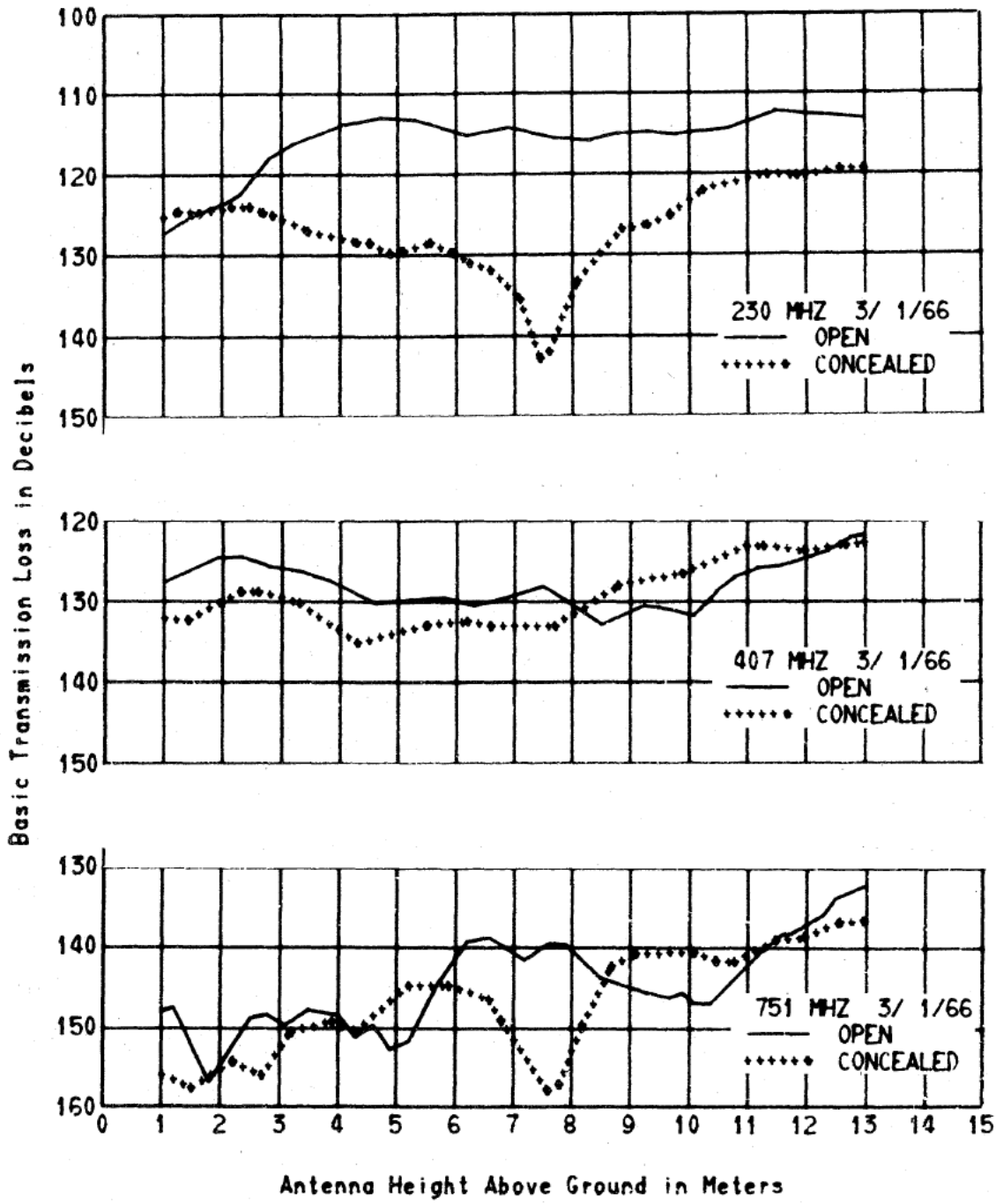
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-1-66 at 13 M				10-6-66 at 13 M		
50%	112.8	121.4	131.9	136.3	150.4	170.7	181.6
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	4.7
					10-6-66 at 7.3 M		
50%				148.3	162.4	181.9	186.0
Δ10%-90%				<3	< 3	5.6	9.5
					10-6-66 at 1 M		
50%				154.6	177.4	194.1	202.0
Δ10%-90%				< 3	< 3	7.5	9.7

The radio path is directed down a gravel road for 150 m to a well-traveled highway which runs at 20° to the path. A 3-wire power line parallels this highway, which converges with the path at a dense clump of pines, 150 m from the antenna. Beyond are rolling hills covered with pine trees.

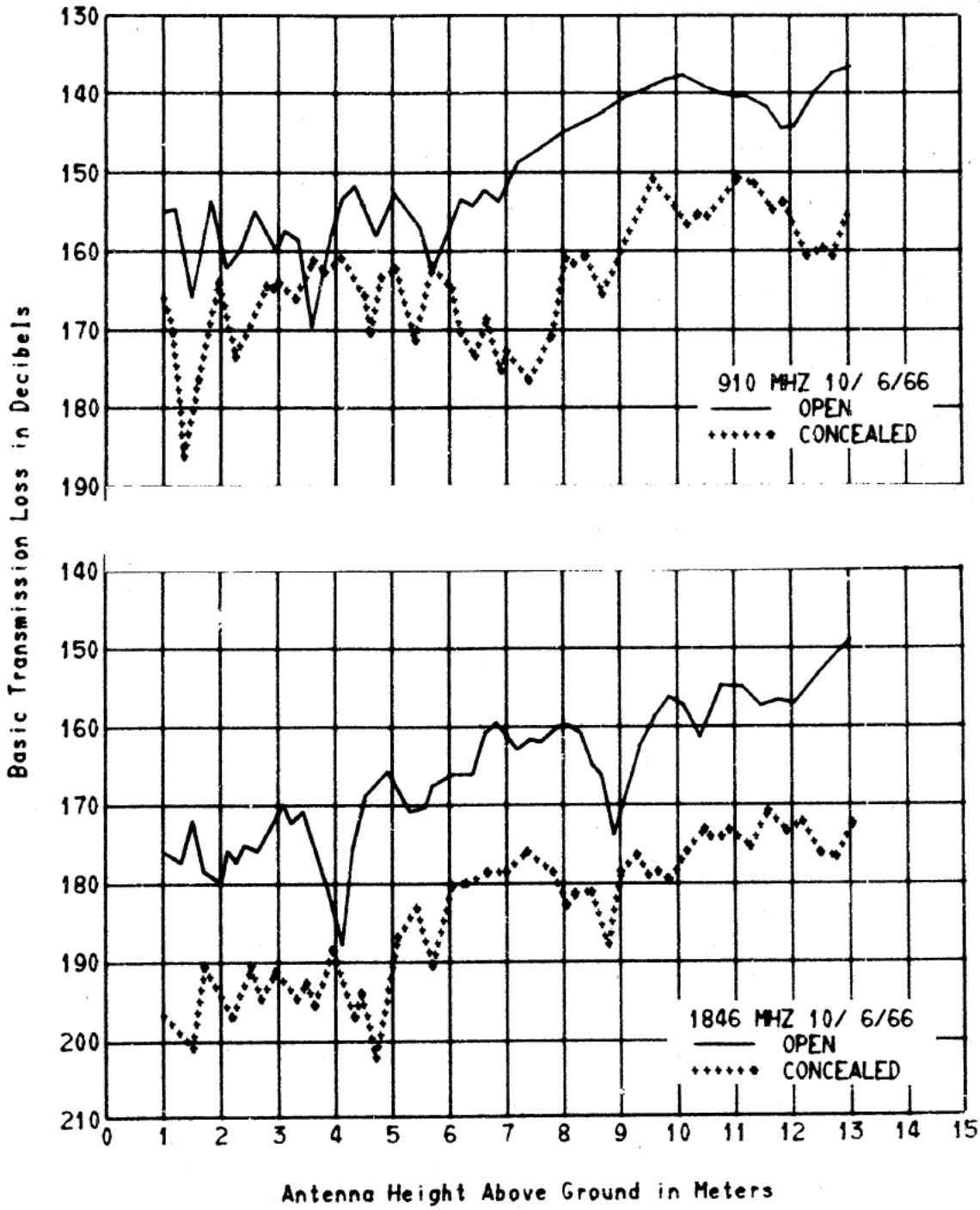
R2-5-T7 O&C

MAGNOLIA ROAD WEST



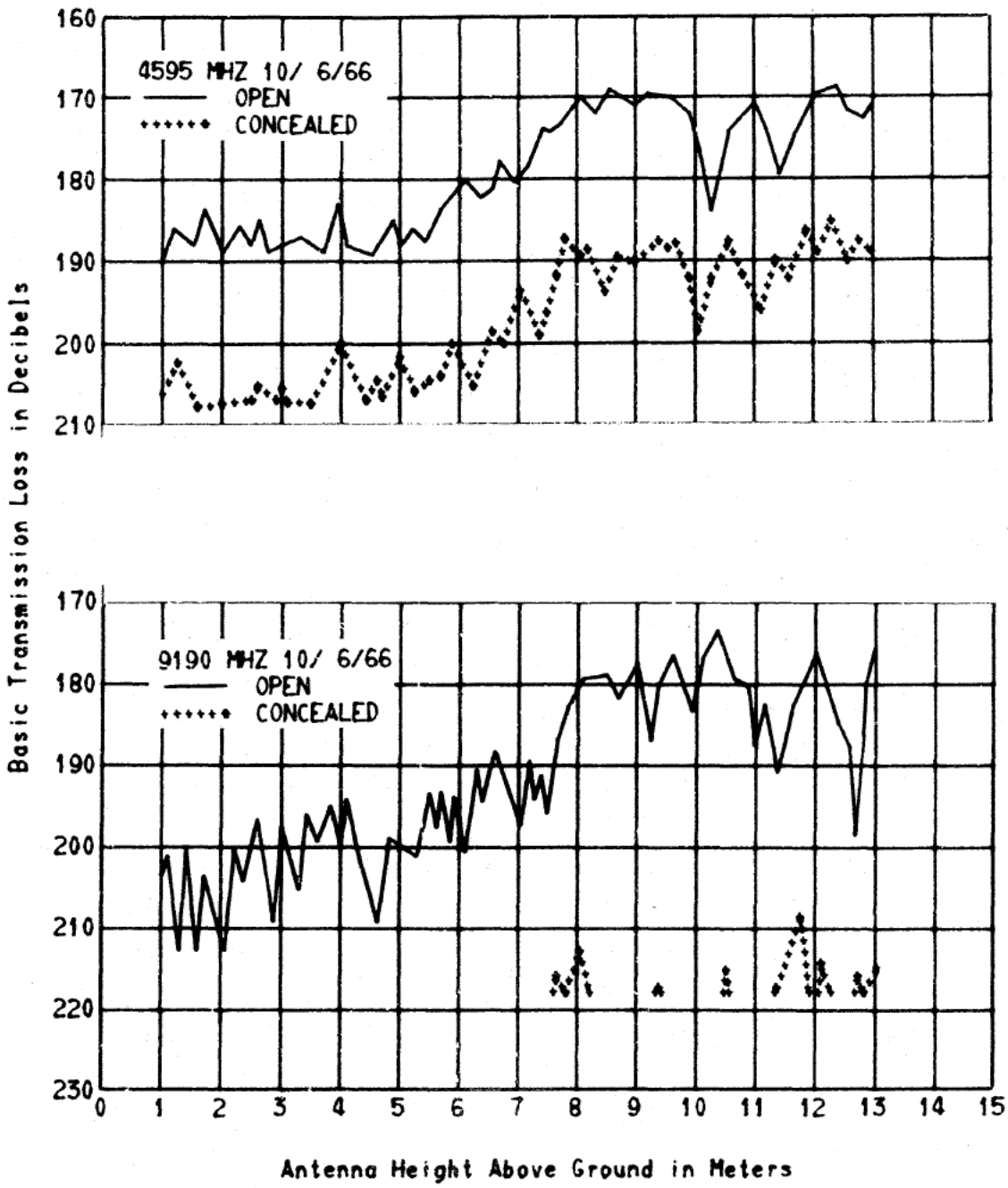
R2-5-T7 O&C

MAGNOLIA ROAD WEST



R2-5-T7 O&C

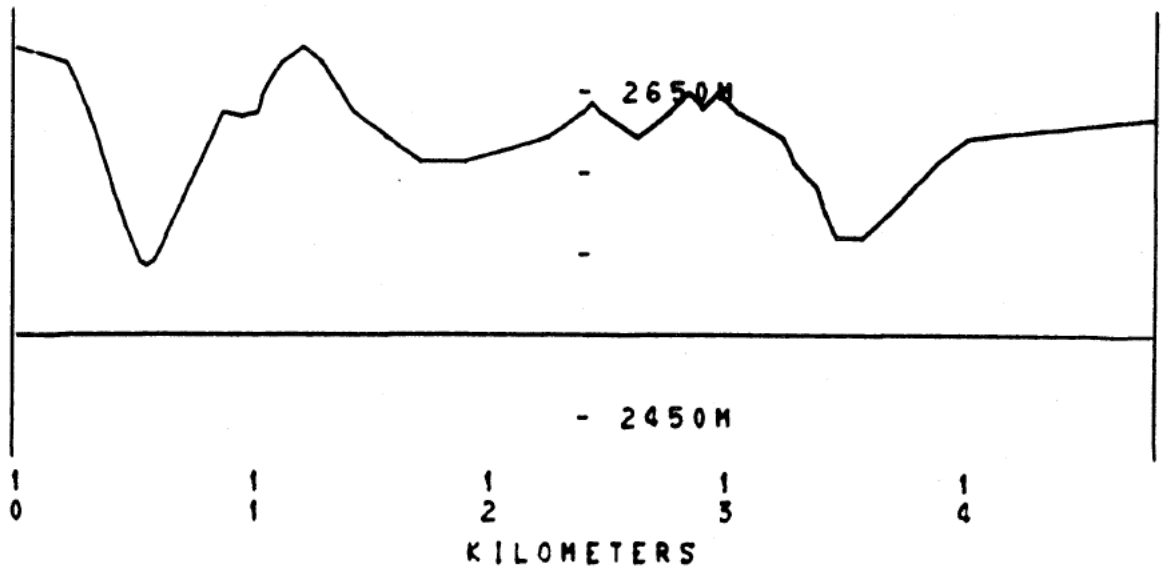
MAGNOLIA ROAD WEST



RCVR. ELEV. 2676 M

R2-5-T7 CONCEALED
PATH LENGTH 4.773 km

XMTR. ELEV. 2633 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

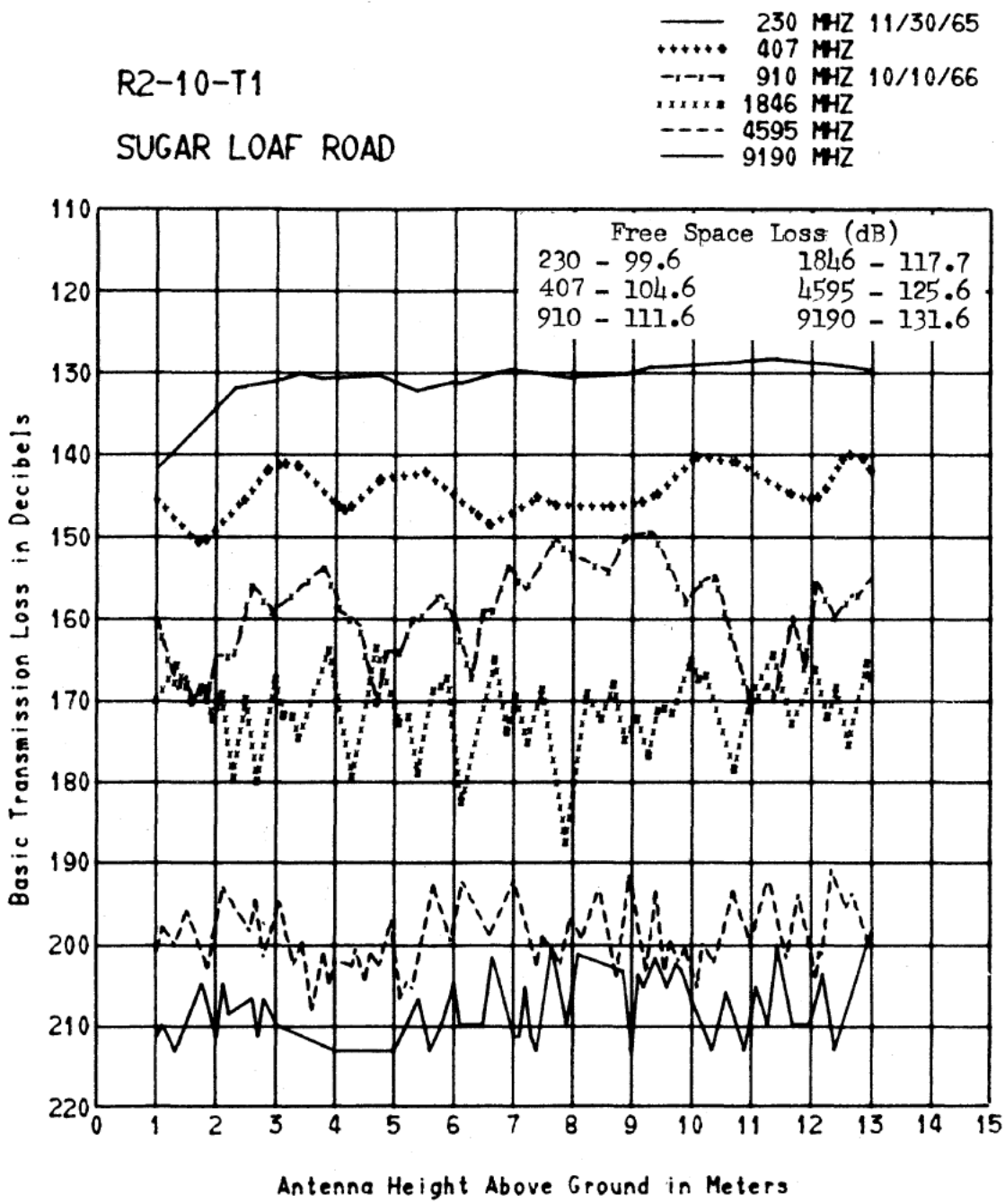
Freq. (MHz)	230	407	751	910	1846	4595	9190
	3-1-66 at 13 M				10-6-66 at 13 M		
50%	120.7	122.6	136.7	154.8	161.2	192.0	208.2
Δ10%-90%	< 3	< 3	< 3	7.0	4.0	10.0	12.6
					10-6-66 at 7.3 M		
50%				167.6	164.7	197.3	
Δ10%-90%				9.5	< 3	6.1	
					10-6-66 at 1 M		
50%				167.9	187.0	210.0	
Δ10%-90%				9.5	4.5	5.0	

At this site the antennas are located approximately 10 m from a dense stand of lodgepole pines, 12-15 m tall and extending from the transmitter for about 800 m. Beyond this the terrain is rolling hills covered with pine trees.

R2-10-T1
SUGAR LOAF ROAD

PATH VIEW FROM TRANSMITTER

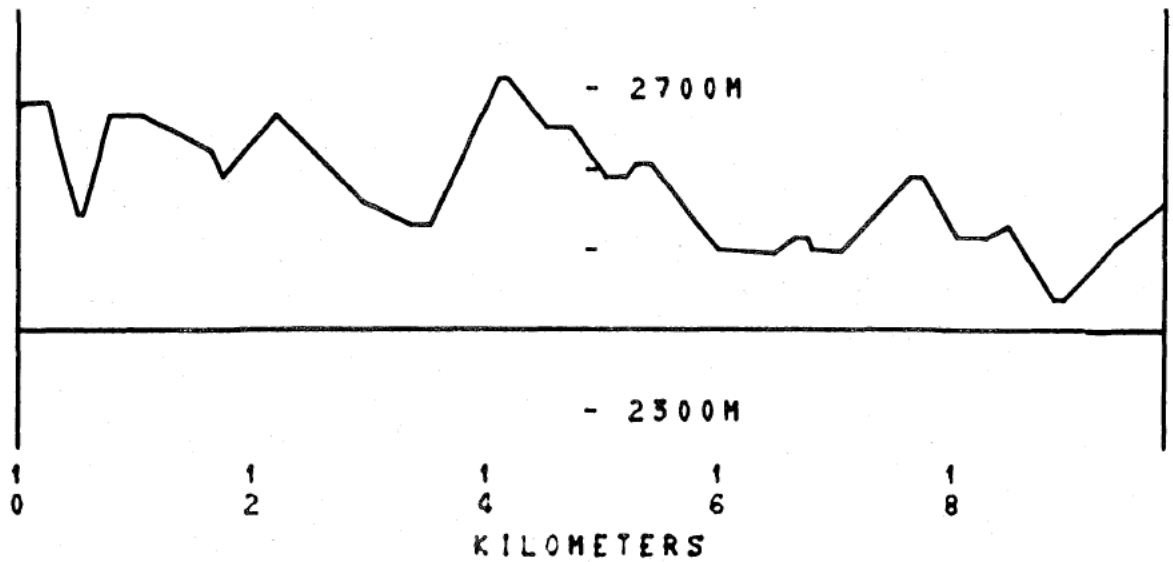
Bearing from common receiver site to transmitter site is 07° 05' 51" T.


230 MHZ 11/30/65
407 MHZ
910 MHZ 10/10/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-10-T1
SUGAR LOAF ROAD
Free Space Loss (dB)
230 - 99.6
407 - 104.6
910 - 111.6
1846 - 117.7
4595 - 125.6
9190 - 131.6
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T1
PATH LENGTH 9.910 km

XMTR. ELEV. 2557 M

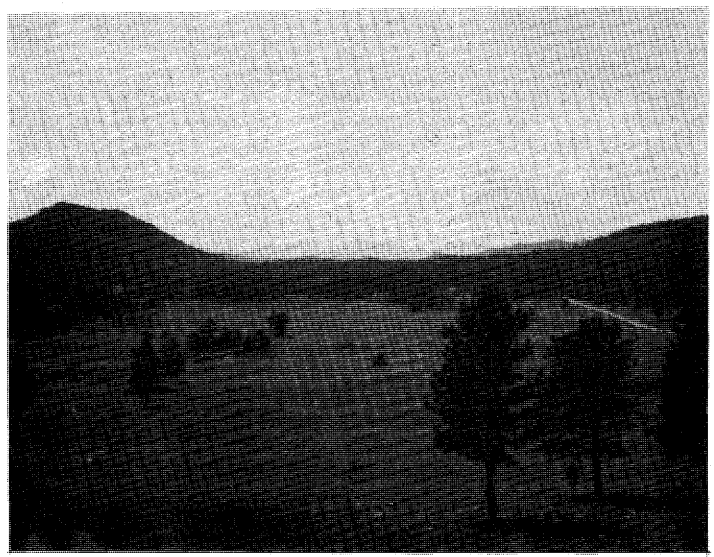


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	910	1846	4595	9190
	11-30-65 at 13 M			10-10-66 at 13 M		
50%	128.0	139.8	153.1	172.6	196.6	196.7
Δ10%-90%	< 3	< 3	< 3	5.2	8.4	4.6
				10-10-66 at 7.3 M		
50%			155.8	172.3	197.1	211.9
Δ10%-90%			<3	7.0	8.8	< 3
				10-10-66 at 1 M		
50%			158.6	176.1	196.5	211.9
Δ10%-90%			<3	8.5	7.1	<3

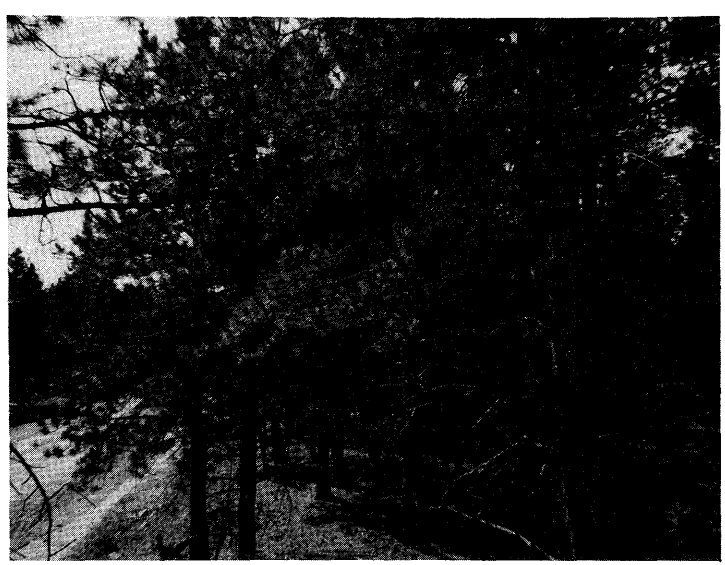
The foreground at this site holds no obstructions except for dense pines, 100 m away. However, these are below the line of sight and continue to a ridge about 3.5 km away. The rest of the terrain is pine-covered, rollings hills to the horizon.

R2-10-T2 OPEN AND CONCEALED
MAGNOLIA ROAD E



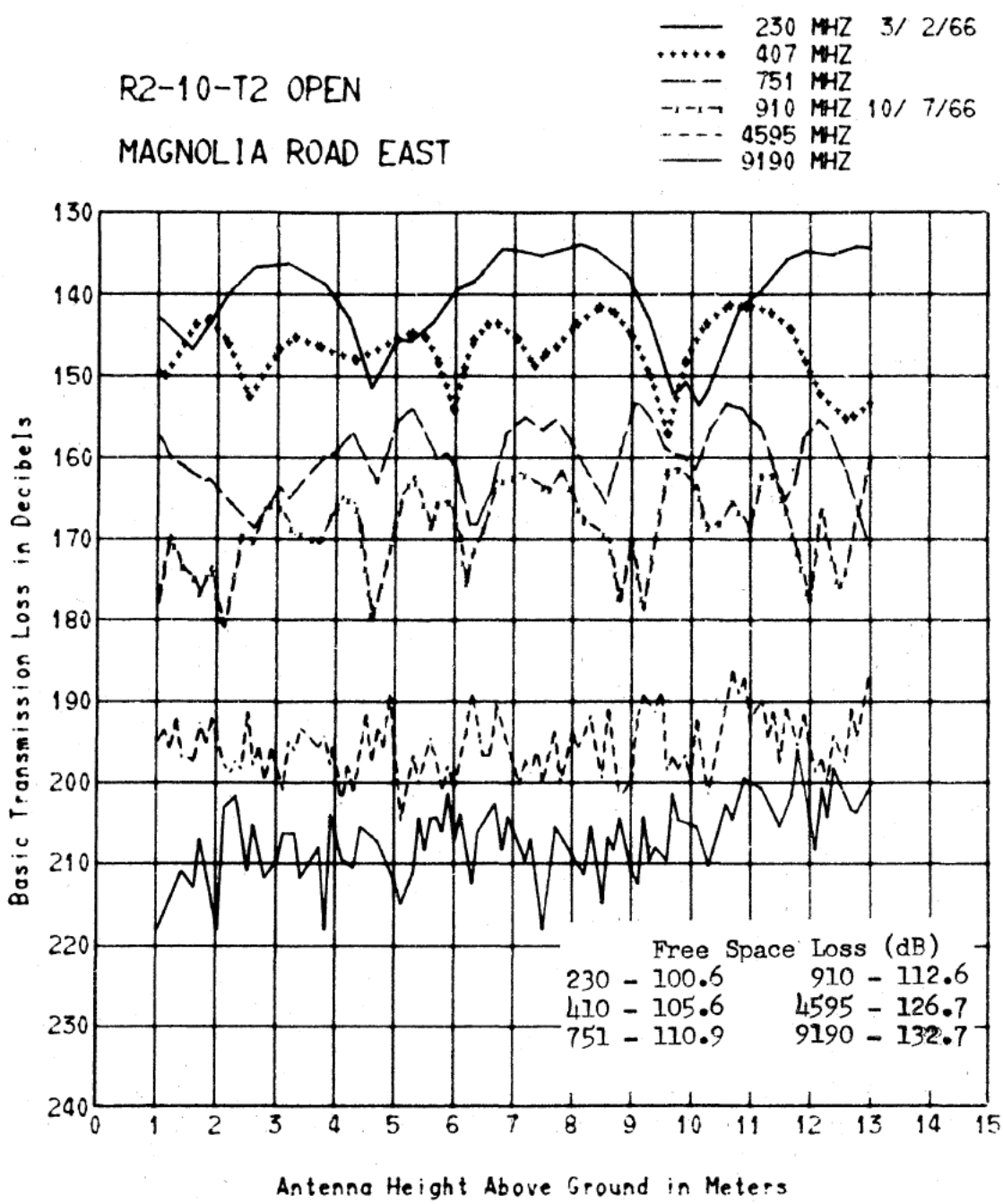
PATH VIEW FROM OPEN SITE

Bearing from common receiver site to transmitter site is
40° 15' 08" T.



PATH VIEW FROM CONCEALED SITE

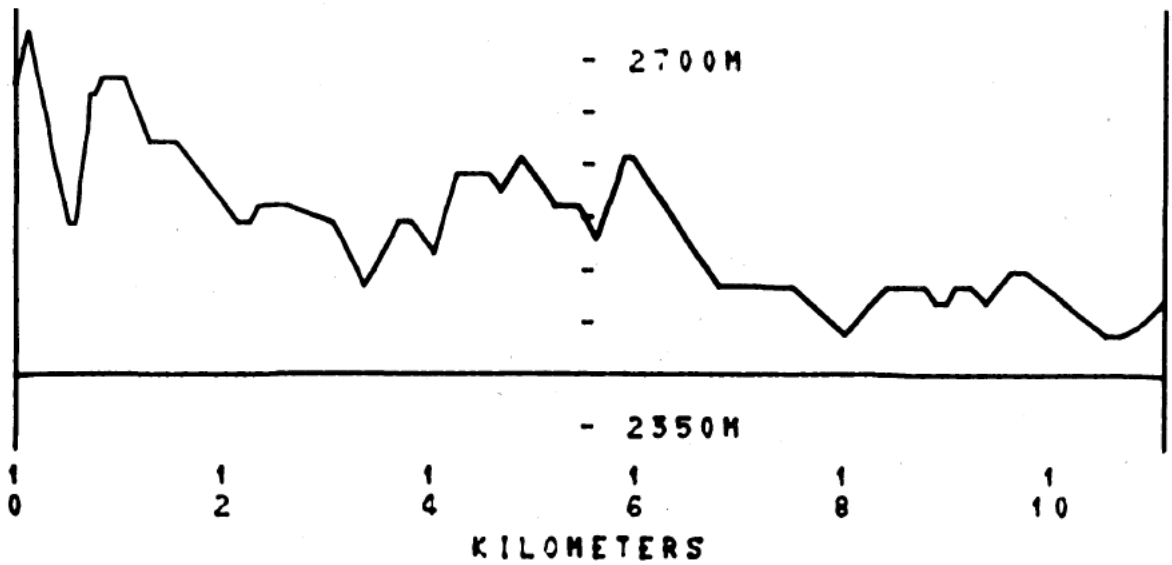
Bearing from common receiver site to transmitter site is
41° 40' 21" T.


230 MHZ 3/ 2/66
407 MHZ
751 MHZ
910 MHZ 10/ 7/66
4595 MHZ
9190 MHZ
R2-10-T2 OPEN
MAGNOLIA ROAD EAST
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss (dB)
230 - 100.6
410 - 105.6
751 - 110.9
910 - 112.6
4595 - 126.7
9190 - 132.7

RCVR. ELEV.
2676 M

R2-10-T2 OPEN
PATH LENGTH 11.166 km

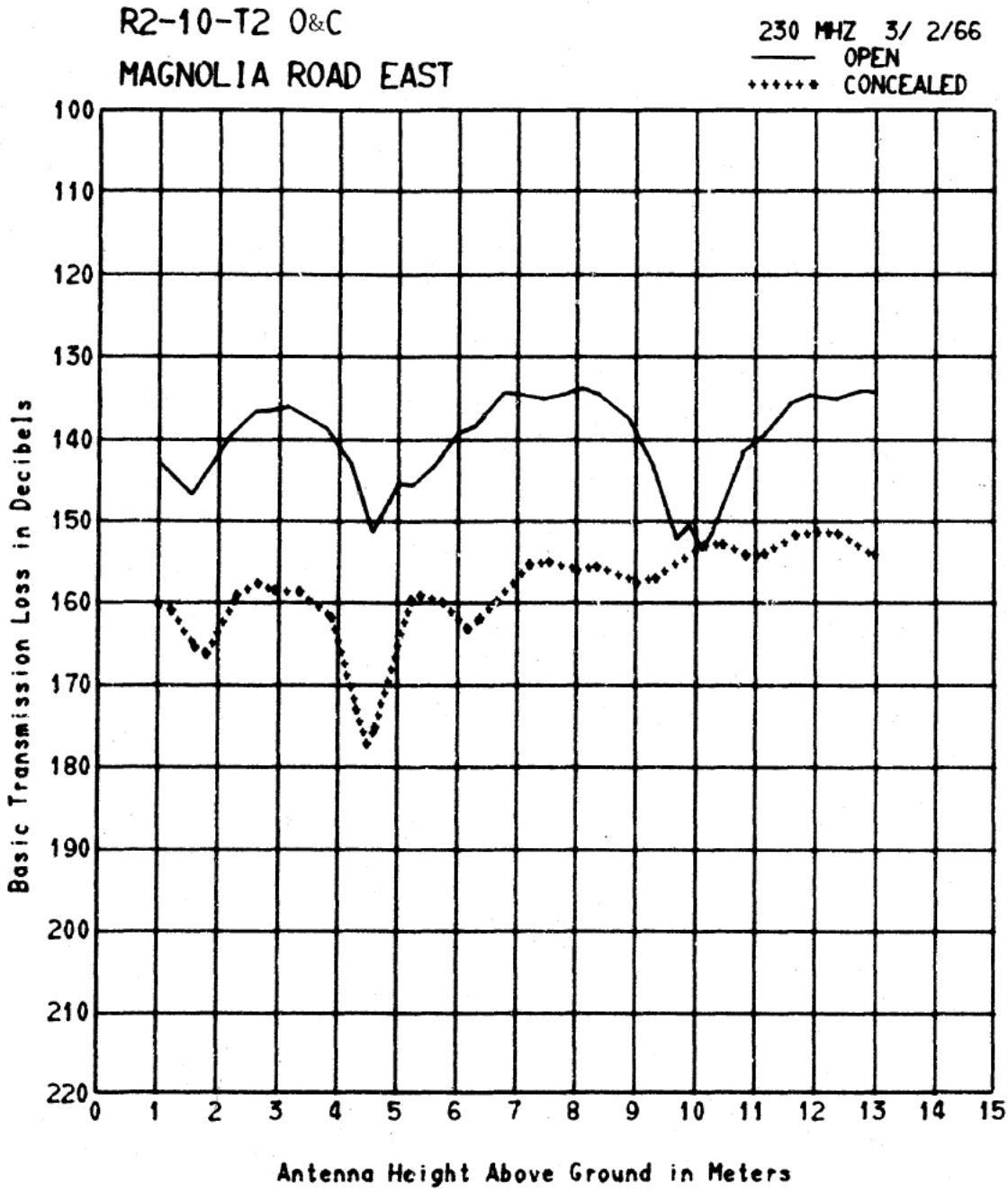
XMTR. ELEV.
2472 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

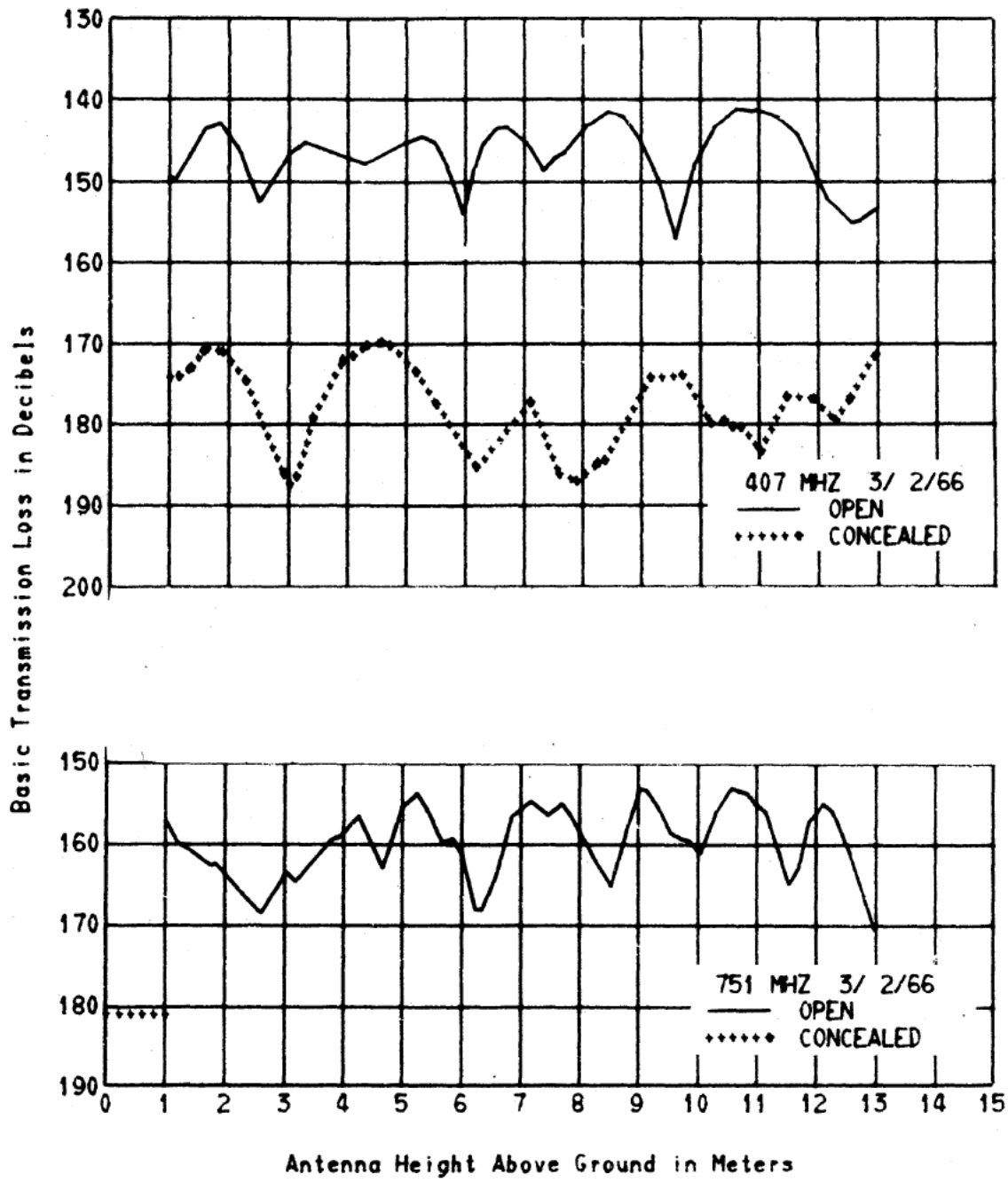
Freq (MHz)	230	407	751	910	4595	9190
	3-2-66 at 13 M				10-7-66 at 13 M	
50%	134.3	153.0	170.6	161.3	190.4	200.2
Δ10%-90%	< 3	< 3	< 3	< 3	6.0	11.0
					10-7-66 at 7.3 M	
50%				163.7	197.1	207.2
Δ10%-90%				3.8	7.4	7.0
					10-7-66 at 1 M	
50%				173.4	199.5	218.2
Δ10%-90%				11.3	7.6	10.0

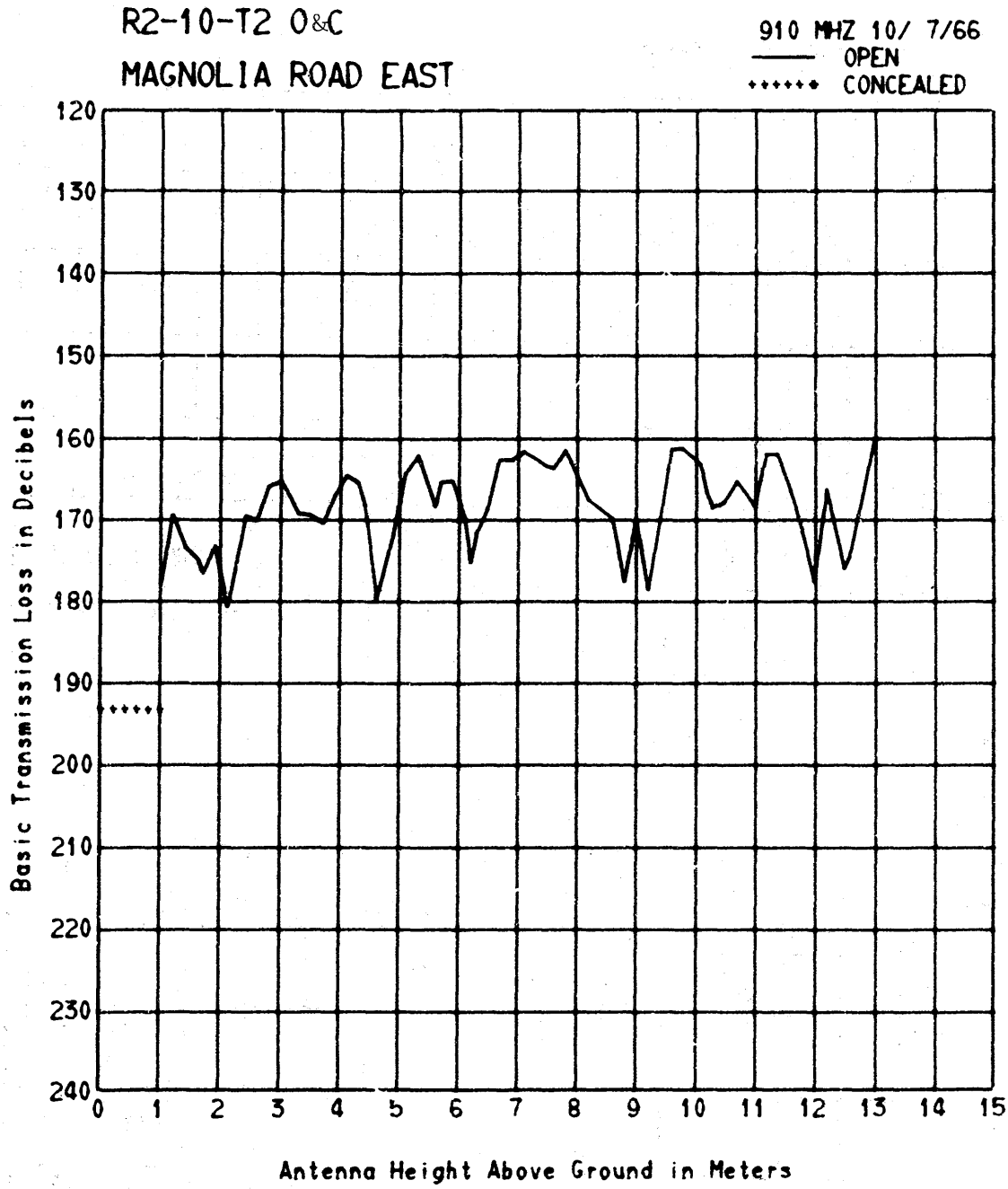
This radio path is across a broad expanse of open area containing scattered pines, all of which are below the line of sight, to a ridge covered with dense pines at the horizon, 5 km away.


R2-10-T2 O&C
MAGNOLIA ROAD EAST
230 MHZ 3/ 2/66
OPEN
CONCEALED
Basic Transmission Loss in Decibels
100
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

R2-10-T2 O&C

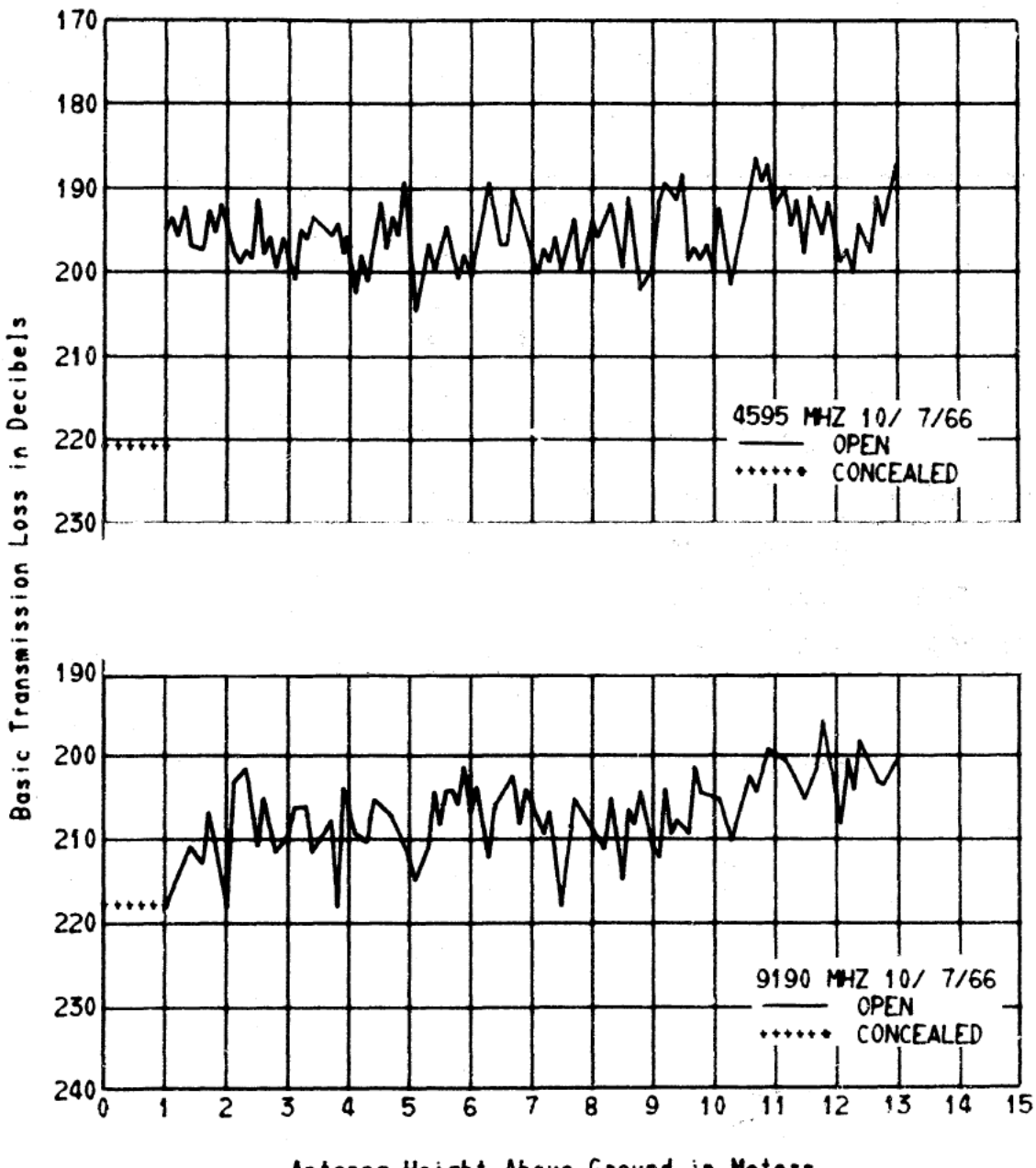
MAGNOLIA ROAD EAST




R2-10-T2 O&C
MAGNOLIA ROAD EAST
910 MHZ 10/ 7/66
OPEN
CONCEALED
120
130
140
150
160
170
180
190
200
210
220
230
240
Basic Transmission Loss in Decibels
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

R2-10-T2 O&C

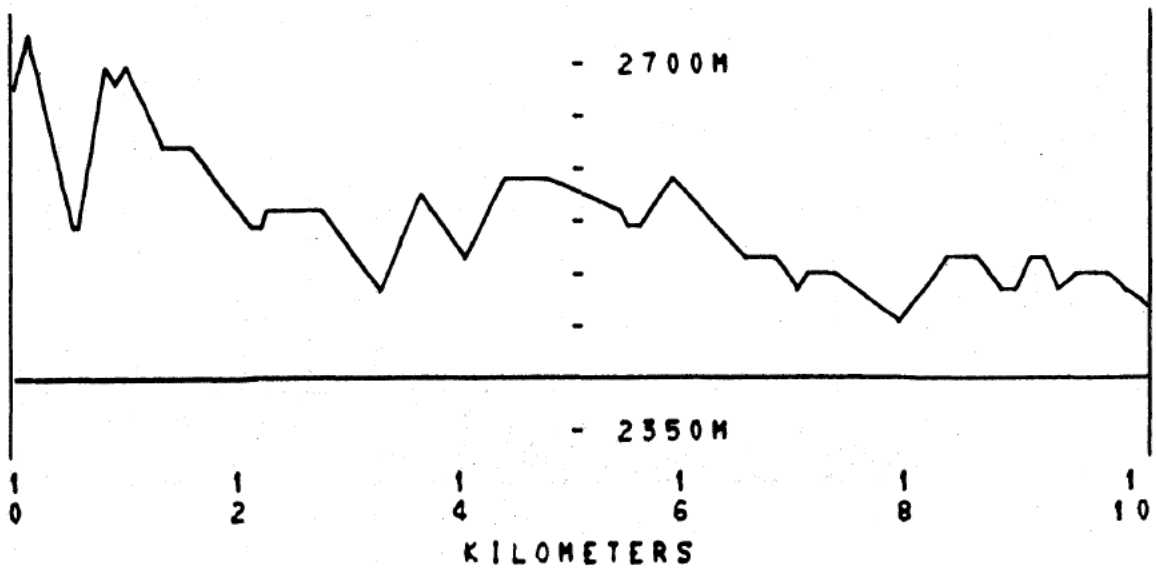
MAGNOLIA ROAD EAST



RCVR. ELEV. 2676 M

R2-10-T2 CONCEALED
PATH LENGTH 10.252 km

XMTR. ELEV. 2469 M

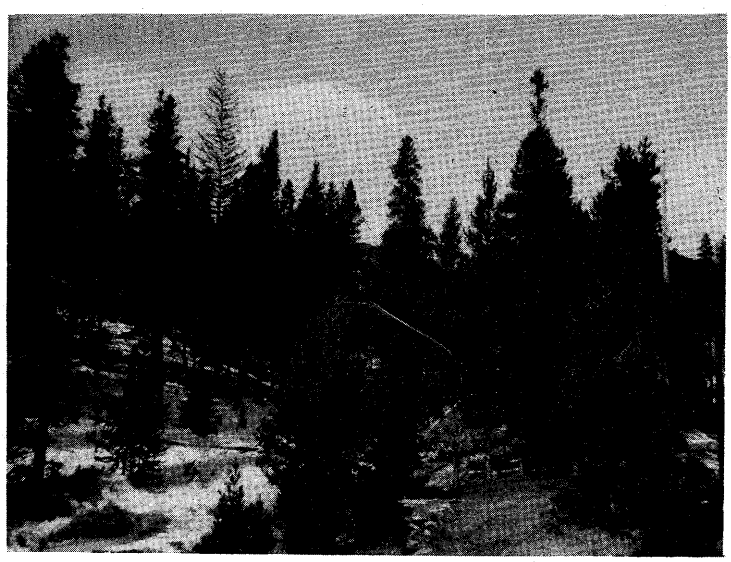


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	4595	9190
3-2-66 at 13 M						
50%	152.3	172.0				
Δ10%-90%	< 3	< 3				

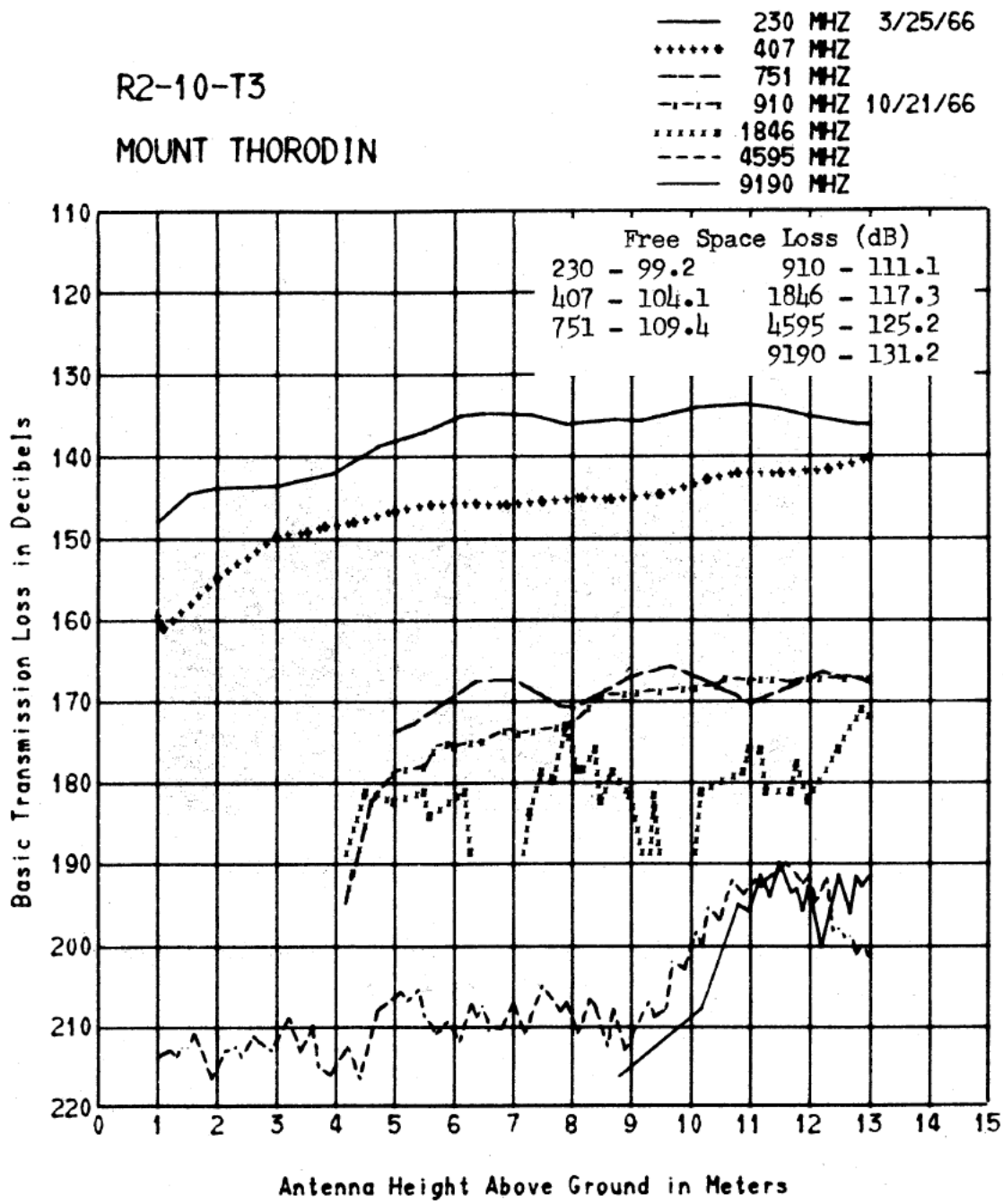
The concealment for this site is a dense stand of yellow pines, 10 - 12 m tall, extending for about 500 m.

R2-10-T3
MOUNT THORODIN



PATH VIEW FROM TRANSMITTER

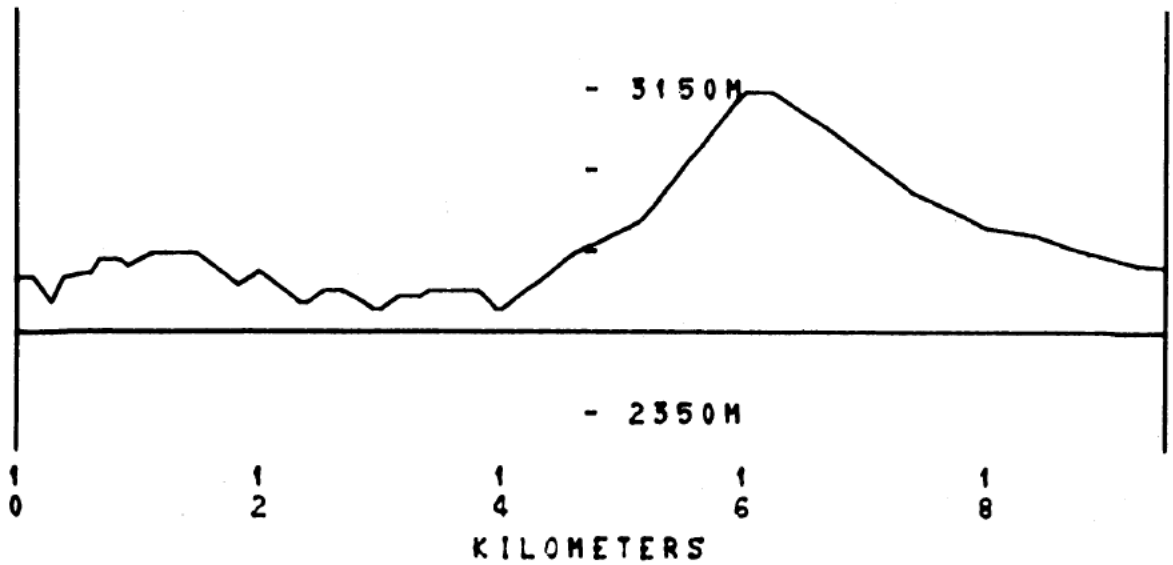
Bearing from common receiver site to transmitter site is
111^{o} 38' 37" T.


R2-10-T3
MOUNT THORODIN
230 MHZ 3/25/66
407 MHZ
751 MHZ
910 MHZ 10/21/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 99.2
407 - 104.1
751 - 109.4
910 - 111.1
1846 - 117.3
4595 - 125.2
9190 - 131.2
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T3
PATH LENGTH 9.426 km

XMTR. ELEV. 2710 M

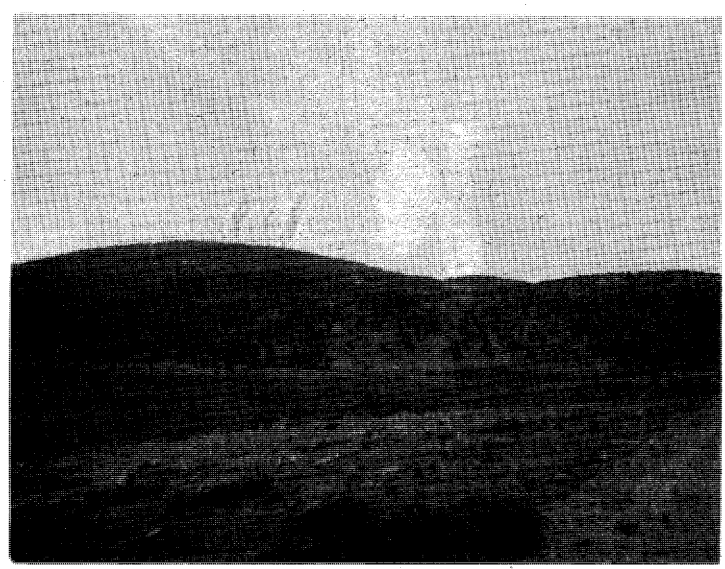


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-25-66 at 13 M				10-21-66 at 13 M		
50%	135.8	140.7	167.3	166.4	168.5	199.0	191.7
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	7.3	5.5
					10-21-66 at 7.3 M		
50%				173.9	180.5	210.5	
Δ10%-90%				< 3	5.0	6.7	
					10-21-66 at 1 M		
50%						216.2	
Δ10%-90%						4.3	

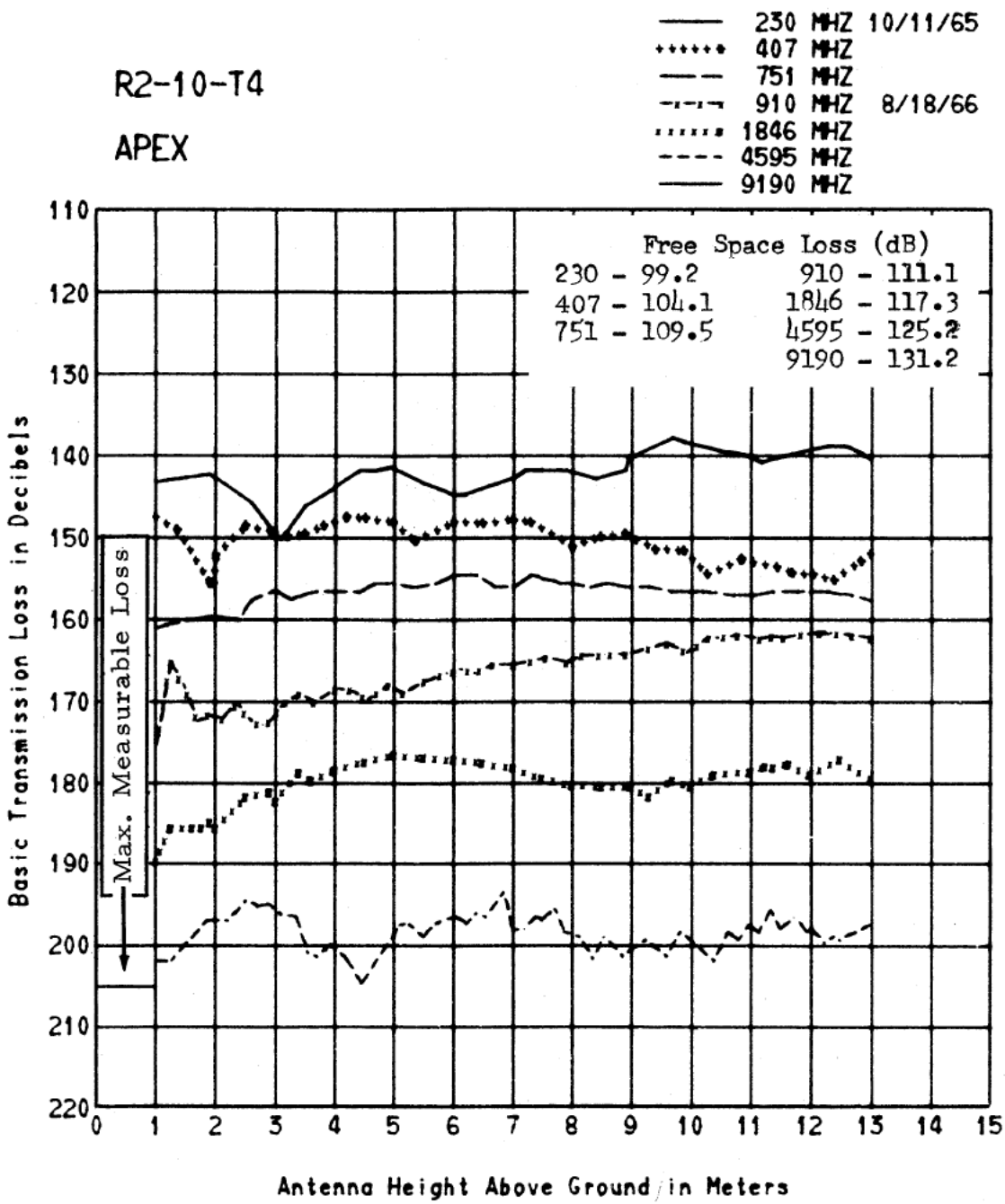
This path is over and through scattered pines for 150 m. The pines then become rather dense. The remainder of the path extends over rolling hills covered with pines to the horizon 1.5 km away.

R2-10-T4
APEX



PATH VIEW FROM TRANSMITTER

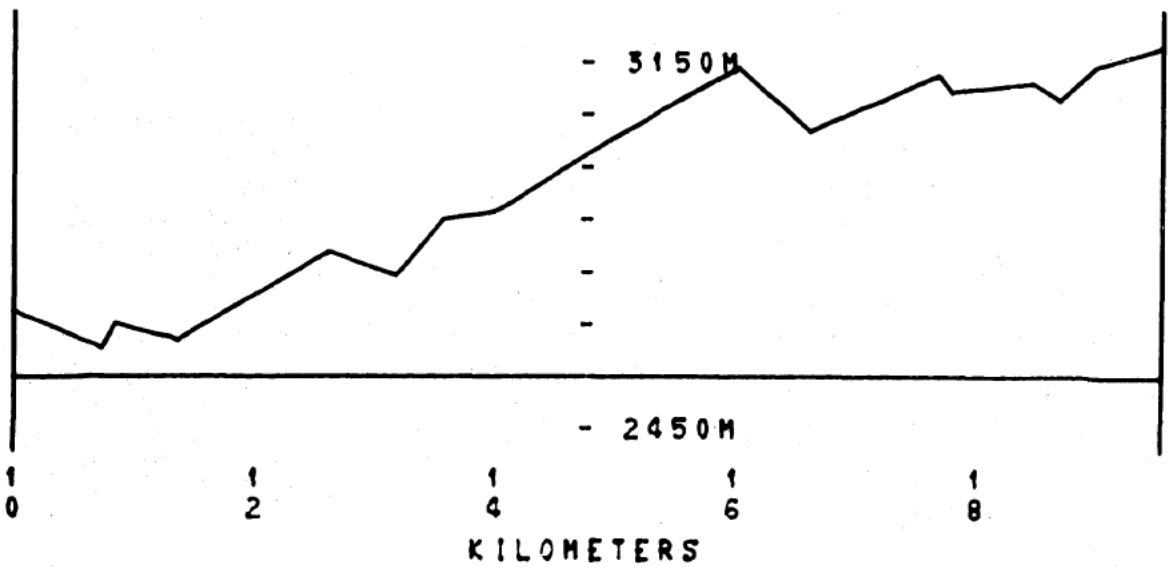
Bearing from common receiver site to transmitter site is
238° 07' 07" T.


230 MHZ 10/11/65
407 MHZ
751 MHZ
910 MHZ 8/18/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-10-T4
APEX
Free Space Loss (dB)
230 - 99.2
407 - 104.1
751 - 109.5
910 - 111.1
1846 - 117.3
4595 - 125.2
9190 - 131.2
Max. Measurable Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T4
PATH LENGTH 9.438 km

XMTR. ELEV. 3178 M

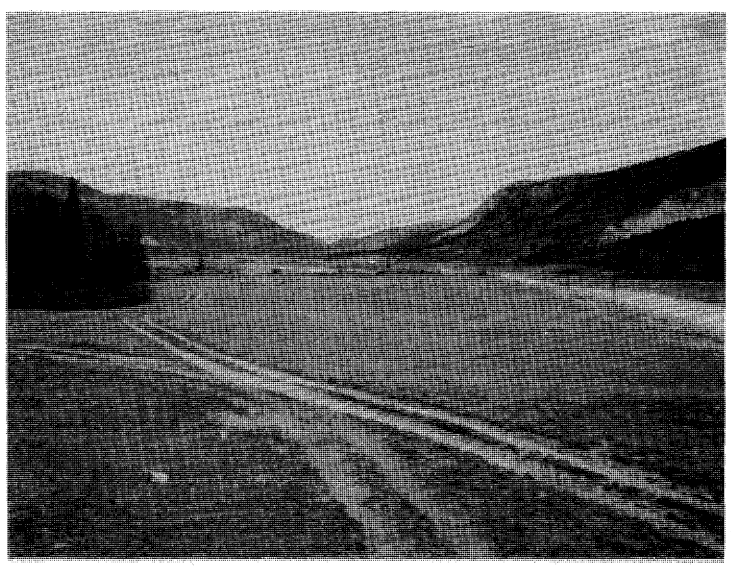


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	10-11-65 at 13 M			8-18-66 at 13 M			
50%	140.3	152.0	157.3	162.3	181.5	199.1	
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	4.0	
				8-18-66 at 7.3 M			
50%				164.8	181.0	202.1	
Δ10%-90%				< 3	< 3	5.5	
				8-18-66 at 1 M			
50%				175.3	193.0	202.6	
Δ10%-90%				< 3	< 3	4.0	

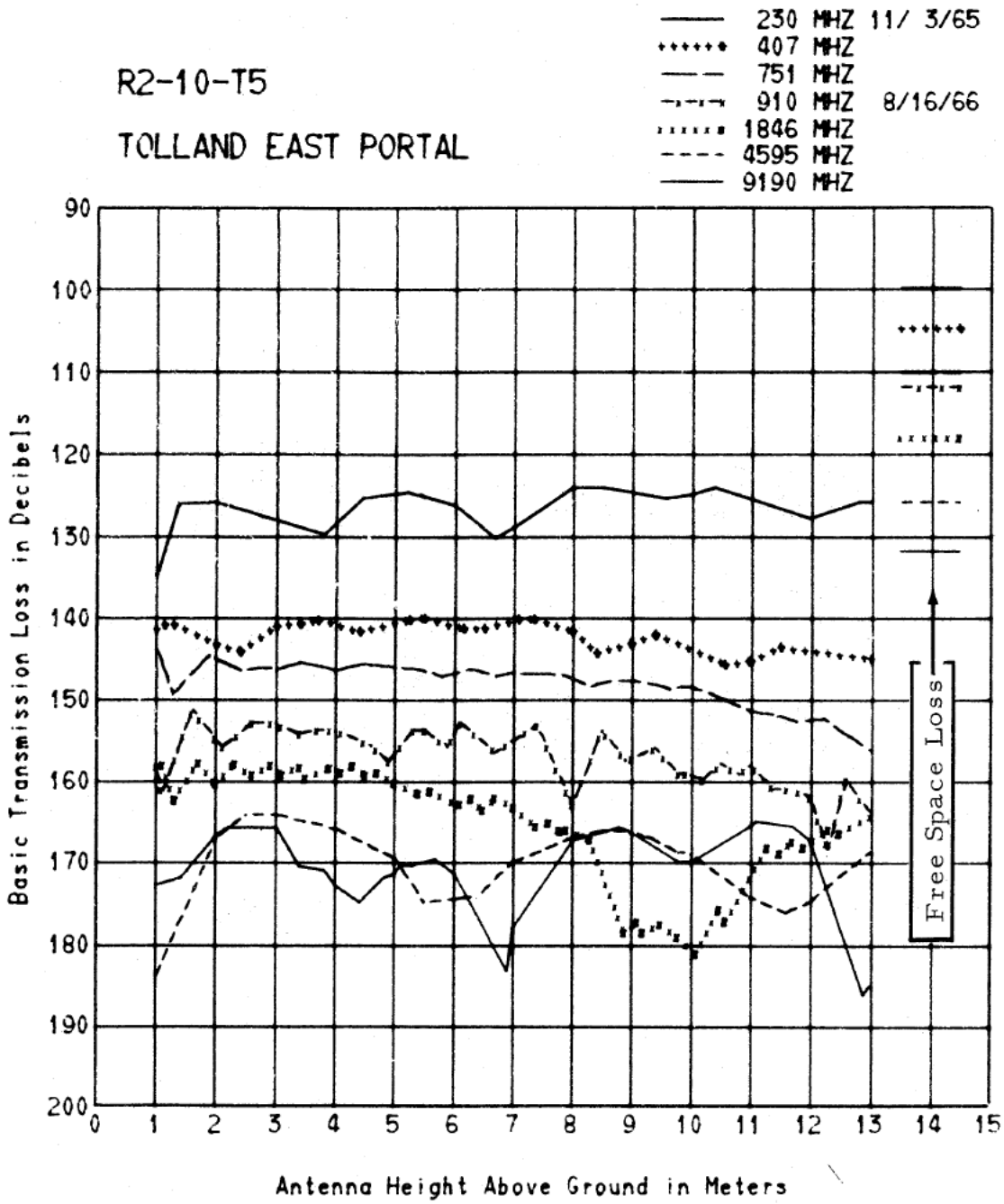
The path covers 100 m of low brush, grass, and scattered tree stumps. For the next 800 m the terrain cover is low brush to the base of a hill, which is covered with scattered pines and a few cabins. The horizon is a tree-covered hill, 1.5 km away.

R2-10-T5
TOLLAND - EAST PORTAL



PATH VIEW FROM TRANSMITTER

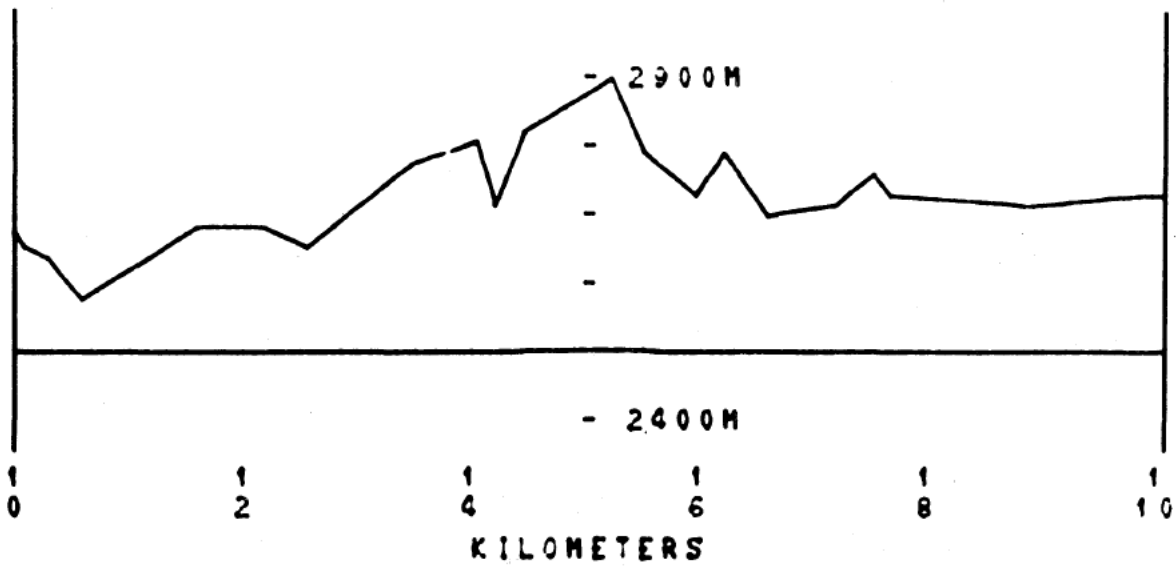
Bearing from common receiver site to transmitter site is 265^{o} 47' 04" T.


R2-10-T5
TOLLAND EAST PORTAL
230 MHZ 11/ 3/65
407 MHZ
751 MHZ
910 MHZ 8/16/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
90
100
110
120
130
140
150
160
170
180
190
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T5
PATH LENGTH 10.066 km

XMTR. ELEV. 2728 M

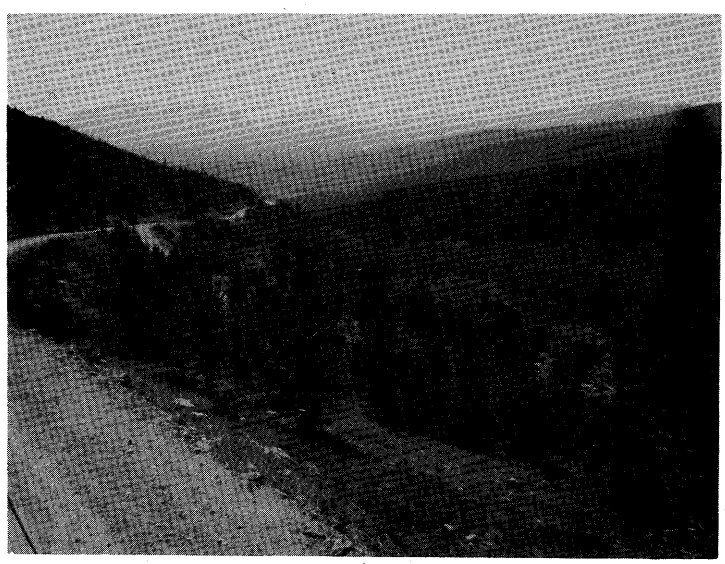


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	11-3-65 at 13 M				8-16-66 at 13 M		
50%	126.7	144.5		162.9	162.6	168.0	185.0
Δ10%-90%	< 3	< 3		< 3	< 3	< 3	< 3
	11-3-65 at 1 M				8-16-66 at 7.3 M		
50%			144.8	152.9	166.1	169.0	170.3
Δ10%-90%			< 3	< 3	< 3	< 3	4.0
					8-16-66 at 1 M		
50%				157.4	157.9	184.0	172.8
Δ10%-90%				< 3	< 3	< 3	< 3

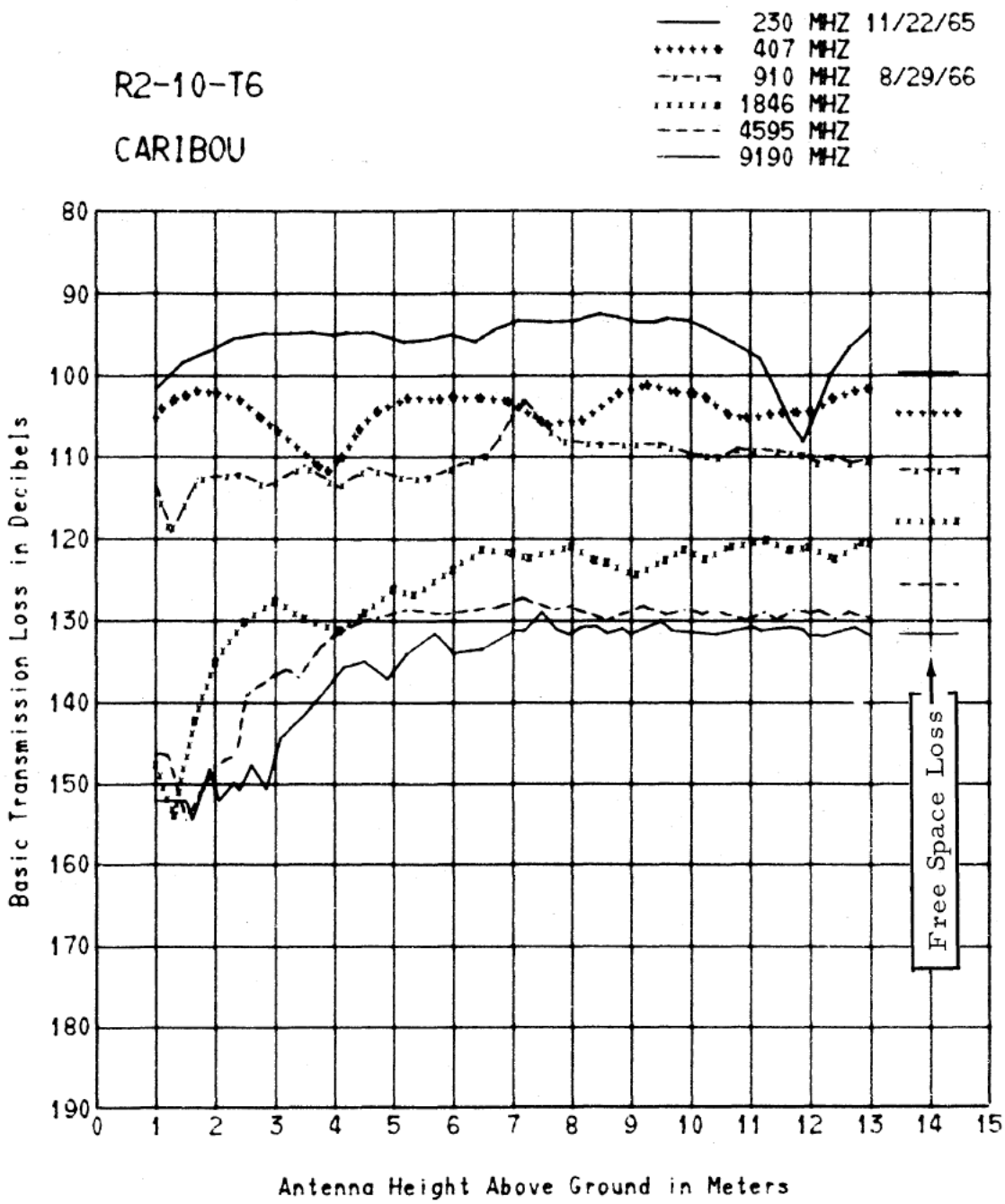
This path lies over open grassland for approximately 1.5 km to the town of Tolland. The terrain is covered with low brush from 0.5 km to the town. A 4-wire telephone line parallels a dirt road running at 10^{o} to the path.

R2-10-T6
CARIBOU



PATH VIEW FROM TRANSMITTER

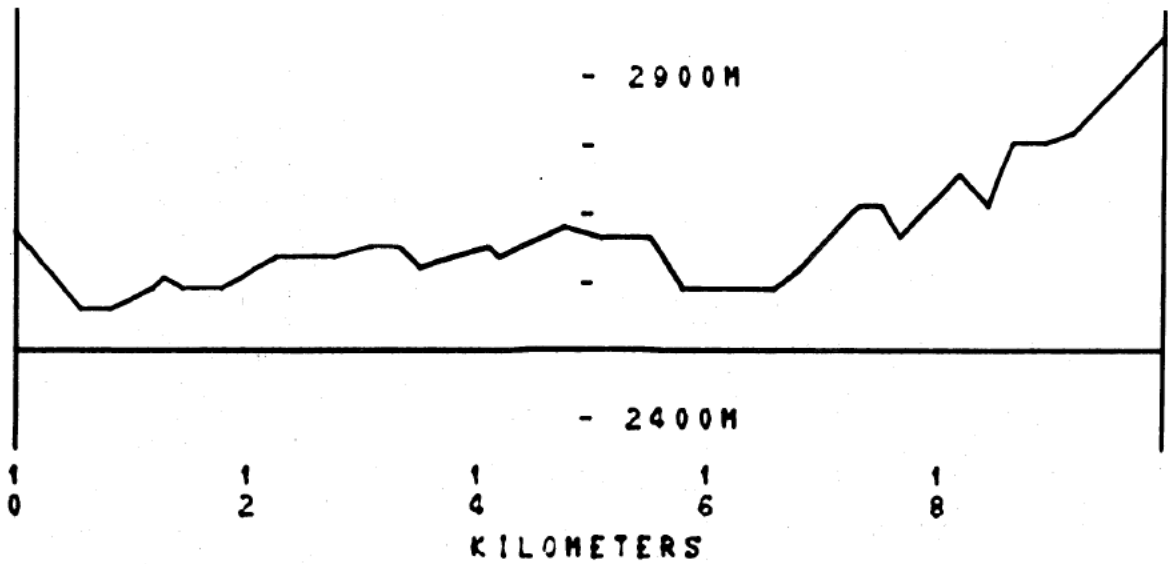
Bearing from common receiver site to transmitter site is 319^{o} 00' 57" T.


230 MHZ 11/22/65
407 MHZ
910 MHZ 8/29/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-10-T6
CARIBOU
Basic Transmission Loss in Decibels
80
90
100
110
120
130
140
150
160
170
180
190
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Free Space Loss
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T6
PATH LENGTH 10.004 km

XMTR. ELEV. 2957 M

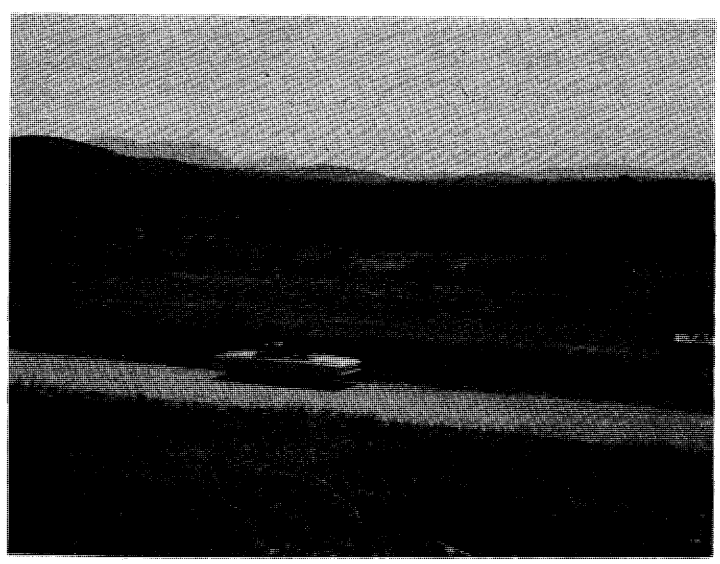


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	910	1846	4595	9190
	11-22-65 at 13 M		8-29-66 at 7.3 M			
50%	93.5	100.9	110.5	121.8	127.4	128.8
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3

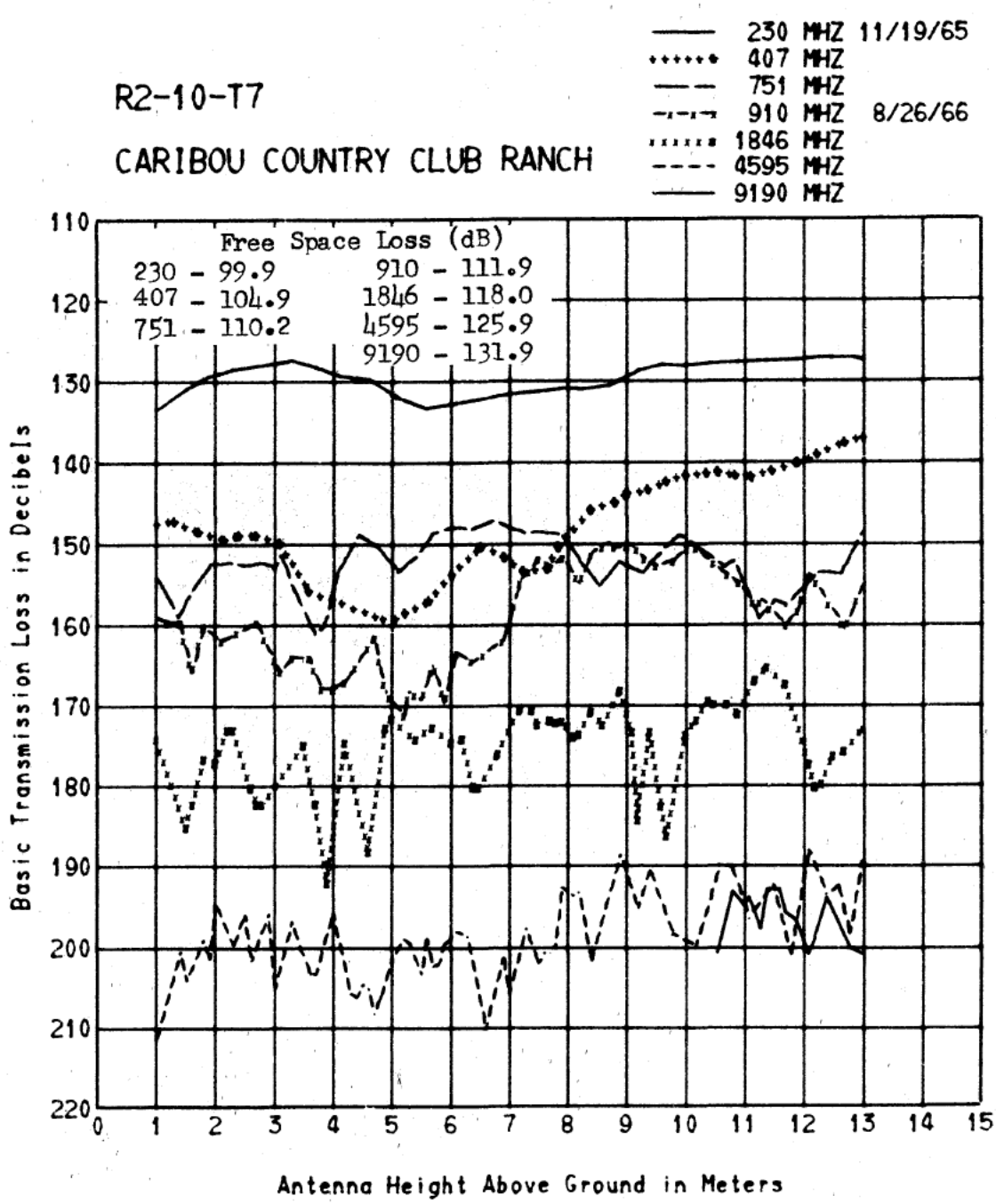
The foreground at this site falls away rapidly to the right of the transmitter. The ground is covered with scattered pines and low brush, all of which are below line of sight. From a distance of 3 km are rolling pine-covered hills to the horizon.

R2-10-T7
CARIBOU COUNTRY CLUB RANCH



PATH VIEW FROM TRANSMITTER

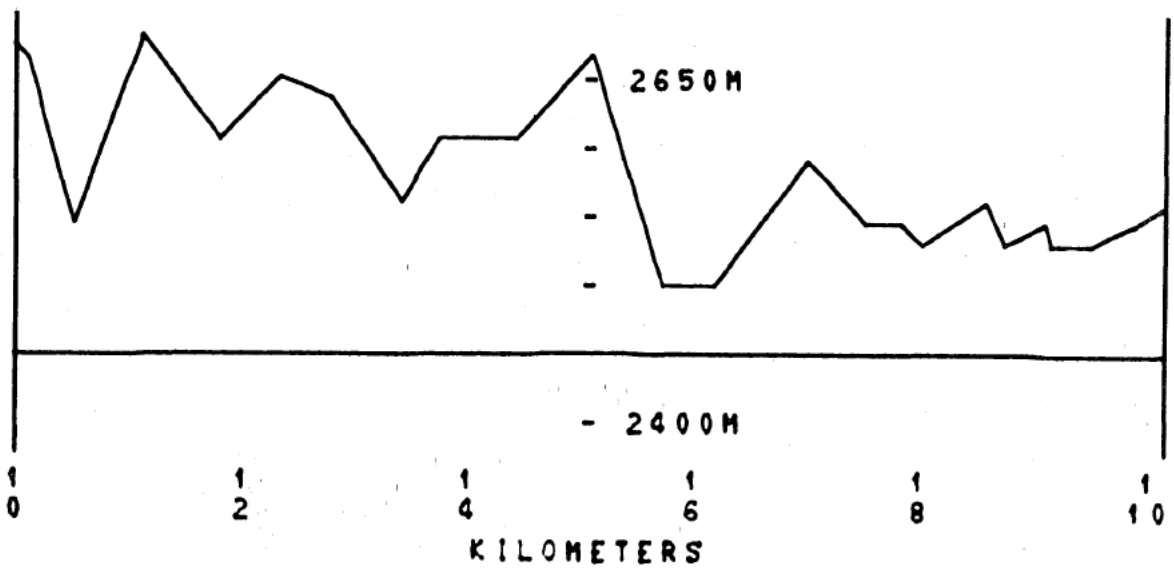
Bearing from common receiver site to transmitter site is
349° 56' 53" T.


R2-10-T7
CARIBOU COUNTRY CLUB RANCH
230 MHZ 11/19/65
407 MHZ
751 MHZ
910 MHZ 8/26/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 99.9
407 - 104.9
751 - 110.2
910 - 111.9
1846 - 118.0
4595 - 125.9
9190 - 131.9
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-10-T7
PATH LENGTH 10.269 km

XMTR. ELEV. 2557 M

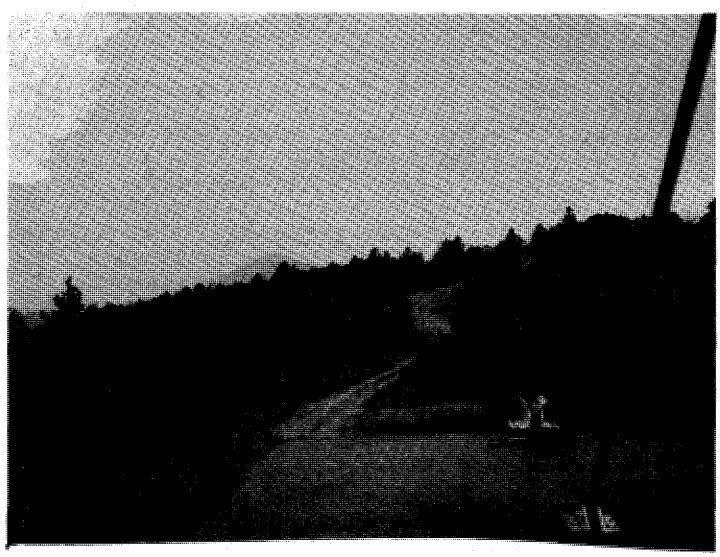


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq. (MHz)	230	407	751	910	1846	4595	9190
	11-19-65 at 13 M				8-26-66 at 13 M		
50%	125.8	136.9	148.5	154.8	170.3	189.2	198.1
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	< 3	6.0
					8-26-66 at 7.3 M		
50%				153.3	171.8	197.4	
Δ10%-90%				< 3	< 3	6.5	
					8-26-66 at 1 M		
50%				159.3	176.8	212.4	
Δ10%-90%				< 3	< 3	5.0	

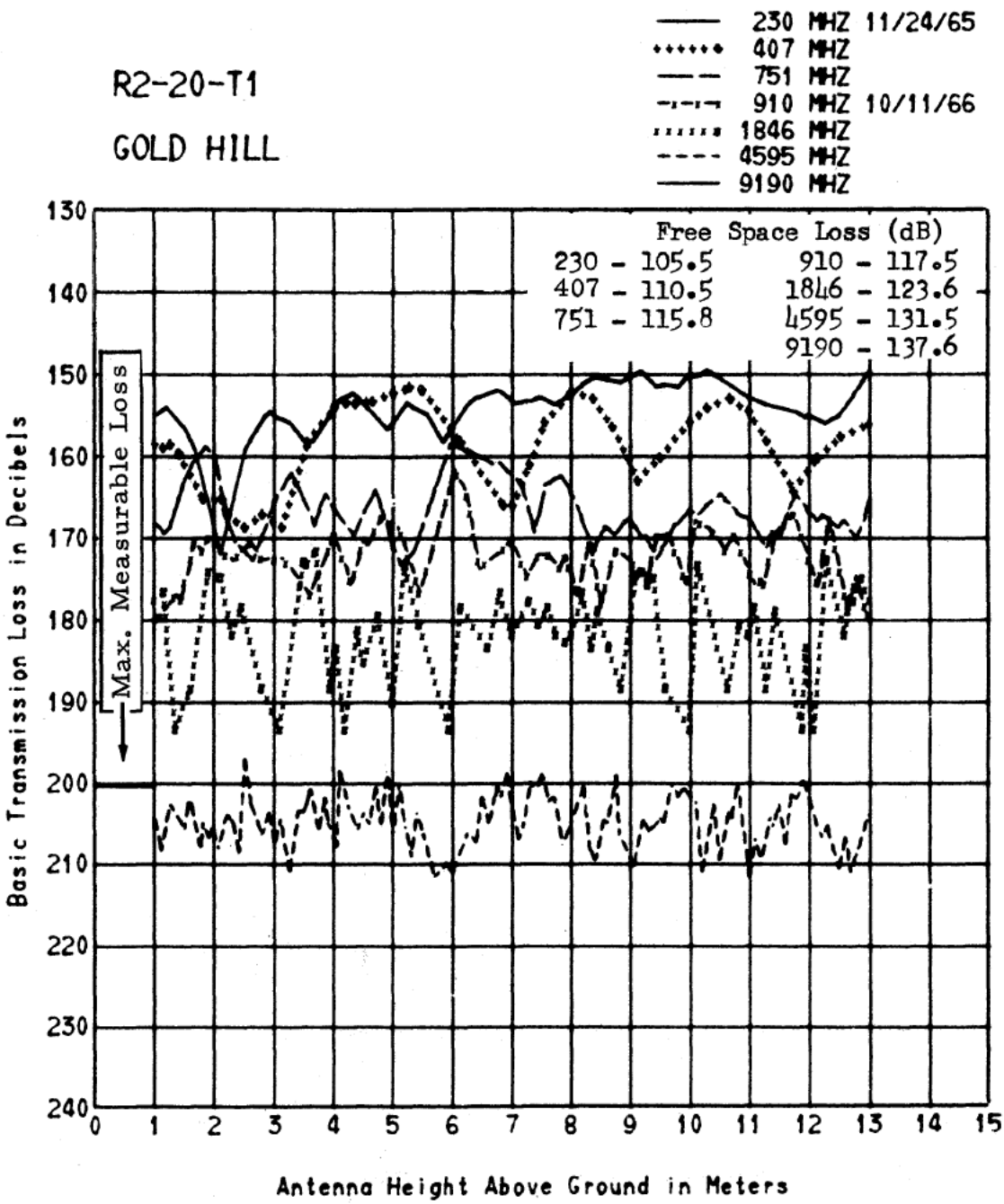
The foreground at this site is covered with field grass for 50 m to a seldom-used, dirt road, running at 80° to the path. The next 200 m are covered with grass and low brush to rolling hills covered with pines, 5 km away. No other obstructions exist.

R2-20-T1
GOLD HILL



PATH VIEW FROM TRANSMITTER

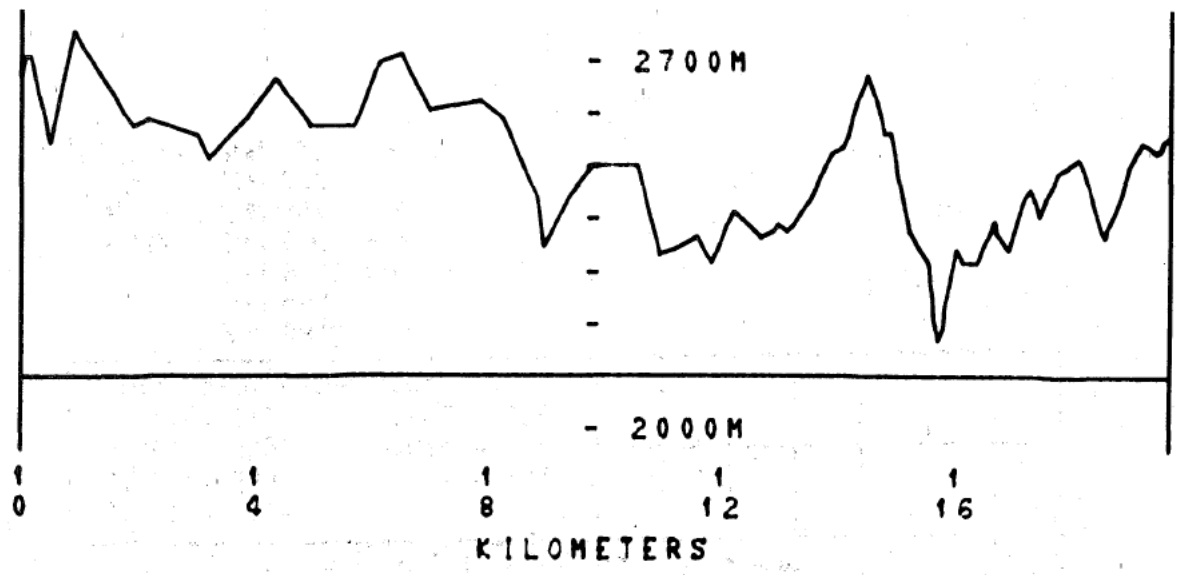
Bearing from common receiver site to transmitter site is 25^{o} 04' 49" T.


230 MHZ 11/24/65
407 MHZ
751 MHZ
910 MHZ 10/11/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-20-T1
GOLD HILL
Free Space Loss (dB)
230 - 105.5
407 - 110.5
751 - 115.8
910 - 117.5
1846 - 123.6
4595 - 131.5
9190 - 137.6
Max. Measurable Loss
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-20-T1
PATH LENGTH 19.609 km

XMTR. ELEV.
2557 M

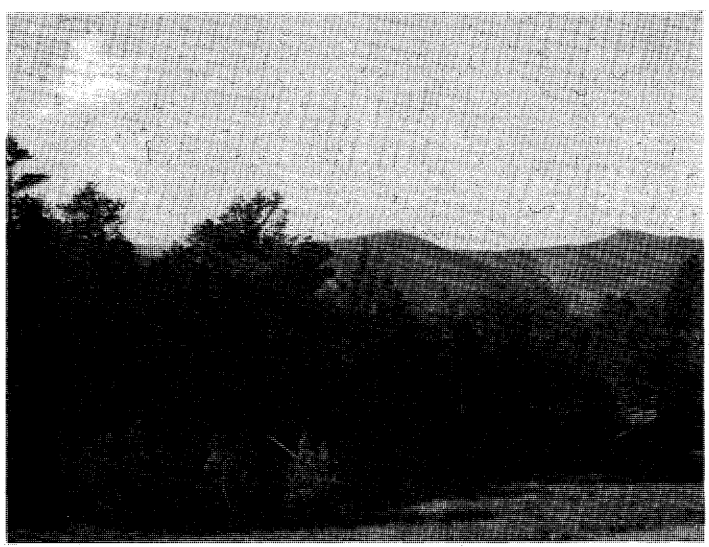


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq. (MHz)	230	407	751	910	1846	4595	9190
	11-24-65 at 13 M				10-11-66 at 13 M		
50%	149.3	156.0	164.8	176.8	183.3	202.9	
Δ10%-90%	< 3	< 3	< 3	10.2	13.0	9.0	
					10-11-66 at 7.3 M		
50%				172.2	176.5	201.9	
Δ10%-90%				6.4	6.0	8.5	
					10-11-66 at 1 M		
50%				172.2	179.3	205.7	
Δ10%-90%				7.3	8.0	8.4	

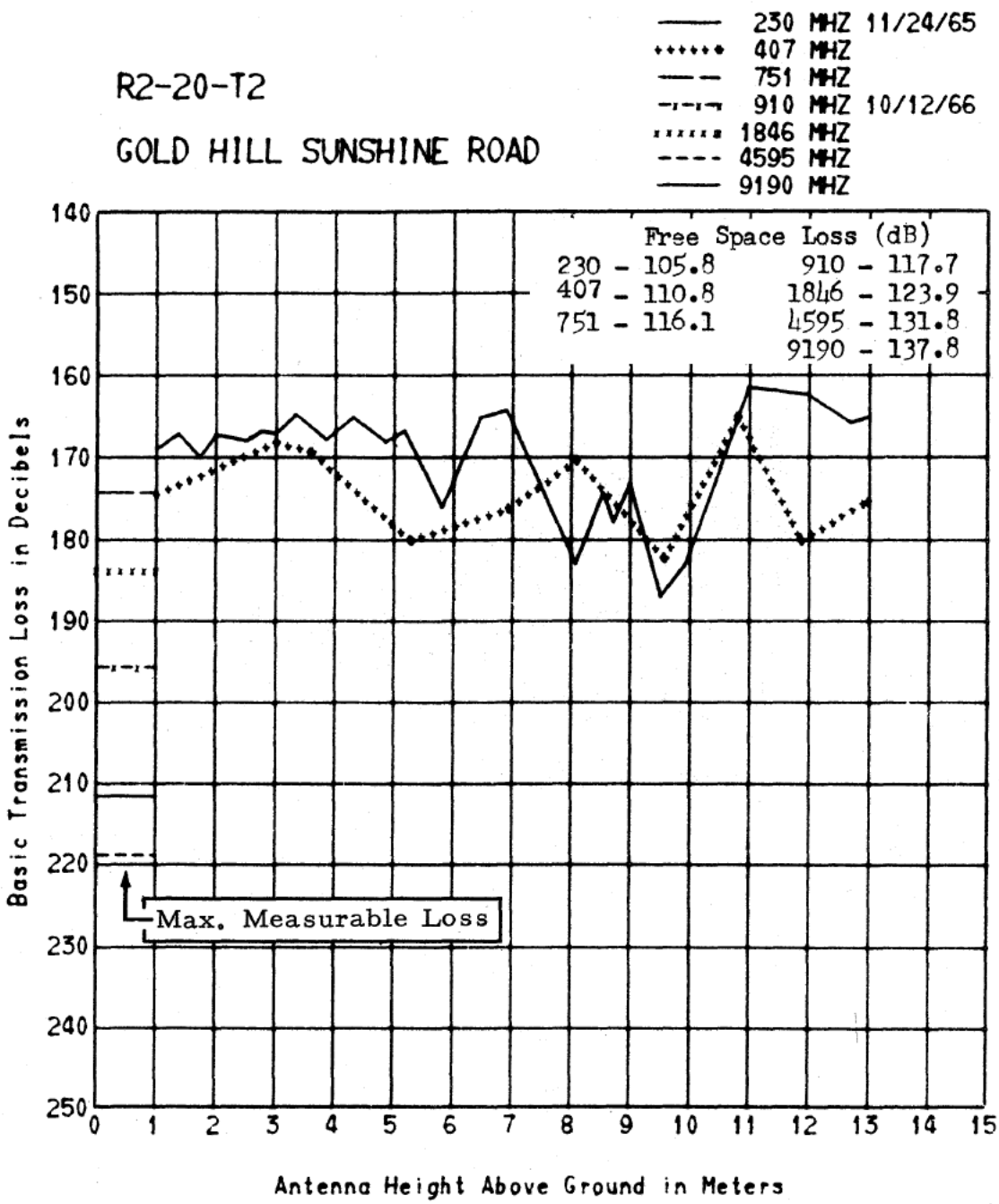
The foreground for 50 m is unobstructed and covered with pasture grass. The next 100 m are covered with aspen trees. Beyond these are rolling hills, covered with pines, to the horizon.

R2-20-T2
GOLD HILL - SUNSHINE ROAD



PATH VIEW FROM TRANSMITTER

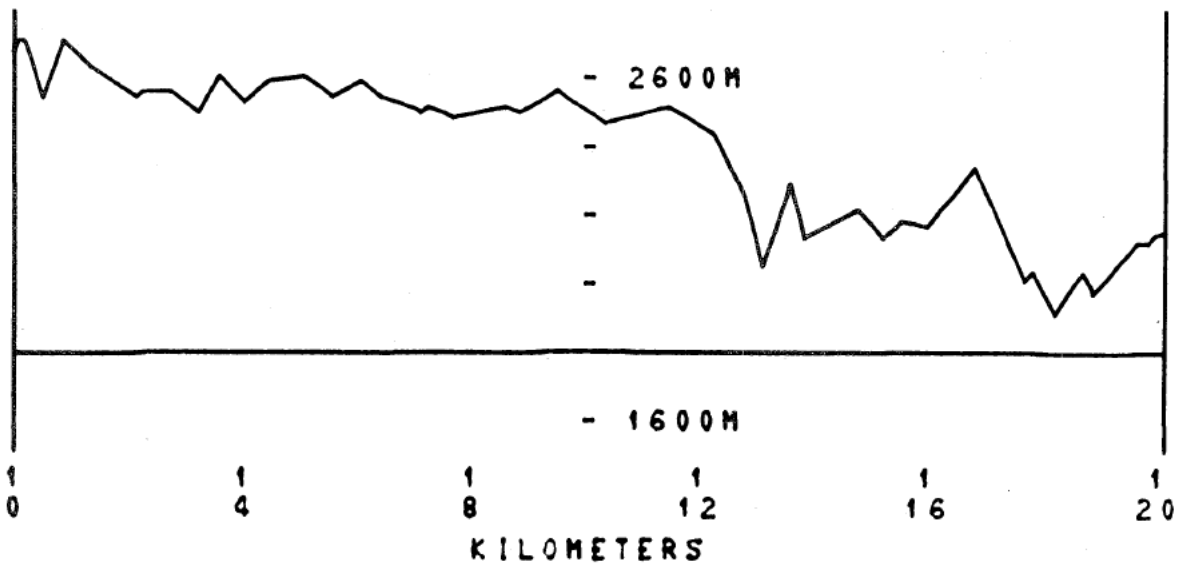
Bearing from common receiver site to transmitter site is 38^{o} 29' 45" T.


R2-20-T2
GOLD HILL SUNSHINE ROAD
230 MHZ 11/24/65
407 MHZ
751 MHZ
910 MHZ 10/12/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 105.8
407 - 110.8
751 - 116.1
910 - 117.7
1846 - 123.9
4595 - 131.8
9190 - 137.8
Max. Measurable Loss
Basic Transmission Loss in Decibels
140
150
160
170
180
190
200
210
220
230
240
250
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-20-T2
PATH LENGTH 20.209 km

XMTR. ELEV. 2155 M

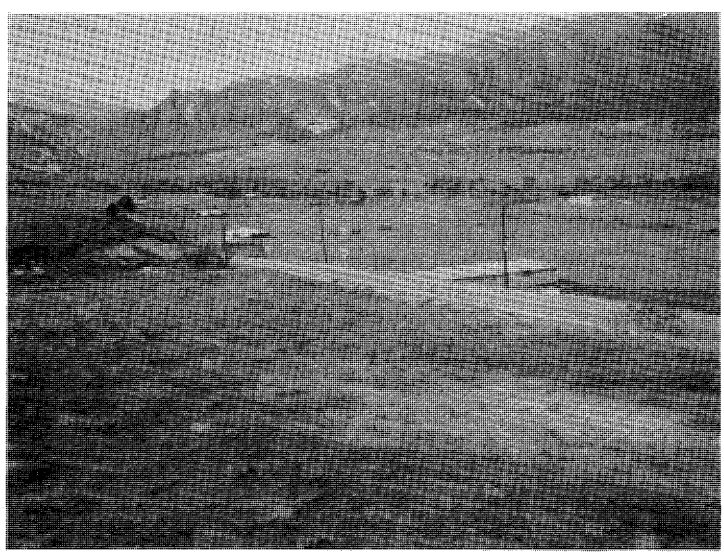


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	11-24-65 at 11 M						
50%	163.2	168.1					
Δ10%-90%	< 3	< 3					
50%							
Δ10%-90%							
50%							
Δ10%-90%							

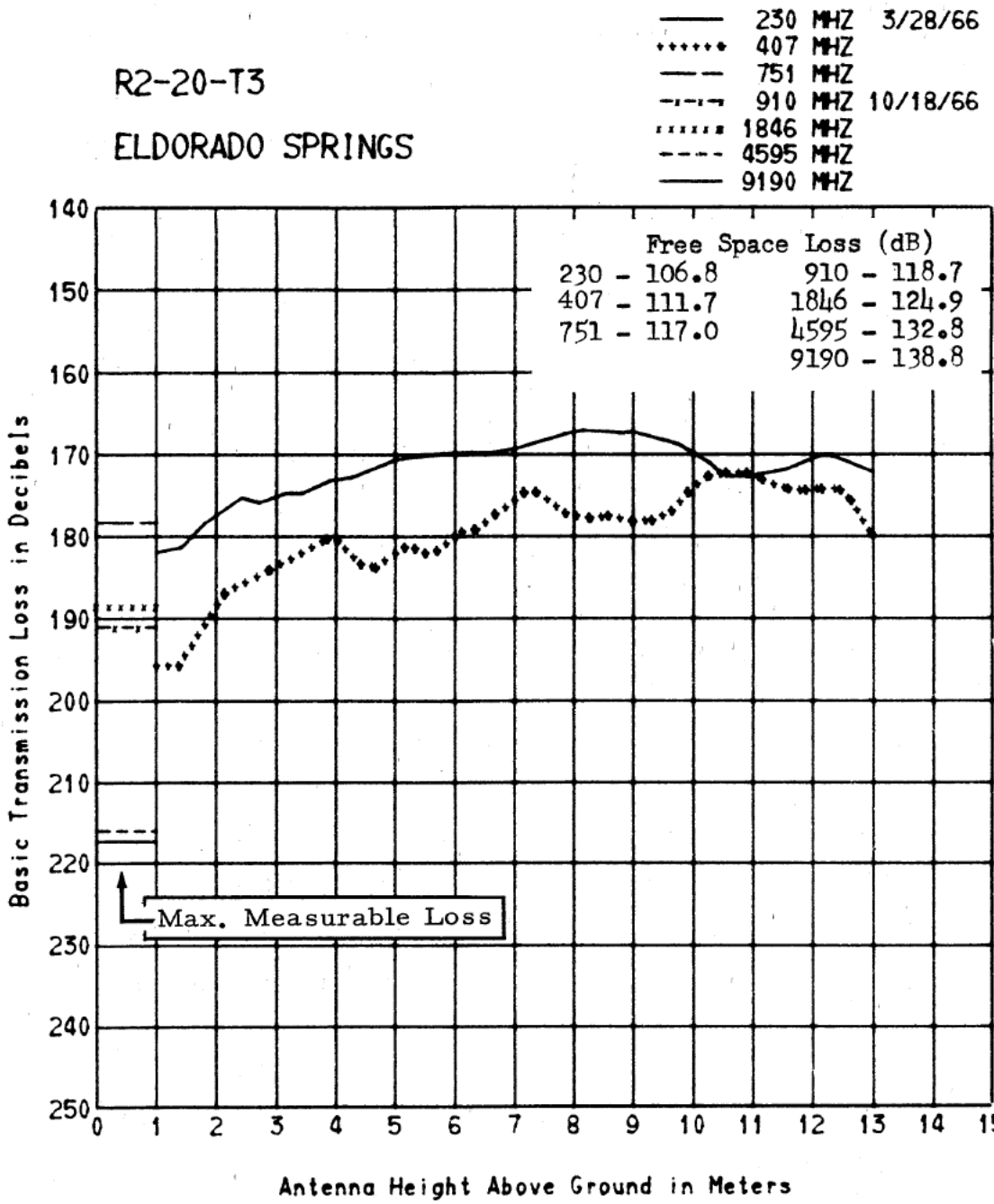
The immediate foreground for 100 m is covered with pasture grass. Beyond is a dense growth of short pine trees, all of which are below the ray path. No other obstructions exist for 3 km up to a ridge, covered with pines, which forms the horizon.

R2-20-T3
ELDORADO SPRINGS



PATH VIEW FROM TRANSMITTER

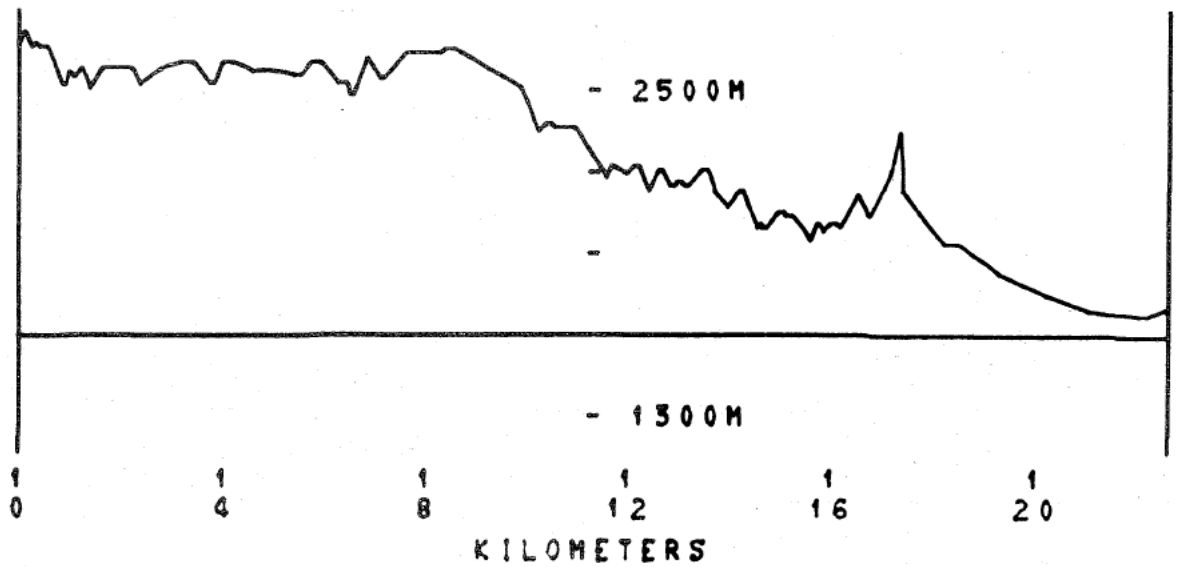
Bearing from common receiver site to transmitter site is 77^{o} 44' 38" T.


R2-20-T3
ELDORADO SPRINGS
230 MHZ 3/28/66
407 MHZ
751 MHZ
910 MHZ 10/18/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 106.8
407 - 111.7
751 - 117.0
910 - 118.7
1846 - 124.9
4595 - 132.8
9190 - 138.8
Max. Measurable Loss
Basic Transmission Loss in Decibels
140
150
160
170
180
190
200
210
220
230
240
250
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-20-T3
PATH LENGTH 22.590 km

XMTR. ELEV. 1698 M

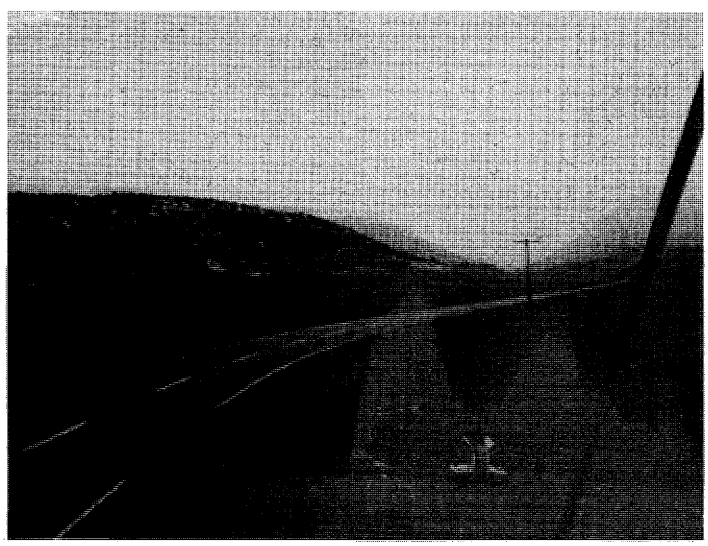


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-28-66 at 9 M						
50%	167.1	174.9					
Δ10%-90%	< 3	< 3					

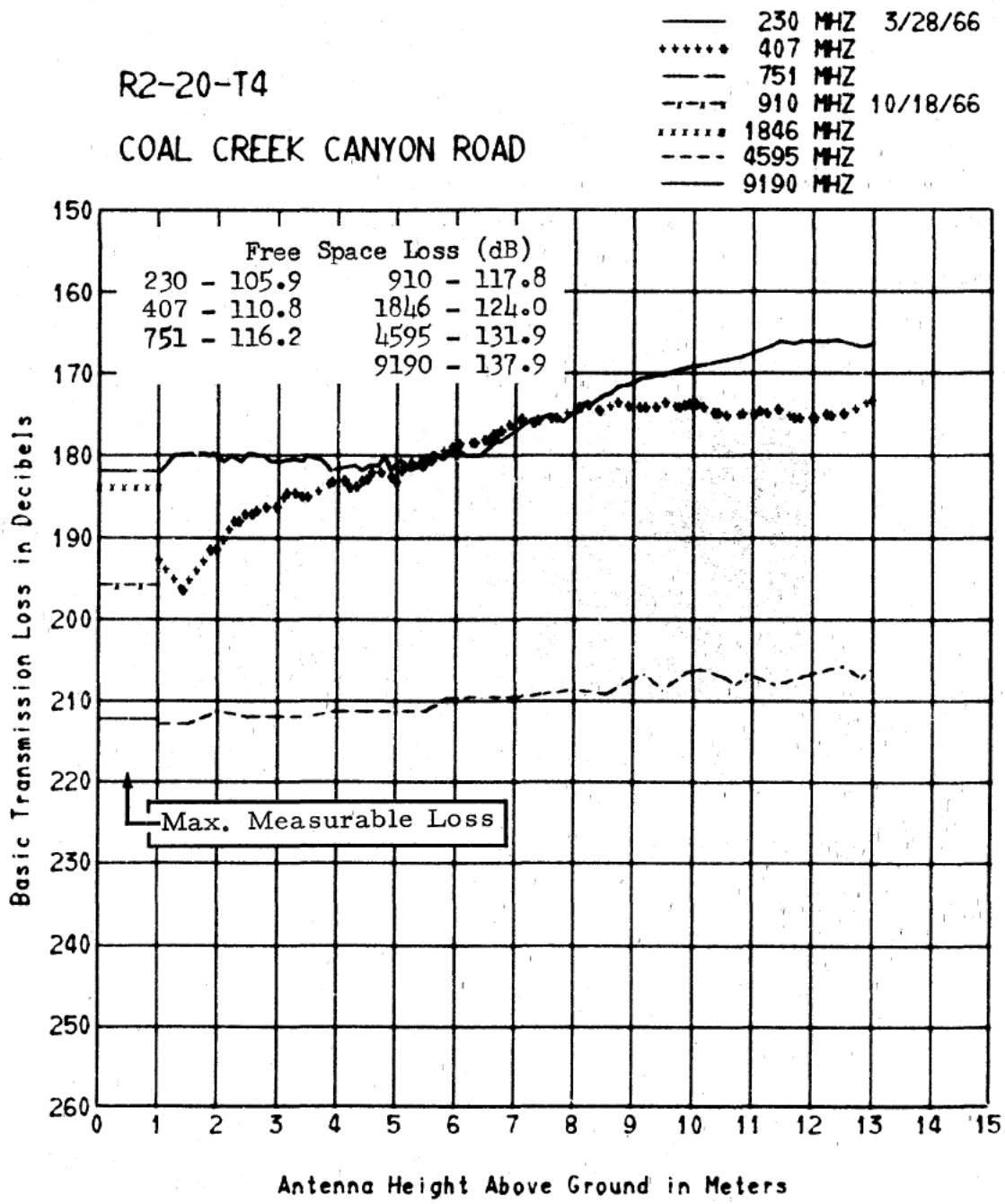
The immediate foreground is pasture grass for 100 m, beyond which a slightly traveled highway runs at 60° to the path. The ground then drops away sharply to a few scattered homes and grassland. Power and telephone lines parallel the highway. Approximately 1.5 km away is a thin line of trees perpendicular to the path. From these to the mountains, forming the horizon, the ground rises sharply.

R2-20-T4
COAL CREEK CANYON ROAD



PATH VIEW FROM TRANSMITTER

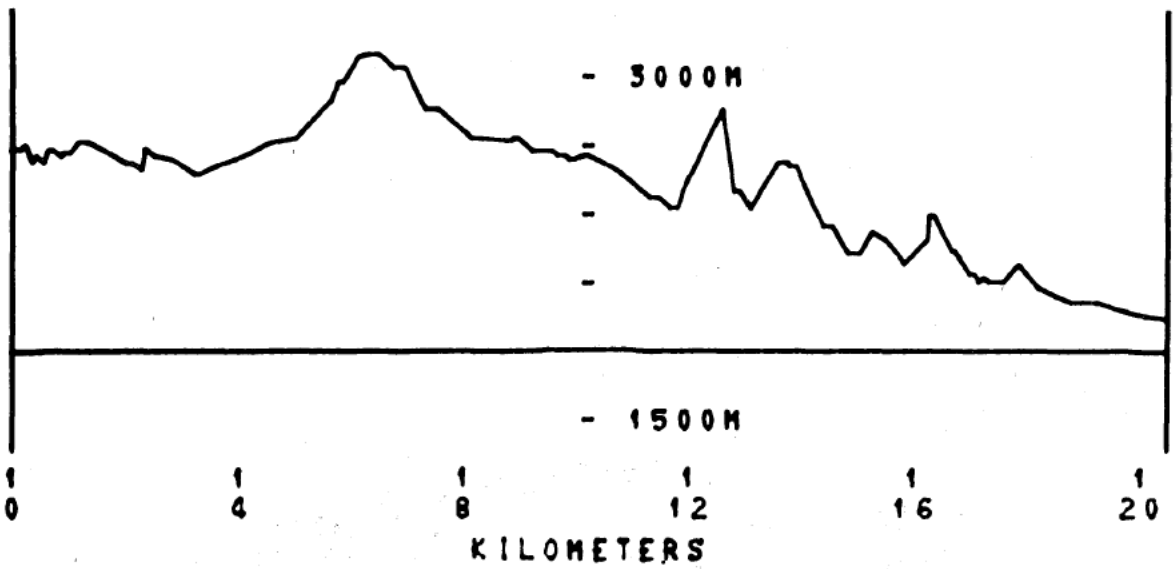
Bearing from common receiver site to transmitter site is 102^{o} 20' 28" T.


R2-20-T4
COAL CREEK CANYON ROAD
230 MHZ 3/28/66
407 MHZ
751 MHZ
910 MHZ 10/18/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 105.9
407 - 110.8
751 - 116.2
910 - 117.8
1846 - 124.0
4595 - 131.9
9190 - 137.9
Max. Measurable Loss
Basic Transmission Loss in Decibels
Antenna Height Above Ground in Meters
150
160
170
180
190
200
210
220
230
240
250
260
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

RCVR. ELEV.
2676 M

R2-20-T4
PATH LENGTH 20.407 km

XMTR. ELEV.
1942 M

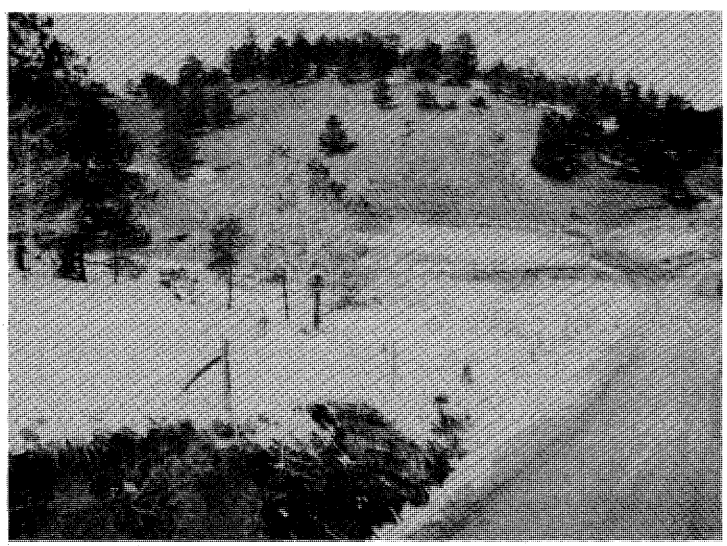


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-28-66 at 13 M				10-18-66 at 13 M		
50%	167.1	174.1				209.1	
Δ10%-90%	< 3	< 3				< 3	
					10-18-66 at 7.3 M		
50%						210.1	
Δ10%-90%						< 3	
					10-18-66 at 1 M		
50%						213.1	
Δ10%-90%						< 3	

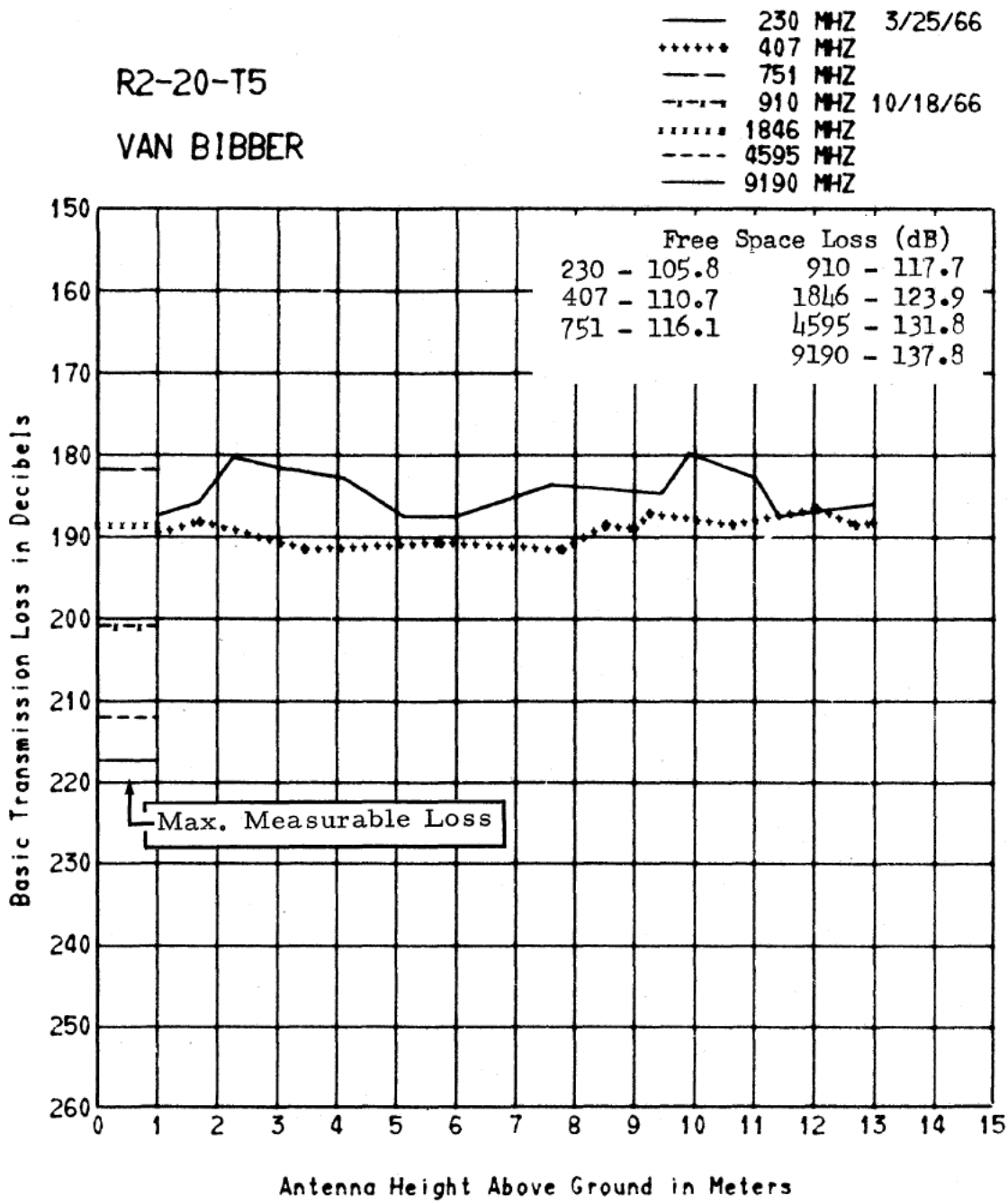
The immediate foreground is open plains covered with grass. An asphalt highway crosses the path approximately 200 m from the transmitter. A 4-wire power line parallels the highway which, after crossing the path at 40°, turns and parallels the right edge of the path. About 1.5 km away, steeply sloping hills form the horizon.

R2-20-T5
VAN BIBBER



PATH VIEW FROM TRANSMITTER

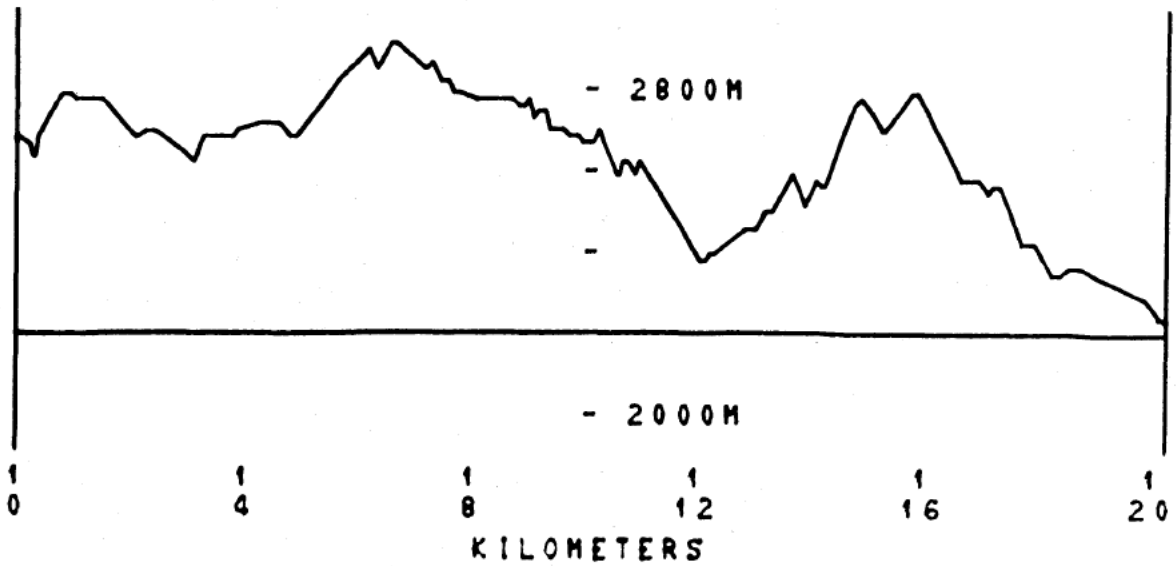
Bearing from common receiver site to transmitter site is
125° 31' 58" T.


230 MHZ 3/25/66
407 MHZ
751 MHZ
910 MHZ 10/18/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-20-T5
VAN BIBBER
Free Space Loss (dB)
230 - 105.8
407 - 110.7
751 - 116.1
910 - 117.7
1846 - 123.9
4595 - 131.8
9190 - 137.8
Max. Measurable Loss
Basic Transmission Loss in Decibels
150
160
170
180
190
200
210
220
230
240
250
260
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-20-T5
PATH LENGTH 20.178 km

XMTR. ELEV. 2240 M

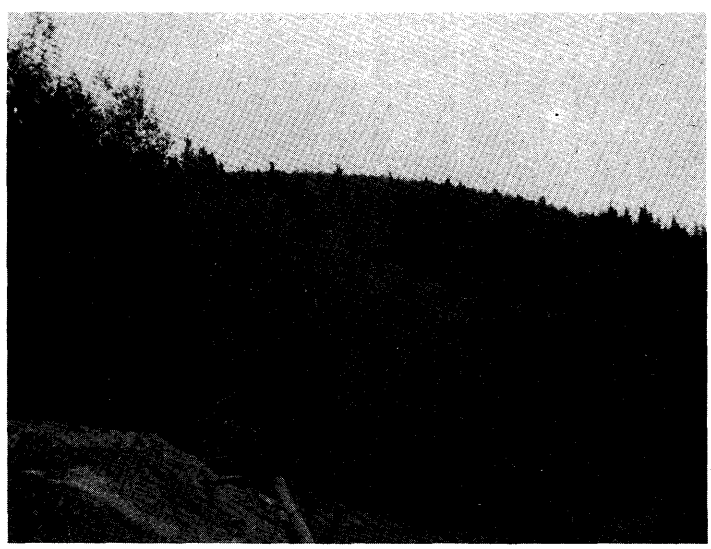


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-25-66 at 13 M						
50%	182.2	188.0					
Δ10%-90%	3.0	< 3					

The path is over grassland, studded with scattered pines and bare aspen trees for 400 m. A low 3-wire fence crosses the path about 30 m from the transmitter. At 400 m the path rises sharply to the horizon covered with scattered pines.

R2-20-T6
IDAHO SPRINGS

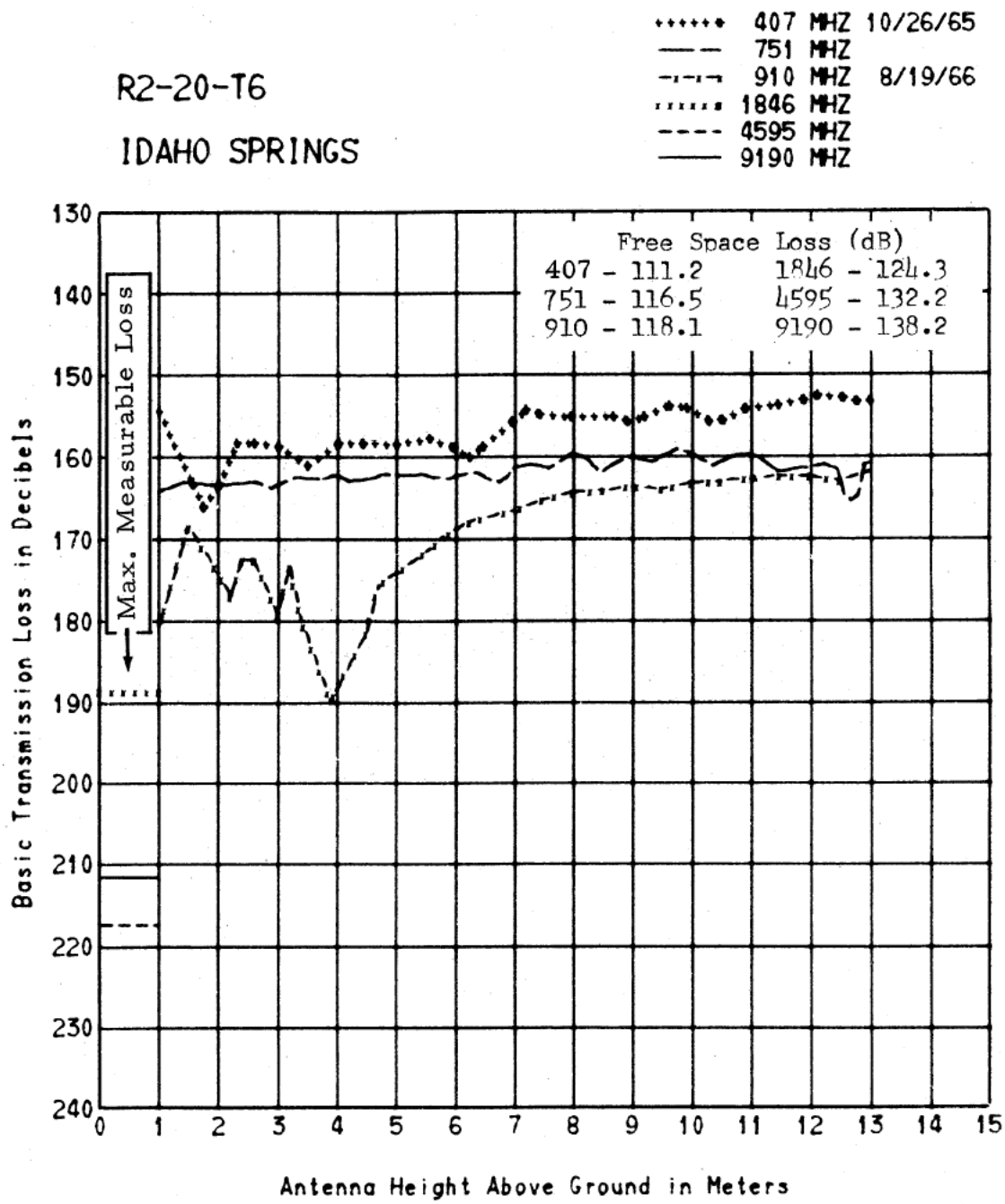


PATH VIEW FROM TRANSMITTER

Bearing from common receiver site to transmitter site is
205° 14' 38" T.

R2-20-T6

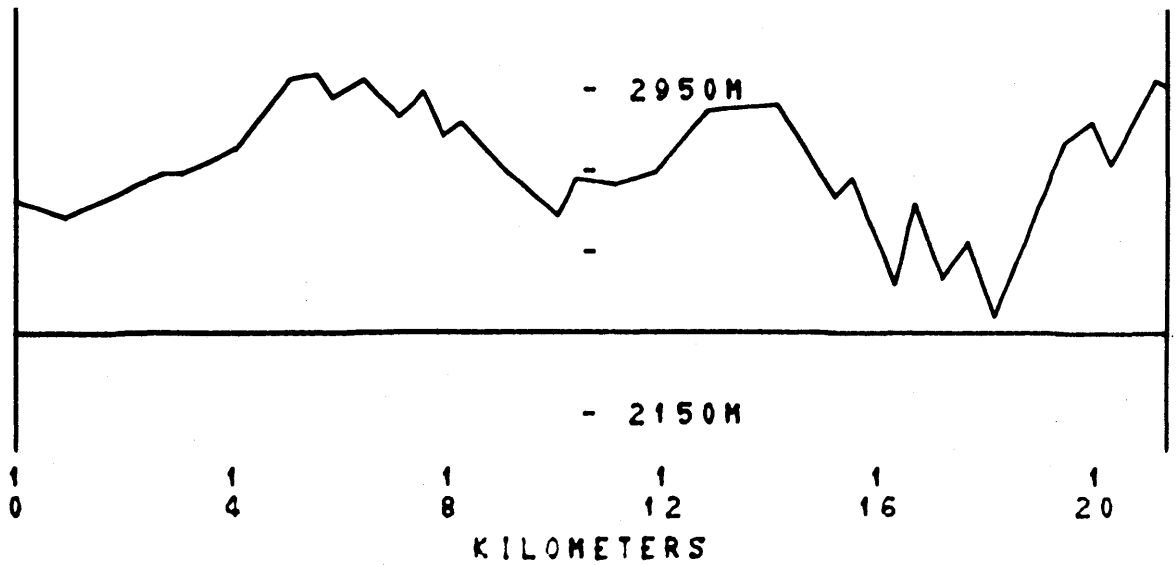
IDAHO SPRINGS



RCVR. ELEV. 2676 M

R2-20-T6
PATH LENGTH 21.176 km

XMTR. ELEV. 2963 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

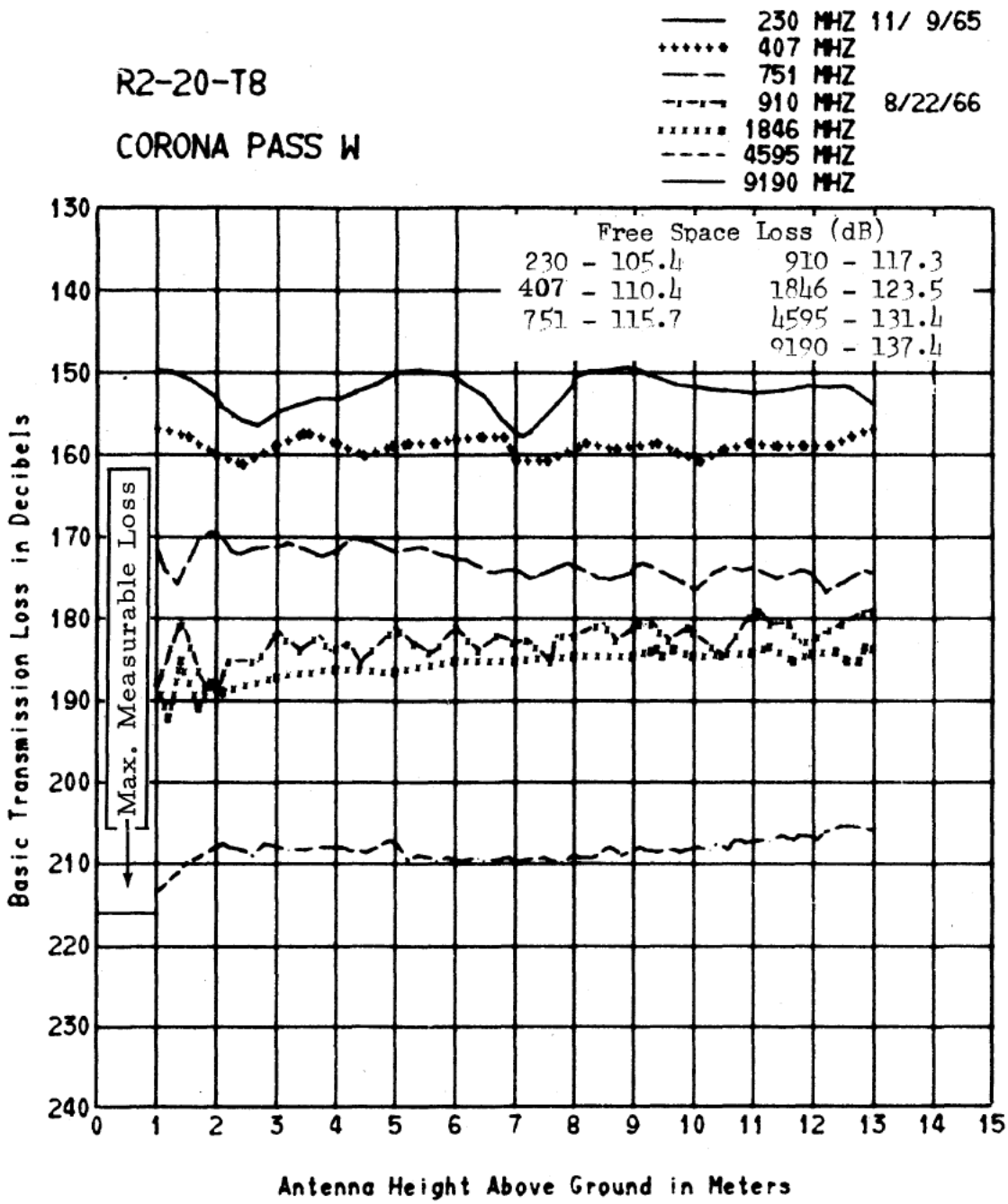
Freq (MHz)	230	407	751	910	1846	4595	9190
	10-26-65 at 13 M				8-19-66 at 13 M		
50%		153.7	163.3	162.1			
Δ10%-90%		< 3	< 3	< 3			
					8-19-66 at 7.3 M		
50%				165.1			
Δ10%-90%				< 3			

This site is located on a pile of mining waste material. Fifteen meters from the transmitter, the grass-covered ground drops sharply. Twenty meters away stands a dense grove of aspen trees, below the line of sight. About 100 m away the ground slopes gently upward to a pine-covered ridge, which forms the horizon 1.5 km away.

R2-20-T8
CORONA PASS W

PATH VIEW FROM TRANSMITTER

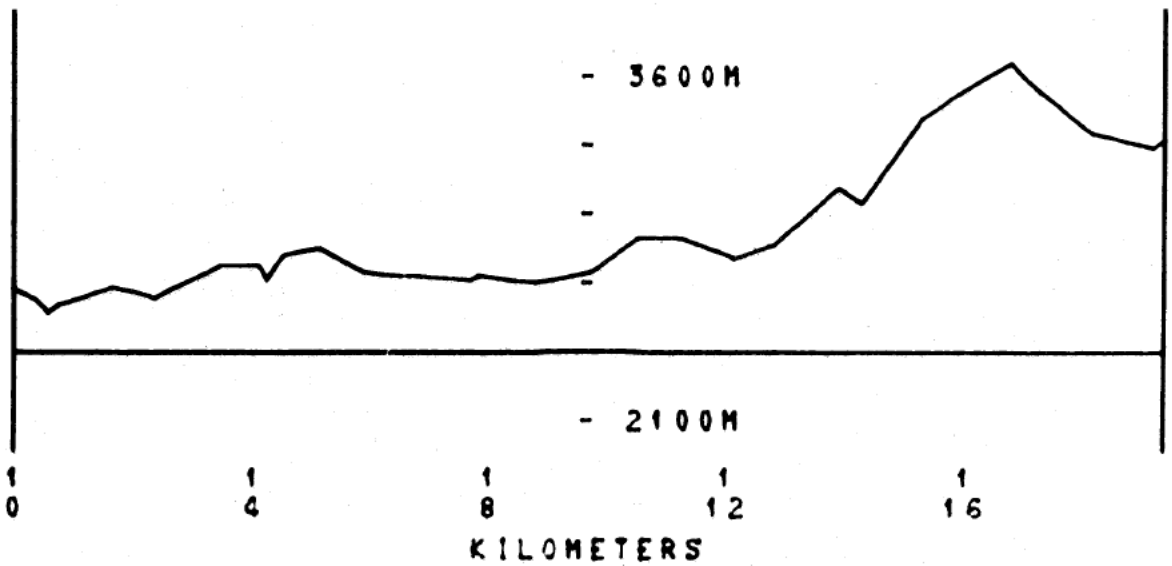
Bearing from common receiver site to transmitter site is 267° 37' 29" T.


230 MHZ 11/ 9/65
407 MHZ
751 MHZ
910 MHZ 8/22/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-20-T8
CORONA PASS W
Free Space Loss (dB)
230 - 105.4
407 - 110.4
751 - 115.7
910 - 117.3
1846 - 123.5
4595 - 131.4
9190 - 137.4
Max. Measurable Loss
Basic Transmission Loss in Decibels
130
140
150
160
170
180
190
200
210
220
230
240
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-20-T8
PATH LENGTH 19.300 km

XMTR. ELEV. 3319 M

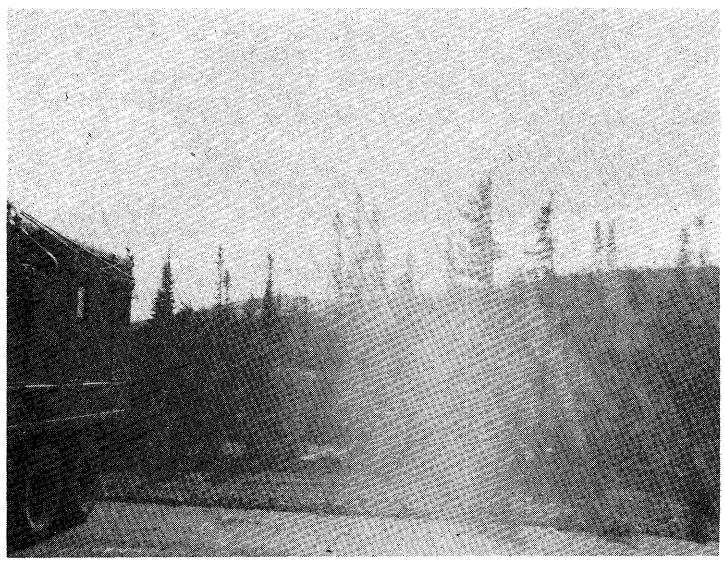


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	11-9-65 at 13 M				8-22-66 at 13 M		
50%	153.8	156.9	172.2	178.5	184.4	205.4	
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	<3	
					8-22-66 at 7.3 M		
50%				180.5	184.9	207.5	
Δ10%-90%				< 3	< 3	< 3	
					8-22-66 at 1 M		
50%				192.5	187.9	213.6	
Δ10%-90%				4.5	< 3	< 3	

This site is just below timberline among scattered trees. The horizon is a ridge about 30 km away. Fifty meters from the transmitter, the ground slopes away gently to a deep valley and rolling, pine-covered hills.

R2-20-T9 OPEN AND CONCEALED
BRAINARD LAKE

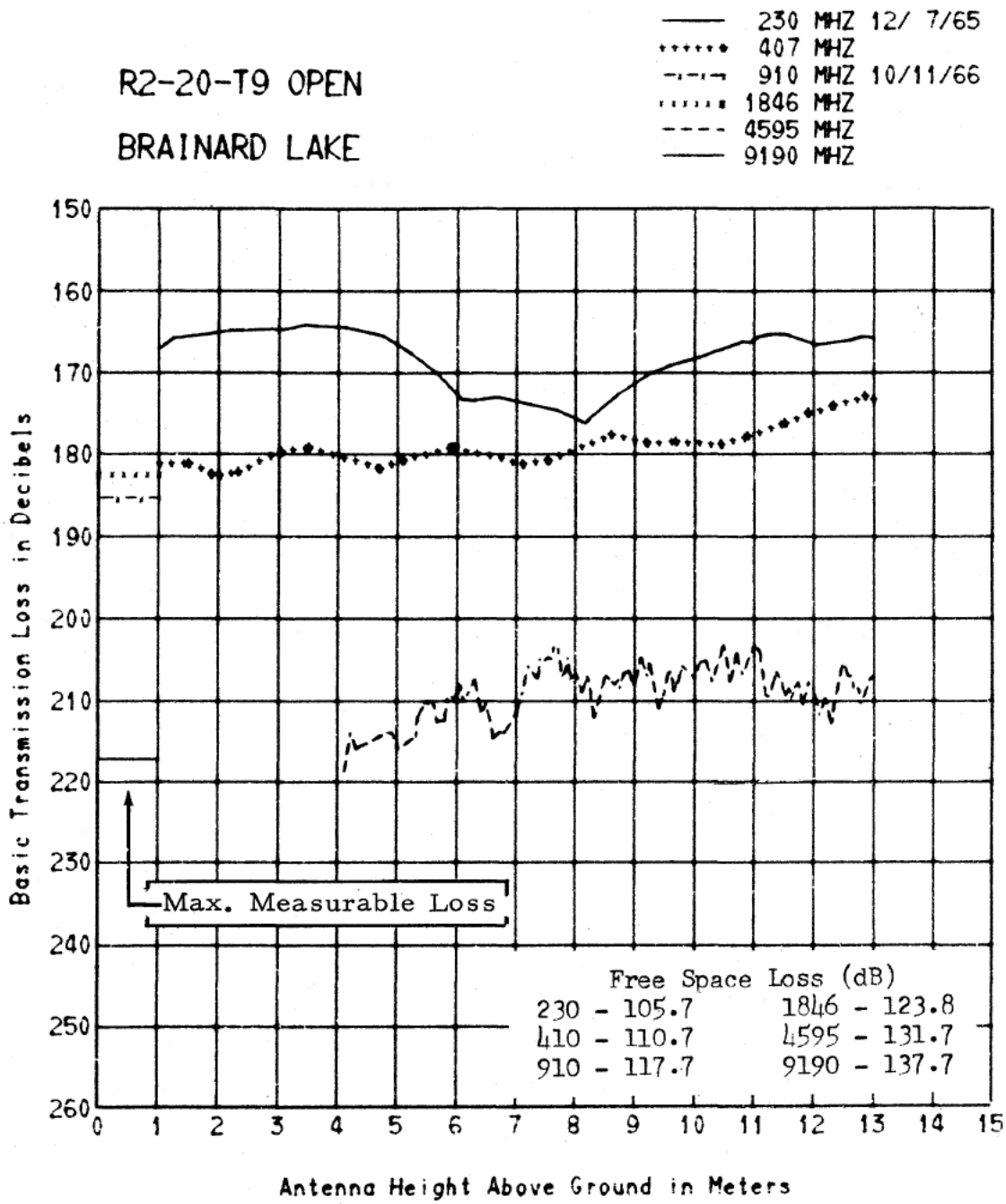


PATH VIEW FROM OPEN SITE

Bearing from common receiver site to transmitter site is 340° 38' 57" T.

PATH VIEW FROM CONCEALED SITE

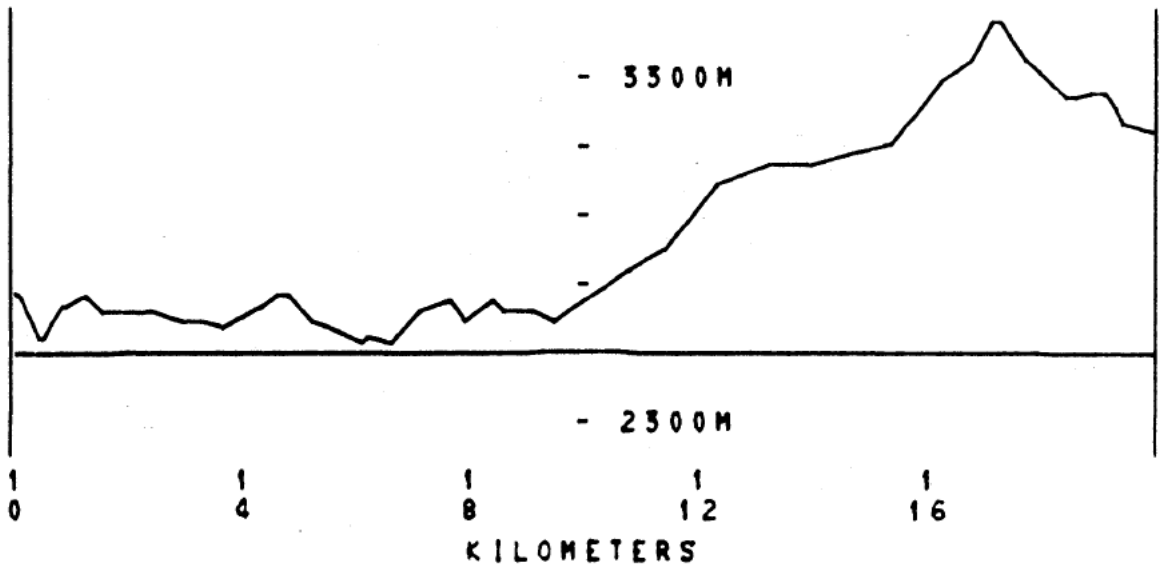
Bearing from common receiver site to transmitter site is 341° 19' 29" T.


230 MHZ 12/ 7/65
407 MHZ
910 MHZ 10/11/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-20-T9 OPEN
BRAINARD LAKE
Basic Transmission Loss in Decibels
150
160
170
180
190
200
210
220
230
240
250
260
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Max. Measurable Loss
Free Space Loss (dB)
230 - 105.7
410 - 110.7
910 - 117.7
1846 - 123.8
4595 - 131.7
9190 - 137.7
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-20-T9 OPEN
PATH LENGTH 20.023 km

XMTR. ELEV. 3146 M

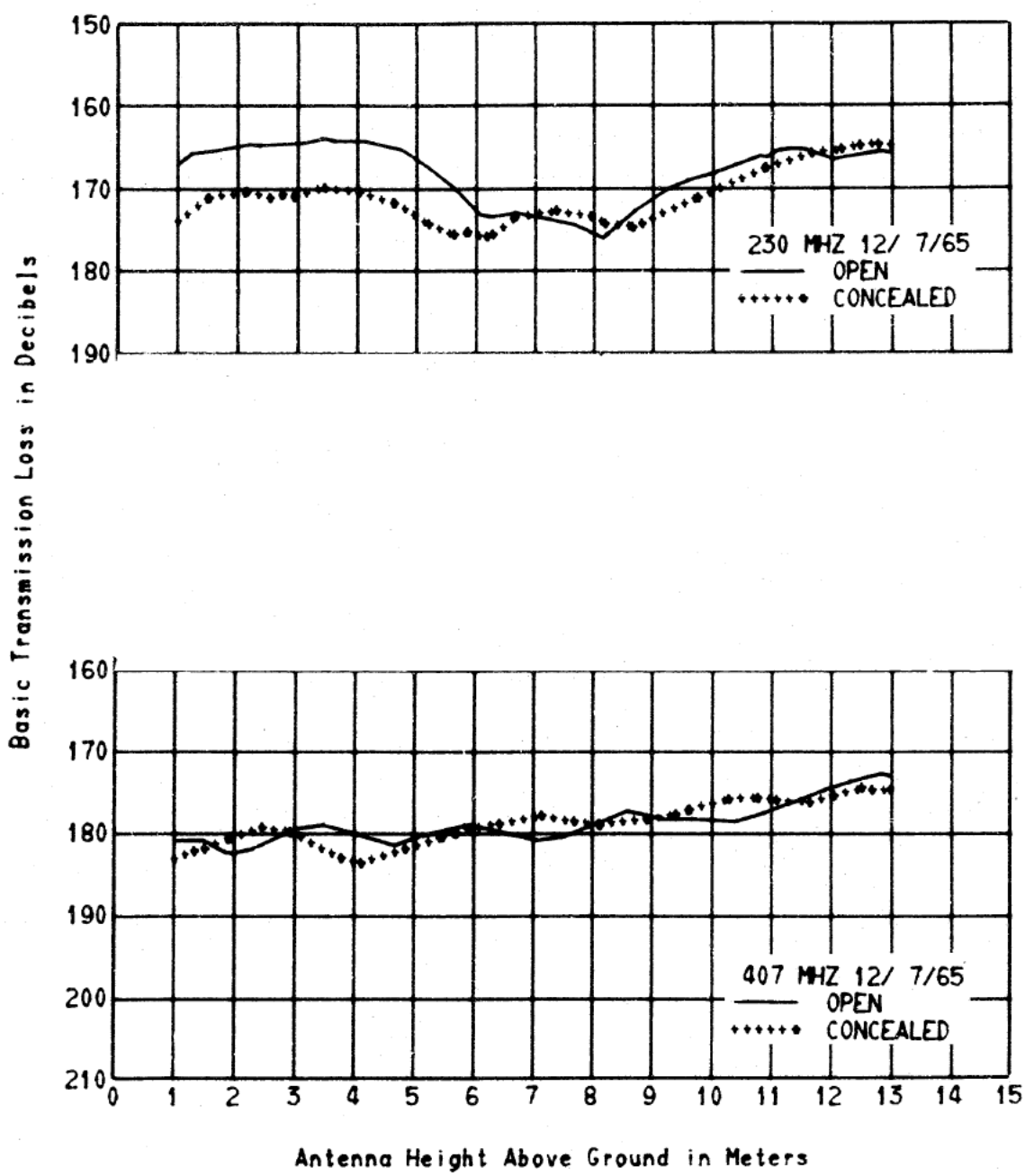


	L_b (dB) SHORT TERM SIGNAL VARIABILITY					
Freq (MHz)	230	407	910	1846	4595	9190
	12-7-65 at 13 M			10-11-66 at 13 M		
50%	165.8	173.3			208.5	
Δ10%-90%	< 3	< 3			6.8	
				10-11-66 at 7.3 M		
50%					209.5	
Δ10%-90%					6.5	

This ray path is over the tops of spruce trees for a distance of 2-3 km. The horizon is formed by a barren, rounded hill, 4-5 km away. All ground cover is pine trees.

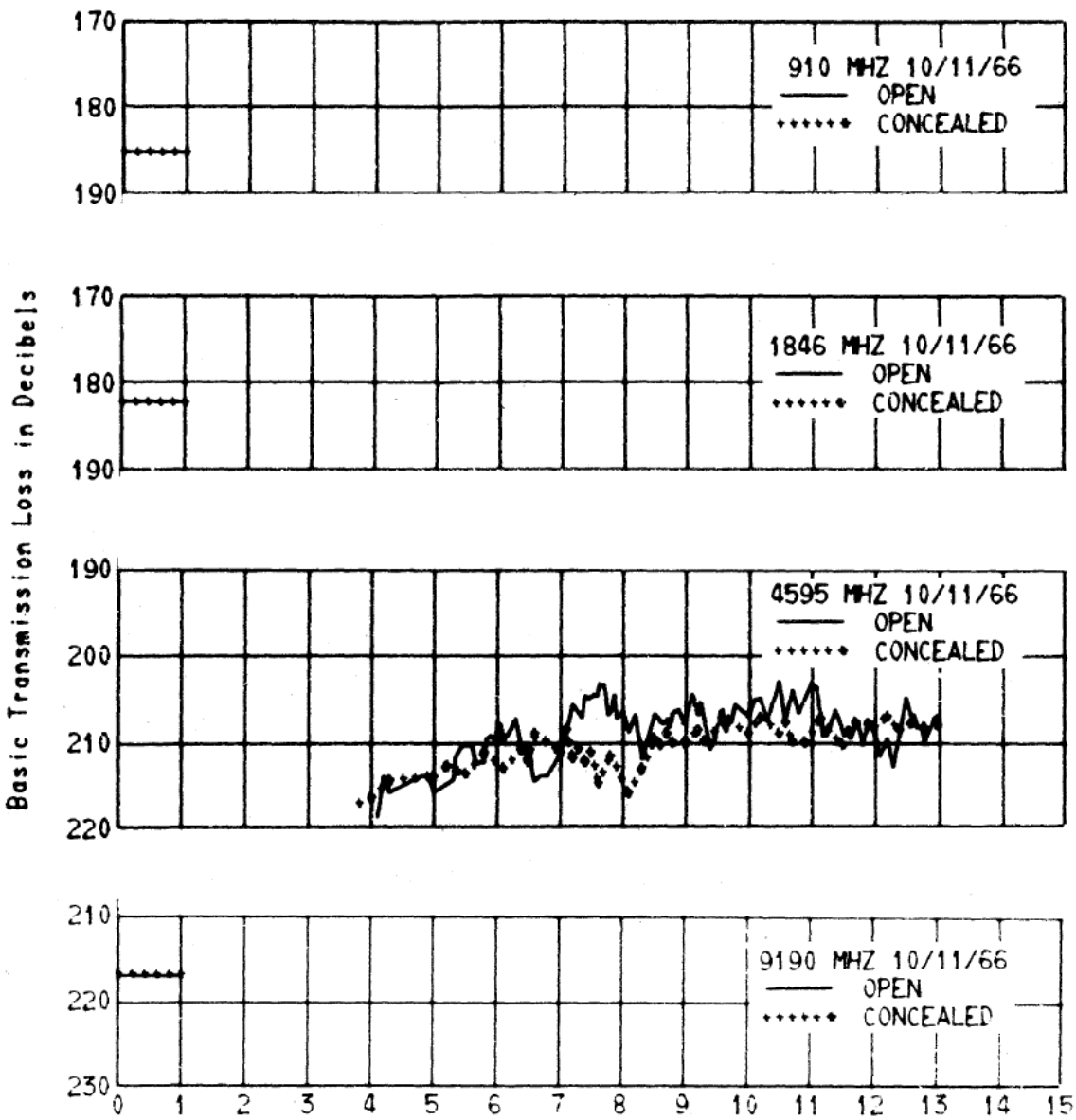
R2-20-T9 O&C

BRAINARD LAKE



R2-20-T9 O&C

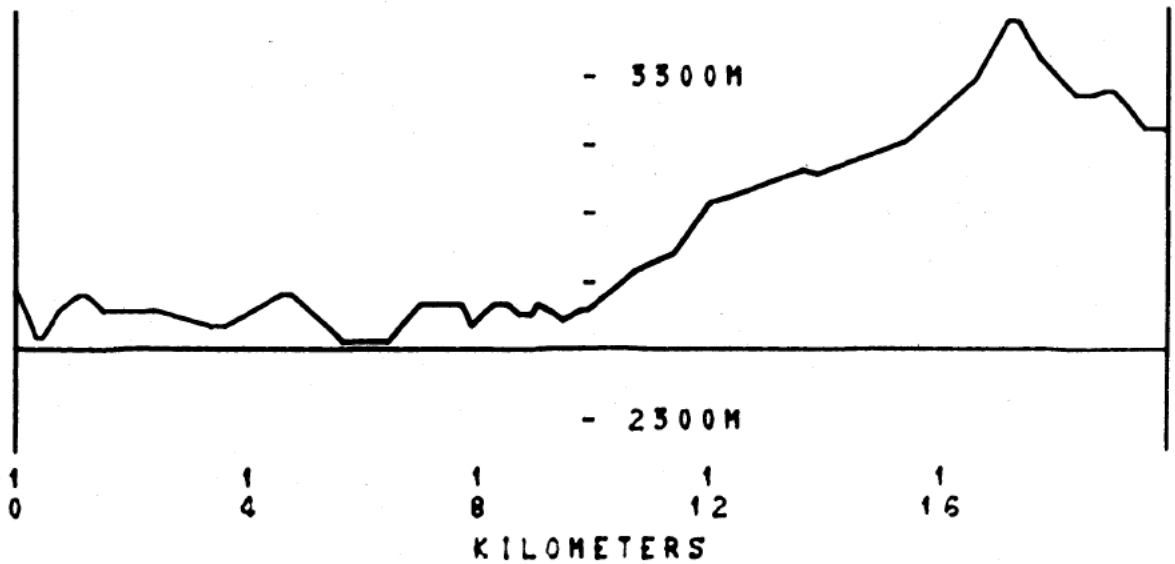
BRAINARD LAKE



RCVR. ELEV. 2676 M

R2-20-T9 CONCEALED
PATH LENGTH 19.978 km

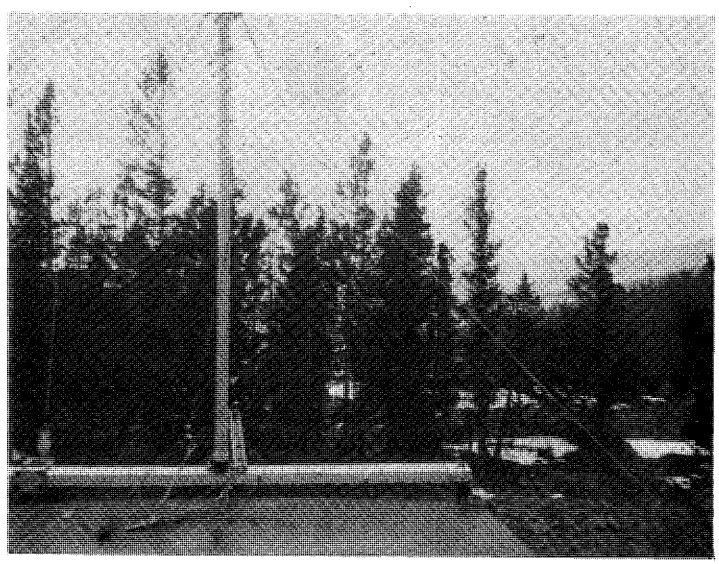
XMTR. ELEV. 3146 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

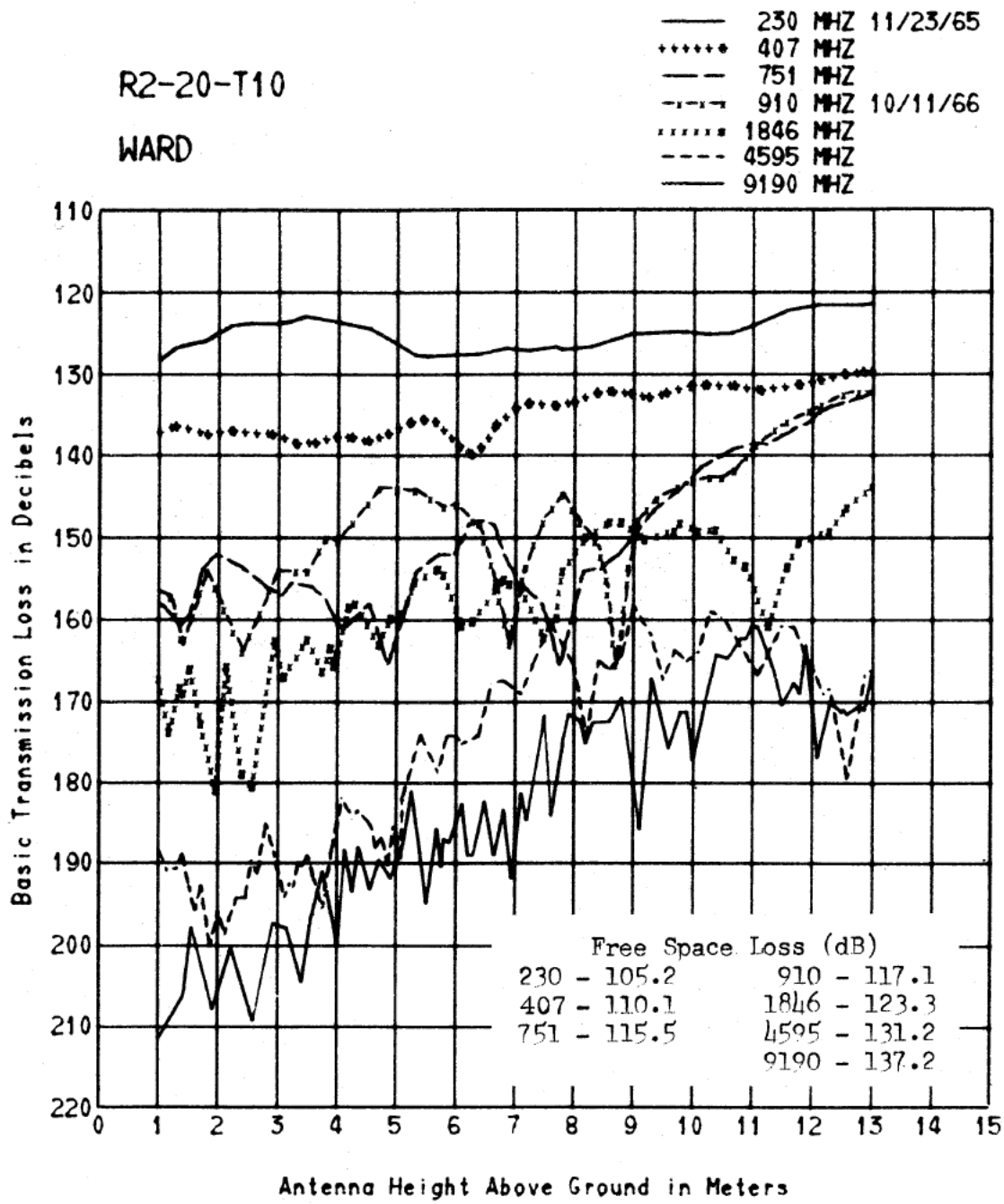
Freq (MHz)	230	407	910	1846	4595	9190
	12-7-65 at 13 M			10-11-66 at 13 M		
50%	164.9	175.1			208.5	
Δ10%-90%	< 3	< 3			< 3	
				10-11-66 at 7.3 M		
50%					209.7	
Δ10%-90%					< 3	

The concealment for this site is a dense grove of pines, extending down the path for about 400 m. The horizon is not visible.



PATH VIEW FROM TRANSMITTER

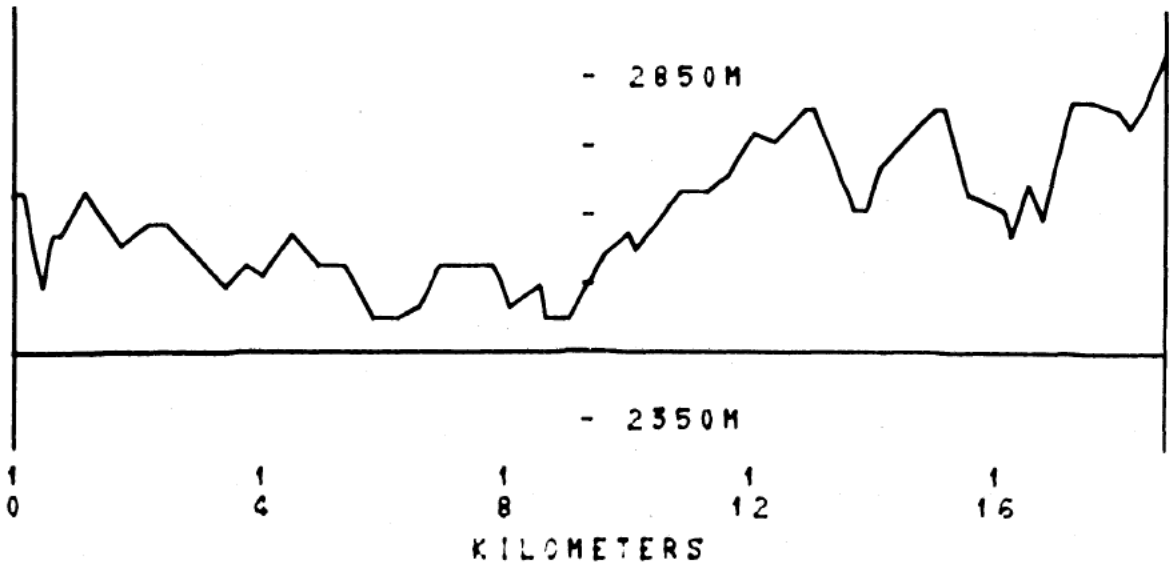
Bearing from common receiver site to transmitter site is 355° 44' 19" T.


230 MHZ 11/23/65
407 MHZ
751 MHZ
910 MHZ 10/11/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-20-T10
WARD
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss (dB)
230 - 105.2
407 - 110.1
751 - 115.5
910 - 117.1
1846 - 123.3
4595 - 131.2
9190 - 137.2

RCVR. ELEV. 2676 M

R2-20-T10
PATH LENGTH 18.825 km

XMTR. ELEV. 2886 M

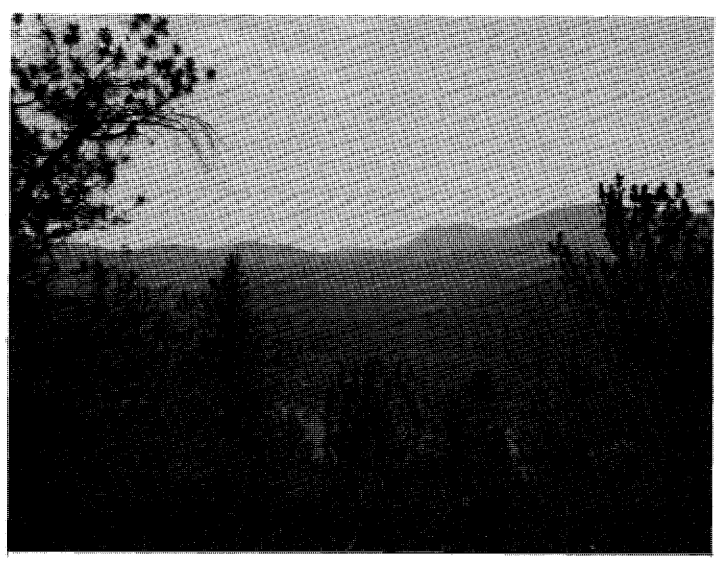


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	11-23-65				10-11-66 at 13 M		
50%	121.7	128.8	132.0	131.4	141.7	168.4	166.7
Δ10%-90%	< 3	< 3	< 3	< 3	< 3	4.8	3.5
					10-11-66 at 7.3 M		
50%				148.9	159.5	164.9	180.0
Δ10%-90%				< 3	5.7	3.8	< 3
					10-11-66 at 1 M		
50%				155.4	168.6	191.8	202.5
Δ10%-90%				< 3	7.7	7.6	10.0

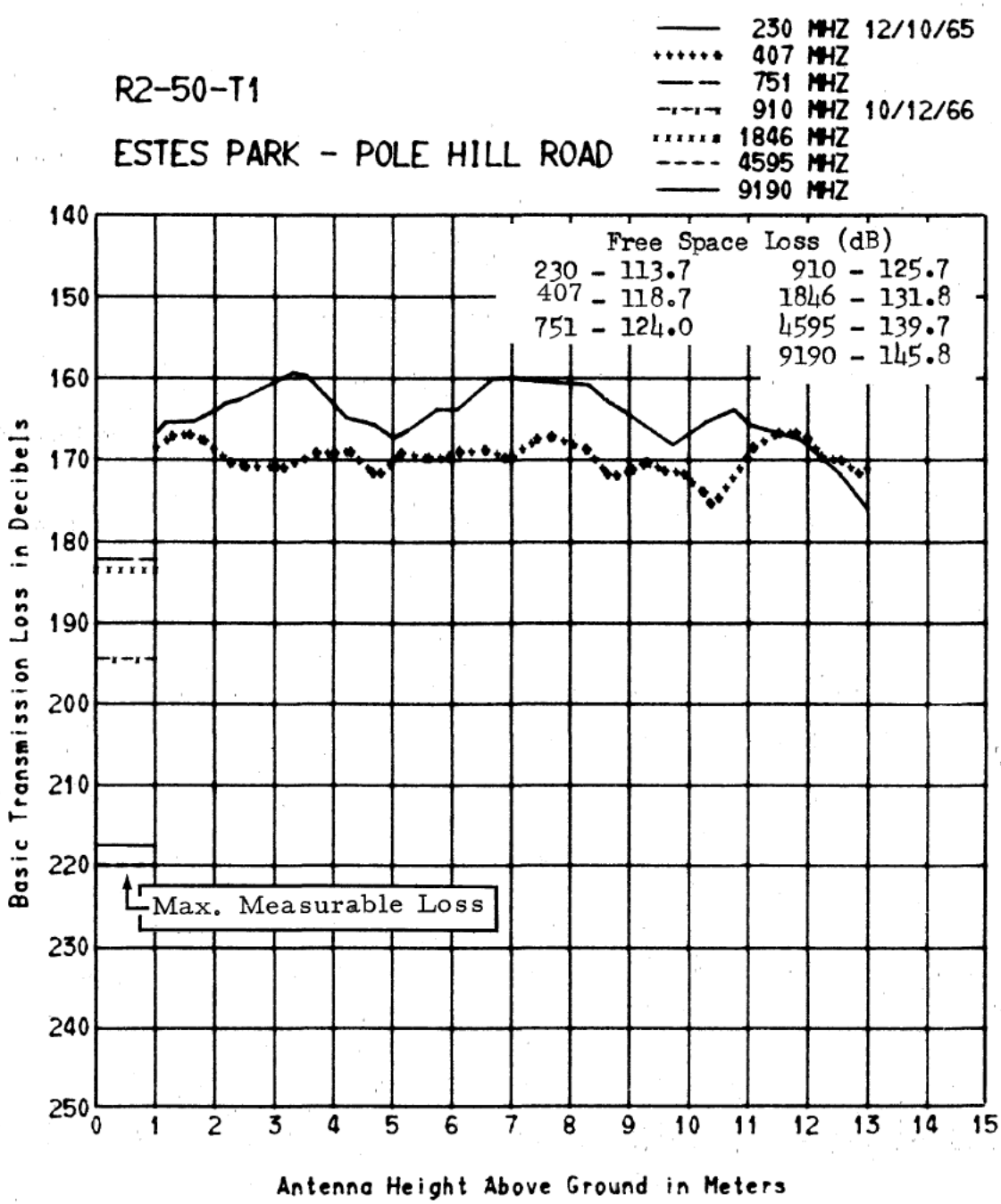
The only obstructions on this path are scattered tree tops, beginning about 15 m from the transmitting antennas. Mountain peaks about 30 km away form the horizon.

R2-50-T1
ESTES PARK - POLE HILL ROAD



PATH VIEW FROM TRANSMITTER

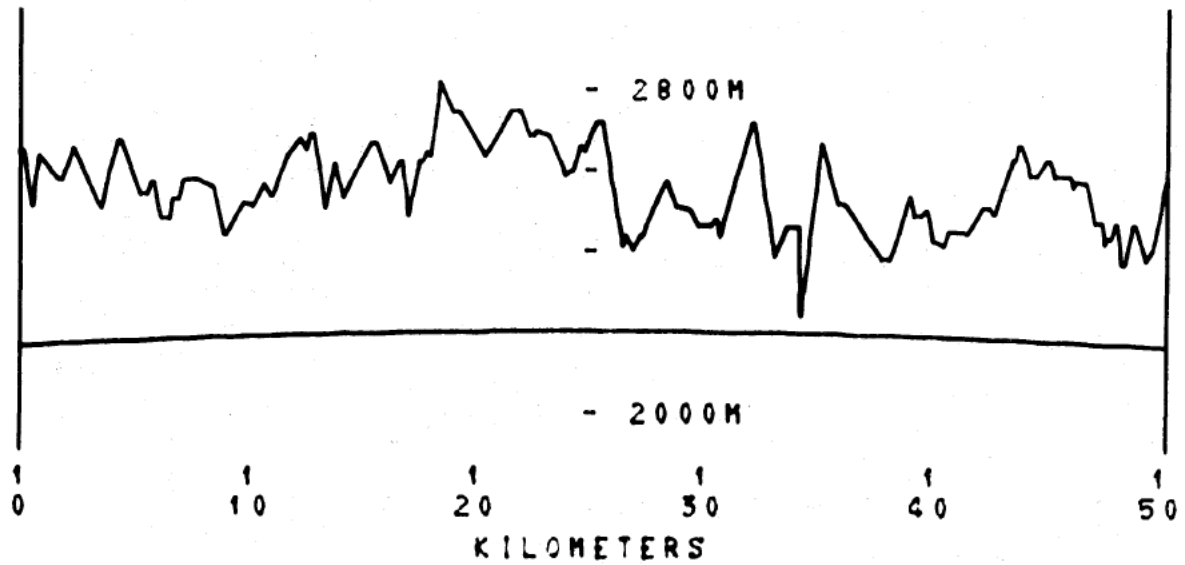
Bearing from common receiver site to transmitter site is 04^{o} 20' 47" T.


R2-50-T1
ESTES PARK - POLE HILL ROAD
230 MHZ 12/10/65
407 MHZ
751 MHZ
910 MHZ 10/12/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 113.7
407 - 118.7
751 - 124.0
910 - 125.7
1846 - 131.8
4595 - 139.7
9190 - 145.8
Max. Measurable Loss
Basic Transmission Loss in Decibels
140
150
160
170
180
190
200
210
220
230
240
250
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-50-T1
PATH LENGTH 50.342 km

XMTR. ELEV. 2609 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

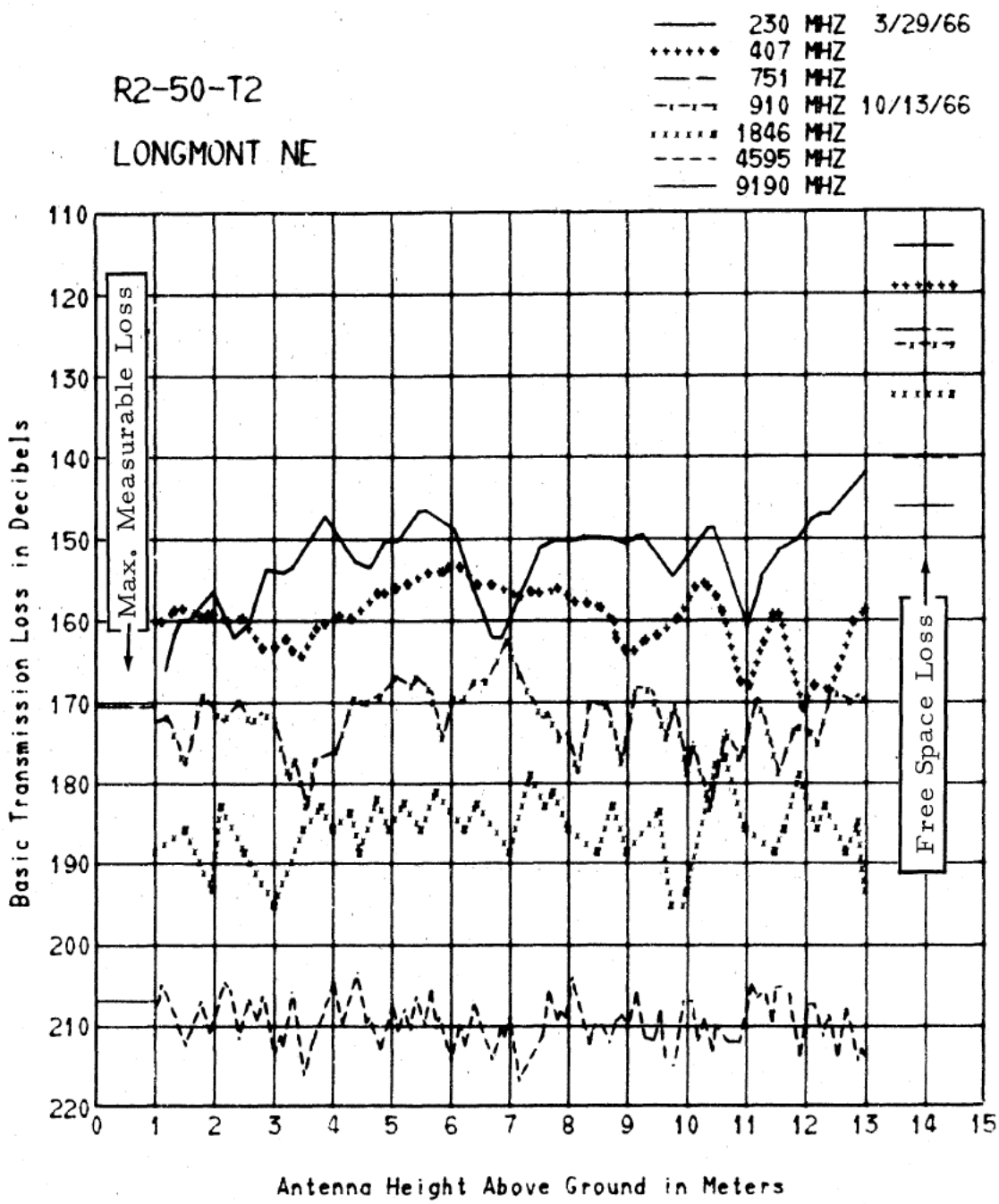
Freq (MHz)	230	407	751	910	1846	4595	9190
	12-10-65 at 11 M						
50%		170.6					
Δ10%-90%		< 3					
	12-10-65 at 3.5 M						
50%	159.9						
Δ10%-90%	< 3						

This path traverses a deep, tree-covered valley to a mountain range 15 km away, which forms the horizon.

R2-50-T2
LONGMONT NE

PATH VIEW FROM TRANSMITTER

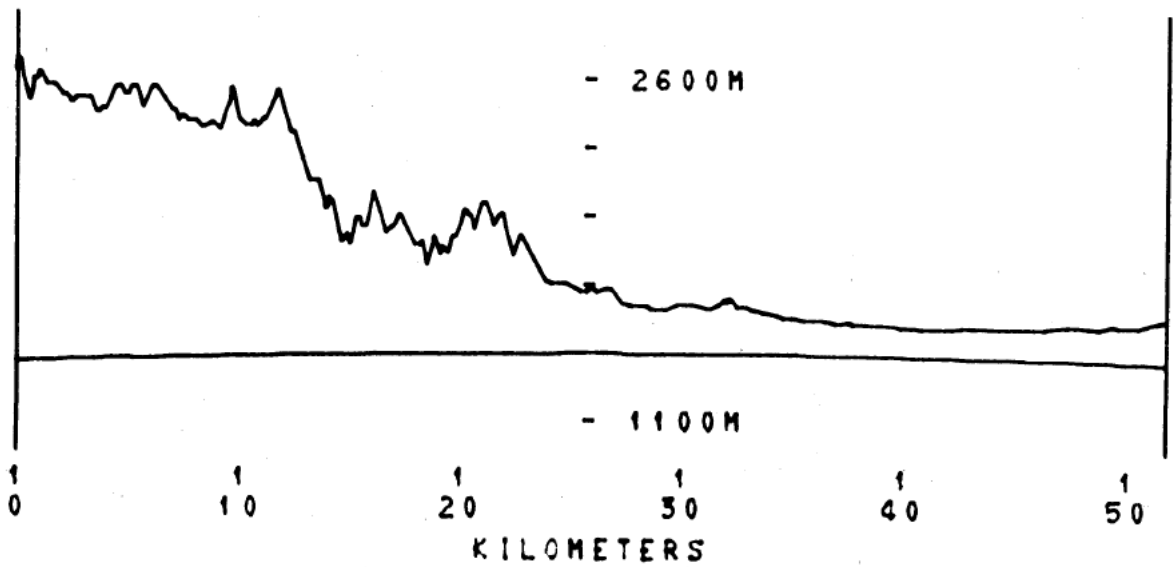
Bearing from common receiver site to transmitter site is
45° 50' 57" T.


R2-50-T2
LONGMONT NE
230 MHZ 3/29/66
407 MHZ
751 MHZ
910 MHZ 10/13/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-50-T2
PATH LENGTH 51.829 km

XMTR. ELEV. 1590 M



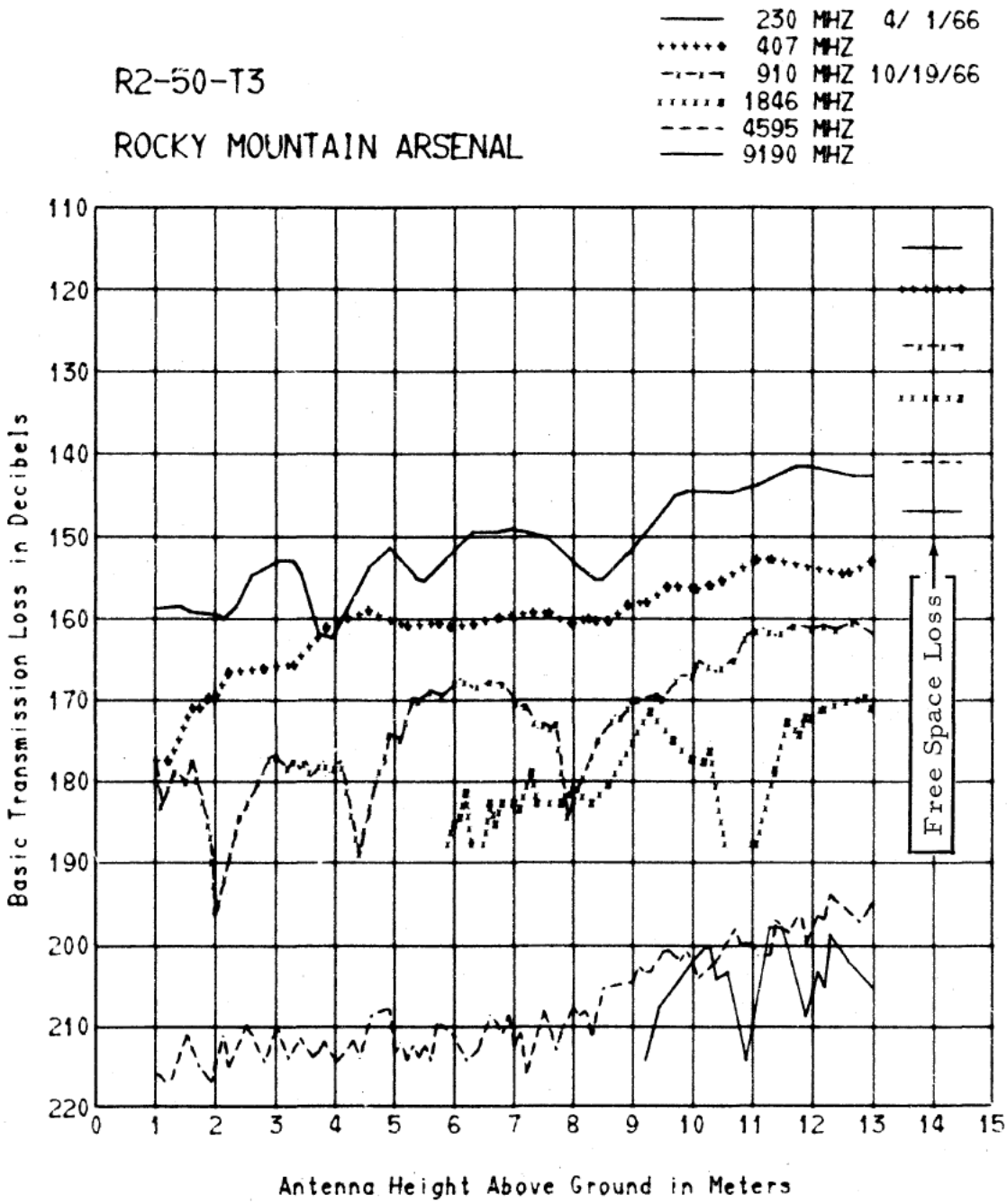
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-29-66 at 13 M			10-13-66 at 13 M			
50%	141.1	157.9		172.5	185.0	208.0	
Δ10%-90%	< 3	< 3		6.2	10.3	8.0	
				10-13-66 at 7.3 M			
50%				166.3	179.5	209.4	
Δ10%-90%				< 3	6.0	7.4	
				10-13-66 at 1 M			
50%				180.7	188.3	207.7	
Δ10%-90%				12.5	10.0	9.3	

The ground along this path slopes downward gradually for about 25 km over farmland with scattered trees. The horizon is a mountain range about 40 km away.

PATH VIEW FROM TRANSMITTER

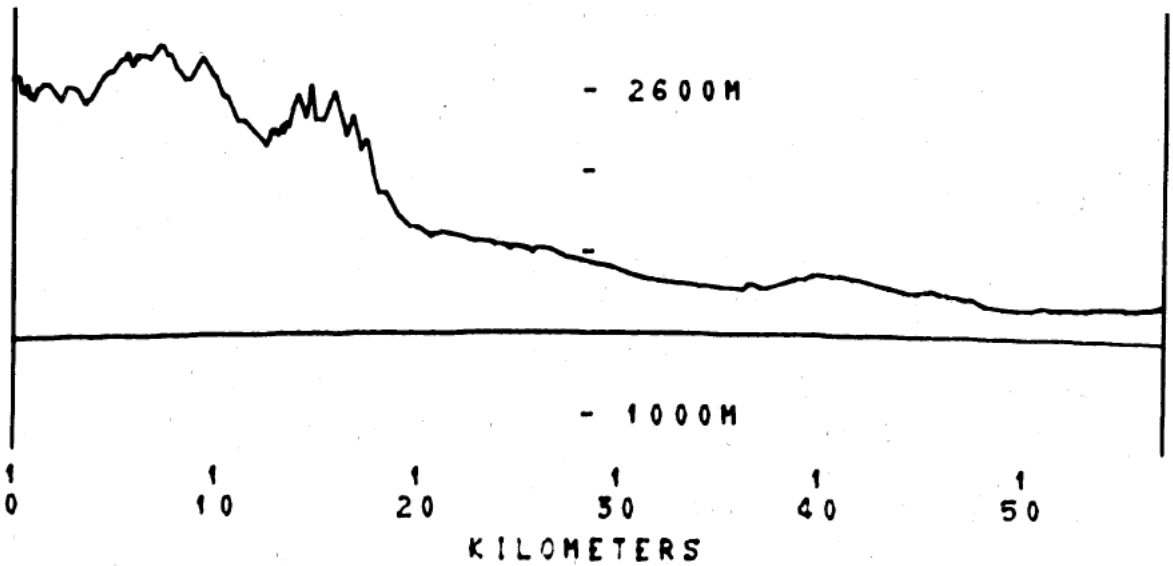
Bearing from common receiver site to transmitter site is 94^{o} 04' 36" T.


R2-50-T3
ROCKY MOUNTAIN ARSENAL
230 MHZ 4/ 1/66
407 MHZ
910 MHZ 10/19/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters
Free Space Loss

RCVR. ELEV. 2676 M

R2-50-T3
PATH LENGTH 56.816 km

XMTR. ELEV. 1585 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

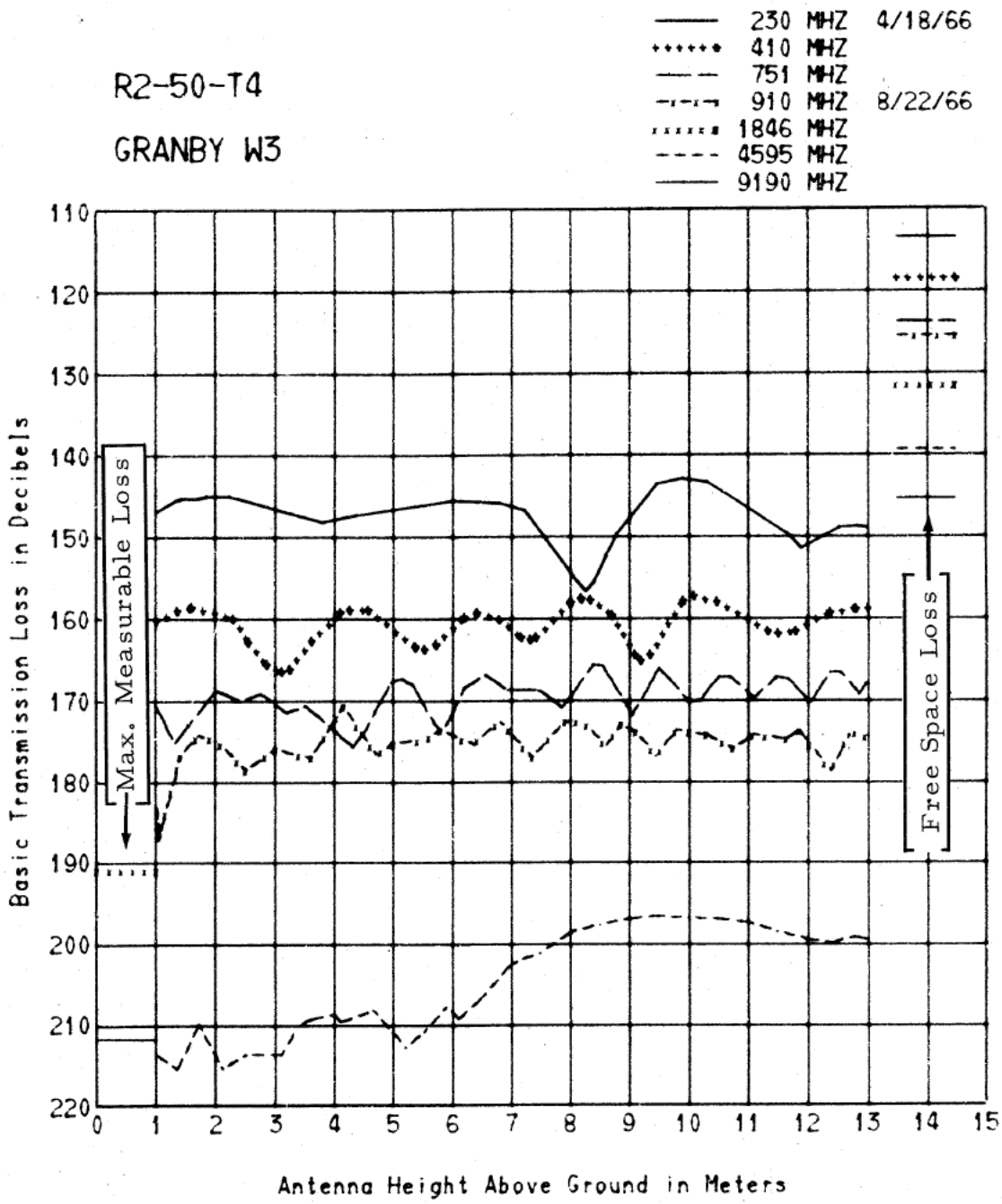
Freq (MHz)	230	407	910	1846	4595	9190
	4-1-66 at 13 M		10-19-66 at 13 M			
50%	142.6	152.9	162.1	168.1	200.0	206.4
Δ10%-90%	< 3	< 3	< 3	< 3	8.0	< 3
			10-19-66 at 7.3 M			
50%			172.1	177.1	210.4	
Δ10%-90%			6.0	< 3	9.1	
			10-19-66 at 1 M			
50%			179.6		214.0	
Δ10%-90%			6.0		5.1	

The path is unobstructed to the mountains, which are 30 km away. It is over grass farmland, with scattered homes about 3 km away from the transmitter.

R2-50-T4
GRANBY W3

PATH VIEW FROM TRANSMITTER

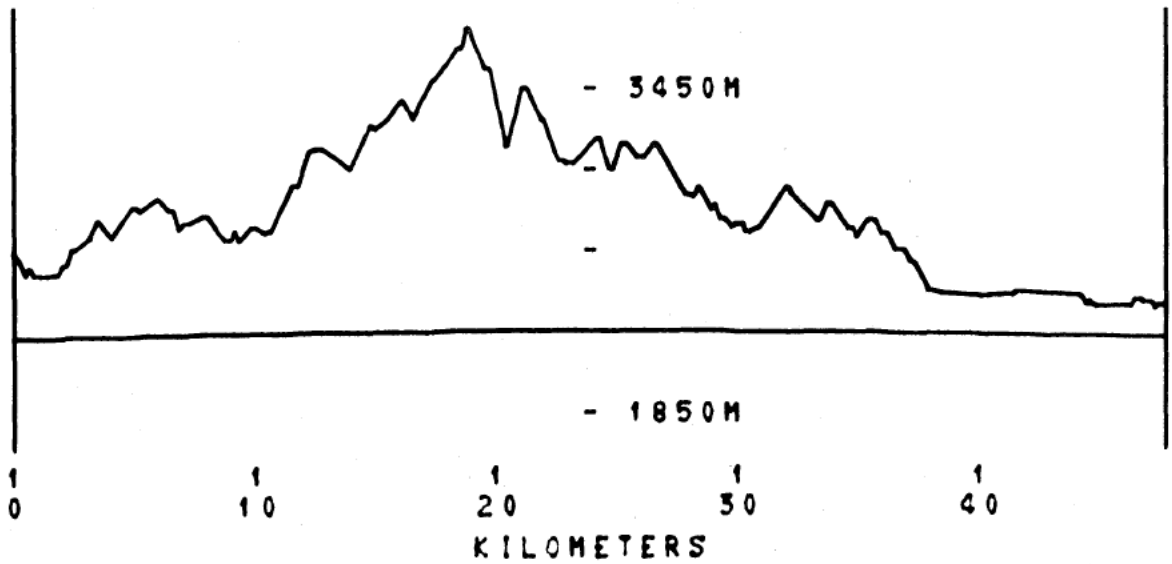
Bearing from common receiver site to transmitter site is
118° 02' 38" T.


R2-50-T4
GRANBY W3
230 MHZ 4/18/66
410 MHZ
751 MHZ
910 MHZ 8/22/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-50-T4
PATH LENGTH 47.656 km

XMTR. ELEV. 2420 M

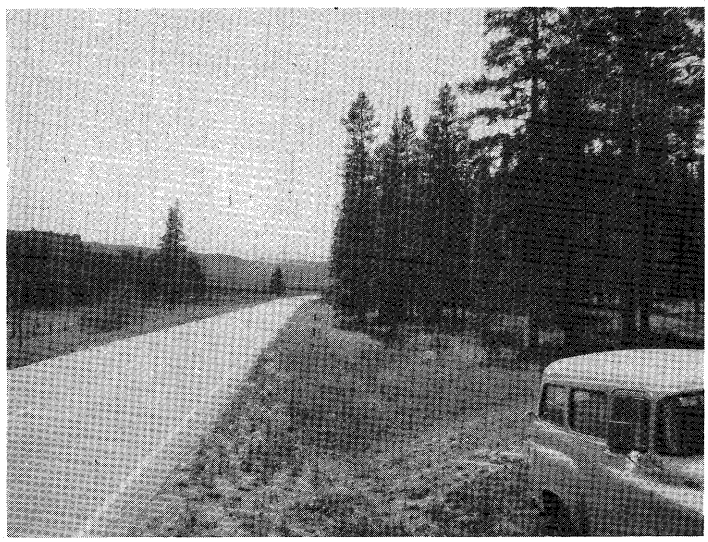


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-18-66 at 13 M				8-22-66 at 13 M		
50%			165.2	171.8		200.5	
Δ10%-90%			< 3	< 3		3.1	
	4-18-66 at 10 M				8-22-66 at 7.3 M		
50%	143.8	161.2		174.3		201.5	
Δ10%-90%	< 3	< 3		< 3		8.0	
					8-22-66 at 1.0 M		
50%				181.8		208.0	
Δ10%-90%				< 3		6.2	

This path is over open, rolling, sagebrush-covered terrain for 10 km, then over rising mountainous terrain covered with pine trees. One hundred meters away, a low fence crosses the path at 80°.

R2-50-T5 OPEN AND CONCEALED
GRANBY NW6

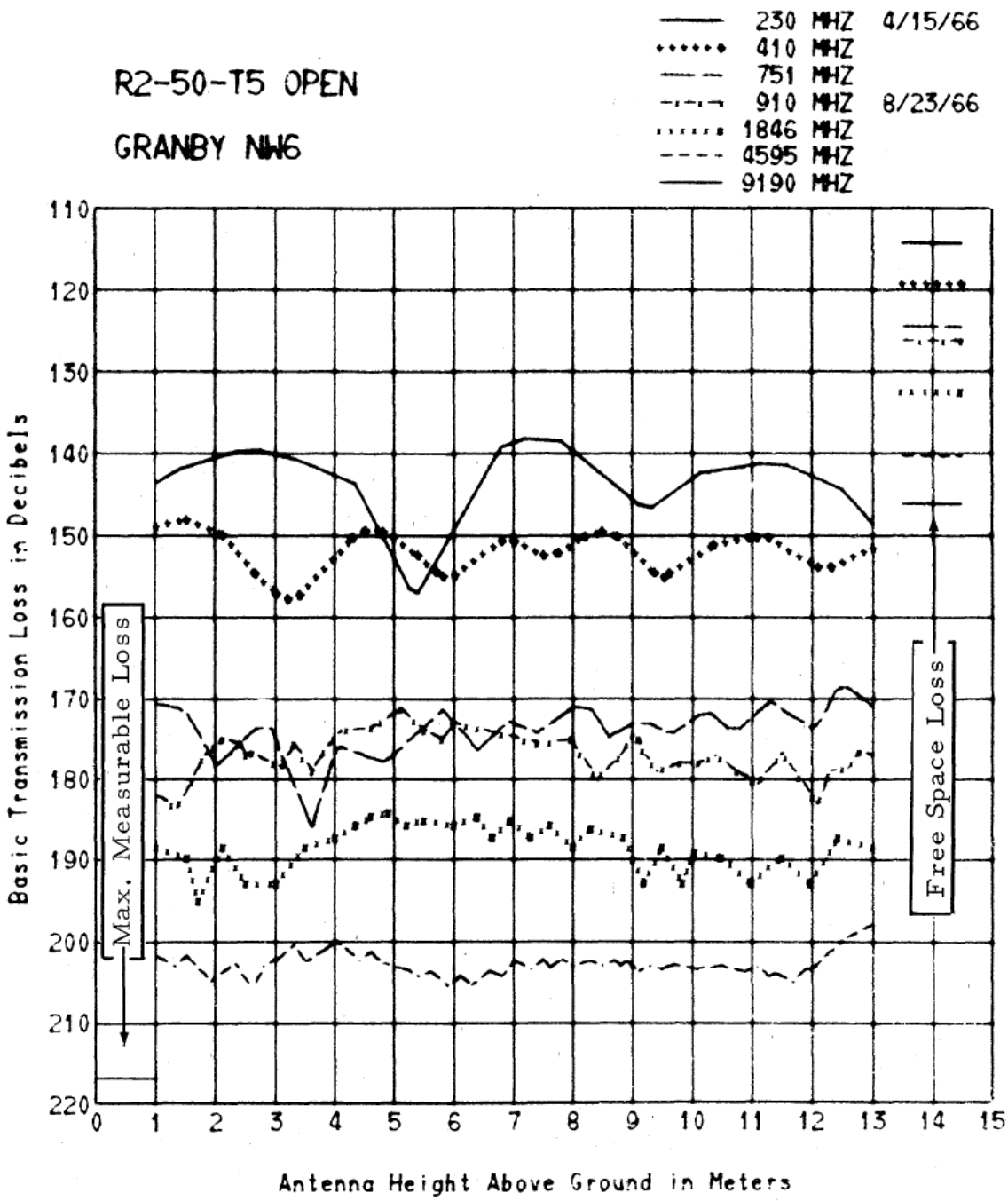


PATH VIEW FROM OPEN SITE

Bearing from common receiver site to transmitter site is 304° 17' 25" T.

PATH VIEW FROM CONCEALED SITE

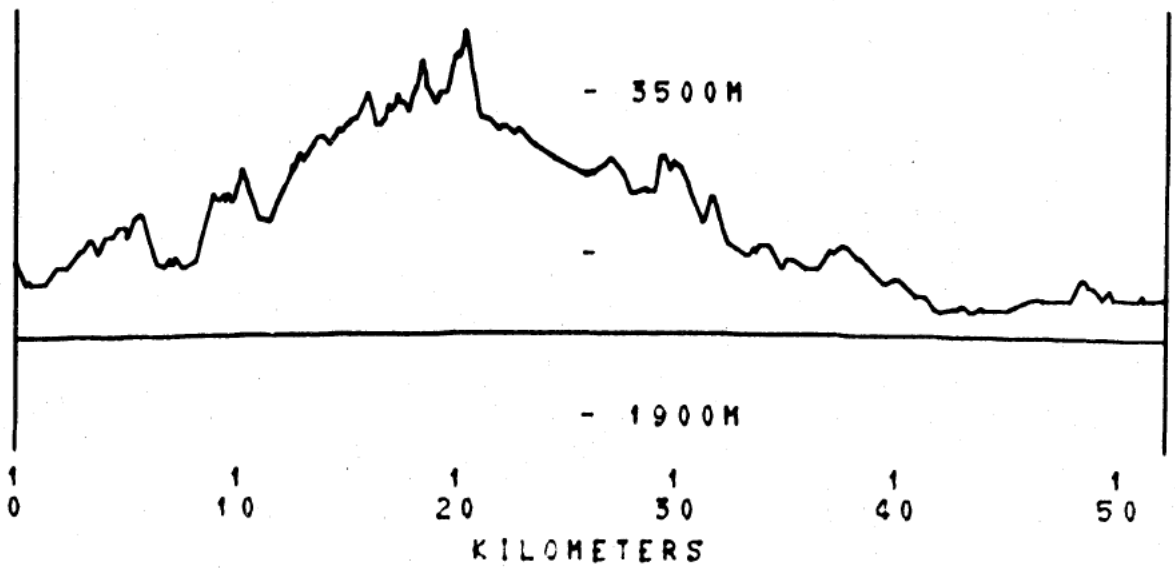
Bearing from common receiver site to transmitter site is 304° 17' 25" T.


R2-50-T5 OPEN
GRANBY NW6
230 MHZ 4/15/66
410 MHZ
751 MHZ
910 MHZ 8/23/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
Max. Measurable Loss
Free Space Loss
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-50-T5 OPEN
PATH LENGTH 52.121 km

XMTR. ELEV. 2515 M



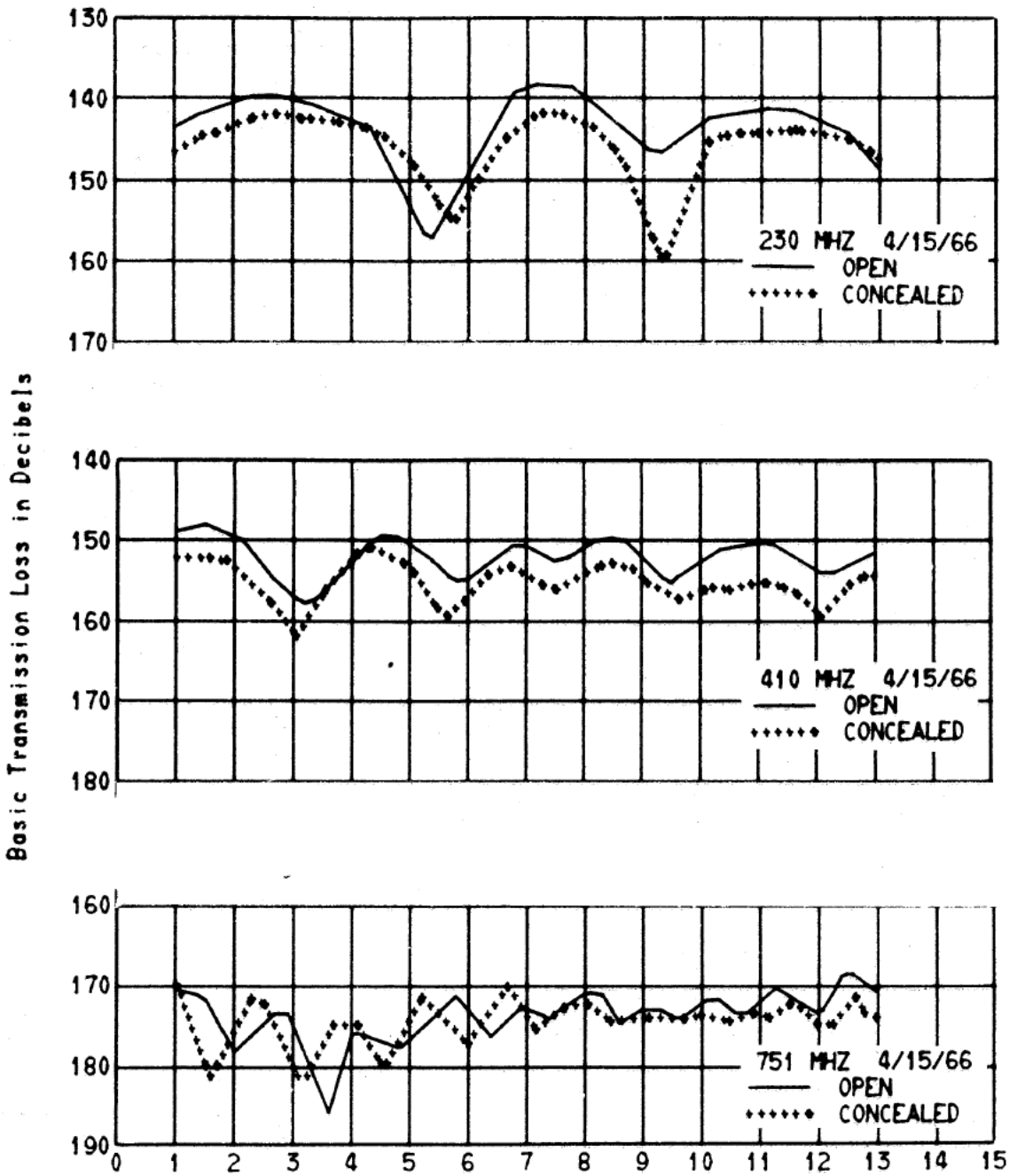
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-15-66 at 13 M				8-23-66 at 13 M		
50%			171.9	176.2	185.8	197.7	
Δ10%-90%			< 3	< 3	< 3	< 3	
	4-15-66 at 11 M				8-23-66 at 7.3 M		
50%	140.0			175.0	186.8	199.8	
Δ10%-90%	< 3			< 3	< 3	5.0	
	4-15-66 at 1 M				8-23-66 at 1 M		
50%		148.1		180.0	190.8	204.1	
Δ10%-90%		< 3		< 3	< 3	3.4	

The path is across an asphalt highway running at 80° to the path. A line of 15-m high pines forms a steep wall to the right of the path. The rest of the path to the horizon, 15 km away, is open fields with scattered trees.

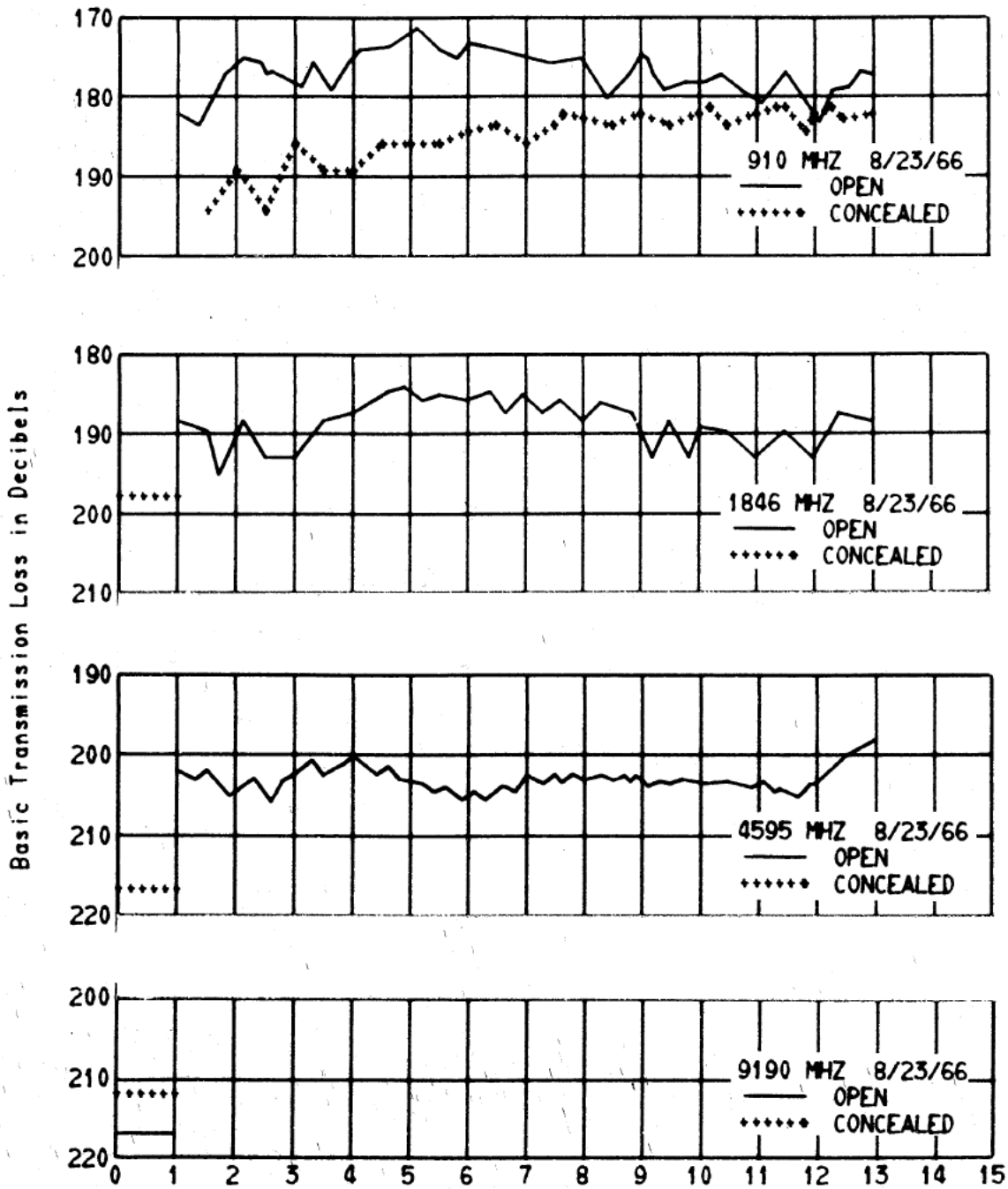
R2-50-T5 O&C

GRANBY NW6



R2-50-T5 O&C

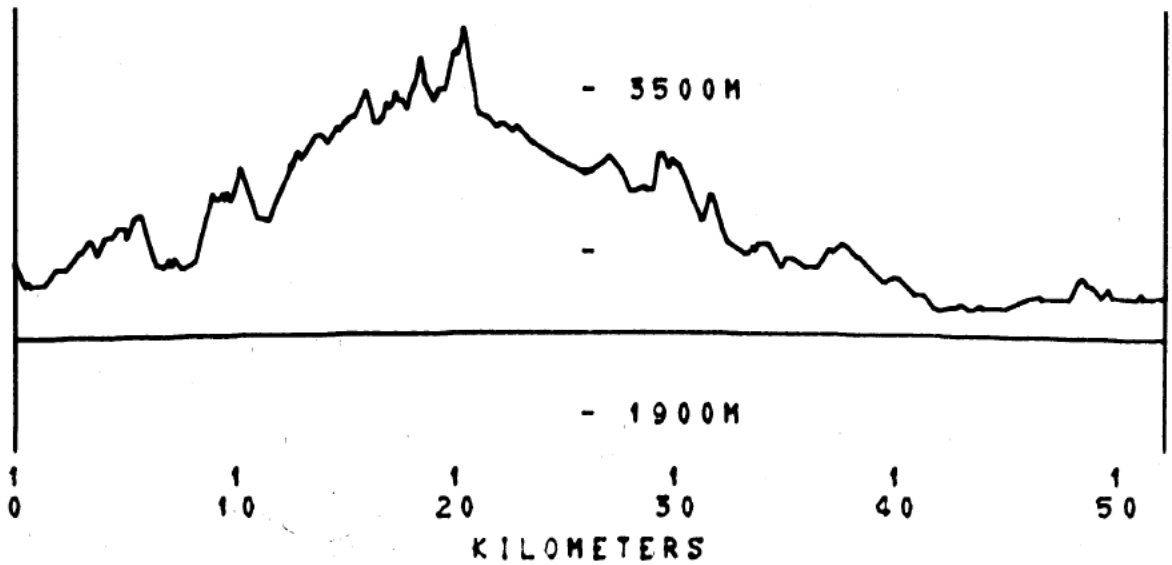
GRANBY NW6



RCVR. ELEV. 2676 M

R2-50-T5 CONCEALED
PATH LENGTH 52.096 km

XMTR. ELEV. 2515 M

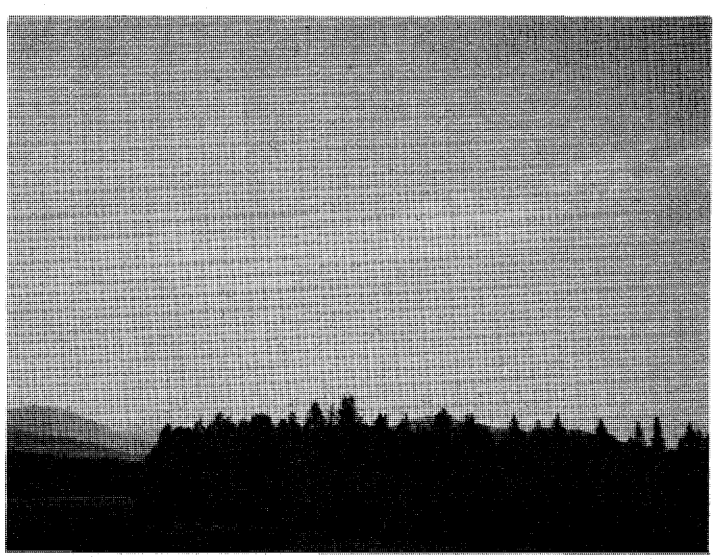


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-15-66 at 13 M				8-23-66 at 13 M		
50%		153.9		184.2			
Δ10%-90%		< 3		8.0			
	4-15-66 at 7.3 M				8-23-66 at 7.3 M		
50%	142.9			182.7			
Δ10%-90%	< 3			< 3			
	4-15-66 at 1 M						
50%			171.5				
Δ10%-90%			< 3				

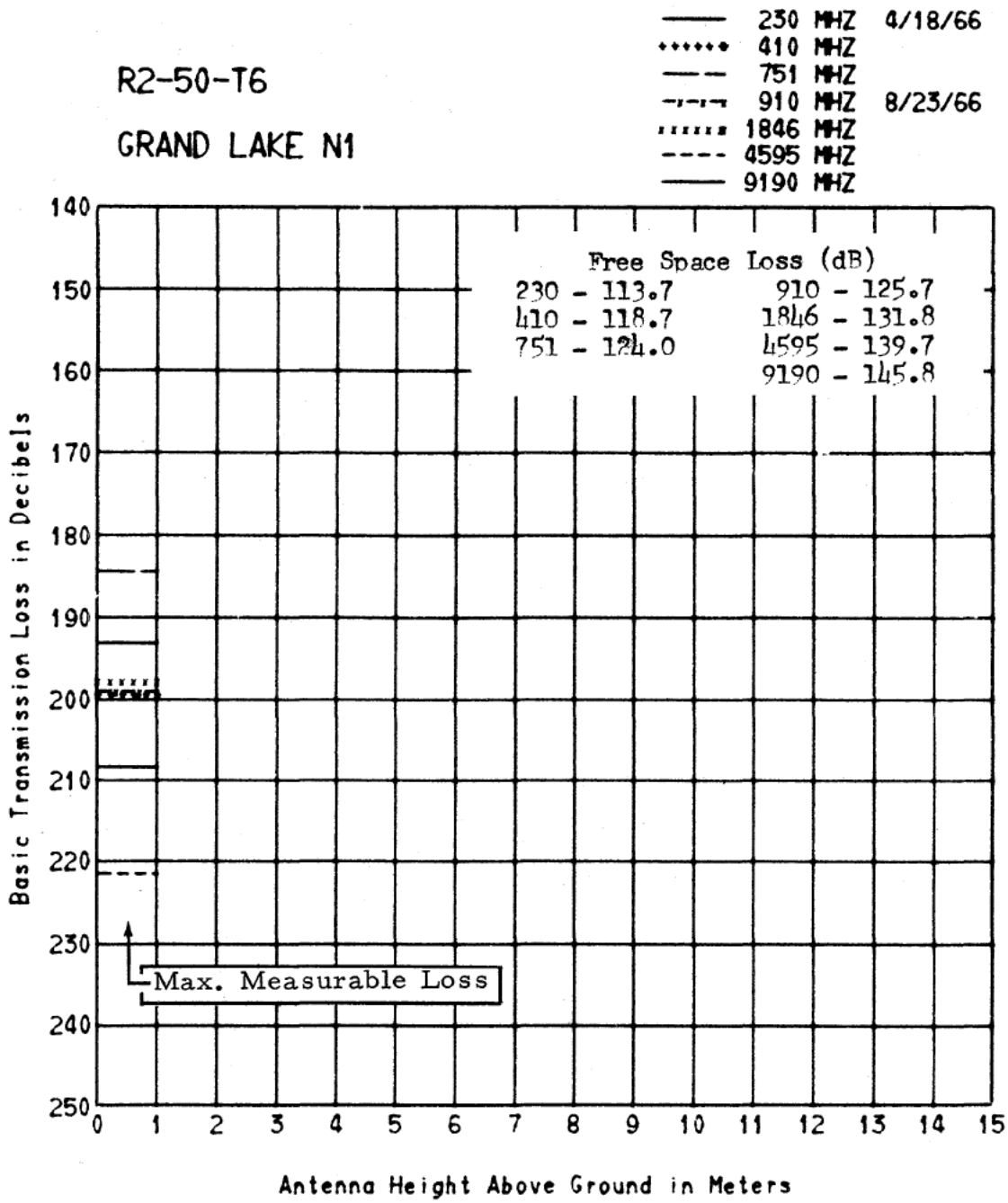
Pine trees form the concealment for this site. Ten meters away and 2 m below the antennas, a 6-wire telephone line crosses the path at 50°. The trees extend for approximately 100 m.

R2-50-T6
GRAND LAKE N1



PATH VIEW FROM TRANSMITTER

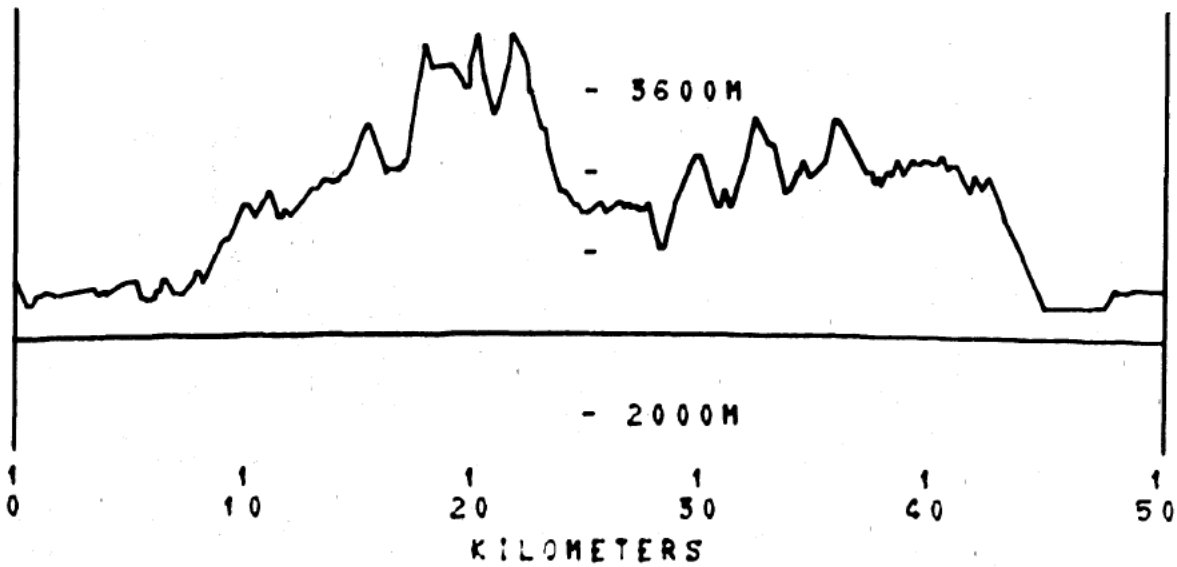
Bearing from common receiver site to transmitter site is 323° 40' 12" T.


R2-50-T6
GRAND LAKE N1
230 MHZ 4/18/66
410 MHZ
751 MHZ
910 MHZ 8/23/66
1846 MHZ
4595 MHZ
9190 MHZ
Free Space Loss (dB)
230 - 113.7
410 - 118.7
751 - 124.0
910 - 125.7
1846 - 131.8
4595 - 139.7
9190 - 145.8
Max. Measurable Loss
Basic Transmission Loss in Decibels
140
150
160
170
180
190
200
210
220
230
240
250
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-50-T6
PATH LENGTH 50.343 km

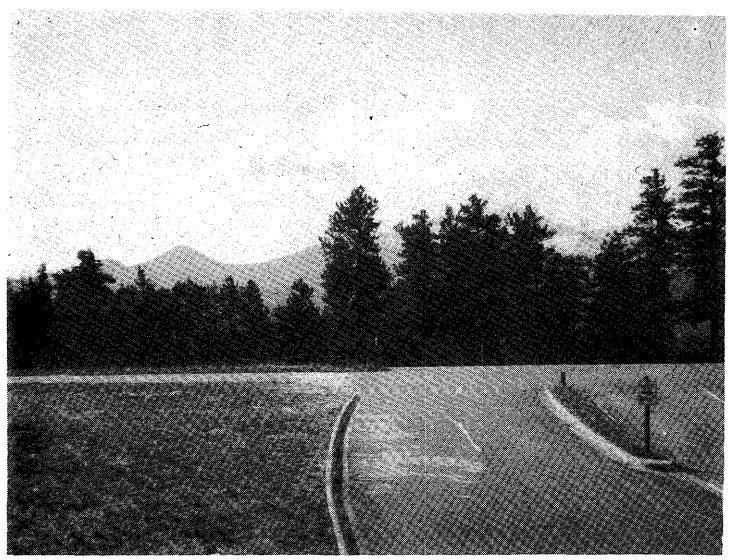
XMTR. ELEV. 2644 M



	L_b (dB) SHORT TERM SIGNAL VARIABILITY						
Freq (MHz)	230	410	751	910	1846	4595	9190
50%							
Δ10%-90%							

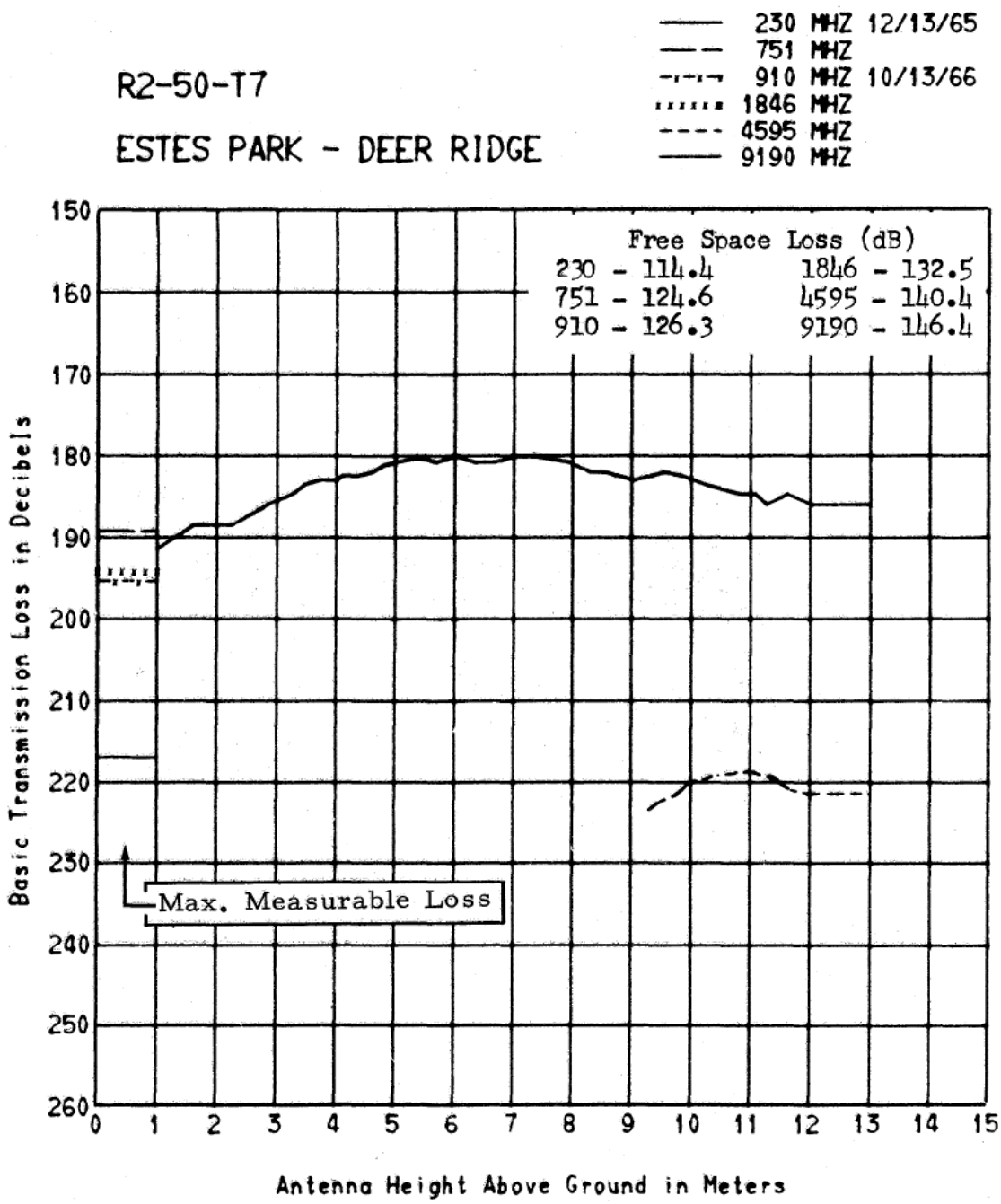
This path foreground consists of field grass extending for 60 m to a grove of pine trees. Alternate portions of pine groves and open meadows make up the rest of the path to the horizon.

R2-50-T7
ESTES PARK - DEER RIDGE



PATH VIEW FROM TRANSMITTER

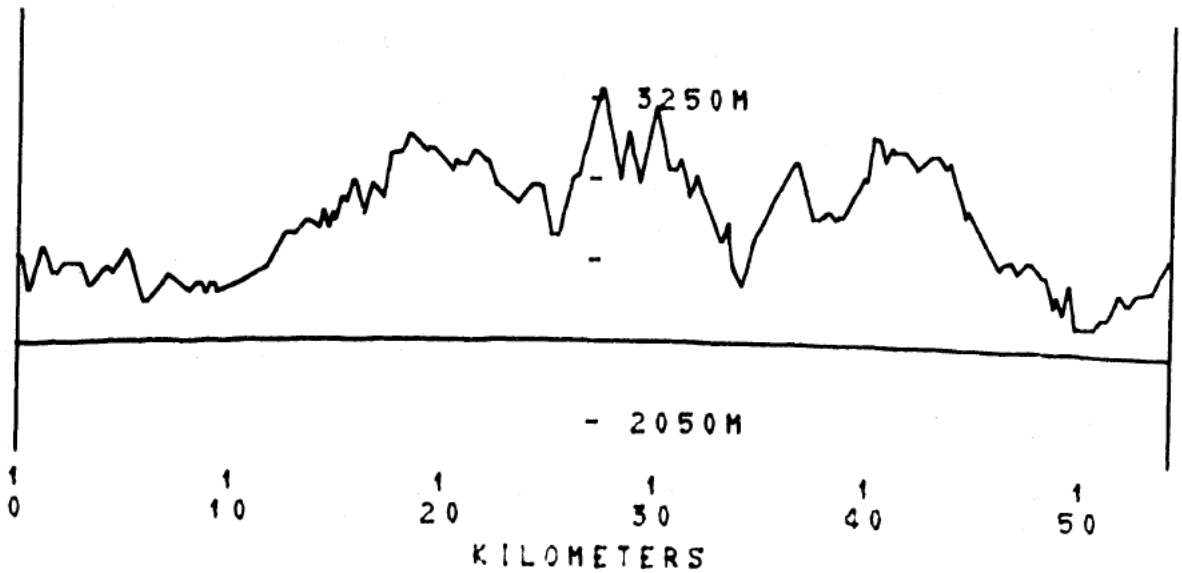
Bearing from common receiver site to transmitter site is
349° 19' 55" T.


230 MHZ 12/13/65
751 MHZ
910 MHZ 10/13/66
1846 MHZ
4595 MHZ
9190 MHZ
R2-50-T7
ESTES PARK - DEER RIDGE
Free Space Loss (dB)
230 - 114.4
751 - 124.6
910 - 126.3
1846 - 132.5
4595 - 140.4
9190 - 146.4
Max. Measurable Loss
Basic Transmission Loss in Decibels
150
160
170
180
190
200
210
220
230
240
250
260
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-50-T7
PATH LENGTH 54.199 km

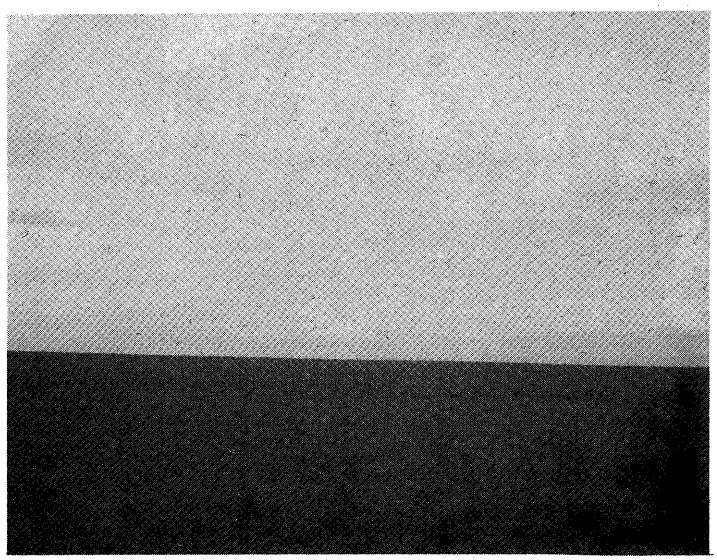
XMTR. ELEV.
2719 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

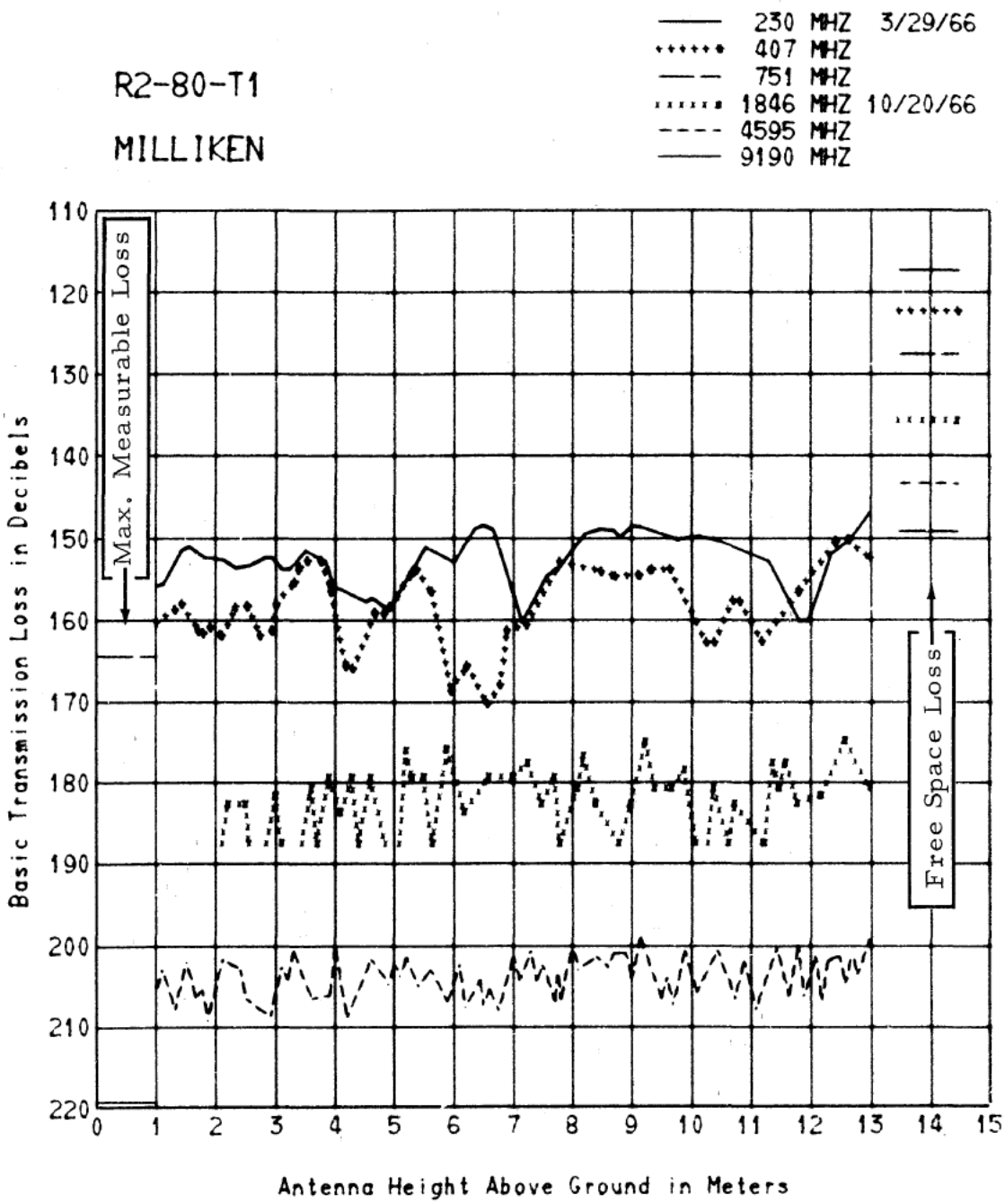
Freq (MHz)	230	751	910	1846	4595	9190
				10-13-66 at 13 M		
50%					221.5	
Δ10%-90%					6.0	
	12-13-65 at 7.3 M					
50%	179.6					
Δ10%-90%	< 3					

The immediate foreground is an asphalt highway for 100 m to a grove of pines running perpendicular to the path. This grove is about 100 m deep. Beyond, the ground slopes downward and then up to a tree-covered mountain range, about 15 km away.



PATH VIEW FROM TRANSMITTER

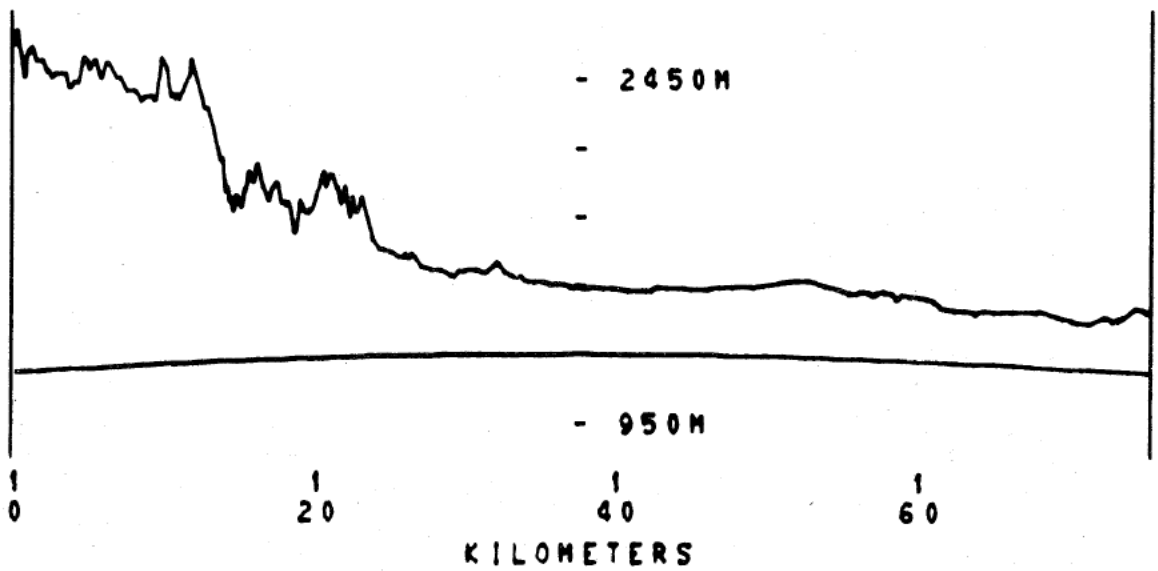
Bearing from common receiver site to transmitter site is
45^{o} 08' 29" T.


R2-80-T1
MILLIKEN
230 MHZ 3/29/66
407 MHZ
751 MHZ
1846 MHZ 10/20/66
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-80-T1
PATH LENGTH 74.993 km

XMTR. ELEV. 1517 M



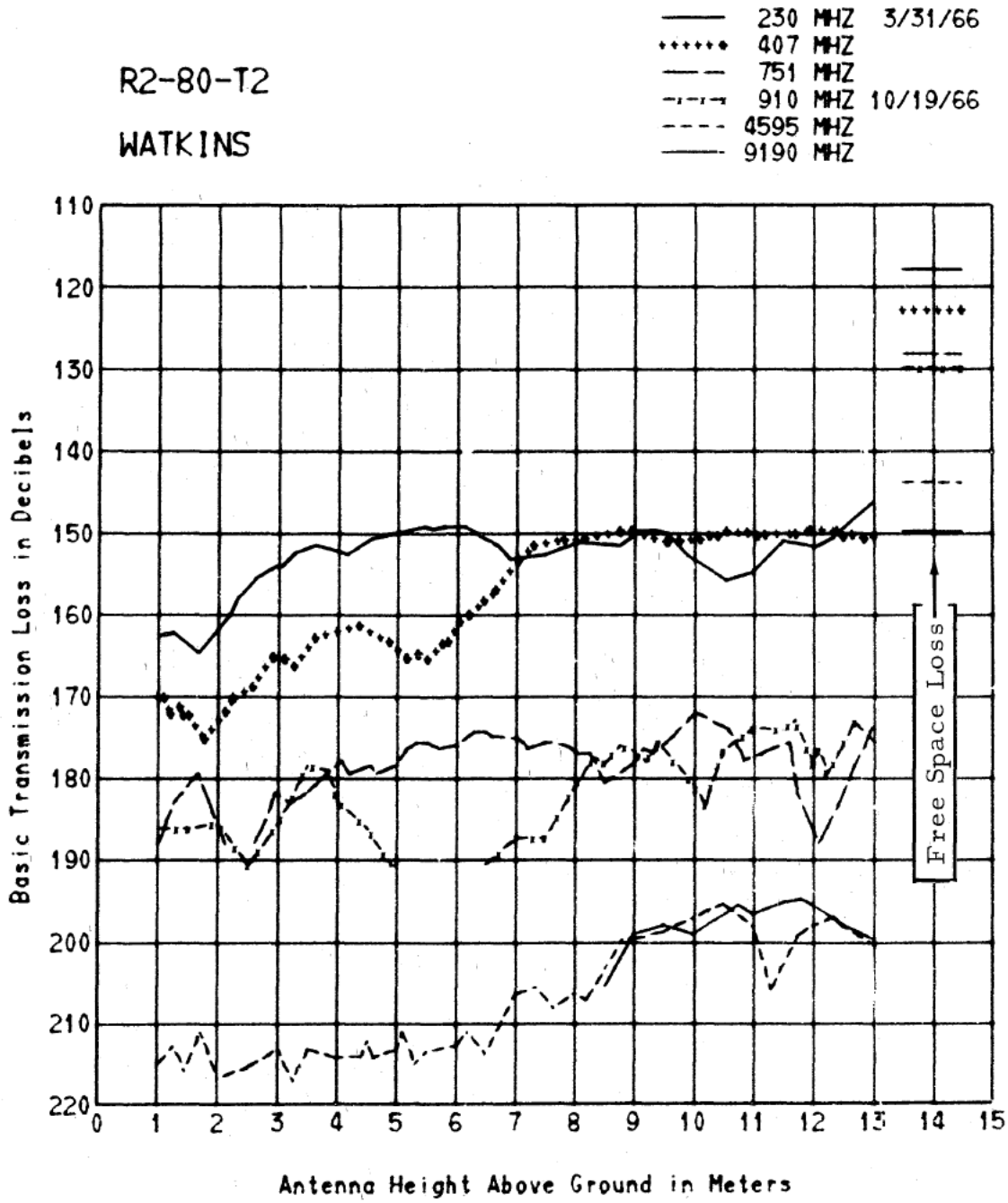
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	1846	4595	9190
	3-29-66 at 13 M			10-20-66 at 13 M		
50%	146.6	151.5		182.4	201.4	
Δ10%-90%	< 3	< 3		9.0	8.2	
	3-29-66 at 5 M			10-20-66 at 7.3 M		
50%				184.4	204.4	
Δ10%-90%				7.0	6.8	
				10-20-66 at 1 M		
50%					205.0	
Δ10%-90%					5.8	

The foreground is completely free of obstructions and the path extends over open grasslands to the mountains.

PATH VIEW FROM TRANSMITTER

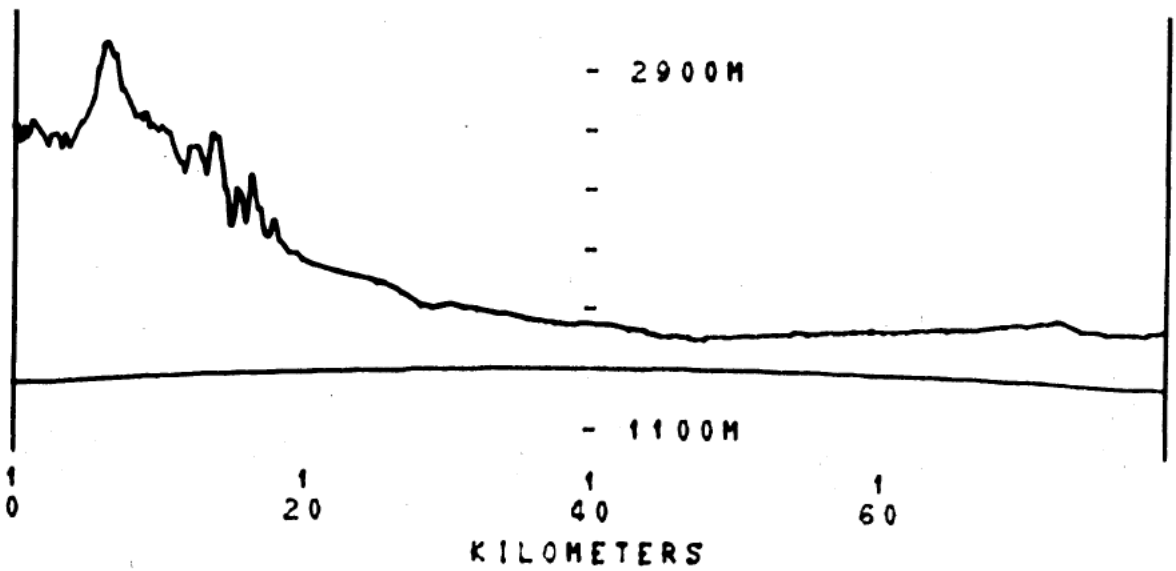
Bearing from common receiver site to transmitter site is
102° 15' 49" T.


R2-80-T2
WATKINS
230 MHZ 3/31/66
407 MHZ
751 MHZ
910 MHZ 10/19/66
4595 MHZ
9190 MHZ
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-80-T2
PATH LENGTH 79.467 km

XMTR. ELEV. 1704 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

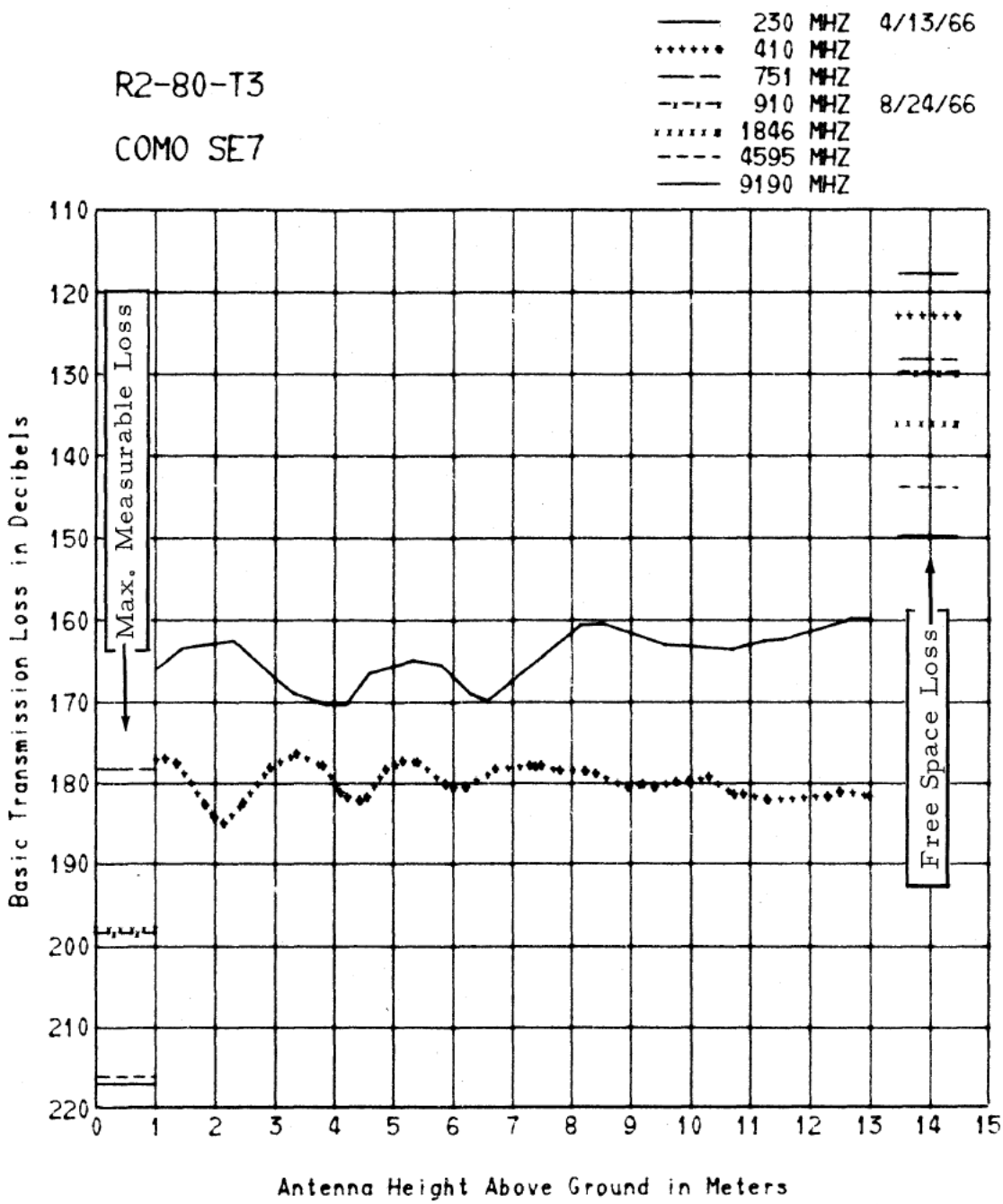
Freq (MHz)	230	407	751	910	4595	9190
	3-31-66 at 13 M			10-19-66 at 13 M		
50%	142.8			175.7	198.6	197.6
Δ10%-90%	< 3			5.5	4.3	< 3
	3-31-66 at 10 M			10-19-66 at 7.3 M		
50%		150.8	173.4	178.7	206.6	
Δ10%-90%		< 3	< 3	10.0	4.0	
				10-19-66 at 1 M		
50%				184.7	215.6	
Δ10%-90%				5.0	4.0	

This path extends over wheat fields for 5 km. A 3-wire power line roughly parallels this path. The mountains, 50 km away, form the horizon.

R2-80-T3
COMO SE7

PATH VIEW FROM TRANSMITTER

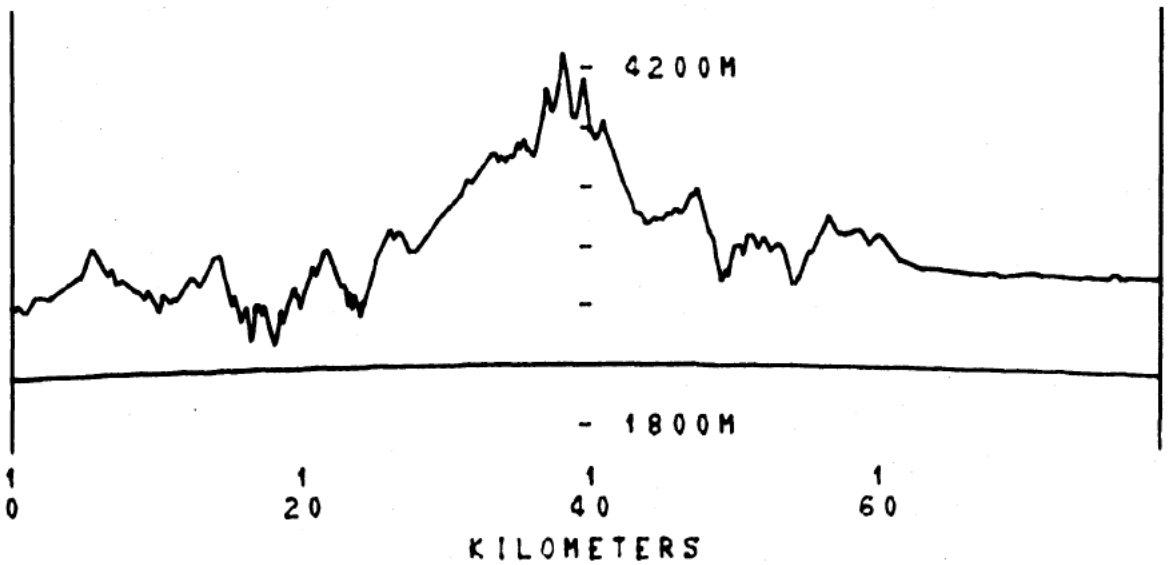
Bearing from common receiver site to transmitter site is 201^{o} 18' 30" T.


R2-80-T3
COMO SE7
230 MHZ 4/13/66
410 MHZ
751 MHZ
910 MHZ 8/24/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-80-T3
PATH LENGTH 78.976 km

XMTR. ELEV. 2860 M



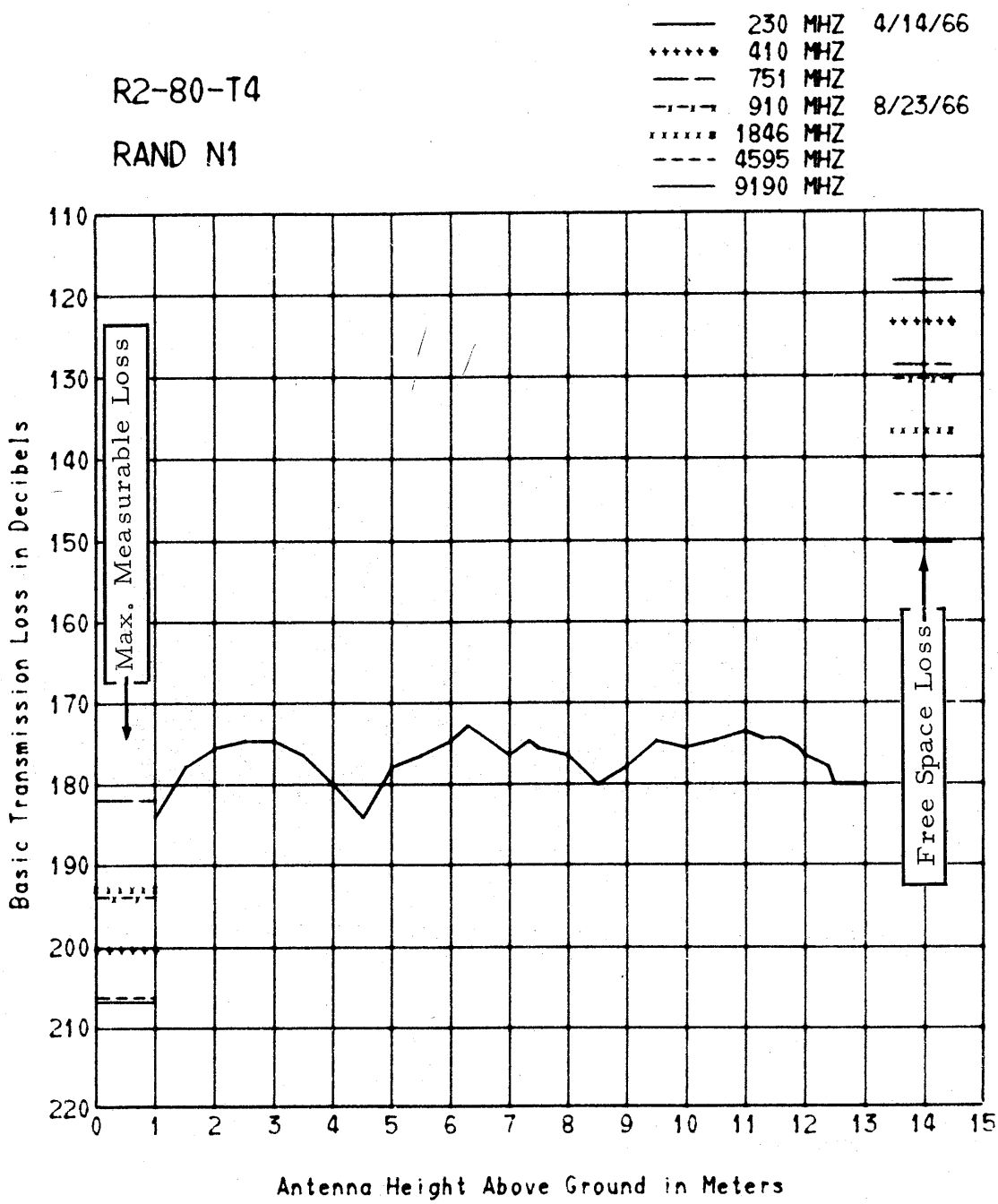
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-13-66 at 13 M						
50%	159.8	182.4					
Δ10%-90%	< 3	< 3					

This site is in open, rolling pasture land. No obstructions exist anywhere near the path. The mountains form the horizon about 25 km away.

PATH VIEW FROM TRANSMITTER

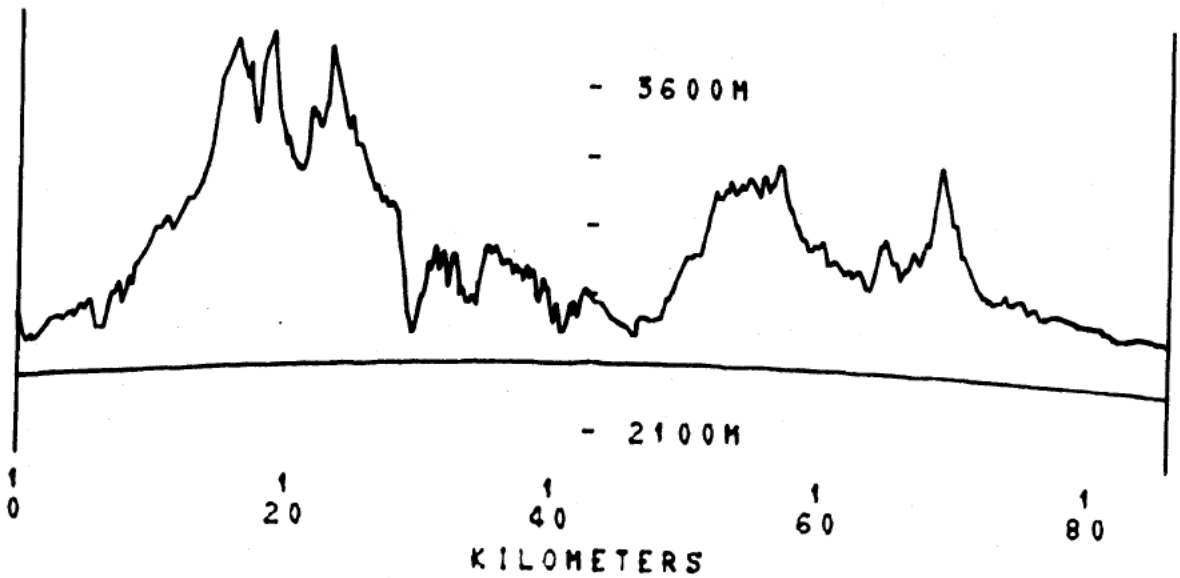
Bearing from common receiver site to transmitter site is 317° 06' 51" T.


R2-80-T4
RAND N1
230 MHZ 4/14/66
410 MHZ
751 MHZ
910 MHZ 8/23/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-80-T4
PATH LENGTH 85.792 km

XMTR. ELEV.
2627 M

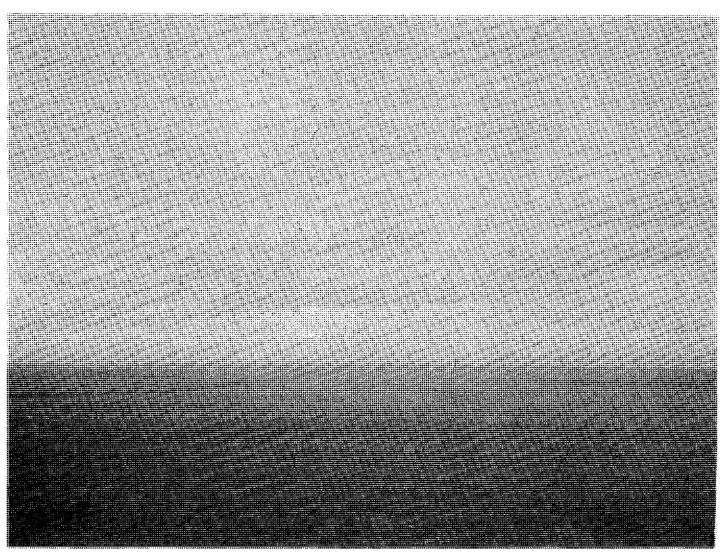


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-14-66 at 13 M						
50%	180.3						
Δ10%-90%	< 3						
50%							
Δ10%-90%							

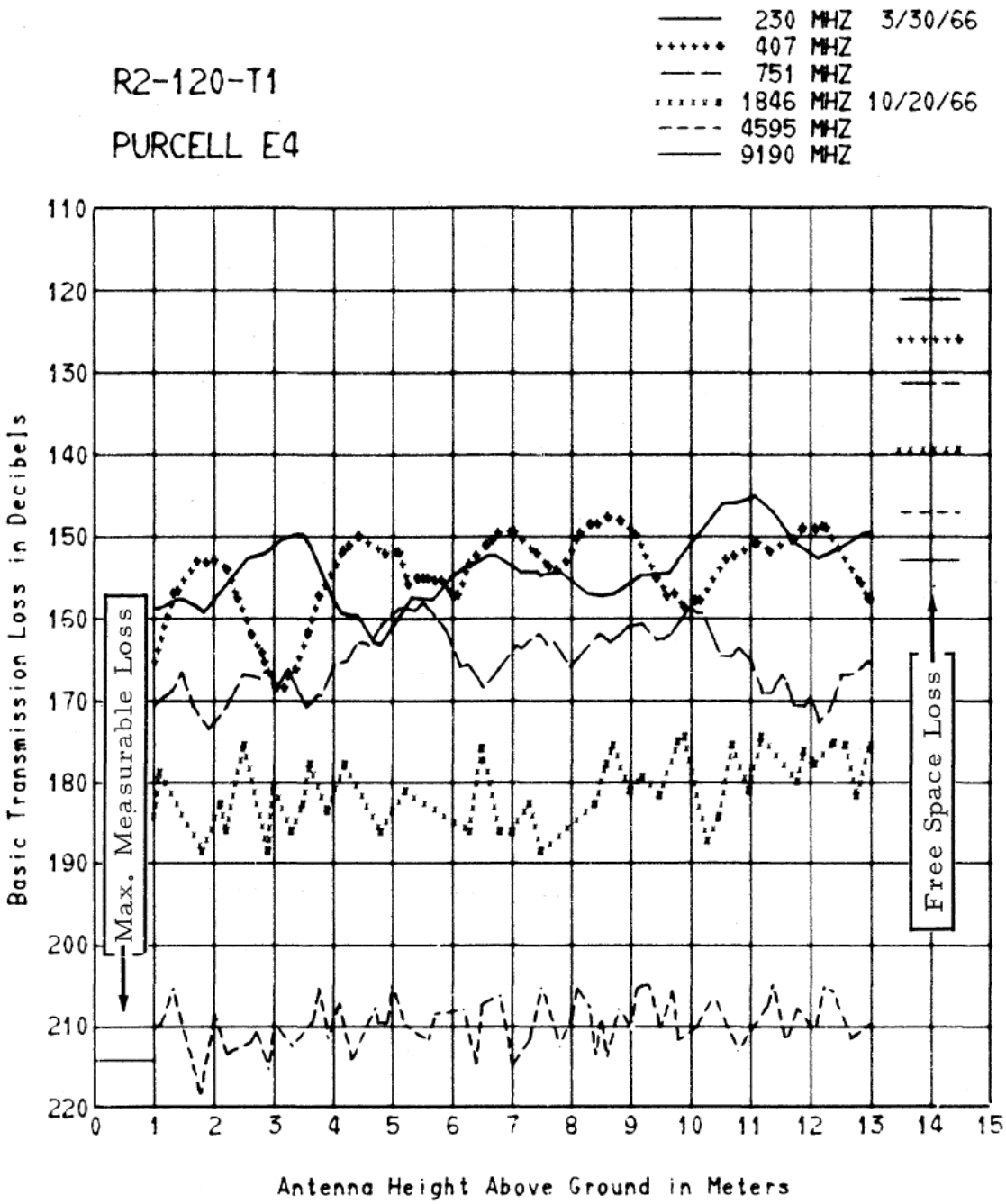
The path is level ground covered with grazing grass for 3 km. A 2-wire power line converging on the path at about 10^{o} from the right intersects it about 1.5 km from the transmitter.

R2-120-T1
PURCELL E4

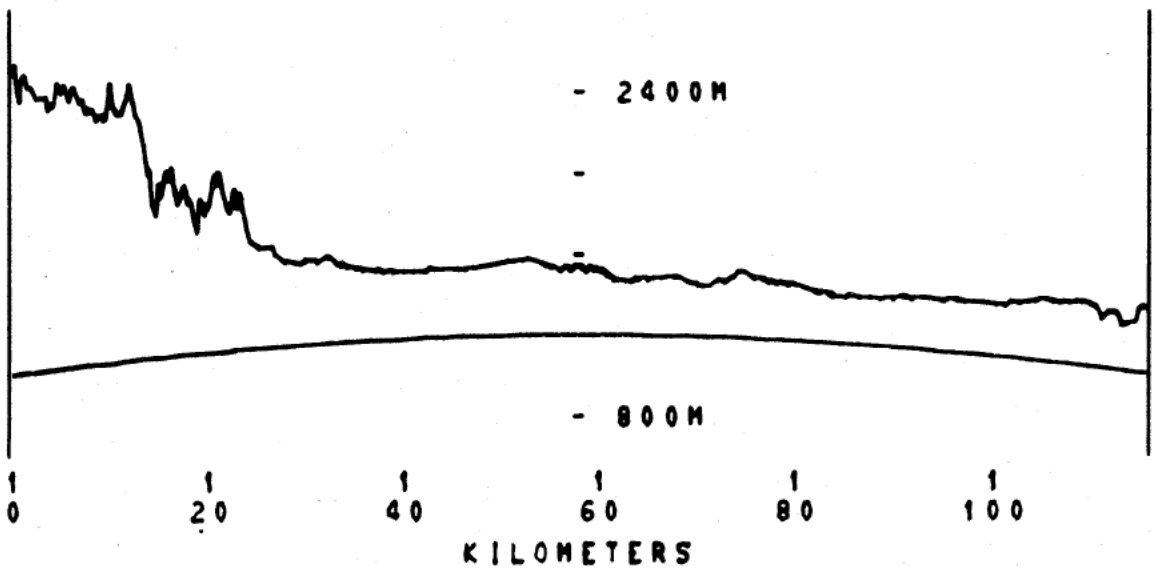


PATH VIEW FROM TRANSMITTER

Bearing from common receiver site to transmitter site is 44° 53' 44" T.


R2-120-T1
PURCELL E4
230 MHZ 3/30/66
407 MHZ
751 MHZ
1846 MHZ 10/20/66
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
Max. Measurable Loss
Free Space Loss
Antenna Height Above Ground in Meters
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

RCVR. ELEV. 2676 | R2-120-T1 PATH LENGTH 115.109 km | XMTR. ELEV. 1536 M



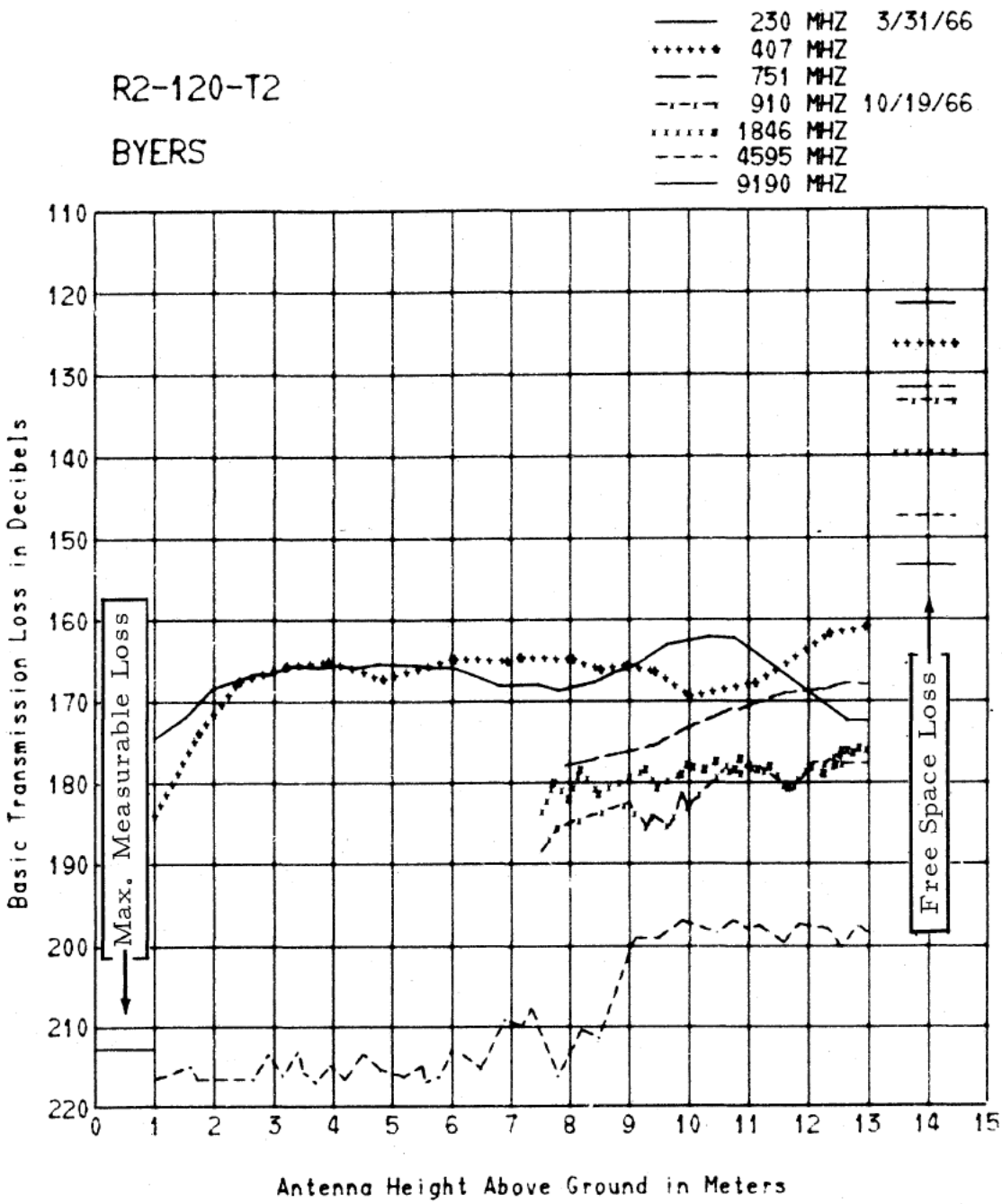
L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	1846	4595	9190
	3-30-66 at 11 M			10-20-66 at 13 M		
50%	146.1			185.7	210.5	
Δ10%-90%	<3			10.0	7.0	
	3-30-66 at 6 M			10-20-66 at 7.3 M		
50%			160.4	184.7	209.5	
Δ10%-90%			5.0	8.0	7.8	
	3-30-66 at 5 M			10-20-66 at 1 M		
		150.0		187.7	211.0	
		4.9		5.0	7.3	

The area is completely free of obstructions. The ground cover is pasture grassland.

PATH VIEW FROM TRANSMITTER

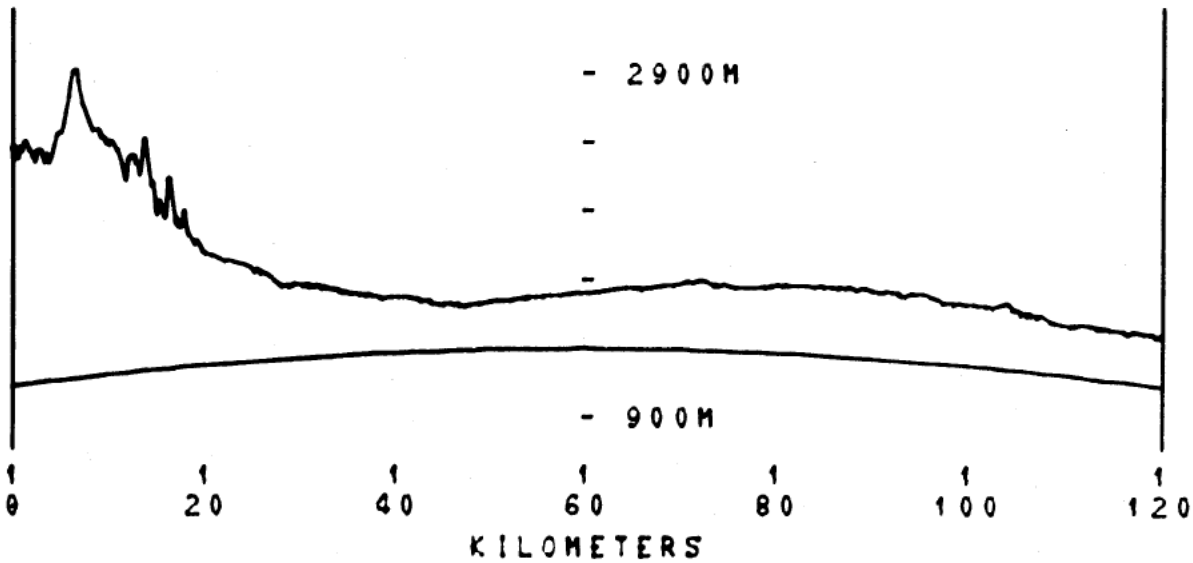
Bearing from common receiver site to transmitter site is 102° 32' 42" T.


R2-120-T2
BYERS
230 MHZ 3/31/66
407 MHZ
751 MHZ
910 MHZ 10/19/66
1846 MHZ
4595 MHZ
9190 MHZ
Basic Transmission Loss in Decibels
Max. Measurable Loss
Free Space Loss
110
120
130
140
150
160
170
180
190
200
210
220
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-120-T2
PATH LENGTH 120.172 km

XMTR. ELEV. 1600 M

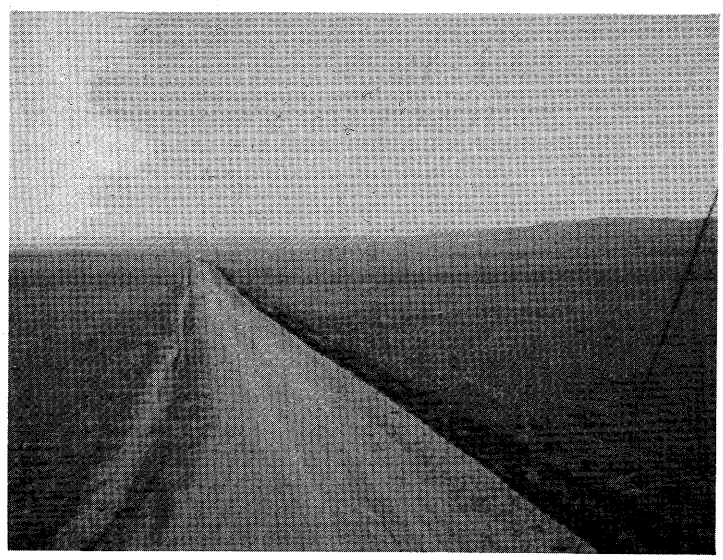


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	407	751	910	1846	4595	9190
	3-31-66 at 13 M				10-19-66 at 13 M		
50%		161.6	168.7	177.0	176.6	197.4	
Δ10%-90%		< 3	< 3	3.0	5.0	3.5	
	3-31-66 at 10 M				10-19-66 at 7.3 M		
50%	162.6					213.4	
Δ10%-90%	< 3					7.0	
					10-19-66 at 1 M		
50%						214.2	
Δ10%-90%						3.8	

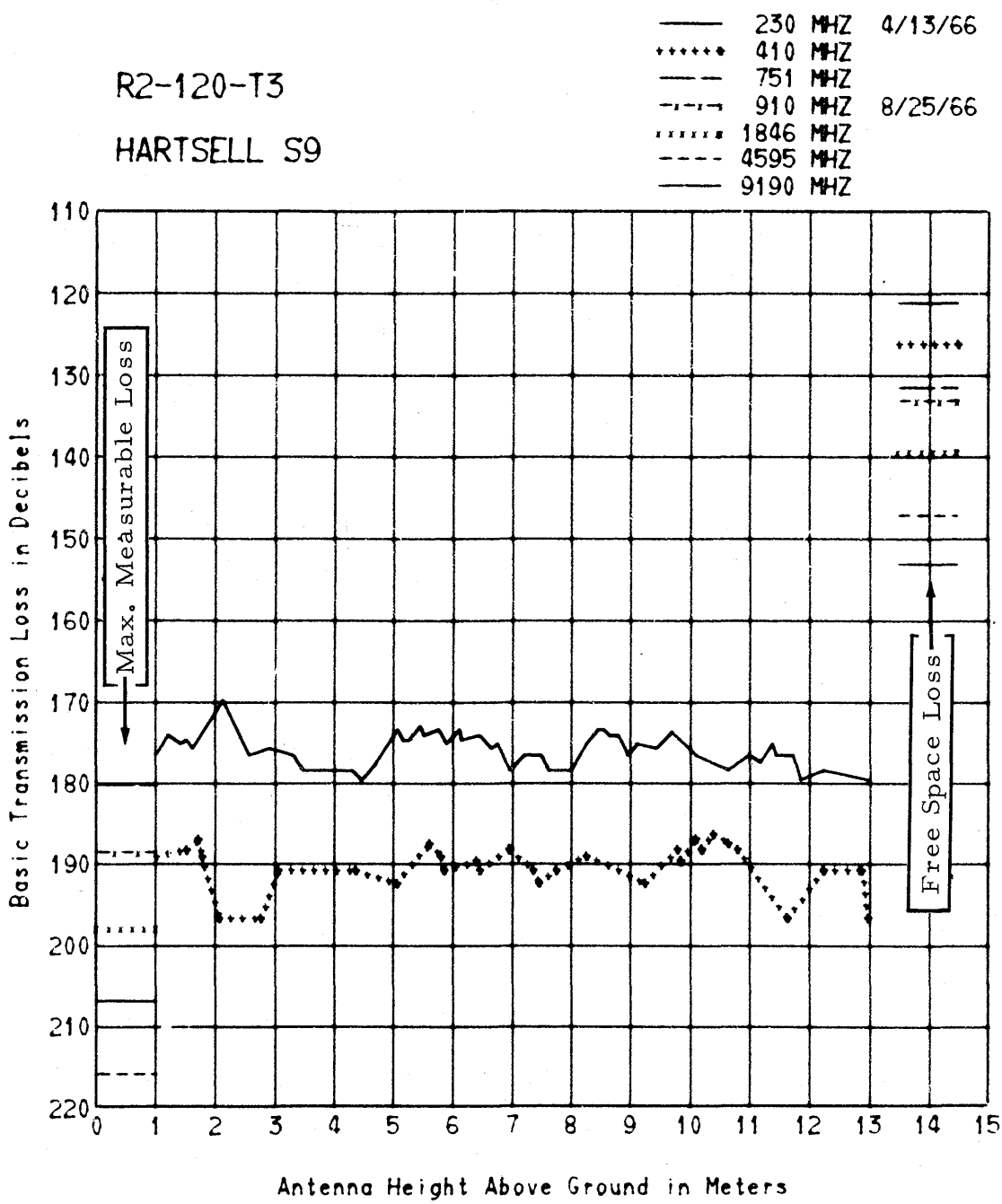
The path is unobstructed over nearly flat wheatland for 2.5 km. The mountainous horizon is 80 km away. A secondary dirt road runs to the left of the path at 10° from the center below the antennas.

R2-120-T3
HARTSELL S9



PATH VIEW FROM TRANSMITTER

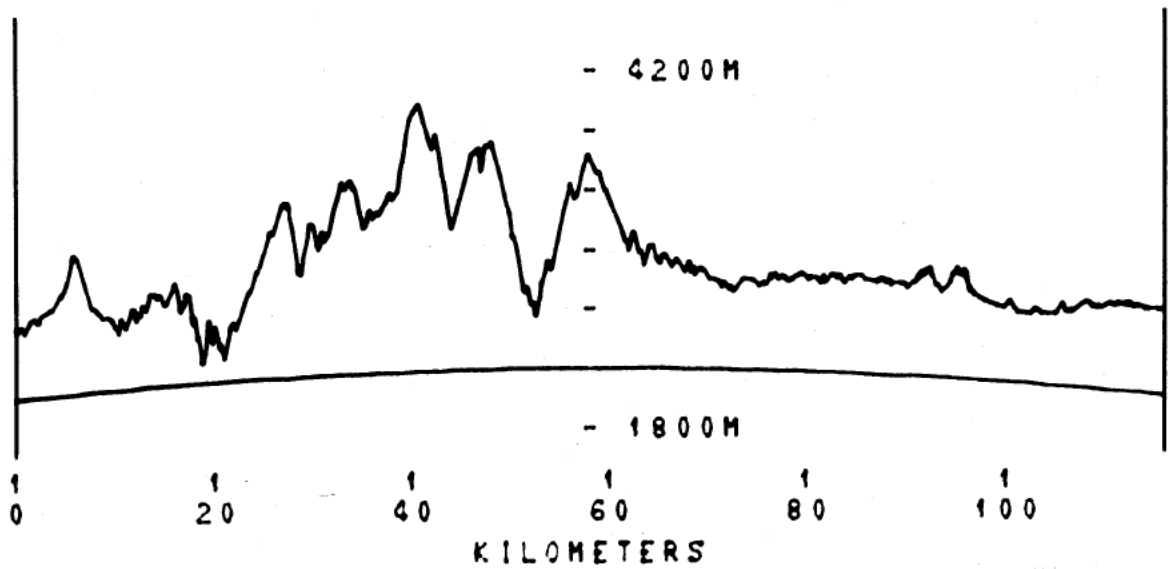
Bearing from common receiver site to transmitter site is 193^{o} 11' 37" T.


R2-120-T3
HARTSELL S9
230 MHZ 4/13/66
410 MHZ
751 MHZ
910 MHZ 8/25/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV.
2676 M

R2-120-T3
PATH LENGTH 115.552 km

XMTR. ELEV.
2788 M

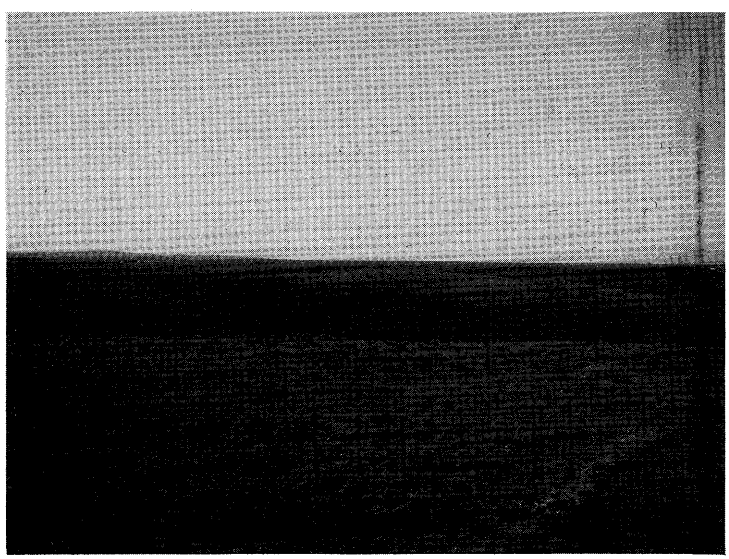


L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
	4-13-66 at 11 M						
50%		190.7					
Δ10%-90%		3.0					
	4-13-66 at 2 M						
50%	172.8						
Δ10%-90%	4.5						

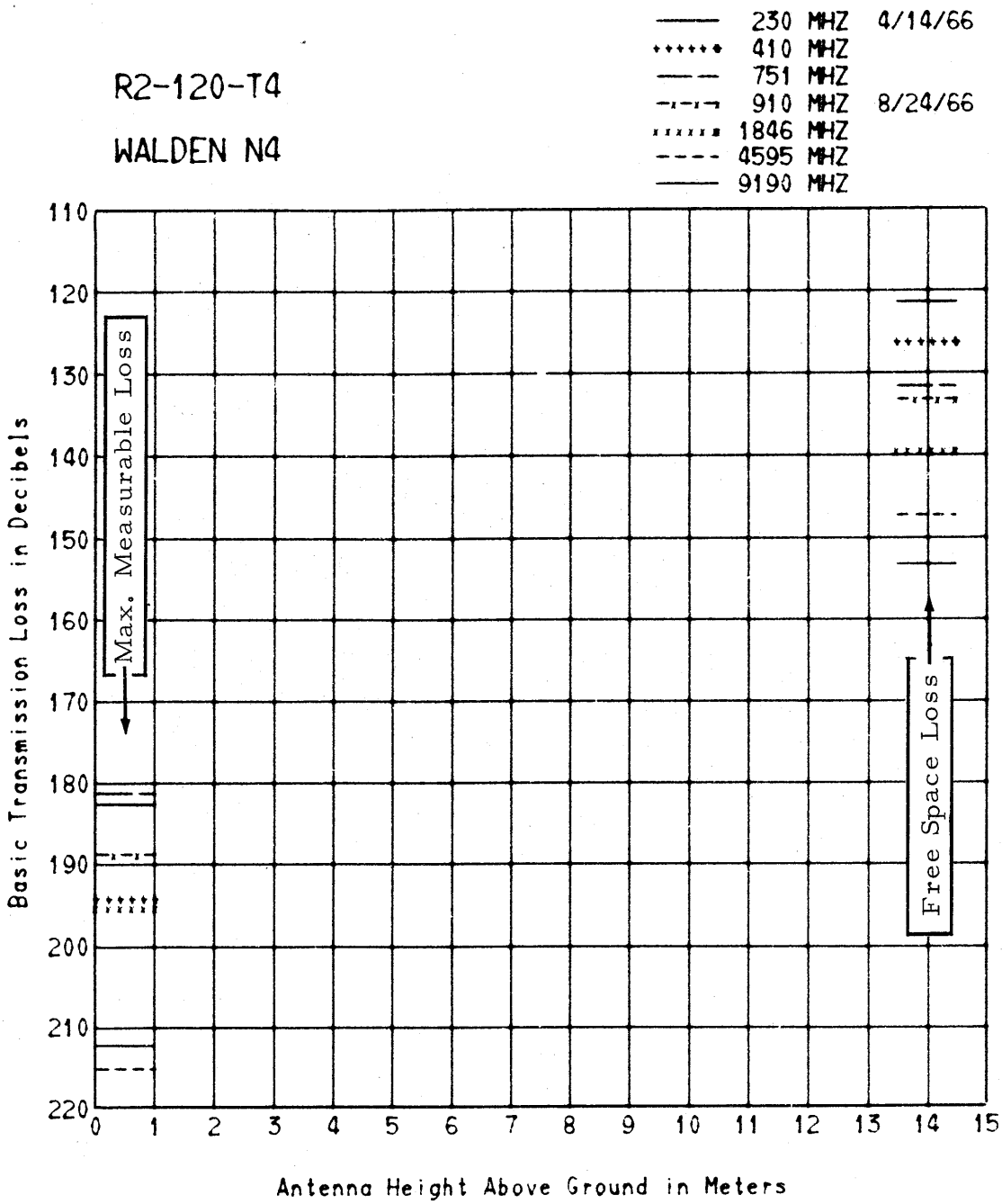
A secondary dirt road parallels the path, which is over pasture lands containing no obstructions. A few scattered trees rise on the path about 4-5 km from the transmitter.

R2-120-T4
WALDEN N4



PATH VIEW FROM TRANSMITTER

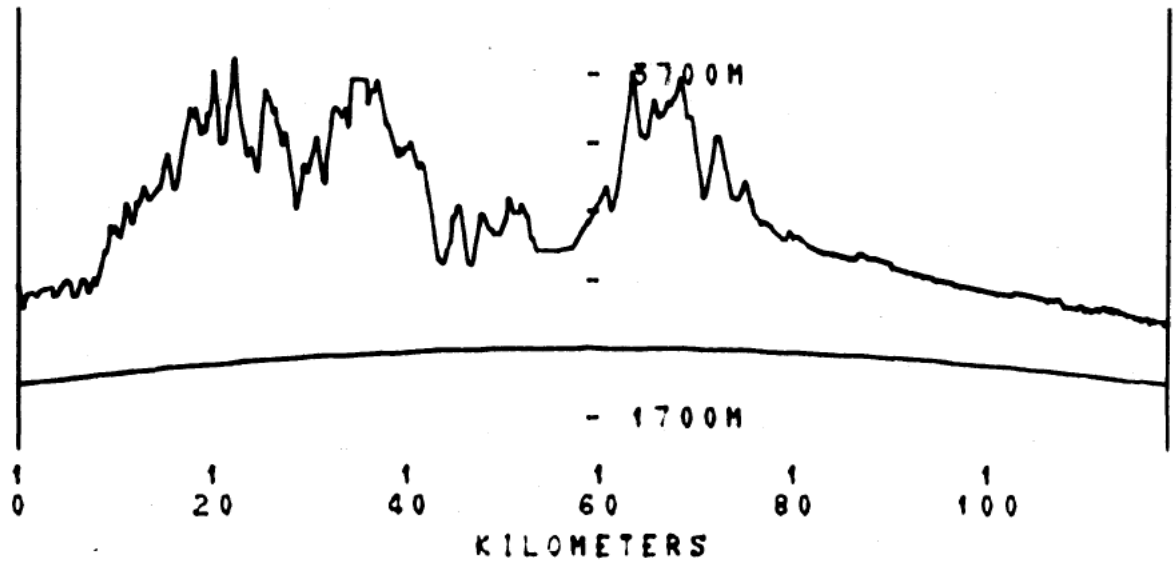
Bearing from common receiver site to transmitter site is
326° 10' 02" T.


R2-120-T4
WALDEN N4
230 MHZ 4/14/66
410 MHZ
751 MHZ
910 MHZ 8/24/66
1846 MHZ
4595 MHZ
9190 MHZ
Max. Measurable Loss
Free Space Loss
Basic Transmission Loss in Decibels
110
120
130
140
150
160
170
180
190
200
210
220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Antenna Height Above Ground in Meters

RCVR. ELEV. 2676 M

R2-120-T4
PATH LENGTH 118.277 km

XMTR. ELEV. 2463 M



L_b (dB) SHORT TERM SIGNAL VARIABILITY

Freq (MHz)	230	410	751	910	1846	4595	9190
50%							
Δ10%-90%							

This path is over pasture land with sagebrush clumps and rolling terrain. The only obstruction is a telephone and power line that crosses the path 1.5 km away at 90^{o}.

R2 Meteorlogical Information

Type of Site	Dry Bulb Temp C	Wet Bulb Temp C	Atmos. Press. mb	% Rel Humid.	Cloud Type	% Cloud Cover	Wind Speed & Dir.	Terminal
			R2-3-T1 Pactolus Road					
UHF	March 21, 1966							
OPEN	6.1	-1.7	724.0	16	L2	90	0-20 N	Rcvr
	6.4	-0.3	748.7	27	L2	90	15 SW	Xmtr
SHF	October 21, 1966							
OPEN	7.8	-0.6	730.1	16	L1	30	15-20 W	Rcvr
	10.6	1.7	743.6	19	L2	20	15 SW	Xmtr
			R2-3-T2 Thorn Lake					
UHF	March 24, 1966							
OPEN	7.8	-0.6	735.2	16	H1, H6	70	5-25 NW	Rcvr
	8.9	0.8	748.4	21	H4, H6	70	10-15 S	Xmtr
SHF	October 24, 1966							
OPEN	8.9	2.1	748.4	33	- -	- -	1-3 N	Rcvr
	10.0	3.3	752.5	36	H9	5	0-5 S	Xmtr
			R2-3-T3 Mount Monarch Hill					
UHF	November 4, 1965							
OPEN	No data available							
SHF	August 16, 1966							
OPEN	23.0	9.0	744.0	16	49	10	Calm	Rcvr
	24.4	11.2	890.5	17	4	40	Calm	Xmtr

R2-3-T4 Rollinsville Ranger Station

UHF	November 4, 1966							
OPEN	No data available							
SHF	August 18, 1966							
OPEN	20.5	10.1	742.6	30	- -	- -	Calm	Rcvr
	23.4	20.2	752.5	77	Ll	1	Calm	Xmtr

R2-3-T5-0 Los Lagos Ranch

UHF	November 17, 1965							
OPEN	No data available							
SHF	October 10, 1966							
OPEN	11.8	5.5	746.4	43	- -	- -	Calm	Rcvr
	12.8	4.4	747.0	28	- -	- -	0-5 E	Xmtr

R2-3-T5-C Los Lagos Ranch

UHF	November 17, 1965							
CONC	No data available							
SHF	October 10, 1966							
CONC	12.8	5.5	746.4	36	- -	- -	1-5 W	Rcvr
	11.9	5.0	747.7	38	- -	- -	5-10 N	Xmtr

R2-5-T1 Magnolia Road E

UHF	February 28, 1966							
OPEN	No data available							Rcvr
	-4.2	-7.2	736.2	43	- -	- -	- -	Xmtr
UHF	March 2, 1966							
OPEN	No data available							Rcvr
	-2.2	-5.6	715.5	43	- -	- -	- -	Xmtr
SHF	October 6, 1966							
OPEN	13.4	6.6	745.3	41	Ll	2	5-10 W	Rcvr
	13.9	6.7	746.4	39	Ll	5	5 SW	Xmtr

R2-5-T2 Winneger Ranch

UHF	March 16, 1966							
OPEN	No data available							Rcvr
	12.2	2.2	- -	- -	C9	70	18 SW	Xmtr
SHF	October 7, 1966							
OPEN	11.6	5.8	743.6	46	L1, H1	10, 80	8 NW	Rcvr
	12.2	5.6	759.9	40	H6, L1	75, 5	10-15 SW	Xmtr

R2-5-T3 Pinecliff

UHF	March 16, 1966							
OPEN	No data available							Rcvr
	12.7	2.2	- -	- -	M1	90	25 SW	Xmtr
SHF	October 21, 1966							
OPEN	7.9	-0.8	730.1	14	L1	50	15-25 W	Rcvr
	10.0	1.1	735.5	18	L2	60	15-20 W	Xmtr

R2-5-T4 Perigo

UHF	October 25, 1965							
OPEN	No data available							
SHF	August 15, 1966							
OPEN	24.8	12.4	742.30	26	L1	10	10 S	Rcvr
	23.3	- -	886.0	- -	L1	10	Calm	Xmtr

R2-5-T5 Jumbo Mountain

UHF	October 6, 1965							
OPEN	No data available							
SHF	August 15, 1966							
OPEN	21.3	9.4	766.0	22	L1	2	3N	Rcvr
	- -	- -	886.5	- -	L1	5	Calm	Xmtr

R2-5-T6 Tolland E2

UHF November 3, 1965

OPEN No data available

SHF August 16, 1966

OPEN	26.0	11.0	743.0	16	H9	10	Calm	Rcvr
	26.0	11.8	889.4	16	L1	20	Calm	Xmtr

R2-5-T7-0 Magnolia Road W

UHF March 1, 1966

OPEN No data available Rcvr

	5.3	-2.5	726.0	13	- -	- -	- -	Xmtr

SHF October 6, 1966

OPEN	13.9	6.5	744.7	38	L1	20	2-10 NW	Rcvr
	16.1	7.8	744.0	35	L2	10	0-5 W	Xmtr

R2-5-T7-C Magnolia Road W

UHF March 1, 1966

CONC No data available Rcvr

	5.3	-1.7	724.0	22	- -	- -	- -	Xmtr

SHF October 6, 1966

CONC	14.4	6.1	744.0	32	L1	30	2-10 NW	Rcvr
	No data available							Xmtr

R2-10-T1 Sugarloaf Road

UHF November 30, 1965

OPEN No data available

SHF October 10, 1966

OPEN	12.6	4.1	745.0	27	- -	- -	1-5 S	Rcvr
	14.4	5.8	785.3	29	- -	- -	Calm	Xmtr

R2-10-T2-0 Magnolia Road E

UHF	March 2, 1966							
OPEN	-5.3	-5.3	729.1	95	Fog	100	--	Rcvr
	95.3	-5.3	729.1	95	Fog	100	--	Xmtr
SHF	October 7, 1966							
OPEN	14.4	8.5	742.3	50	L1, H1	30,10	2-10 NW	Rcvr
	17.8	8.9	756.3	34	L1, H1	10,10	10-15 SW	Xmtr

R2-10-T2-C Magnolia Road E

UHF	March 2, 1966							
CONC	-2.8	-5.3	732.5	54	- -	- -	- -	Rcvr
	-2.8	-5.3	732.5	54	- -	- -	- -	Xmtr
SHF	October 7, 1966							
CONC	14.0	8.3	743.0	51	L1, H1	10, 60	2-10 W	Rcvr
	16.1	7.8	758.2	35	H4, L1	40,10	5-10 SW	Xmtr

R2-10-T3 Mount Thorodin

UHF	March 25, 1966							
OPEN	5.6	-1.1	734.8	25	H1	10	0-5 S	Rcvr
	4.2	-1.4	734.2	33	H1, H2	80	12 S	Xmtr
SHF	October 21, 1966							
OPEN	7.1	1.3	730.1	37	L1, H1	50	15-25 W	Rcvr
	7.8	0.0	757.2	21	L2	40	10-15 NW	Xmtr

R2-10-T4 Apex

UHF	October 11, 1965							
OPEN	No data available							
SHF	August 18, 1966							
OPEN	20.2	10.2	741.6	31	M1, M2	80	5 W	Rcvr
	16.8	9.6	707.8	45	L1	80	5 NE	Xmtr

R2-10-T5 Tolland-East Portal

UHF November 3, 1965

OPEN No data available

SHF August 16, 1966

OPEN	25.0	10.0	742.3	15	L1	40	Calm	Rcvr
	26.2	11.6	887.4	14	L1	30	Calm	Xmtr

R2-10-T6 Caribou

UHF November 22, 1965

OPEN No data available

SHF August 29, 1966

OPEN	19.0	8.0	745.0	24	L1	1	Calm	Rcvr
	20.0	18.6	718.9	89	L1	5	Calm	Xmtr

R2-10-T7 Caribou Country Club Ranch

UHF November 19, 1965

OPEN No data available

SHF August 26, 1966

OPEN	12.0	8.3	744.3	65	L1	30	Calm	Rcvr
	26.6	24.2	751.1	83	L1	30	Calm	Xmtr

R2-20-T1 Gold Hill

UHF November 24, 1965

OPEN No data available

SHF October 11, 1966

OPEN	6.6	5.7	738.9	89	L5	95	4 W	Rcvr
	11.7	7.2	- -	- -	L5	100	15 SE	Xmtr

R2-20-T2 Gold Hill - Sunshine Road

UHF	November 24, 1965							
OPEN	No data available							
SHF	October 12, 1966							
OPEN	8.4	4.4	745.3	58	L1	5	3-10 W	Rcvr
	13.9	5.6	779.2	30	L1	5	Calm	Xmtr

R2-20-T3 Eldorado Springs

UHF	March 28, 1966							
OPEN	11.7	2.2	736.9	18	H2	70	0-10 SW	Rcvr
	19.2	6.7	829.0	13	L1	5	5 E	Xmtr
SHF	October 18, 1966							
OPEN	-4.6	-5.1	744.3	86	L9	100	2-5 NW	Rcvr
	3.3	1.1	836.1	70	L5	100	0-5 SW	Xmtr

R2-20-T4 Coal Creek

UHF	March 28, 1966							
OPEN	9.4	1.1	737.9	21	- -	- -	0-5	Rcvr
	15.3	5.0	811.4	18	- -	- -	20 E	Xmtr
SHF	October 18, 1966							
OPEN	-2.6	-4.5	744.0	65	L1, L9	90	10 W	Rcvr
	3.3	0.0	813.8	56	L9	100	2 NW	Xmtr

R2-20-T5 Van Bibber

UHF	March 25, 1966							
OPEN	5.6	0.0	734.8	37	H2	5	- -	Rcvr
	8.3	2.2	777.8	37	H1	10	Calm	Xmtr
SHF	October 18, 1966							
OPEN	-0.4	-0.5	743.3	98	H6, L9	100	10-25 NW	Rcvr
	2.8	0.0	781.6	62	L9	70	0-10 SE	Xmtr

R2-20-T6 Idaho Springs

UHF October 26, 1965

OPEN No data available

SHF August 19, 1966

OPEN	10.4	10.2	778.2	98	L9	100	Calm	Rcvr
	18.8	11.8	715.2	48	L1, L2	80	Calm	Xmtr

R2-20-T8 Corona Pass W

UHF November 9, 1965

OPEN No data available

SHF August 22, 1966

OPEN	16.0	7.8	747.7	36	L1, H2	12	Calm	Rcvr
	14.6	8.8	688.8	52	L1	20	Calm	Xmtr

R2-20-T9-0 Brainard Lake

UHF December 7, 1965

OPEN No data available

SHF October 11, 1966

OPEN	15.1	5.7	739.2	26	H6, L1	80	5 NW	Rcvr
	9.2	2.8	693.9	39	H9, L1	50	5-10 SW	Xmtr

R2-20-T9-C Brainard Lake

UHF December 7, 1965

CONC No data available

SHF October 11, 1966

CONC	13.6	5.0	738.2	29	L1, L5, H6	100	2-5 W	Rcvr
	10.6	4.2	694.2	41	H9, L1	70	Calm	Xmtr

R2-20-T10 Ward

UHF November 23, 1965

OPEN No data available

SHF October 11, 1966

OPEN	12.1	4.3	740.6	31	M4	20	2-8 W	Rcvr
	10.8	3.6	716.9	34	H9, L1	50	0-5 E	Xmtr

R2-50-T1 Estes Park-Pole Hill Road

UHF December 10, 1965

OPEN No data available

SHF October 12, 1966

OPEN	13.6	4.7	736.2	27	L1	50	3-10 W	Rcvr
	16.4	6.7	739.2	27	L1	5	0-5 S	Xmtr

R2-50-T2 Longmont NE

UHF March 29, 1966

OPEN	8.6	2.2	739.6	36	L2, M6	90	0-5 SSW	Rcvr
	14.7	6.1	842.5	27	H1, H4, L5	85	18 NE	Xmtr

SHF October 13, 1966

OPEN	12.7	2.3	728.8	15	L1	10	2-8 S	Rcvr
	16.1	9.4	827.0	44	L1	5	0-5 NW	Xmtr

R2-50-T3 Rocky Mountain Arsenal

UHF	April 1, 1966							
OPEN	8.3	2.2	744.0	38	L1	10	0-10 NNW	Rcvr
	9.4	3.3	844.6	36	H1	40	12 SE	Xmtr
SHF	October 19, 1966							
OPEN	5.9	2.3	745.0	58	- -	- -	10-25 SW	Rcvr
	12.2	5.0	844.9	33	H1	5	10 S	Xmtr

R2-50-T4 Granby W3

UHF	April 18, 1966							
OPEN	6.1	1.7	716.6	53	L2, H2	70	0-5 SE	Rcvr
	9.9	2.5	744.7	30	L2, L5	80	5-15 W	Xmtr
SHF	August 22, 1966							
OPEN	16.7	8.7	747.7	38	L1	20	Calm	Rcvr
	23.0	11.5	764.3	27	L1, L2	30	10 NW	Xmtr

R2-50-T5-0 Granby NW 6

UHF	April 15, 1966							
OPEN	10.6	2.2	741.6	23	H7	50	0-10 NNE	Rcvr
	9.7	2.2	760.2	28	H1, H6	85	15 SE	Xmtr

R2-50-T5-C Granby NW 6

UHF	April 15, 1966							
CONC	11.7	3.3	740.3	26	H7	50	0-5 NNW	Rcvr
	13.3	4.4	759.2	25	L1, H2	40	Calm	Xmtr
SHF	August 23, 1966							
CONC	13.0	11.0	749.1	81	L2, M1	100	Calm	Rcvr
	19.0	8.8	758.9	28	L2, L9	90	Calm	Xmtr

R2-50-T6 Grand Lake N1

UHF	April 18, 1966							
OPEN	5.6	2.2	717.9	61	H7	80	0-5 SW	Rcvr
	14.9	3.5	736.5	13	L2	95	5 SE	Xmtr
SHF	August 23, 1966							
OPEN	12.1	8.7	716.2	68	L1	40	Calm	Rcvr
	10.4	6.5	681.4	63	L1	5	Calm	Xmtr

R2-50-T7 Estes Park-Deer Ridge

UHF	December 13, 1965							
OPEN	No data available							
SHF	October 13, 1966							
OPEN	8.1	4.0	731.8	57	L1	10	1-4 SE	Rcvr
	8.6	2.8	724.0	42	L1, L5	60	0-5 SW	Xmtr

R2-80-T1 Milliken

UHF	March 29, 1966							
OPEN	7.8	2.2	738.6	42	L2, M6	95	0-5 SSW	Rcvr
	16.4	6.7	844.9	23	L1, L5	85	15 NE	Xmtr
SHF	October 20, 1966							
OPEN	14.0	4.3	736.5	22	M4	50	2-10 NW	Rcvr
	16.7	8.3	837.4	33	M3	90	0-5 SW	Xmtr

R2-80-T2 Watkins

UHF	March 31, 1966							
OPEN				- -	H7	80	0-30 NW	Rcvr
	22.2	7.8	824.2	10	M2	75	15 SE	Xmtr
SHF	October 19, 1966							
OPEN	8.1	2.4	745.0	41	H9	5	5-12 W	Rcvr
	16.1	7.2	832.71	28	H1	5	10 SW	Xmtr

R2-80-T3 Como SE 7

UHF	April 13, 1966							
OPEN	5.6	1.1	738.2	48	L2, M6	90	0-5 N	Rcvr
	5.0	-0.7	736.5	34	L1, L3	85	8 NNE	Xmtr
SHF	August 24, 1966							
OPEN	17.0	7.5	749.4	29	L1	30	Calm	Rcvr
	19.4	9.2	730.1	29	L1	30	5 W	Xmtr

R2-80-T4 Rand N1

UHF	April 14, 1966							
OPEN	10.6	2.2	742.3	23	L1	10	0-5 NW	Rcvr
	12.5	3.1	752.5	20	L5	5	5-10 W	Xmtr
SHF	August 23, 1966							
OPEN	12.6	9.7	715.9	72	L5	80	Calm	Rcvr
	22.0	11.2	748.4	30	L2	20	5 NNW	Xmtr

R2-120-T1 Purcell E4

UHF	March 30, 1966							
OPEN	12.8	1.1	737.9	6	H9	10	0-30 N	Rcvr
	20.6	7.9	775.8	16	H9	10	12-20 NE	Xmtr
SHF	October 20, 1966							
OPEN	12.0	6.0	738.2	46	H6	80	0-3 W	Rcvr
	11.7	6.1	772.8	47	M3	95	Calm	Xmtr

R2-120-T2 Byers

UHF	March 31, 1966							
OPEN	7.2	0.0	737.6	25	H7	60	0-10 NNW	Rcvr
	19.2	6.6	835.1	12	H1, H6	90	10 NE	Xmtr
SHF	October 19, 1966							
OPEN	7.7	3.2	743.3	52	H9	40	6-15 W	Rcvr
	18.3	8.3	841.5	25	L1	5	3 SSW	Xmtr

R2-120-T3 Hartsell S9

UHF	April 13, 1966							
OPEN	7.8	2.8	738.9	47	L1	70	0-5 N	Rcvr
	6.7	0.8	733.2	37	L2, L9	98	20 WNW	Xmtr
SHF	August 25, 1966							
OPEN	17.2	5.8	749.1	18	H1	2	5 W	Rcvr
	10.5	6.2	736.5	58	M1	1	Calm	Xmtr

R2-120-T4 Walden N4

UHF	April 14, 1966							
OPEN	11.1	2.8	742.9	25	L1	30	0-5 NW	Rcvr
	11.1	2.7	768.7	23	L1	10	5-20 WNW	Xmtr
SHF	August 24, 1966							
OPEN	12.4	5.1	751.4	36	- -	- -	Calm	Rcvr
	7.4	3.0	767.4	52	- -	- -	Calm	Xmtr

USGS Quadrangles and Great Circle Course Intercepts

From Receiver to Transmitter

Quadrangle	Latitude	Longitude	Distance
	R2-3-T1 Pactolus Lake Road		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 55 15.8	105 27 06.0	3.627 km XMTR
	R2-3-T2 Thorn Lake		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 54 03.0	105 27 03.5	3.609 km XMTR
	R2-3-T3 Mount Monarch Hill		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 20.304	105 30 00.0	0.856 km
	39 53 43.0	105 31 14.1	2.956 km XMTR
	R2-3-T4 Rollinsville Ranger Station		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 44.019	105 30 00.0	0.474 km
	39 55 07.7	105 31 24.0	2.883 km XMTR
	R2-3-T5-0 Los Lagos Ranch		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 25.002	105 30 00.0	1.688 km
	39 55 58.1	105 30 20.2	2.817 km XMTR
	R2-3-T5-C Los Lagos Ranch		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 31.526	105 30 00.0	1.873 km
	39 55 49.7	105 30 09.8	2.480 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-5-T1 Magnolia Road E		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 57 07.7	105 28 44.0	4.825 km XMTR
	R2-5-T2 Winneger Ranch		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 56 17.2	105 26 35.5	5.188 km XMTR
	R2-5-T3 Pine Cliff		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 55 37.7	105 26 18.0	4.933 km XMTR
	R2-5-T4 Perigo		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 10.270	105 30 00.0	1.058 km
	39 52 31.7	105 31 57.9	5.191 km XMTR
	R2-5-T5 Jumbo Mountain		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 30.348	105 30 00.0	0.733 km
	39 54 00.0	105 32 57.6	5.044 km XMTR
	R2-5-T6 Tolland E2 Picnic Area		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 37.481	105 30 00.0	0.718 km
	39 54 49.1	105 32 57.8	4.946 km XMTR
	R2-5-T7-0 Magnolia Road W		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 56 10.387	105 30 00.0	3.017 km
	39 57 00.0	105 30 15.8	4.594 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-5-T7-C Magnolia Road W		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 56 23.490	105 30 00.0	3.411 km
	39 57 02.8	105 30 11.0	4.653 km XMTR
	R2-10-T1 Sugar Loaf Road		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	30 59 49.9	105 28 38.7	9.786 km XMTR
	R2-10-T2-0 Magnolia Road E		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 59 03.1	105 24 18.8	11.071 km XMTR
	R2-10-T2-C Magnolia Road E		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 58 46.3	105 24 52.6	10.154 km XMTR
	R2-10-T3 Mount Thorodin		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
	39 52 42.3	105 23 18.6	9.466 km XMTR
	R2-10-T4 Apex		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 21.090	105 30 00.0	0.843 km
Central City	39 52 30.0	105 33 52.538	7.335 km
	39 51 52.8	105 35 10.3	9.507 km XMTR
	R2-10-T5 Tolland - East Portal		
Tungsten	30 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 33.792	105 30 00.0	0.717 km
	39 54 11.3	105 36 34.0	10.079 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-10-T6 Caribou		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 02.159	105 30 00.0	1.091 km
	39 58 37.7	105 34 04.5	9.914 km XMTR
	R2-10-T7 Caribou Country Club Ranch		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 56 46.041	105 30 00.0	4.095 km
	39 59 59.0	105 30 44.7	10.149 km XMTR
	R2-20-T1 Gold Hill		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Gold Hill	40 00 00.0	105 26 11.517	11.068 km
	40.04 07.0	105 23 40.2	19.495 km XMTR
	R2-20-T2 Gold Hill - Sunshine Road		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Gold Hill	40 00 00.0	105 23 52.761	12.812 km
Boulder	40 01 19.510	105 22 30.0	15.953 km
	40 03 04.7	105 20 40.4	20.109 km XMTR
	R2-20-T3 Eldorado Springs		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 55 45.220	105 22 30.0	10.175 km
Louisville	39 56 59.446	105 15 00.0	21.077 km
	39 57 09.5	105 13 58.8	22.559 km XMTR

Quadrangle	Latitude	Longitude	Distance
		R2-20-T4 Coal Creek Canyon Road	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 53 24.818	105 22 30.0	10.185 km
Ralston Buttes	39 52 30.0	105 17 06.295	18.042 km
	30 52 13.3	105 15 28.0	20.428 km XMTR
		R2-20-T5 Van Bibber	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Black Hawk	39 52 30.0	105 25 40.932	6.667 km
Ralston Buttes	39 50 45.109	105 22 30.0	12.234 km
	39 48 14.0	105 17 55.5	20.246 km XMTR
		R2-20-T6 Idaho Springs	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 53 46.352	105 30 00.0	1.678 km
Central City	39 52 30.0	105 30 46.090	4.285 km
Idaho Springs	39 45 00.0	105 35 29.596	19.648 km
	39 44 11.9	105 35 52.0	21.289 km XMTR
		R2-20-T8 Corona Pass W	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 34.538	105 30 00.0	0.716 km
East Portal	39 54 19.945	105 37 30.0	11.388 km
	39 54 08.8	105 43 04.0	19.310 km XMTR

Quadrangle	Latitude	Longitude	Distance
		R2-20-T9-0 Brainard Lake	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 41.443	105 30 00.0	2.159 km
Ward	40 00 00.0	105 31 58.578	10.624 km
	40 04 43.5	105 34 08.9	19.908 km XMTR
		R2-20-T9-C Brainard Lake	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 44.016	105 30 00.0	2.234 km
Ward	40 00 00.0	105 31 52.988	10.581 km
	40 04 44.6	105 33 58.9	19.863 km XMTR
		R2-20-T10 Ward	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 59 45.987	105 30 00.0	9.617 km
Ward	40 00 00.0	105 30 01.365	10.051 km
	40 04 39.3	105 30 28.6	18.702 km XMTR
		R2-50-T1 Estes Park - Pole Hill Road	
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Gold Hill	40 00 00.0	105 28 57.604	10.052 km
Raymond	40 07 30.0	105 28 12.814	23.992 km
Panorama Peak	40 15 00.0	105 27 27.859	37.932 km
	40 21 36.6	105 26 48.1	50.219 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-50-T2 Longmont NE		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 59 47.497	105 22 30.0	13.845 km
Boulder	40 00 00.0	105 22 13.143	14.400 km
Niwot	40 05 20.596	105 15 00.0	28.647 km
Hygiene	40 07 30.0	105 12 04.675	34.403 km
Longmont	40 10 52.309	105 07 30.0	43.408 km
	40 13 59.3	105 03 15.5	51.739 km XMTR
	R2-50-T3 Rocky Mountain Arsenal		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 54 12.337	105 22 30.0	9.973 km
Louisville	39 53 47.035	105 15 00.0	20.665 km
Lafayette	39 53 21.245	105 07 30.0	31.359 km
East Lake	39 52 54.967	105 00 00.0	42.055 km
Derby	39 52 30.0	104 53 0.009	52.041 km
Sable	39 52 28.200	104 52 30.0	52.754 km
	39 52 17.9	104 49 39.0	56.820 km XMTR
	R2-50-T4 Granby W3		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 48.003	105 30 00.0	0.813 km
East Portal	39 57 53.899	105 37 30.0	12.919 km
Monarch Lake	40 00 00.0	105 42 36.310	21.149 km
Strawberry Lake	40 00 59.032	105 45 00.0	25.006 km
Granby	40 04 03.404	105 52 30.0	37.076 km
	40 06 43.8	105 59 03.0	47.601 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-50-T5-0 Granby NW 6		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 54 51.294	105 30 00.0	0.866 km
East Portal	39 58 46.143	105 37 30.0	13.757 km
Monarch Lake	40 00 00.0	105 39 51.890	17.816 km
Strawberry Lake	40 02 40.061	105 45 00.0	26.623 km
Granby	40 06 33.052	105 52 30.0	39.465 km
Trail Mountain	40 07 30.0	105 54 20.262	42.608 km
	40 10 21.0	105 59 52.0	52.055 km XMTR
	R2-50-T5-C Granby NW 6		
Nederland	39 54 35.5	105 29 29.8	0.000 km RCVR
Tungsten	39 54 51.257	105 30 00.0	0.865 km
East Portal	39 58 45.545	105 37 30.0	13.746 km
Monarch Lake	40 00 00.0	105 39 53.382	17.846 km
Strawberry Lake	40 02 38.905	105 45 00.0	26.603 km
Granby	40 06 31.340	105 52 30.0	39.435 km
Trail Mountain	40 07 30.0	105 54 23.852	42.678 km
	40 10 19.0	105 59 52.5	52.030 km XMTR
	R2-50-T6 Grand Lake N1		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 6.996	105 30 00.0	1.208 km
Ward	40 00 00.0	105 34 41.420	12.446 km
Monarch Lake	40 02 55.095	105 37 30.0	19.166 km

Quadrangle	Latitude	Longitude	Distance
R2-50-T6 (Continued)			
Isolation Peak	40 07 30.0	105 41 55.295	29.721 km
Shadow Mountain	40 10 40.933	105 45 00.0	37.055 km
Grand Lake	40 15 00.0	105 49 11.206	47.012 km
	40 16 24.1	105 50 32.9	50.246 km XMTR
	R2-50-T7 Estes Park - Deer Ridge		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 56 38.413	105 30 00.0	3.863 km
Ward	40 00 00.0	105 30 49.597	10.200 km
Allenspark	40 07 30.0	105 32 40.611	24.345 km
Longs Peak	40 15 00.0	105 34 32.042	38.491 km
Estes Park	40 22 30.0	105 36 23.892	52.639 km
	40 23 15.8	105 36 35.3	54.079 km XMTR
	R2-80-T1 Milliken		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 59 55.298	105 22 30.0	14.013 km
Boulder	40 00 00.0	105 22 23.815	14.220 km
Niwot	40 05 36.714	105 15 00.0	28.995 km
Hygiene	40 07 30.0	105 12 30.266	33.970 km
Longmont	40 11 16.699	105 07 30.0	43.934 km
Berthoud	40 15 00.0	105 02 33.408	53.758 km
Johnstown	40 16 55.257	105 00 00.00	58.832 km
Windsor	40 22 30.0	104 52 33.200	73.584 km
Bracewell	40 22 32.393	104 52 30.0	73.689 km
	40 22 59.9	104 51 53.2	74.902 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-80-T2 Watkins		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 53 25.274	105 22 30.0	10.182 km
Ralston Buttes	39 52 30.0	105 17 01.502	18.153 km
Golden	39 52 09.484	105 15 00.0	21.102 km
Arvada	39 50 53.165	105 07 30.0	32.029 km
Derby	39 49 36.315	105 00 00.0	42.963 km
Sable	39 48 18.934	104 52 30.0	53.904 km
Box Elder School	39 47 01.022	104 45 00.0	64.851 km
Manila	39 45 42.577	104 37 30.0	75.806 km
	39 45 16.1	104 34 58.8	79.488 km
	R2-80-T3 Como SE 7		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 53 36.0949	105 30 00.0	1.970 km
Central City	39 52 30.0	105 30 33.582	4.161 km
Idaho Springs	39 45 00.0	105 34 21.713	19.077 km
Georgetown	39 38 47.264	105 37 30.0	31.430 km
Mount Evans	39 37 30.0	105 38 08.954	33.990 km
Mount Logan	39 30 00.0	105 41 55.314	48.898 km
Jefferson	39 23 51.554	105 45 00.0	61.101 km
Milligan Lakes	39 22 30.0	105 45 40.801	63.802 km
Elkhorn	39 15 00.0	105 49 25.422	78.703 km
	39 14 48.2	105 49 31.3	79.093 km XMTR

Quadrangle	Latitude	Longitude	Distance
	R2-80-T4 Rand N1		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 00.437	105 30 00.0	1.051 km
Ward	40 00 00.0	105 36 03.467	13.688 km
Monarch Lake	40 01 11.165	105 37 30.0	16.691 km
Strawberry Lake	40 07 20.295	105 45 00.0	32.284 km
Shadow Mountain	40 07 30.0	105 45 11.857	32.695 km
Trail Mountain	40 13 27.833	105 52 30.0	47.831 km
Bowen Mountain	40 15 00.0	105 54 23.152	51.732 km
Radial Mountain	40 19 33.783	106 00 00.0	63.330 km
Jack Creek Ranch	40 22 30.0	106 03 37.386	70.801 km
Rand	40 25 38.152	106 07 30.0	78.783 km
	40 28 21.2	106 10 52.0	85.704 km XMTR
	R2-120-T1 Purcell E 4		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Eldorado Springs	39 59 58.052	105 22 30.0	14.074 km
Boulder	40 00 00.0	105 22 27.460	14.159 km
Niwot	40 05 42.404	105 15 00.0	29.119 km
Hygiene	40 07 30.0	105 12 39.005	33.824 km
Longmont	40 11 25.309	105 07 30.0	44.122 km
Berthoud	40 15 00.0	105 02 47.289	53.526 km
Johnstown	40 17 06.771	105 00 00.0	59.082 km

Quadrangle	Latitude	Longitude	Distance	
R2-120-T1 (Continued)				
Windsor	40 22 30.0	104 52 52.271	73.264 km	
Bracewell	40 22 46.795	104 52 30.0	74.002 km	
Greeley	40 28 25.384	104 45 00.0	88.879 km	
Eaton	40 30 00.0	104 42 53.910	93.040 km	
Galeton	40 34 02.544	104 37 30.0	103.715 km	
Purcell	40 37 30.0	104 32 52.164	112.854 km	
	40 38 19.1	104 31 46.3	115.018 km	XMTR
	R2-120-T2 Byers			
Tungsten	39 54 35.5	105 29 29.8	0.000 km	RCVR
Eldorado Springs	39 53 23.616	105 22 30.0	10.193 km	
Ralston Buttes	39 52 30.0	105 17 18.625	17.756 km	
Golden	39 52 06.048	105 15 00.0	21.125 km	
Arvada	39 50 47.947	105 07 30.0	32.064 km	
Derby	39 49 29.314	105 00 00.0	43.011 km	
Sable	39 48 10.148	104 52 30.0	53.964 km	
Box Elder School	39 46 50.447	104 45 00.0	64.924 km	
Manila	39 45 30.213	104 37 30.0	75.892 km	
Watkins	39 45 00.0	104 34 41.324	80.004 km	
Strasburg NW	39 44 09.443	104 30 00.0	86.866 km	
Strasburg	39 42 48.138	104 22 30.0	97.848 km	
Byers	39 41 26.296	104 15 00.0	108.837 km	

Quadrangle	Latitude	Longitude	Distance
R2-120-T2 (Continued)			
Peoria	39 40 03.918	104 07 30.0	119.833 km
	39 40 01.2	104 07 15.2	120.195 km XMTR
	R2-120-T3 Hartsell S 9		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 52 56.646	105 30 00.0	3.136 km
Central City	39 52 30.0	105 30 08.136	3.982 km
Idaho Springs	39 45 00.0	105 32 25.267	18.257 km
Harris Peak	39 37 30.0	105 34 41.888	32.531 km
Shawnee	39 30 00.0	105 36 58.003	46.804 km
Mount Logan	39 28 13.976	105 37 30.0	50.166 km
Observatory Rock	39 22 30.0	105 39 13.616	61.075 km
Eagle Rock	39 15 00.0	105 41 28.732	75.345 km
Sulphur Mountain	39 07 30.0	105 43 43.353	89.613 km
Hartsell	39 03 13.056	105 45 00.0	97.760 km
Antero	39 00 00.0	105 45 57.485	103.881km
Reservoir NE	38 53 48.0	105 47 48.0	115.674 km XMTR
	R2-120-T4 Walden N 4		
Tungsten	39 54 35.5	105 29 29.8	0.000 km RCVR
Nederland	39 55 10.058	105 30 00.0	1.285 km
Ward	40 00 00.0	105 34 13.815	12.070 km
Monarch Lake	40 03 43.593	105 37 30.0	20.389 km

Quadrangle	Latitude	Longitude	Distance	
R2-120-T4 (Continued)				
Isolation Peak	40 07 30.0	105 40 49.197	28.820 km	
Shadow Mountain	40 12 14.401	105 45 00.0	39.414 km	
Grand Lake	40 15 00.0	105 47 26.366	45.584 km	
Bowen Mountain	40 20 42.651	105 52 30.0	58.359 km	
Mount Richthoffen	40 22 30.0	105 54 05.342	62.363 km	
Jack Creek Ranch	40 29 08.300	106 00 00.0	77.225 km	
Gould	40 30 00.0	106 00 46.141	79.155 km	
Johnny Moor Mountain	40 37 30.0	106 07 28.782	95.962 km	
Gould NW	40 37 31.3587	106 07 30.0	96.013 km	
Eagle Hill	40 45 00.0	106 14 13.283	112.784 km	
Cowdrey	40 45 51.838	106 15 00.0	114.722 km	
	40 47 24.2	106 16 23.3	118.177 km	XMTR

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