Chapter 9

MICROWAVE

The term microwave frequency is very commonly used for those wavelengths measured in centimeters, roughty from 1,000 MHz upward in frequency (30-cm wavelength and shorter) and usually including the range of millimeter wavelonghts. It is clear that the microwave ranges provide potentially tramendeous bandwidths compared with thelower frequency ranges, but thepropagation characteristics are special and have so forlimited the usefullness to special services.

The effects that mentioned above is very important in microwave communication, especially for the telemetering and supervisory control system which use microwave as the main medium. The control signals which are in the form of pulse codes may be disturbed by " fading "

Fading of Microwave signals is of 4 types.

(1) Obstruction fading : The rays are bent upward so that the rays reaching receiver may be partially blocked. This is called " Earth bulging "

(2) Multipath fading : The signal at the receiver is the sum of the direcr ray plus are or more indirect rays. The indirect rays arrive via atmospheric paths above or below the direct signal; these paths change in lenght because

of random changes in that air layers through which they travel. The rays adding to the direct signal and those subtracting from it will change constantly. Hence the net signal will fade rapidly (this fading will be much worse if "earth bulging" reflections have already depressed the signal)

(3) Reflection fading (or Fresnel-zone fading) so-called because the reflected ray cancels the direct ray. It occurs whenever the path clearance

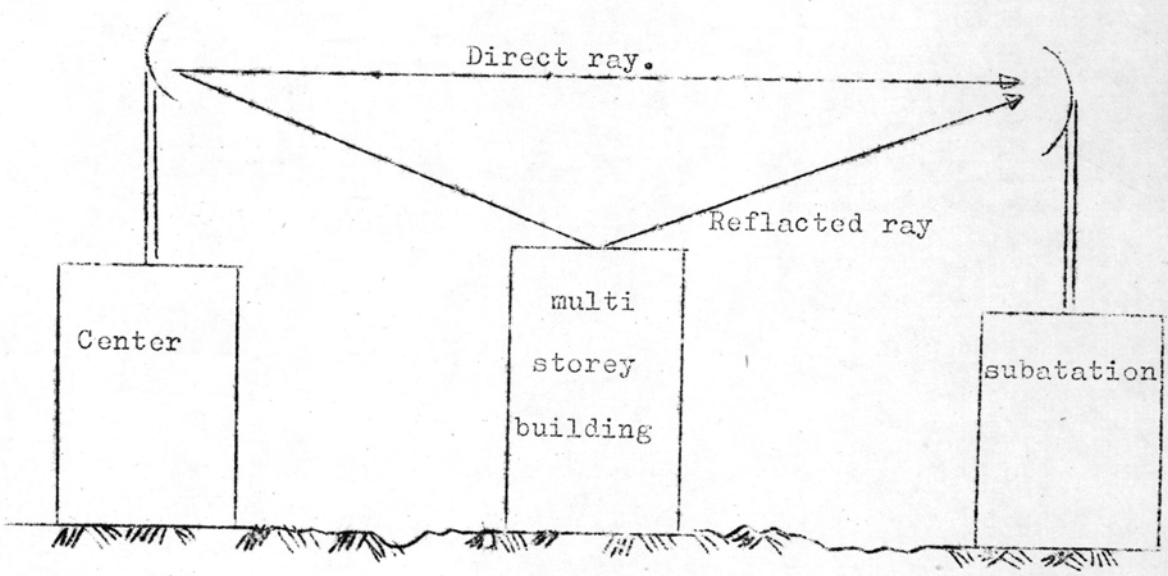

Fig. 20

The reflection fading.

equals, or is closed to, an even-zone radius. This fading is the great problem for the Microwave communication in the

city area, especially in the MEA. power transmission zone. In the cities of Bangkok and Thanburi there are many multi-storey buildings which can cause the blocking of the microwave signals.

The substations of MEA. that are settled among the multi-storey buildings are.

1. Mahamek.
2. Phrakanong.
3. Lumpini.
4. Sapandam.
5. Makasan.
6. Watlieb.
7. Patumwan.

These substations may be affected by reflection fading because of the locations they are settled. To eliminate this effect the anternas of transmitter and receiver must be high enough in order to be clear of the obstruction but the construction of multi-storey buildings are so many that the height of the antennas now will be abstructed by the buildings in the very future. This causes rebuilding of the structrues of the antennas and a lot of money must be paid.

(4) Rain fading is caused by absorbtion and scattering of the microwave beam by water vapor and rain;

Table 4

The measurement of Precipitation.

Month.	Precipitation mm.
January	9.7
February	28.36
March	44.32
April	116.11
May	301.65
June	283.32
July	233.38
August	117.97
September	277.67
October	118.37
November	1.08
December	116.38

9.1 Surface Weather Observations of AIT. Bangkok

Table 4 shows the amount of rain in each month of the year 2514. The measurments was done at the Asian Institute oftechrology ofin Bangkok. This may be accepted as the rain data for the Metropolitan area. The data shows the highest of the rain measured in May which is equal to 301.65 milimeteros. This amount of rain may cause the rain faiding seriously only at frequencies of 10,000 MHs and up, SO, this effect may be eliminated easily by using microwave at the frequency not more than 10,000 MHs, In ordinary microwave communication, the frequencies range from 4000 MHs to 11,000 MHs, if we use the frequencies from 4000 MHs to 9000 MHs, the rain faiding will be so less effect that we need not account it.

There are a lot of signed channels in microwave transmission, become the higher this frequency, the preater the greater the band width that can conveniently be obtained for the channels and the smaller the antennas for a given antenna gain but the poorer the efficiency and reliability of the available amplifiers.

9.2 Disadvantages.

The disadvantages of the Microwave in MEA. control system are.

1. The microwave communication is suit only to the chain transmission or point - to - point transmission, not the radial- type communication of the MEA. system.

2. The cost of installation is very expensive, the price of paraboloid antenna and microwave set are too high (about 1,200,000 Baht per substation)

3. The Microwave transmission is not suit in the urban area, because of obstacles such as multi - storey building etc. The severity of this effect will be increased because of construction of multi -storey building in the future.