CHAPTER V

APPLICATIONS OF K FACTOR

The applications of K factor[11] are

1. Finding the minimum value of the antenna height to be expected over the path for calculating the antenna height. It also extablishes the lower end of clearance range over which reflective path analysis must be made, in the case of paths where reflections are expected

2. Minimum value of clearance to be expected over the path. This leads to greater than normal clearance and is of significance primarily on reflective analysis must be made.

3. Median or normal value of clearance to be expected over the paths. Clearance under this condition should be at least sufficient paths. Additionaly, on paths with significant reflections the clearances under normal conditions should not fall at or near an even fresnel zone[11]

K factor is the most important value for planning the path of radio wave propagation,[11] an example of the radio wave propagation test is illustrated in this chapter.

As an application of K, the profiles are plotted to evaluate the height of antennas in both sides. This is an example of using the value of K is in designing the microwave path.

For the propagation test between Bangkok and Chachoengsao, using the value of K = 1.6 , which is determined in this thesis, we want to know whether the signal can be received or not. This propagation is done by the Test and Development Division, Department of Plant Engineering, Telephone Organization of Thailand. The microwave system under test is PYE -PTC M 1000 A with a frequency of transmission at7200 MHz and its details are shown.

Transmitter :

Type	PYE-PTC M 1000 A
Frequency	7,200 MHz
Frequency stability	± 0.03 %
Antenna diameter	4 ft.
Antenna gain	36.6 dB.
RF. power output	1 watt nominal
Power consumption	300 watts.

Receiver :

Type	PYE-PTC M 1000 A
IF frequency	130 MHz
Frequency stability	± 0.03 %
Noise figure	less than 13 dB
Threshold level	-70 dBm.
Antenna diameter	4 ft.
Antenna gain	36.6 dB.

The propagation test, during January, 7, 1974 to January 28, 1974 is separated into two cases;

i) Using the profile of K = 1.6 to evaluate the height of antenna as shown in Fig.87

ii) Using the profile of K =4/3 to evaluate the height of the antenna as shown in Fig.88

From the path profile of K = 1.6, the transmitted antenna is fixed at Bangkok at the height of 80 m above MSL.[11] By using a full fresnel zone the height of receiving antenna at Chachoengsao is 62.5 m above MSL.

For the path profile of K = 4/3, the transmitted antenna is also fixed at Bangkok at the height of antenna 80 m above MSL. Using full fresnel zone the height of the receiving antenna is 79 m above MSL.

Then the test is devided into two parts

i) Using the antenna height of the transmitter 80 m above MSL, and the antenna height of the receiver is 62.5 m above MSL. during January 17, 1974 to January 21, 1974.

ii) Using the antenna height of the transmitter 80 m above MSL, and the antenna height of the receiver is 79 m above MSL, during January 21, 1974 to January 25, 1974.

The method of planning is separated into two parts, path profile, and path calculation [11) — (13)] as explained in Appendix V. The path profiles of K = 1.6 and K = 4/3 are shown in Figs. 87 and 88 respectively. The free space loss [(13)] in a distance of 60.5 Km. is equal to 145.2 dB, calculated received signal is -42 dBm, transmitter output power is 30 dBm.

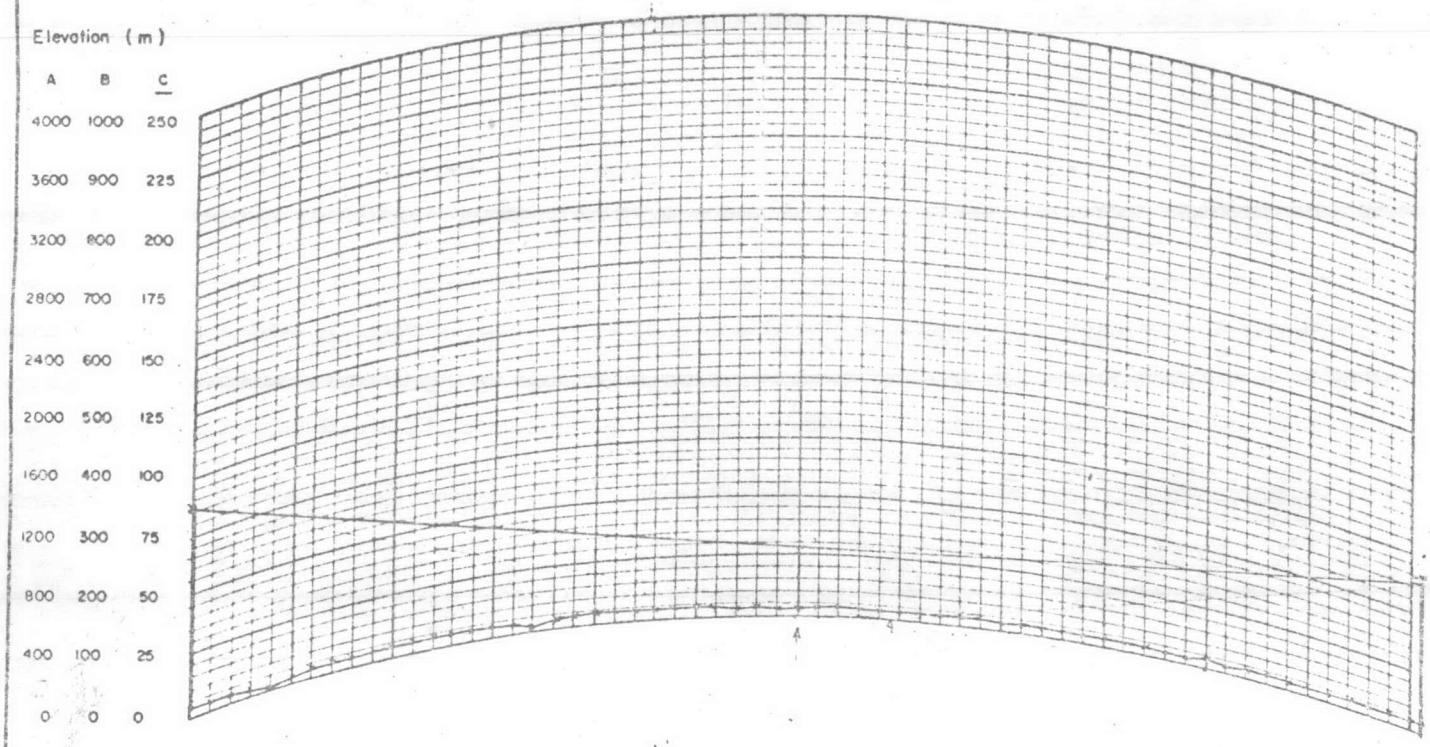
The results of both path propagation tests are shown in Figs. 89 to 92. The receiver could received all the transmitted signal, because the received signal level was not lower than the threshold level (-70 dBm)

By using the transmitting antenna height of 80 m above MSL, and the receiving antenna height of 62.5 m above MSL, the maximum received level of -36 dBm and the minimum received level of -68 dBm. The results are shown in Figs. 89 and 90, during January 17, 1974. to January 21, 1974.

When the antenna height of 80 m above MSL at the transmitter, and 79 m above MSL at the receiver are used, the maximum received level is -40 dBm and the minimum received level is -64 dBm as shown in Fig.91 to 92, during the period from January 21, 1974 to January 25, 1974.

The conclusion of these propagation tests is, if economical consideration the lower height of antenna is preferable.

Path Profile K = 1.6



Station Bangkok
Location Latitude 13° 45′ 26″ N
Longitude 100° 30′ 58″ E
Azimuth 98° N →
Altitude 02 m.(MSL)
Antenna height 80 m.
Feeder Length — m.
loss — dB

Center Frequency 7000 MHz
Distance full scale
A = 240 Km
B = 120 Km
C = 60 Km

Total path length 60.5 Km.

Station Cha choeng Sao
Location Latitude 13° 40′ 44″ N
Longitude 101° 04′ 16″ E
Azimuth 278° N ←
Altitude 02 m.(MSL)
Antenna height 62.5 m.
Feeder Length — m.
loss — dB.

Path Calculation

Minimum Relative Clearance of 1 Fresnel Zone 25.43 m
Reflection point 34.78 km from Bangkok

Free space loss	145.2		dB
Feeder loss	4.8	/ 3.75	dB
Path loss	153.75		dB
Antenna gain	36.6	/ 36.6	dB
Obstruction loss			dB
Net loss			dB

Highest frequency of Baseband	kHz
RMS Frequency Deviation	kHz
System Figure merit	dB
Signal / Thermal Noise	dBmop
Thermal noise Power	pWop
Intermodulation noise	pWop
Interference noise	pWop
Total noise Power	pWop

Fading Margin (to practical threshold) dB

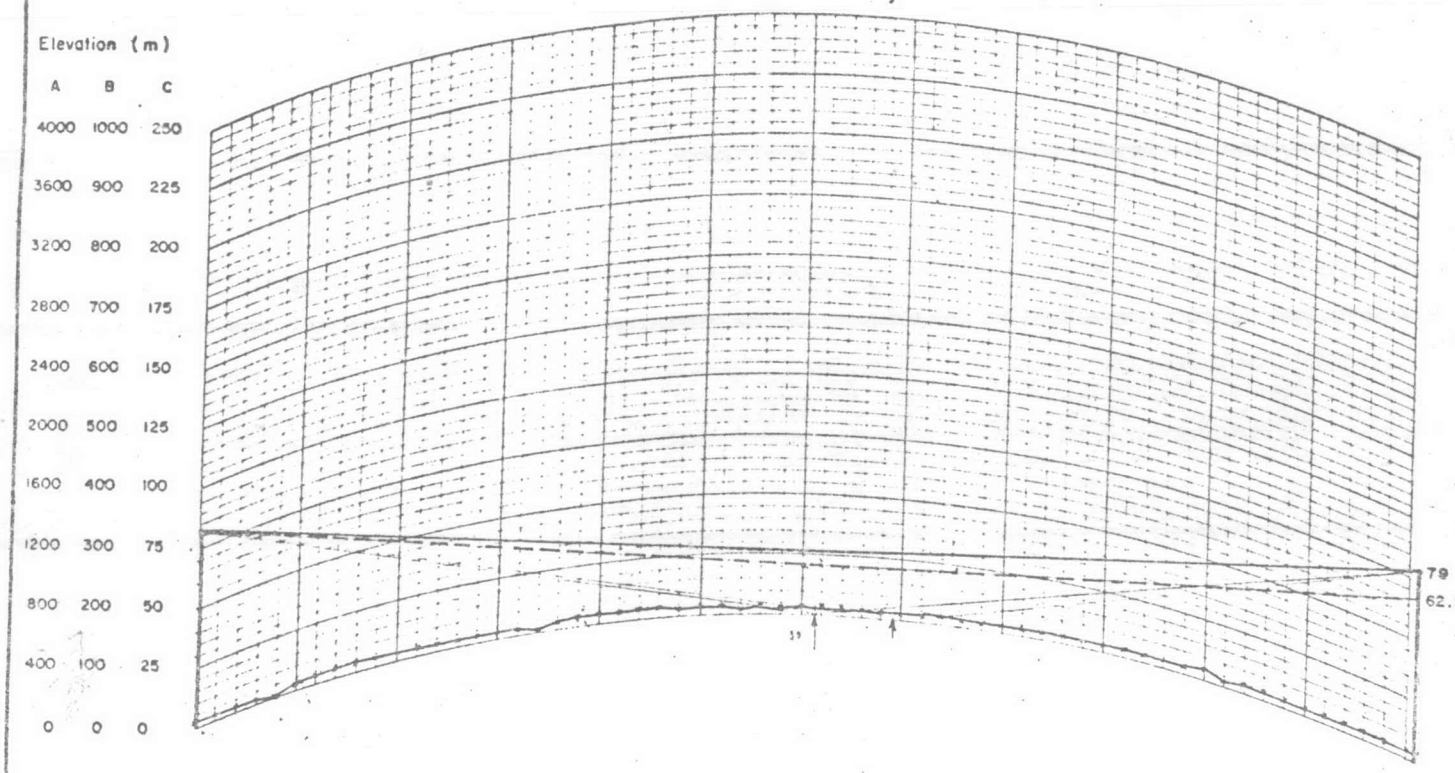
Reliability

Fig. 87.
Path profile of K = 1.6 showing the designning - antenna height of the microwave route from Bangkok to Chachoengsao.

Path Profile & Path calculation	
From Bangkok	
To Cha Choeng Sao	
Engineer	Date

A3

Path Profile K = 4/3



Station Bangkok
Location Latitude 13° 45′ 26″ N
Longitude 100° 30′ 58″ E
Azimuth 99° N ——→
Altitude 2 m.(MSL)
Antenna height 80 m.
Feeder Length m.
loss dB

Center Frequency MHz
Distance full scale
A = 240 Km
B = 120 Km
C = 60 Km

Total path length 60.5 Km.

Station Cha Choeng Sao
Location Latitude 13° 40′ 44″ N
Longitude 101° 04′ 16″ E
Azimuth 278° N ←——
Altitude 2 m.(MSL)
Antenna height 79 m
Feeder Length m.
loss dB

Path Calculation

Minimum Relative Clearance of 1st Fresnel Zone 25.43 m
Reflection point 30.88 km from Bangkok

Free space loss	145.2	dB
Feeder loss	4.8 / 4.74	dB
Path loss	154.74	dB
Antenna gain	36.6 / 36.6	dB
Obstruction loss		dB
Net loss		dB

Highest frequency of Baseband	kHz
RMS Frequency Deviation	kHz
System Figure merit	dB
Signal / Thermal Noise	dBm
Thermal noise Power	pWop
Intermodulation noise	pWop
Interference noise	pWop
Total noise Power	pWop

Fading Margin (to practical threshold) dB

Reliability

Fig. 88.
Path profile of K = 4/3 showing the designning - antenna height of the - microwave route from Bangkok to Chachoengsao.

Path Profile & Path calculation	
From Bangkok	
To Cha Choeng Sao	
Engineer	Date

A3

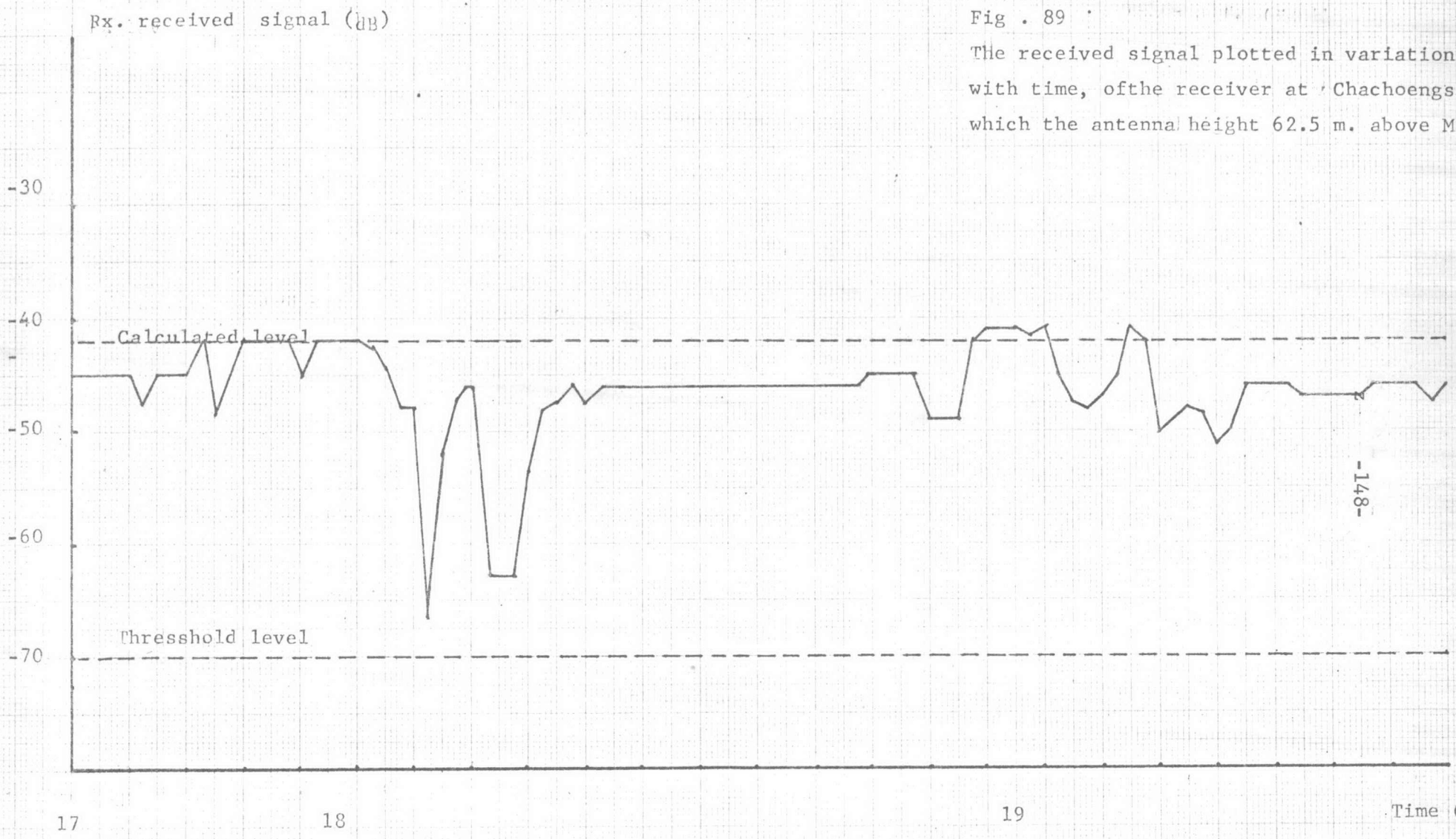


Fig . 89

The received signal plotted in variation with time, ofthe receiver at Chachoengsao which the antenna height 62.5 m. above MSL

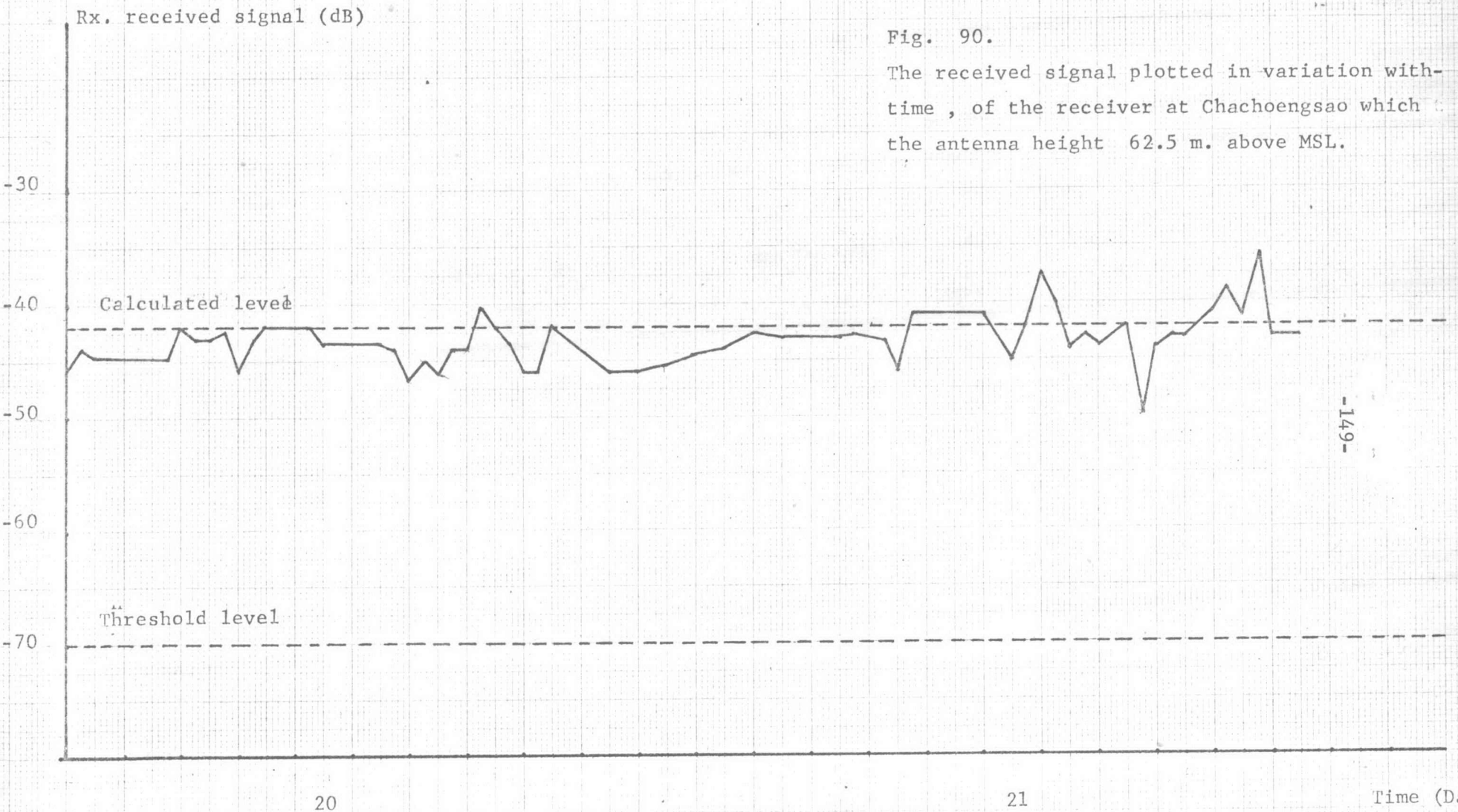


Fig. 90.
The received signal plotted in variation with-time , of the receiver at Chachoengsao which the antenna height 62.5 m. above MSL.

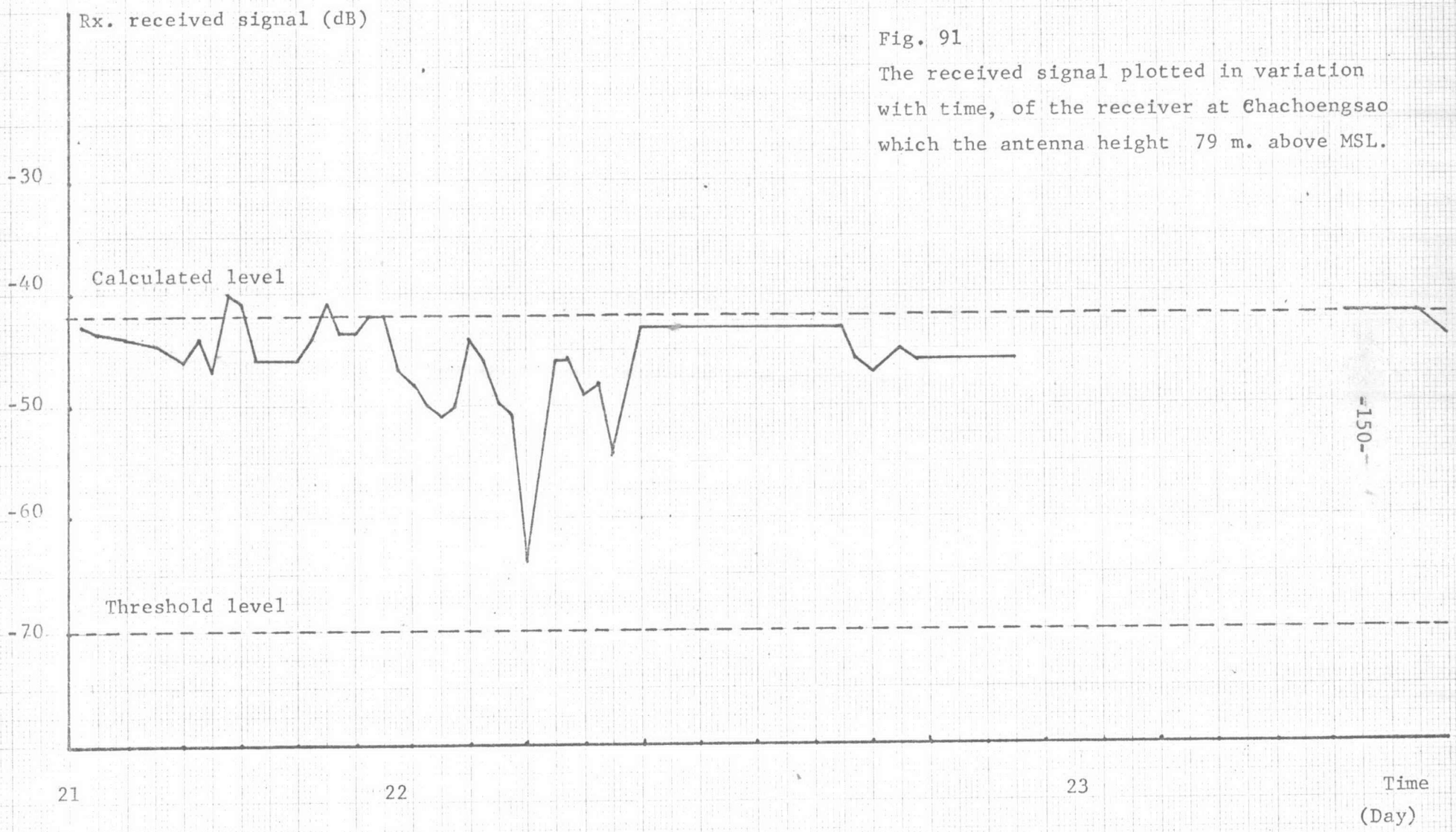


Fig. 91
The received signal plotted in variation with time, of the receiver at Chachoengsao which the antenna height 79 m. above MSL.

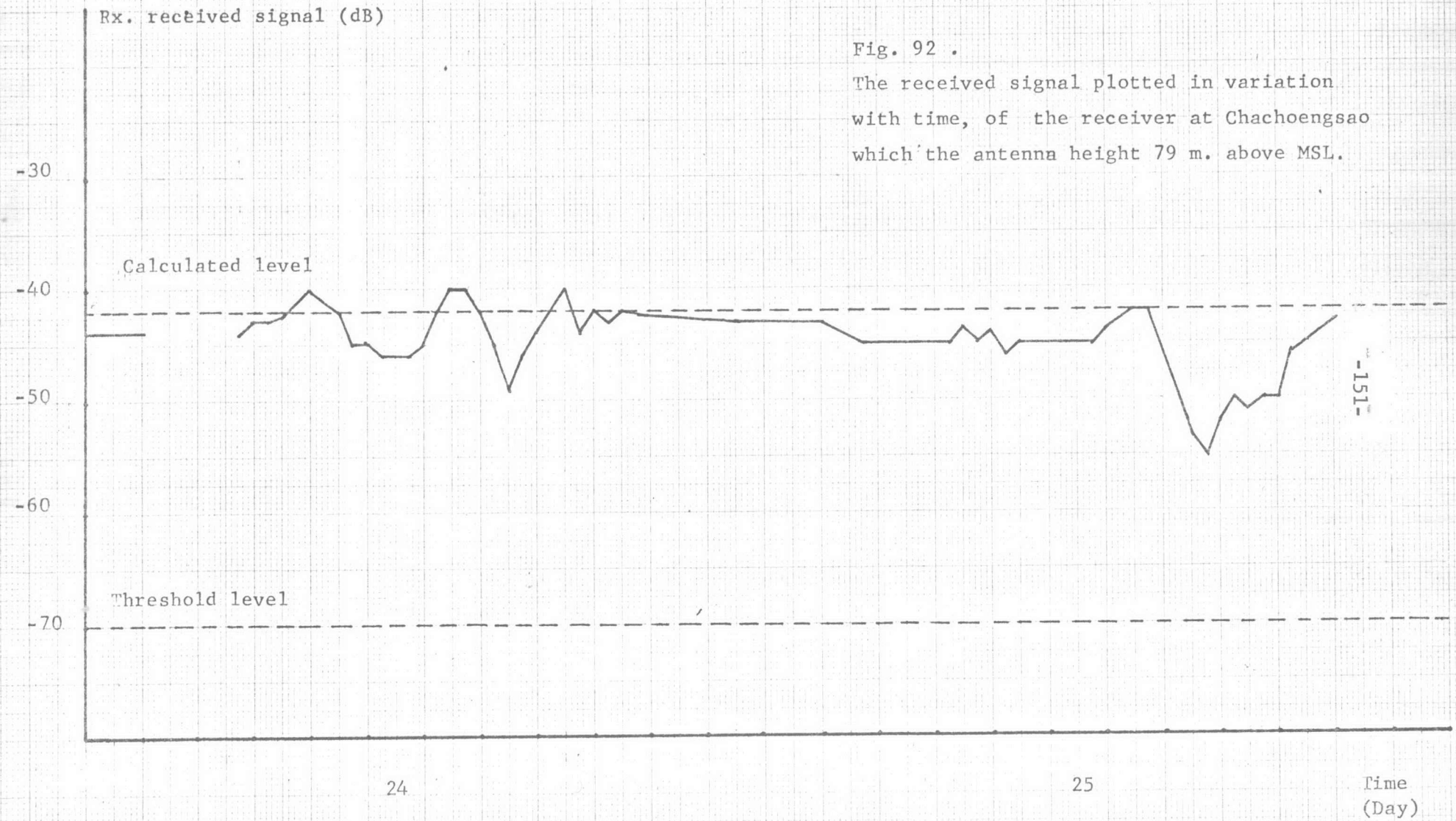


Fig. 92 .
The received signal plotted in variation with time, of the receiver at Chachoengsao which the antenna height 79 m. above MSL.