CHAPTER IV

RESULTS AND DISCUSSION

From fig. 15 and 16, it is found that the field patterns obtained from the experiments are in good agreement with those obtained from theory. And the field patterns of a hollow cylindrical antenna are nearly the same as those of a thin **cylindrical** antenna. The only difference is the field patterns of a hollow cylindrical antenna are a little smaller beamwidth than those of a thin cylindrical antenna.

From the derived expressions, equations (96) and (100)

$$E_\theta = \frac{j30\pi I_o(4-\beta^2a^2\operatorname{cosec}^2\theta)\left[\cos(\beta l\cos\theta)-\cos\beta l\right]e^{j(wt-\beta r)}}{r\sin\theta} \qquad (96)$$

$$H_\phi = \frac{jI_o(4-\beta^2a^2\operatorname{cosec}^2\theta)\left[\cos(\beta l\cos\theta)-\cos\beta l\right]e^{j(wt-\beta r)}}{4r\sin\theta} \qquad (100)$$

It is seen that the field patterns are independent of the radius a, and when the radius a is very small and for θ greater than 5°, $4 \gg \beta^2a^2\operatorname{cosec}^2\theta$. Then equations (96) and (100) become

$$E_\theta = \frac{j120\pi I_o\left[\cos(\beta l\cos\theta)-\cos\beta l\right]e^{j(wt-\beta r)}}{r\sin\theta} \qquad (137)$$

$$H_\phi = \frac{jI_o\left[\cos(\beta l\cos\theta)-\cos\beta l\right]e^{j(wt-\beta r)}}{r\sin\theta} \qquad (138)$$

It is found that equations (137) and (138) are similar to equations (5-81) and (5-80) (equations for a thin linear antenna) which were developed by J.D. Kraus (6) respectively.

Then, it might be conclude that the field expressions derived are satisfy for a hollow cylindrical antenna of any diameter. And the sinusoidal current distribution along a hollow cylindrical antenna is a good assumption.

Let us consider equations (52) and (60)

$$E_\theta = \frac{j30\pi I_o(4-\beta^2a^2\text{cosec}^2\theta)\tan\theta\sin(\beta l\cos\theta)\ e^{j(wt-\beta r)}}{r} \qquad (52)$$

$$H_\phi = \frac{jI_o(4-\beta^2a^2\text{cosec}^2\theta)\tan\theta\sin(\beta l\cos\theta)\ e^{j(wt-\beta r)}}{4r} \qquad (60)$$

For very small radius a and small l (very short antenna) equations(52) and (63) become

$$E_\theta = \frac{j120\pi I_o\beta l\sin\theta e^{j(wt-\beta r)}}{r}$$

$$= \frac{jI_o wl\sin\theta e^{j(wt-\beta r)}}{\epsilon c^2 r} \qquad (139)$$

$$H_\phi = \frac{jI_o\beta l\sin\theta e^{j(wt-\beta r)}}{r}$$

$$= \frac{jwI_o l\sin\theta e^{j(wt-\beta r)}}{cr} \qquad (140)$$

It is found that equations(139) and (140) are similar to equations(5-34) and (5-35) (equations for a short dipole antenna) developed by J.D. Kraus, (6) respectively.

This shows that the derived expressions for a hollow cylindrical antenna with uniform current distribution assumed along the antenna is also satisfy.

From the experimental results, fig. 13 and 14, the field patterns are not exactly symmetrical. This is greatly due to the reflection of the fields from the surrounding where the experiments are performed, and the hollow cylindrical antenna itself is not exactly symmetrical, and due to personal error in reading values from degree indicator and from field strength meter. A problem in performing the radiation field measurements is the interference of undesired fields from broad casting and from other communications in Bangkok. To avoid this problem, the radiation field measurements are performed after midnight through daybreak when the broadcasting and most communications in Bangkok are ended.

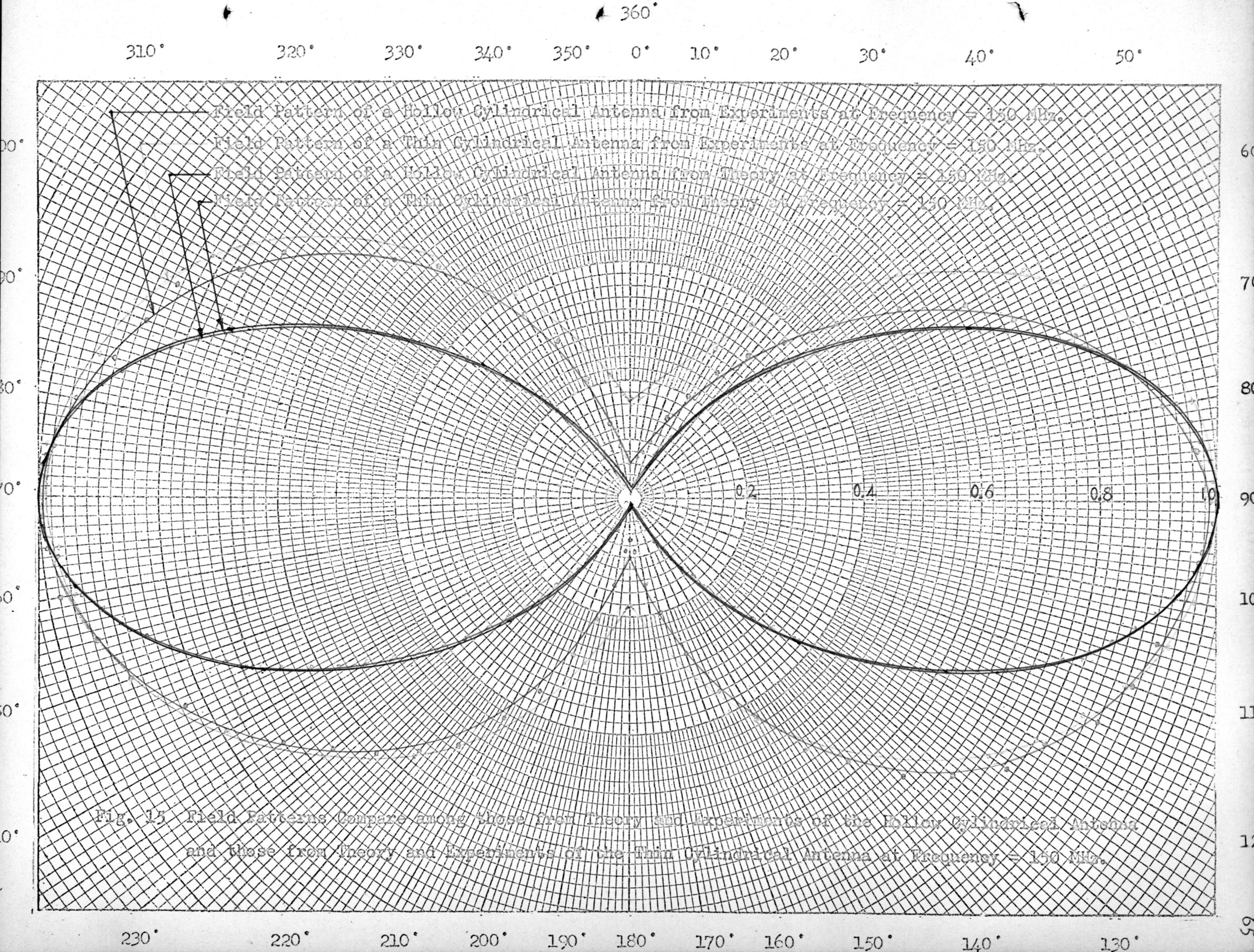

Fig. 15 Field Patterns Compare among those from Theory and Experiments of the Hollow Cylindrical Antenna and those from Theory and Experiments of the Thin Cylindrical Antenna at Frequency = 150 MHz.

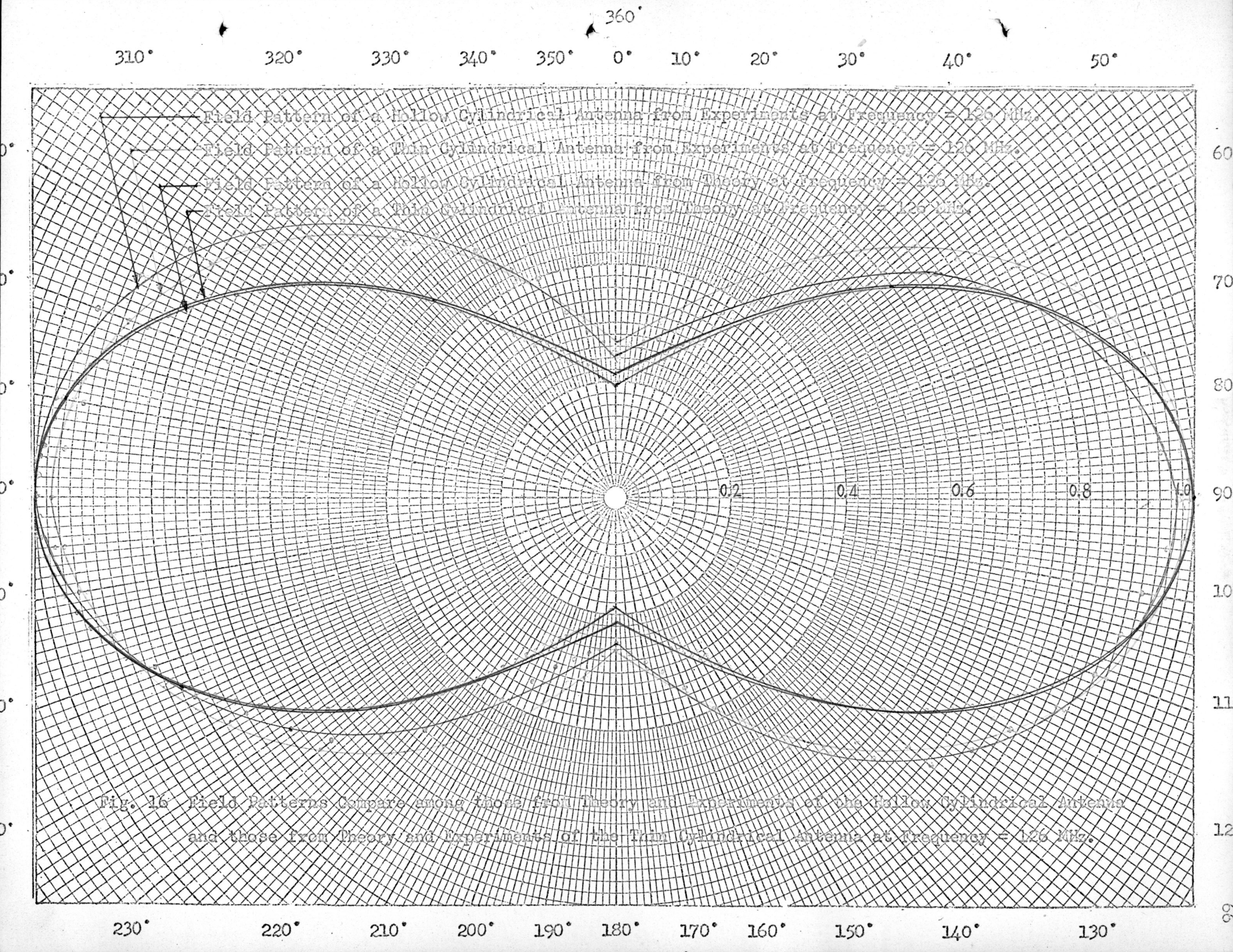

Fig. 16 Field Patterns Compare among those from Theory and Experiments of the Hollow Cylindrical Antenna and those from Theory and Experiments of the Thin Cylindrical Antenna at Frequency = 126 MHz.