PROBLEM IN PROPAGATION ON THAI TELEVISION RECEPTED IN LAOS

K. Southysombath, P. Indarack*, P. Chantamaly*, M. Mangnomek*, S. Ikeda***
W. Phromphanich#, S. Choomchuay#,##, Y. Nakajima§ and Y. Moriya§

* Faculty of Engineering and Architecture
National University of Laos
Sokpaluang Rd. Vientaine, Lao PDR., P.O. Box 3166
Phone: (+856) 21 312198, Fax: (+856) 21 314382

** JICA Laos Office, Sisangvone Rd., Vientiane, Lao PDR.

Faculty of Engineering
Research Center for Communications and Information Technology (ReCCIT)
King Mongkut's Institute of Technology Ladkrabang
Chalongkrung Road, Ladkrabang, Bangoko 10520, Thailand
Phone: (+66) 2 326 9969, Fax: (+66) 2 326 9965
Email: kchsomsa@kmitl.ac.th

§ Department of Electrical Engineering, Tokai University
117 Kitakaname, Hiratsuka, Kanakawa 259-1292, Japan
Phone: (+81) 463 581211, Fax: (+81) 463 588320

ABSTRACT

This paper outlines the observation of Thai television reception performance. The results of this research indicate that the field strength of the transmission in the propagation path examined is influenced by the ***K*** value at the geographical point of 51 km from the transmission station. Topography is also the primary factor responsible for the propagation instability of Thai Television broadcasting reception in Vientiane.

1. INTRODUCTION

Vientiane is one of many municipalities located along the Mekong River in Laos. The Mekong River forms part of the border between Laos and Thailand. Television broadcasting from neighboring Thailand can be received in Laos, and many families actually watch Thai television because the broadcasting systems is the same as that in Laos and the languages are similar. Thai television can be picked up using on the market multi-element antenna (Yagi Antenna).

In this research, from the National University of Laos (NUOL), Faculty of Engineering and Architecture (FEA), the television broadcast signal from Thailand was monitored over a long period. According to the data recorder, it was found that there is a regular diurnal variation of propagation mode.

1) At night, the signal strength increases to a maximum at midnight.
2) From 9 am, the signal strength starts to decline rapidly, thereafter fluctuating at low levels throughout the day.

As well known, the diurnal variation of signal appeared. In order to examine the atmospheric effects responsible for this variation,

A receiver was set up and measured near the Mekong river in an area surrounded by rice fields.

The large amounts of water evaporated in such areas is expected to alter the atmospheric refractive index.

In this experiment, the signal level of a line-of-sight transmission fluctuated by 20dB or more over the cause of a day. In the daytime, the effect of the effective radius of the earth is reduced, and the propagation path moved into the diffraction region. The received signal level remains relatively stable during the day at a lower level than at night.

Following this analysis, the authors analyzed the factors contributing to the diurnal variation in received field strength.

2. PRESENT STATE OF TELEVISION BROADCASTING RECEPTION IN LAOS

The construction of a low power repeater in 1982 represented the inauguration of broadcasting network has increased to 21 (as of 2000), all of which are government operated. The network currently covers 30% of total land are of Laos, and 60% more or less of the population watch national television broadcasting. Content is transmitted digitally to local TV stations from Vientiane via the THAICOM 1A satellite. Local content makes up approximately 10% of the daily content for each local station.

There are two nationwide broadcasting channels and one French-language channel specifically provided for Vientiane citizens.

Identical television channels are broadcast in the regions of Laos and Thailand along the Mekong river. Laos uses even-numbered channels and Thailand uses odd numbers. The television standards of both countries is 625/50 PAL, and each channel occupies 7 MHz of bandwidth. As an exception, even numbers are used for 12 channels in Savannakhet, southern Laos.

The Thai television broadcasting stations a number of entertainment programs which are commonly watched in Laos. In Vientiane, people can not watch clearly with the lower channel due to the signal level are too low. In contrast, the high channels can be watched clearly using a high-gain antenna. However, it is necessary to adjust the antenna azimuth when changing its direction from Laotian to Thai sources.

Some research at the National University of Laos have studied the relative in-band signaling levels using a spectrum analyzer. Figure 1 illustrates the spectrum for Thai broadcast television in the frequency range 210 to 230 MHz. The receiving antenna was set in the direction of the Channel 9 relaying station, the signal received for Channel 11 was weak in this orientation.

3. OBSERVATIONS

In this research, on the market (Yagi Antenna) was used, and mounted at the height of 25m on a 30-m steel tower inside the campus of the Engineering and Architecture in the NUOL which located in the center of Vientiane. The antenna gain was about 6dB at 230 MHz. The equipment employed include a field strength meter (Anritsu ML-518A), a spectrum analyzer (Advantest R-3131), and a data recorder (Yokogawa Electric Corporation). The recording chart speed was set to 6cm/h, and the 5-min average was recorded numerically. Data was recorded over a period from August to October, 2000.

The receiving signal was set at 229.75 MHz, assigned to Thai channel 3 and transmitted from Udon-Thani. The specifications of the transmitting antenna are as follows.

Location	Latitude : N 17 13' 46"
	Longitude : E 102 29' 14"
	Height : 440 m
Supporting Tower	Type : Self-Supporting
	Height : 80 m

The receiving antenna was mounted at a height of 25 m on the tower, corresponding to 166 m above mean sea level.

Figure 2 shows the propagation path, this path passes near the Mekong river in the neighborhood of the reception point, and crosses the river three times. The receiving signal reflected from the surface of Mekong river will interfere with the line-of-sight signal depending on the water level. This interference is expected to affect the strength of the field at any given point. A 200m high hill of 51km from the transmission point is considered causing these local effects, while the flat areas and rice fields around the receiver and urban area will have little effect. From this analysis, the broadcast signal is received as a line-of-sight transmission, and may affected by intrusion into the narrow Fresnel zone.

Figure 3 shows the average water level of the Mekong river between September and October, 1996.

The water level of the Mekong river changes tremendously. The reflected signal wave from the water surface will severely weaken the broadcast signal at points of destructive interference. The exact location of which vary according to the water level. It seems that Vientiane City will be affected by such apparently intermittent destructive interference at times.

Figure 4 illustrates the diurnal variation of the field strength recorded on the 18th, 25th and 26th of September, and the 3rd of October. The received signal level began to decline from 9 AM on every day except for September 25th. A similar diurnal pattern of decreasing temperature and increasing humidity by 5 PM was observed on all days. The received signal level increased again at night. The signal remained low yet steady during the day.

Figure 5 shows the probability distribution of the field strength at the reception point for hourly received signal level data taken over the entire research period. The field strength was normalized by setting 50% of the signal level between 8 AM and 9AM as 0dB. The 50% value of the signal level in the distribution at 12 PM noon was approximately 8dB less than that at 12 AM, representing the variation within the range 1 to 99%. In contrast, the signal level fluctuated by more than 20dB at 2 AM.

4. CONSIDERATIONS

Specific types of meteorological data are required in order to analyze the tropospheric propagation characteristics. Regular data is not particularly useful. Such data is necessary to analyze the propagation path.

In this research, the findings of many theses were referred in order to reach the conclusion. We focused primarily on clarifying the reasons why the signal level fluctuates so dramatically given that the broadcast transmission should follow a line-of-sight propagation path.

The propagation distance of 80 Km is comparatively long. The longer the distance, the more the signal level is affected by atmospheric factors. The reduction in field strength at 9 AM is thought to be associated with the drop in ***K*** (coefficient of effective radius of the earth) down to nearly 1 from the standard value of 4/3. The signal level is also expected to drop at this time due to Fresnel zone effects as result of the lower transmission path. The atmospheric temperature at the surface rises as the sun heats up the earth, increasing in proportion to the altitude of the sun. The high humidity in Laos does not influence ΔN or Δh significantly, but reduces ***K***.

The geographical point of 51 km from the transmission point is elevate approximately 200m above mean sea level, the first Fresnel zone radius is not enough for clearance in radio wave pass way. Thus, K variations always trigger variations in received signal level. The propagation path follows a over horizon propagation when ***K*** drops below 4/3, and the received signal level drops to stable low level, representing detection of the diffracted wave. The atmospheric state at the 51 km point also shift in the interference with the reflected wave from the Mekong river.

A marked signal level reduction was occasionally observed just before dawn, as shown in the probability distribution of field strength (Fig. 5). The mountain height rising to 2000 m is located about 100 km north of Vientiane. Cold air from the mountains occasionally forms an atmospheric duct, and ducting was most frequently observed in the morning.

Within 51 km of the transmission source, the line-of-sight propagation path is unobstructed and is relatively unaffected by interference and diurnal variations, as indicated by the stability of the signal strength during over horizon propagation.

The results of this research indicate that the field strength in the propagation path examined is primarily influenced by the ***K*** value at the geographical point of 51 km from the transmission source.

5. CONCLUSIONS

Geographical features is the primary factor responsible for the state of propagation instability of Thai Television broadcasting reception in Vientiane, the capital city of Laos.

REFERENCES

[1] Ministry of Agriculture and Forestry, Dept. of Meteorology and Hydrology "Water resource Guide Book on Lao P.D.R", JICA, June 1999.

[2] JTEC, "Telecommunication Investigation Report on Lao P.D.R ", March 2000.

[3] K. Southisombath, K. Chanthavong, S. Mangnomek, S.Ikeda and Y.Moriya, "The some problem of Meteorological Characteristics and Communication Reception System at Laos", 2000 APSBC, pp 284-287.

[4] Hristo D. H. "Fresnel zones in wireless links, Zone Plate Lense and Antennas" A.H, 2000.

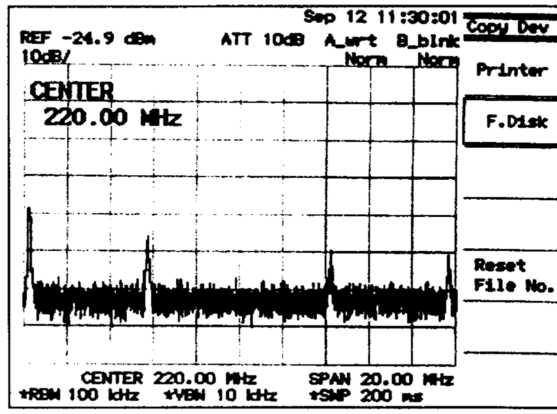

Figure 1 Spectrum of Thai television in the frequency range 210 to 230 MHz

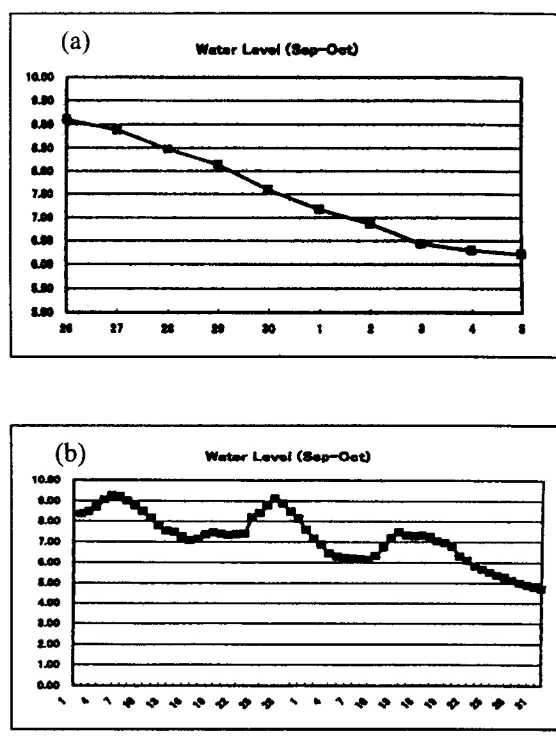

Figure 3 (a), (b) Water level change of Mekhong river observed in Vientiane

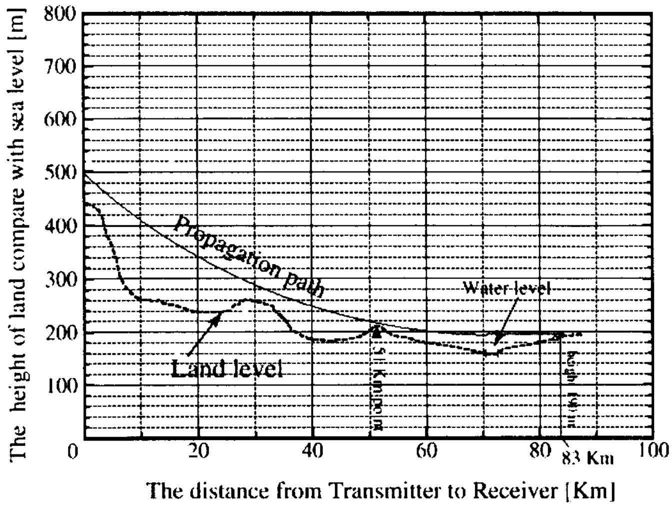

Figure 2 The profile of propagation path

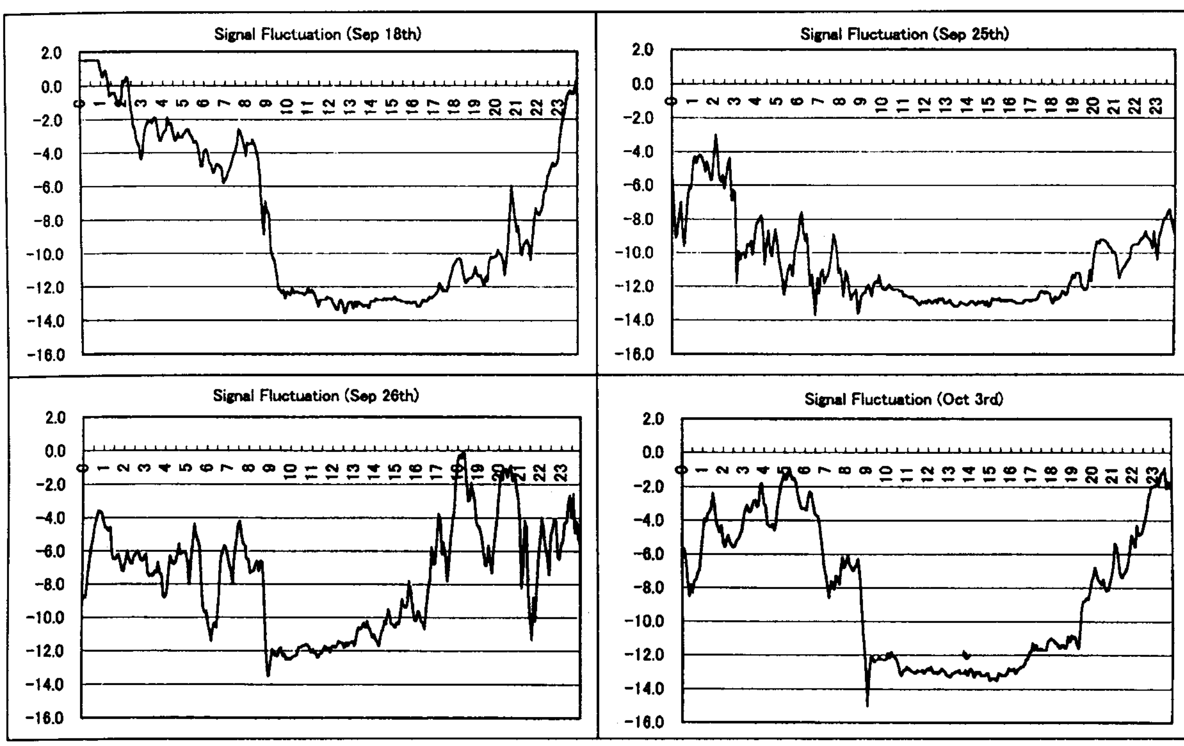

Figure 4 Diurnal variation characteristics

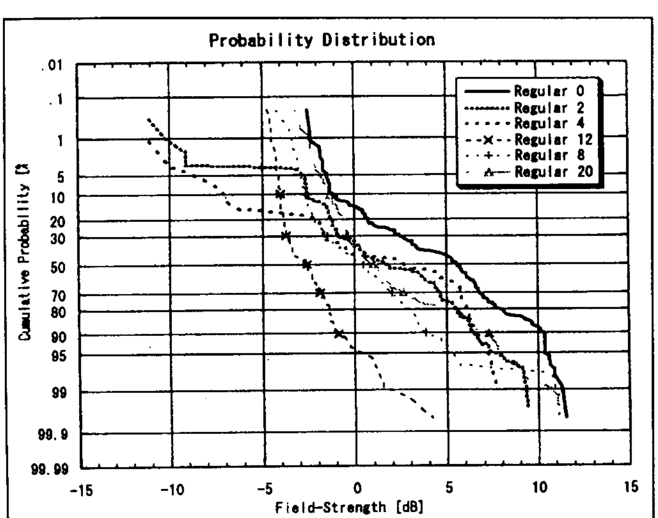

Figure 5 Probability distribution characteristics