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Report (National Research Council of Canada. Radio and Electrical Engineering Division : ERB), 1970-12

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RADIO AND ELECTRICAL ENGINEERING DIVISION

ANALYZED

SELECTION OF AN ANTENNA SITE FOR
A 35 - FOOT WHIP ON OSS - 509 FOR PROJECT TOBACCO

- J. Y. WONG AND G. GIBSON -

CANADA INSTITUTE FOR S.T.I.
N.R.C.C.

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ABSTRACT

The top of the aft block-support on OSS-509 has been suggested as a suitable site for a 35-foot whip for project TOBACCO. In order to assess the installation and to compare its performance with that of an HF whip located on the forward block-support a radiation pattern study was carried out on a $\frac{1}{48}$ scale model of the OSS-509.

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RADIATION PATTERNS

Aft block-support whip — patterns 1–14

Forward block-support whip — patterns 15–28

SELECTION OF AN ANTENNA SITE FOR A 35-FOOT WHIP ON OSS-509 FOR PROJECT TOBACCO

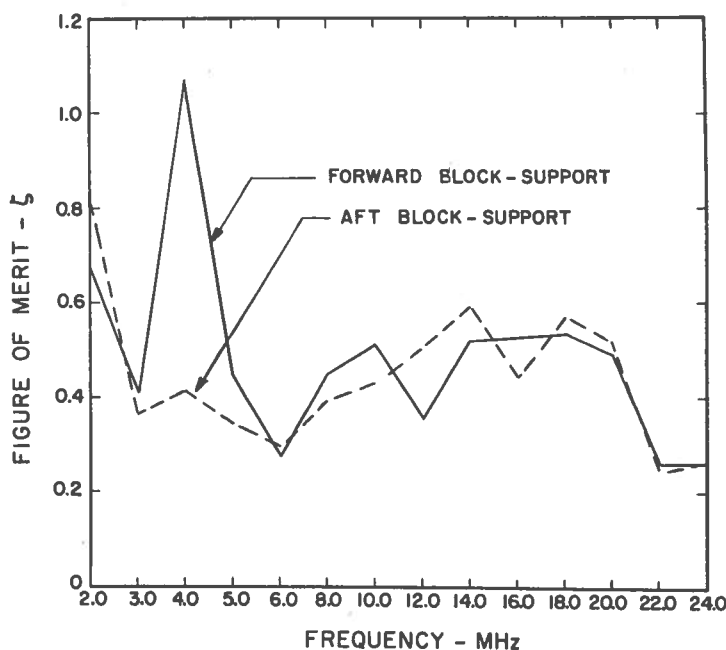
— J.Y. Wong and G. Gibson —

Introduction

The top of the aft block-support on the OSS-509 has been suggested for a proposed 35-foot whip installation for project TOBACCO. This choice seems to be a logical one since the forward block-support is already being used for an HF transmitting whip location. However, in order to evaluate the antenna and to compare its performance with that of the HF whip, a radiation pattern analysis was carried out on a $\frac{1}{48}$ scale model of the OSS-509. A photograph of the pattern model is shown in Plate I.

Measurements

Three-dimensional patterns were obtained for the whip antenna. For each frequency, both E_θ and E_ϕ components of the radiated field were measured for a 5-degree increment in the vertical angle θ , but only the principal-plane patterns, which are plotted on a relative decibel scale, are included in this report. For completeness, patterns of the HF transmitting whip are also given. To facilitate the pattern analysis, the patterns were also recorded digitally on paper tape. An IBM 360 computer was used to calculate the antenna figure of merit based on the method given in Reference 1. For each frequency the figure of merit ξ is compared with that of a $\lambda/4$ base-fed monopole which is assumed to have a value of one. The results are shown in Fig. 1.



*Figure 1 Figure of merit of 35-foot whip
mounted on top of the block-support*

At 4 MHz the figure of merit of the TOBACCO whip is 1.08 compared to 0.42 for the HF whip. If one examines the patterns, it can be seen that the azimuth pattern of the TOBACCO whip is characterized by a number of deep nulls; however, the performance of the antenna over the rest of the frequency band compares favourably with the HF whip.

Conclusions

On the basis of our model measurements, a 35-foot whip for project TOBACCO should provide satisfactory performance when mounted on the top of the aft block-support on the OSS-509.

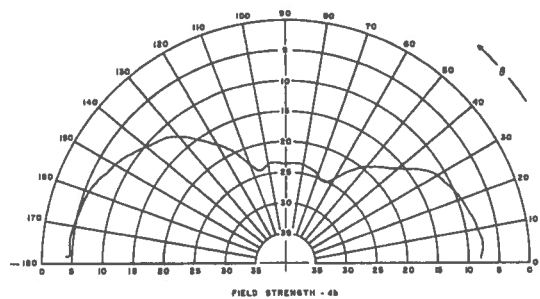
Reference

1. Wong, J.Y. An improved method for calculating the figure of merit of a non-uniform radiation pattern. NRC Report ERB-829, July 1969.

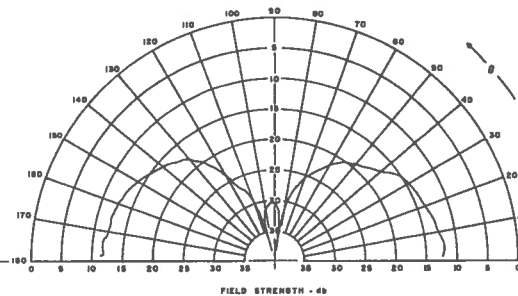
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RADIATION PATTERNS

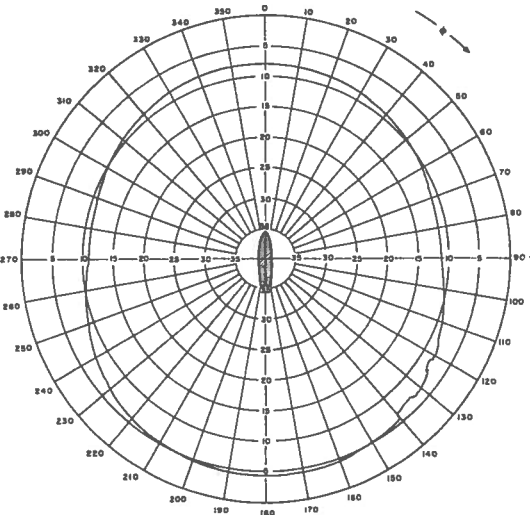
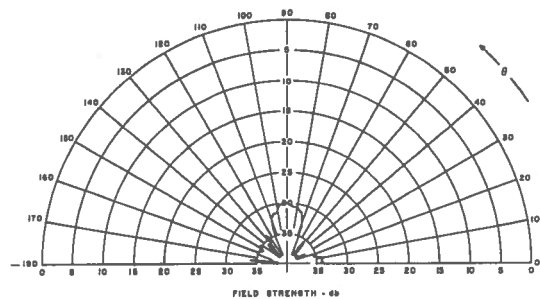
Aft block-support whip – patterns 1–14

E_{θ} 

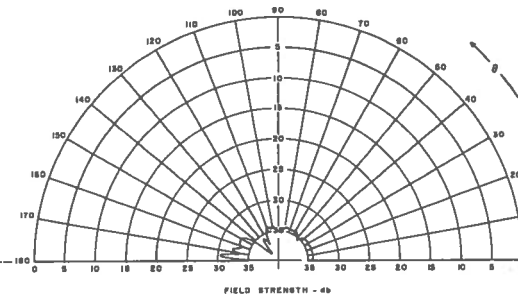
FWD-AFT



PORT-STBD

 $\theta = 0^\circ$ E_{ϕ} 

FIELD STRENGTH - dB

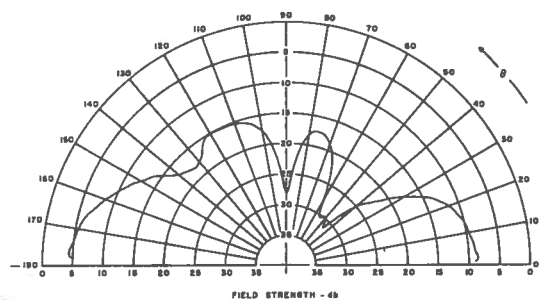


FIELD STRENGTH - dB

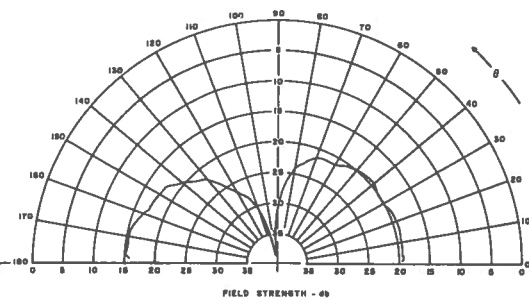
ANTENNA : AFT BLOCK - SUPPORT WHIP

FREQ. : 2 MHz

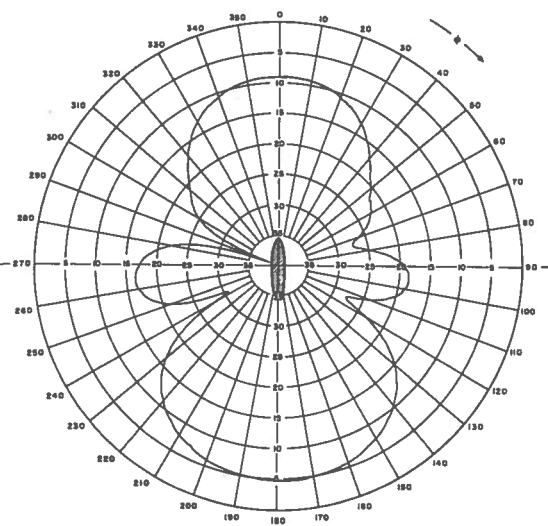
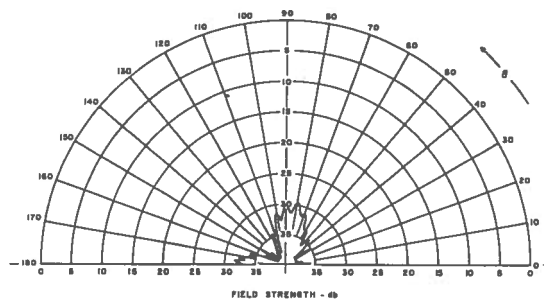
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω

E_{θ} 

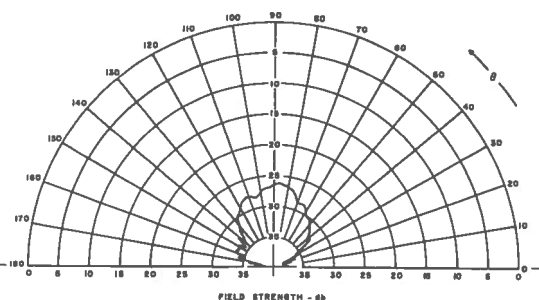
FWD-AFT



PORT-STBD

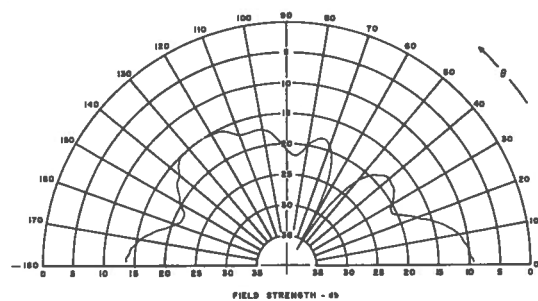
 $\theta = 0^\circ$ E_{ϕ} 

FIELD STRENGTH - dB

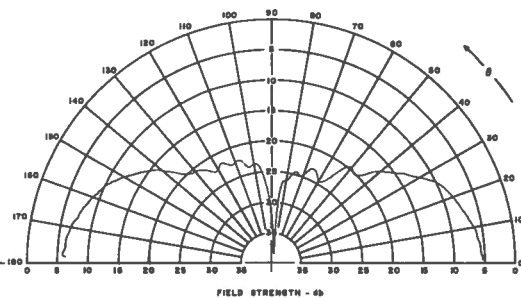


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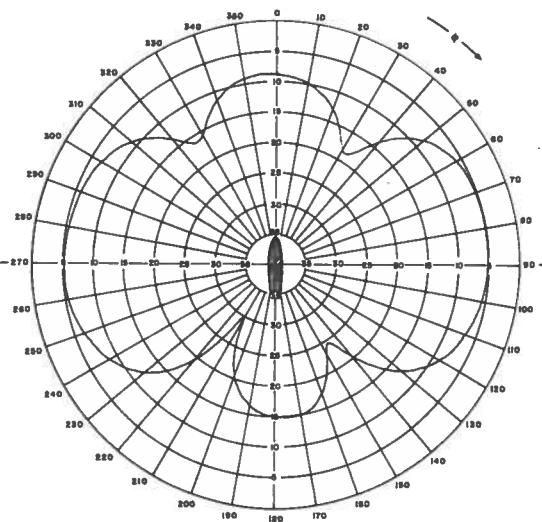
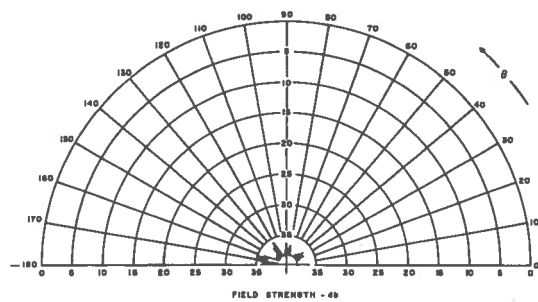
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FREQ. : 3 MHz
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω

E_{θ} 

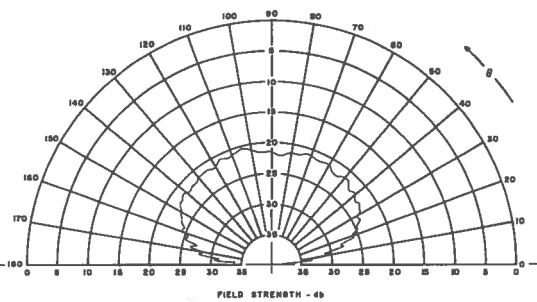
FWD-AFT



PORT-STBD

 $\theta = 0^\circ$ E_{ϕ} 

FIELD STRENGTH - dB

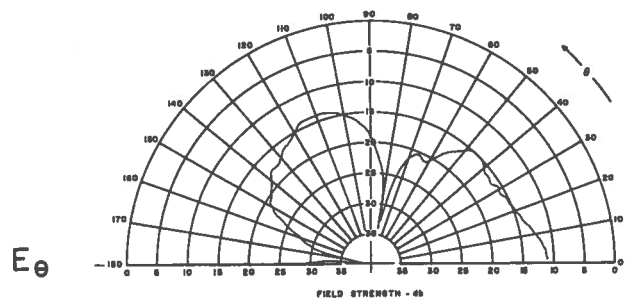


FIELD STRENGTH - dB

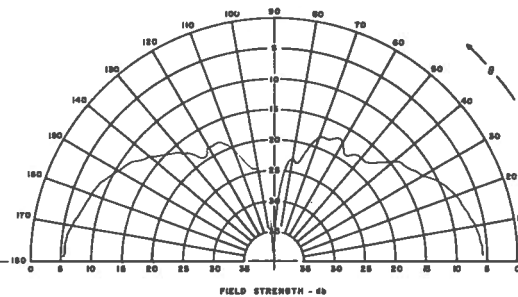
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FREQ. : 4 MHz

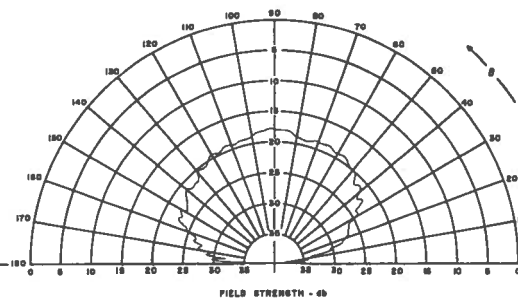
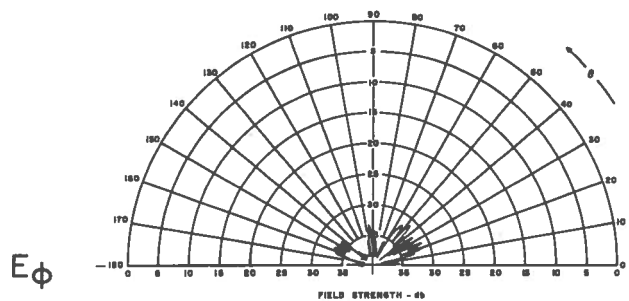
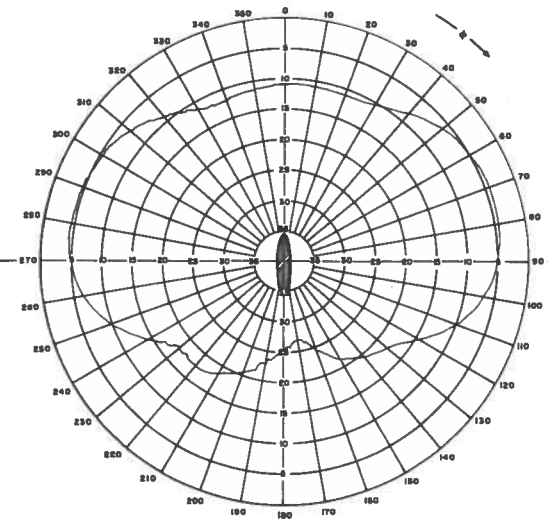
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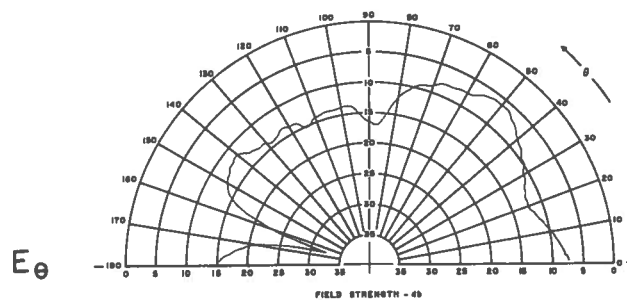
FWD-AFT



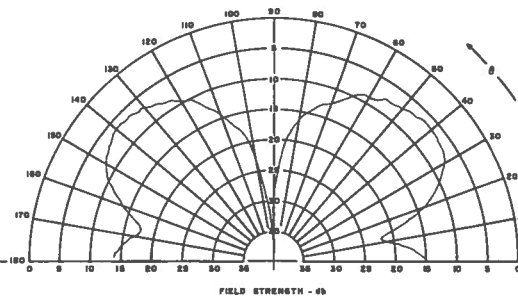
PORT-STBD



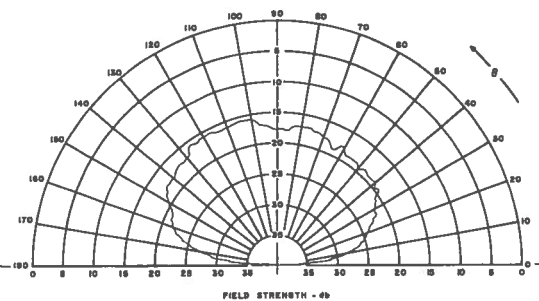
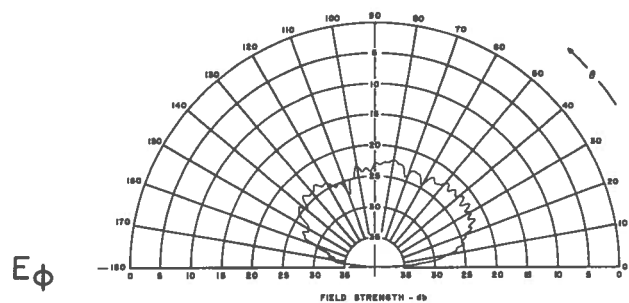
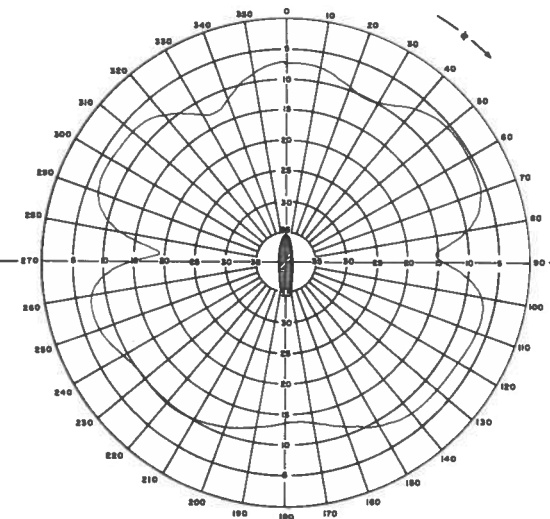
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 FREQ. : 5 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50Ω



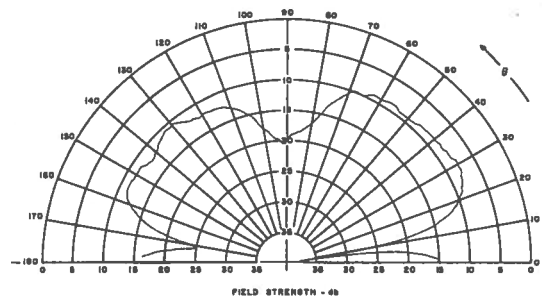
FWD-AFT



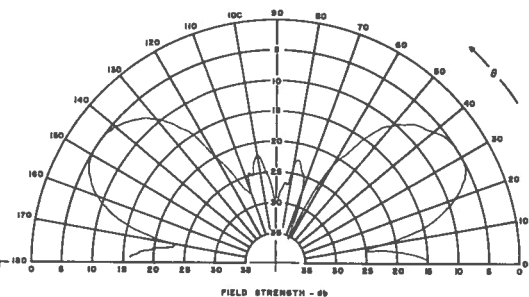
PORT-STBD



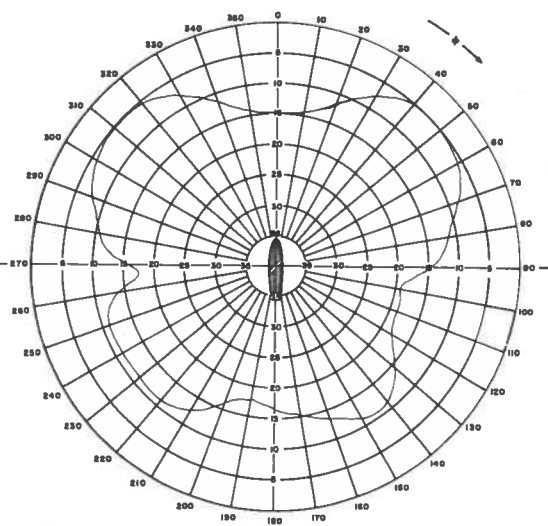
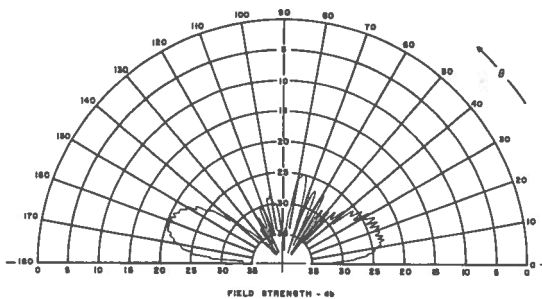
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 FREQ. : 6 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50Ω

E_{θ} 

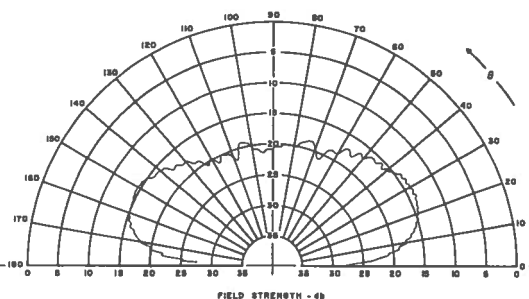
FWD-AFT



PORT-STBD

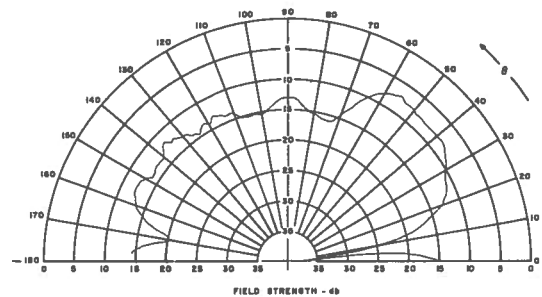
 $\theta = 0^\circ$ E_{ϕ} 

FIELD STRENGTH - dB

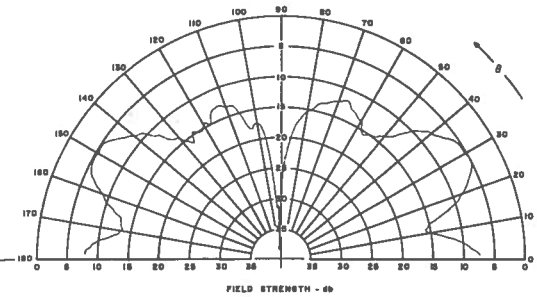


FIELD STRENGTH - dB

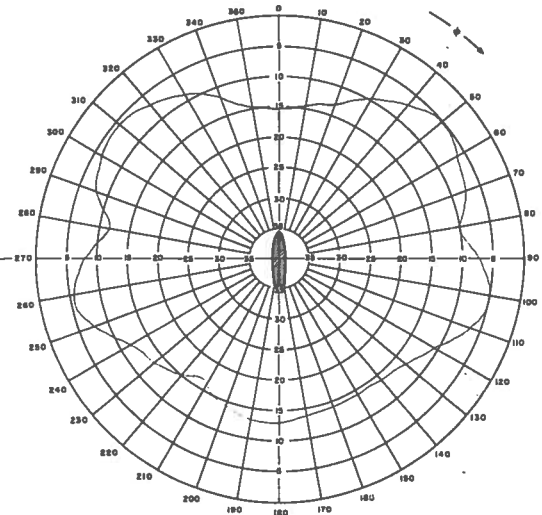
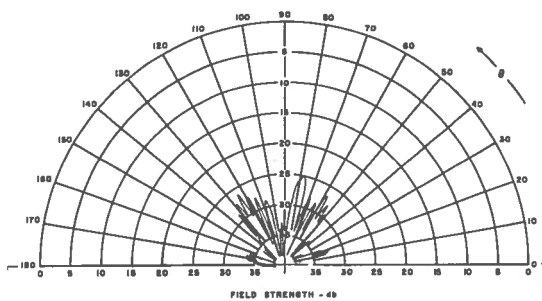
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 FREQ. : 8 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50 Ω

E_{θ} 

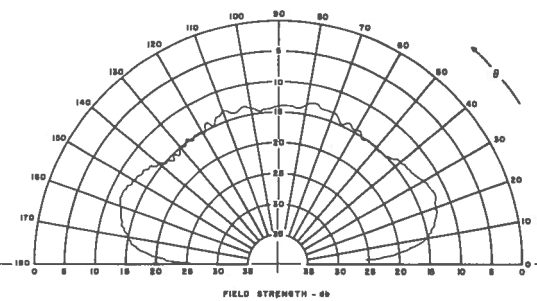
FWD-AFT



PORT-STBD

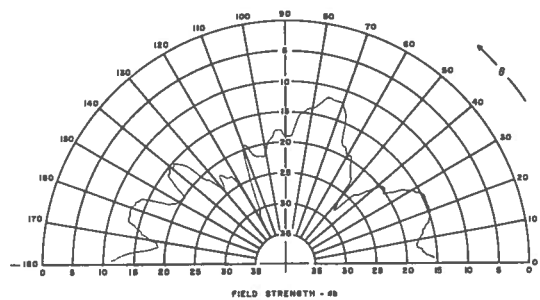
 $\theta = 0^\circ$ E_{ϕ} 

FIELD STRENGTH - dB

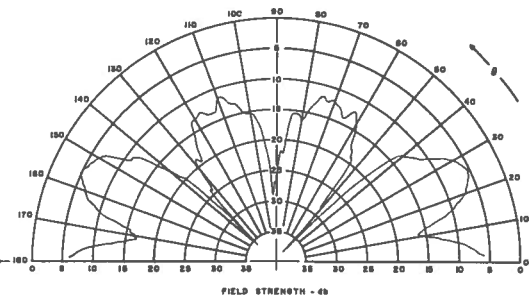


FIELD STRENGTH - dB

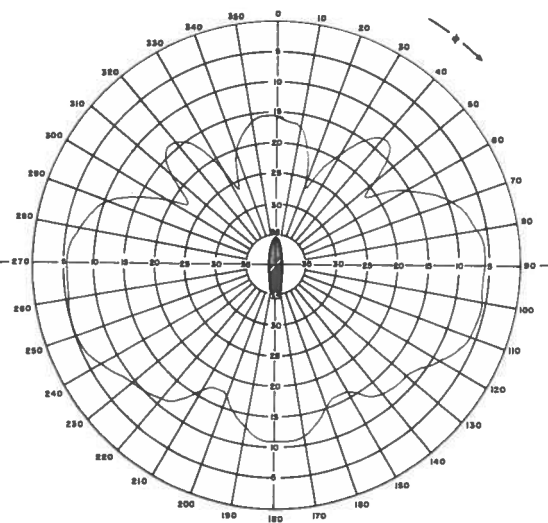
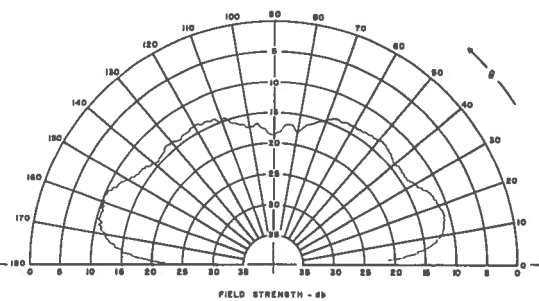
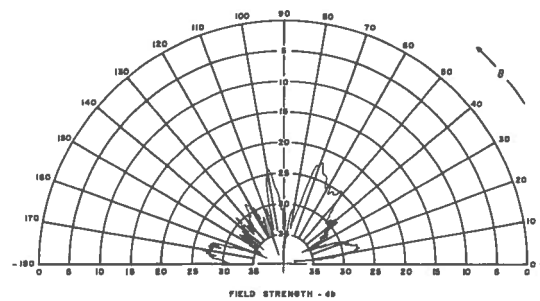
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FREQ. : 10 MHz
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω

E_{θ} 

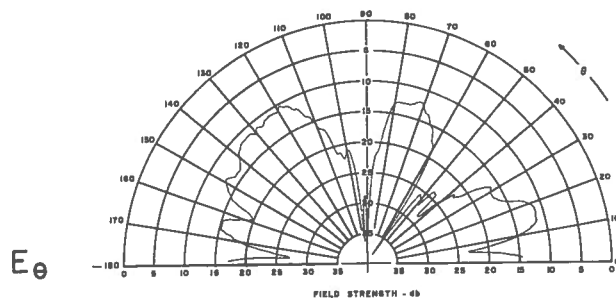
FWD-AFT



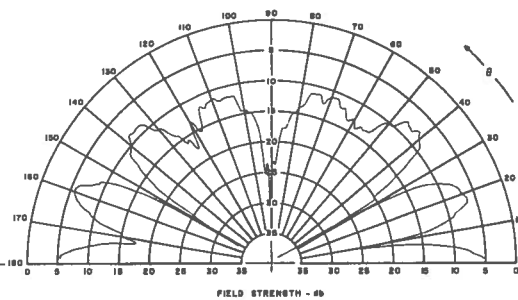
PORT-STBD

 E_{ϕ} 

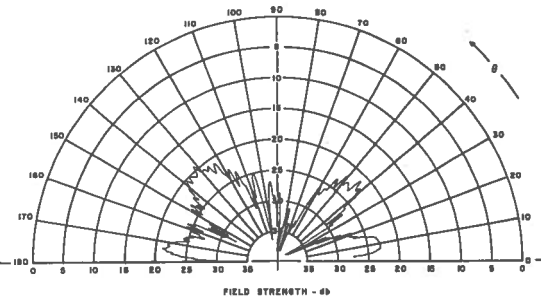
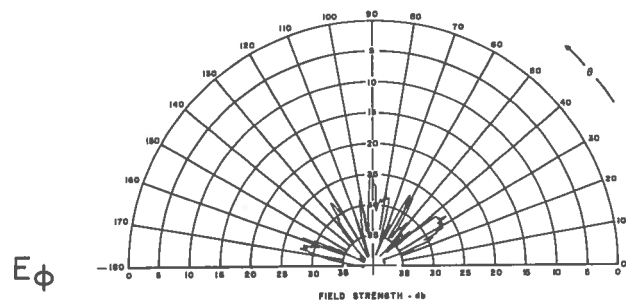
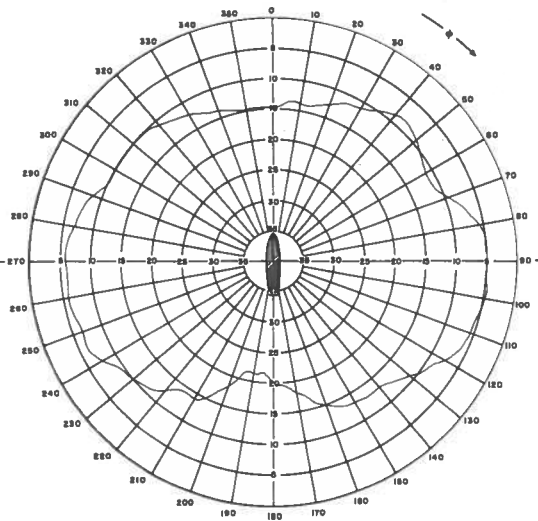
ANTENNA : AFT BLOCK - SUPPORT WHIP
 FREQ. : 12 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50Ω



FWD-AFT



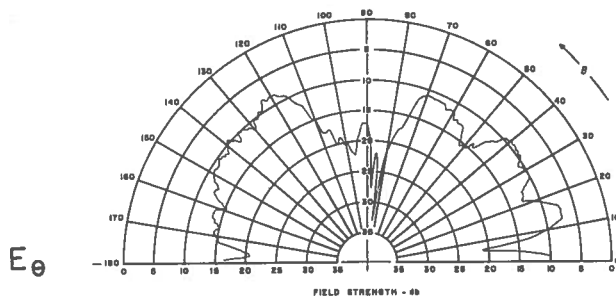
PORT-STBD



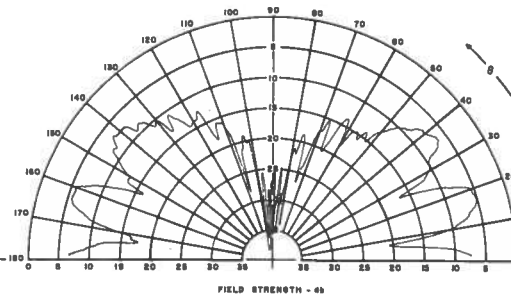
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FREQ. : 14 MHz

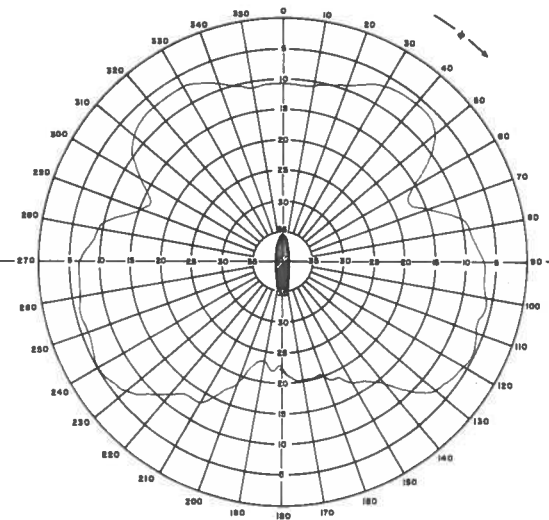
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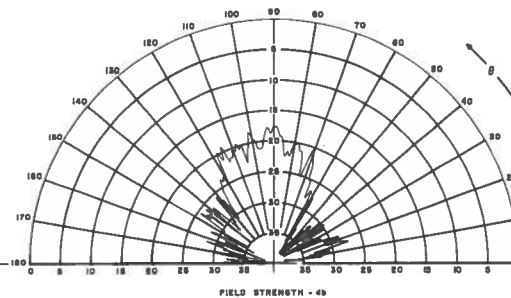
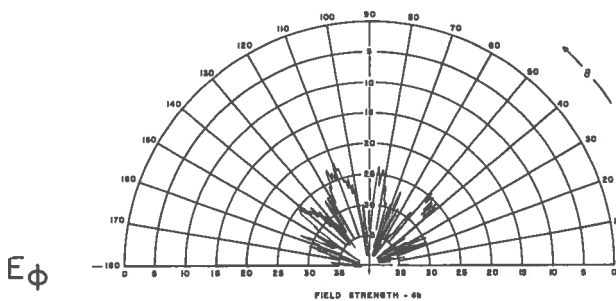
FWD-AFT

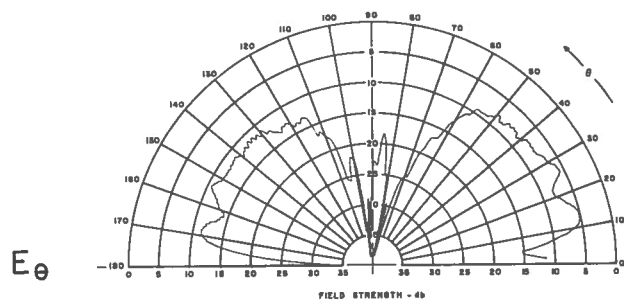


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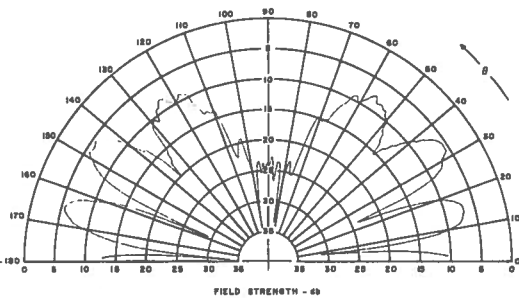


ANTENNA : AFT BLOCK - SUPPORT WHIP
 FREQ. : 16 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50Ω

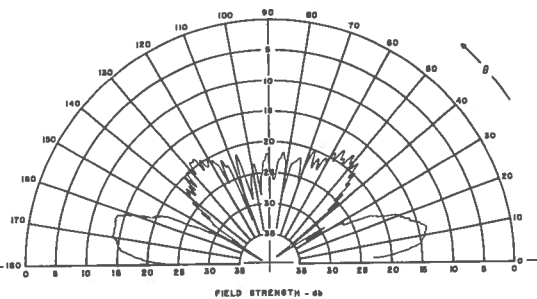
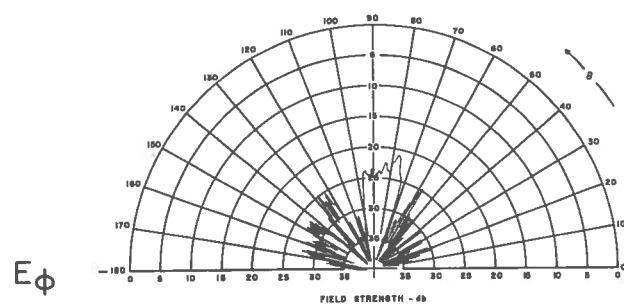
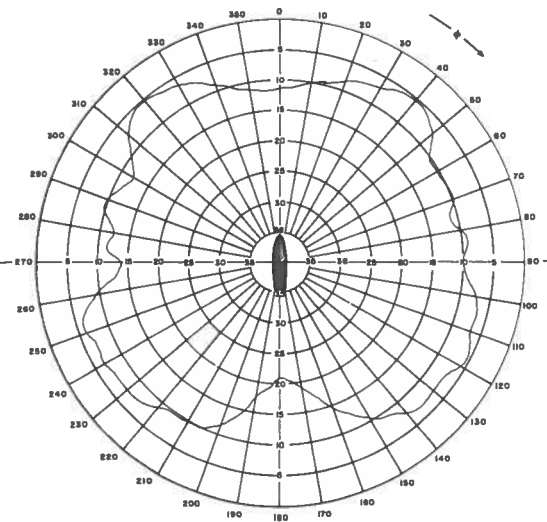




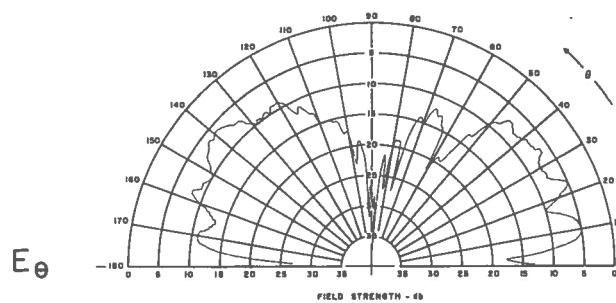
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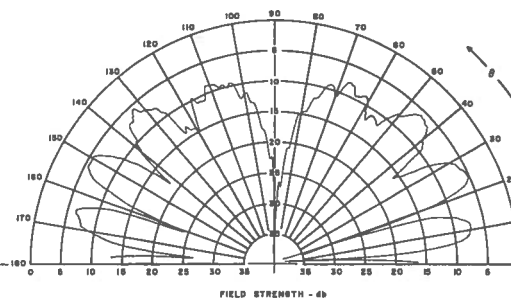
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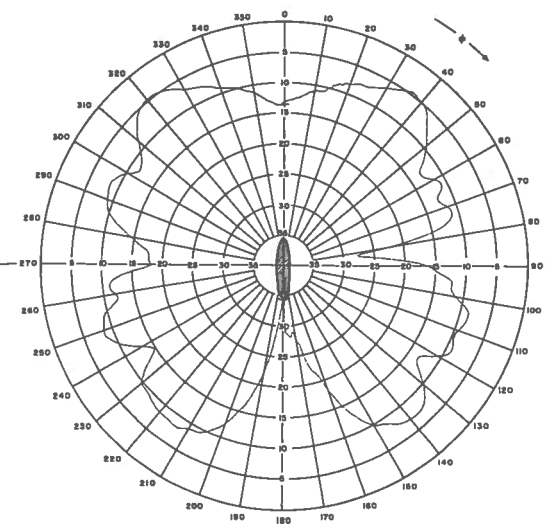
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 FREQ. : 18 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50Ω



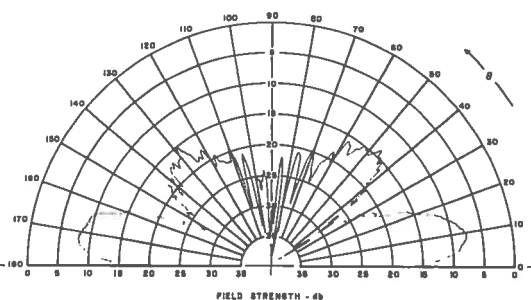
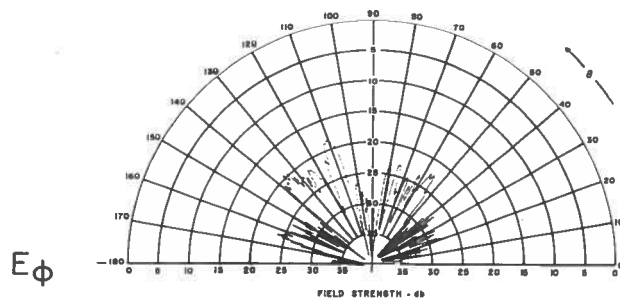
FWD-AFT



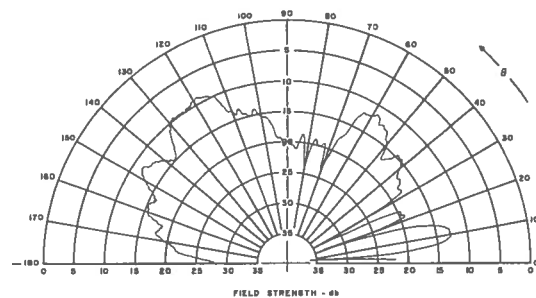
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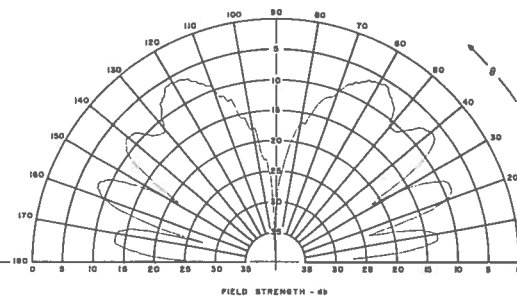
ANTENNA : AFT BLOCK - SUPPORT WHIP
 FREQ. : 20 MHz
 REMARKS : ALL OTHER ANTENNAS
 TERMINATED IN 50 Ω



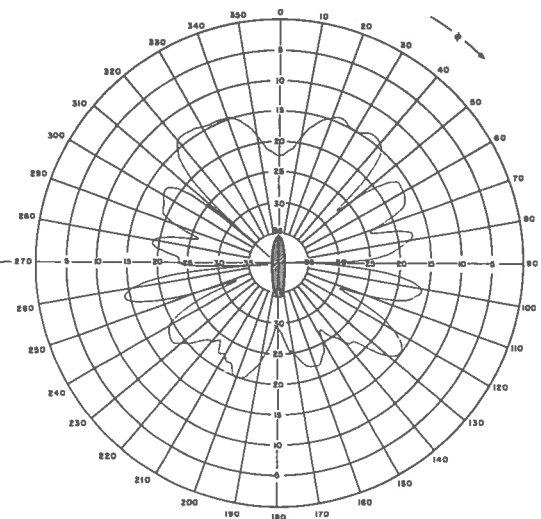
E_θ



FWD-AFT

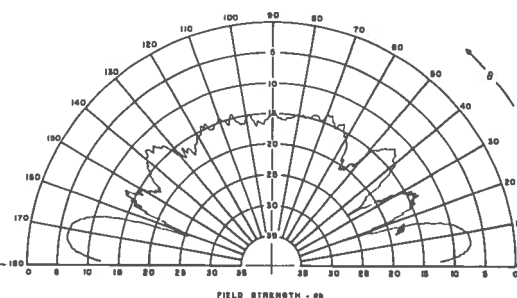
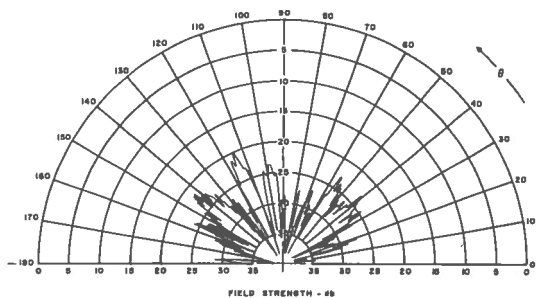


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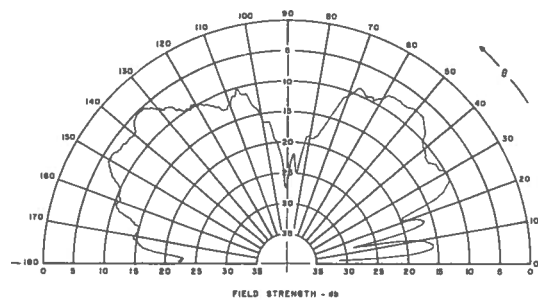


$\theta = 0^\circ$

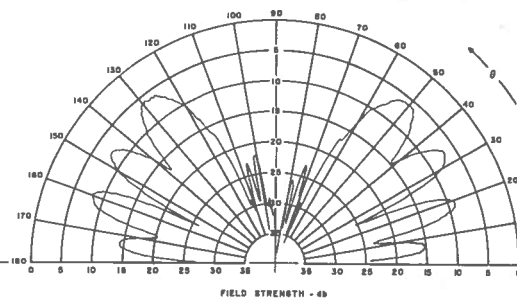
E_ϕ



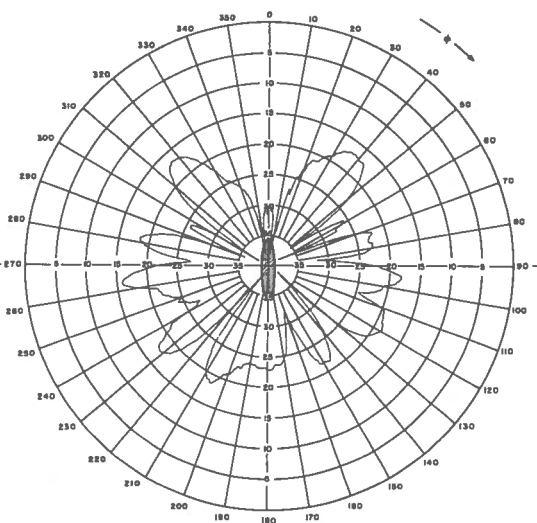
ANTENNA : AFT BLOCK - SUPPORT WHIP
FREQ. : 22 MHz
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω

E_{θ} 

FWD-AFT

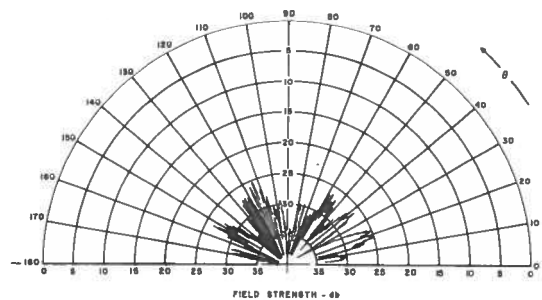


PORT-STBD

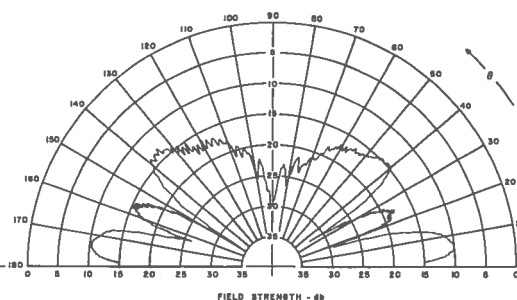
 $\theta = 0^\circ$

ANTENNA : AFT BLOCK - SUPPORT WHIP

FREQ. : 24 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω E_{ϕ} 

FIELD STRENGTH - dB

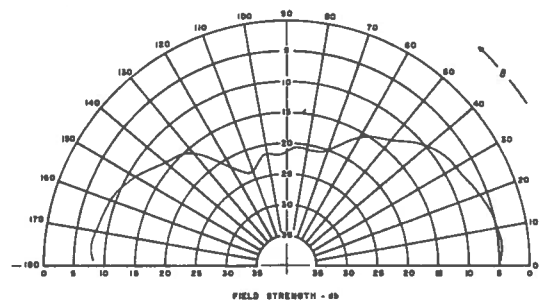


FIELD STRENGTH - dB

Confidential

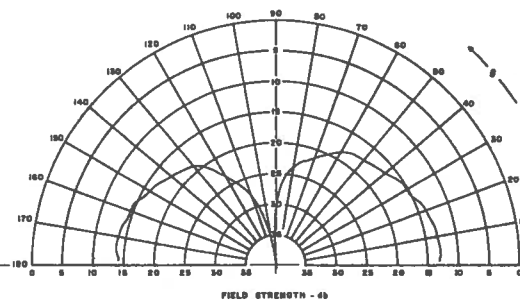
RADIATION PATTERNS

Forward block-support whip — patterns 15–28

E_{θ} 

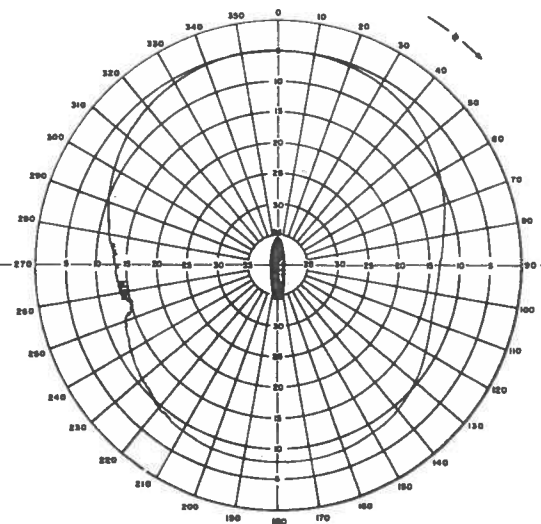
FIELD STRENGTH - dB

FWD-AFT



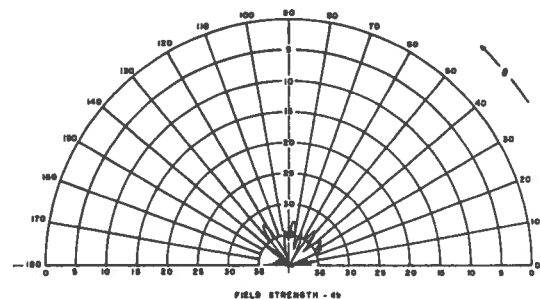
FIELD STRENGTH - dB

PORT-STBD

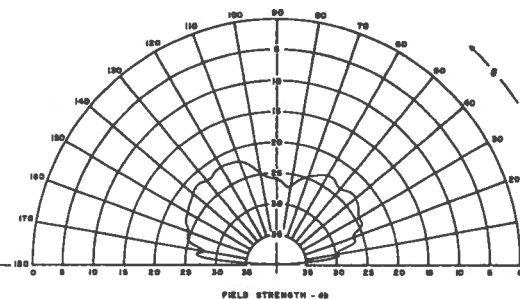
 $\theta = 0^\circ$

ANTENNA : GOAL POST WHIP

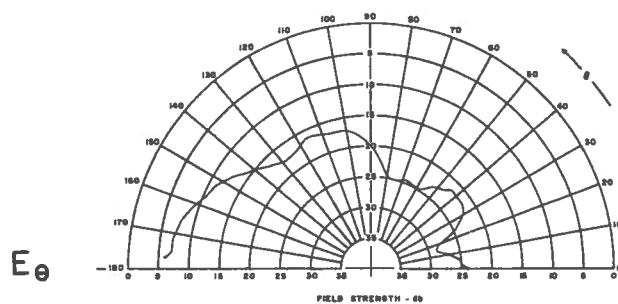
FREQ. : 2 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω E_{ϕ} 

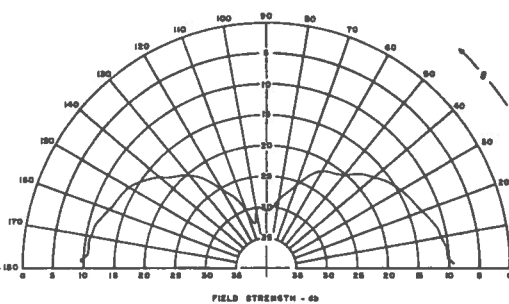
FIELD STRENGTH - dB



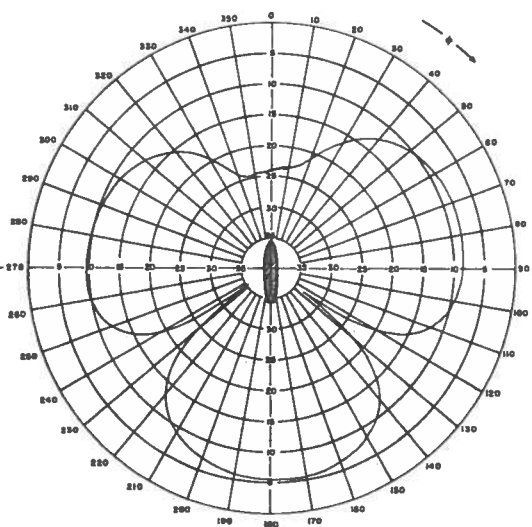
FIELD STRENGTH - dB



FWD-AFT



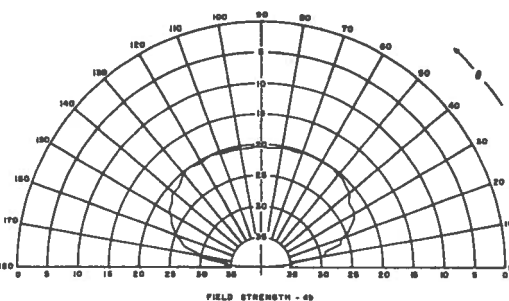
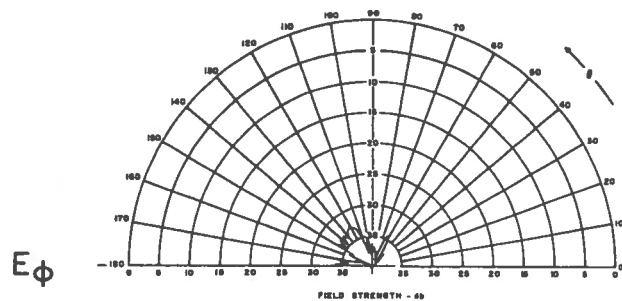
PORT-STBD

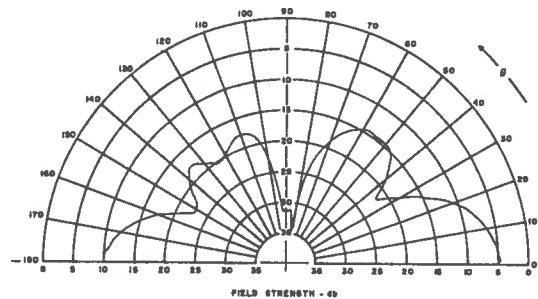


ANTENNA : GOAL POST WHIP

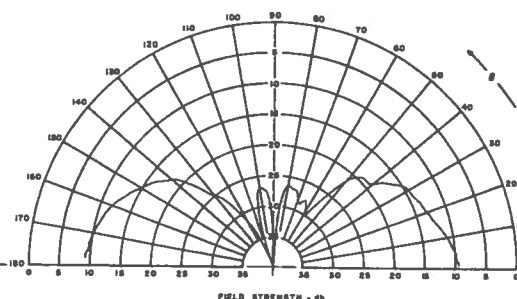
FREQ. : 3 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω

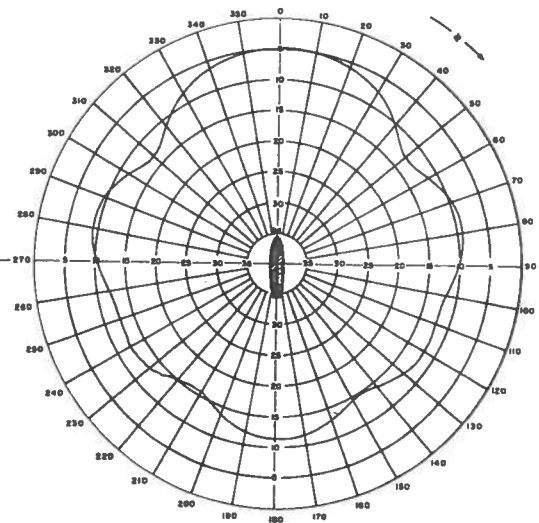


E_θ 

FIELD STRENGTH - dB

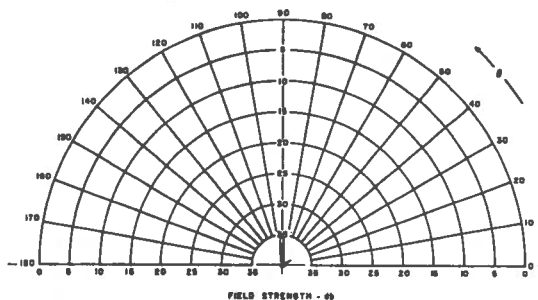


FIELD STRENGTH - dB

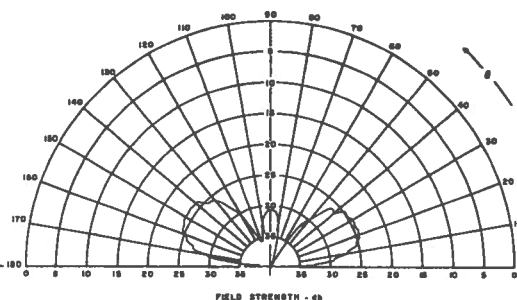


FWD-AFT

PORT-STBD

 $\theta = 0^\circ$ E_ϕ 

FIELD STRENGTH - dB

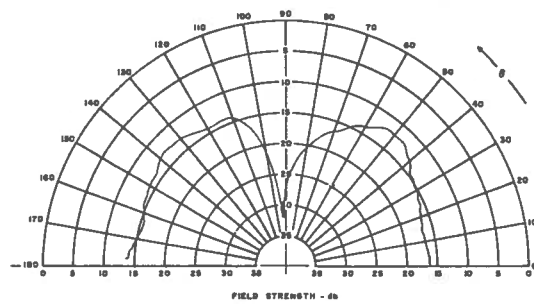


FIELD STRENGTH - dB

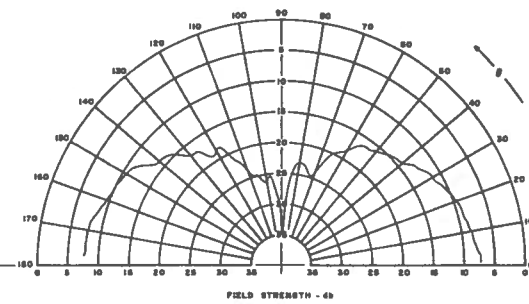
ANTENNA : GOAL POST WHIP

FREQ. : 4 MHz

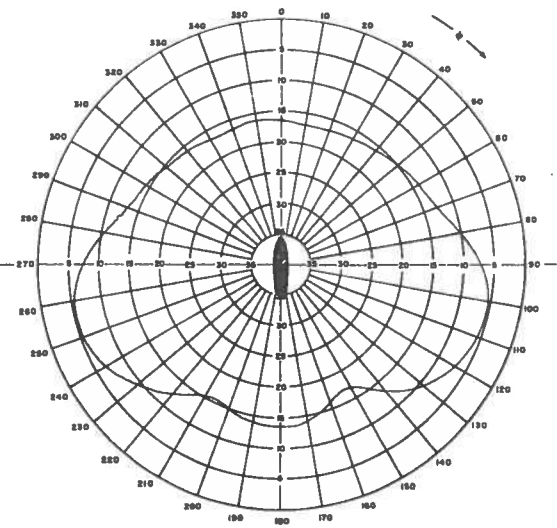
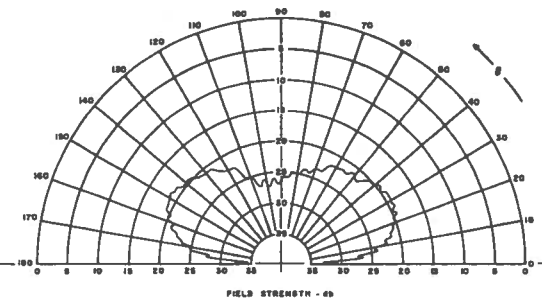
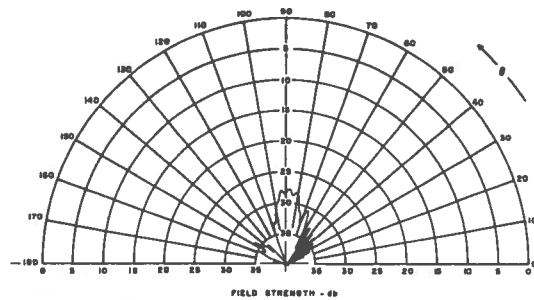
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω

E_{θ} 

FWD-AFT



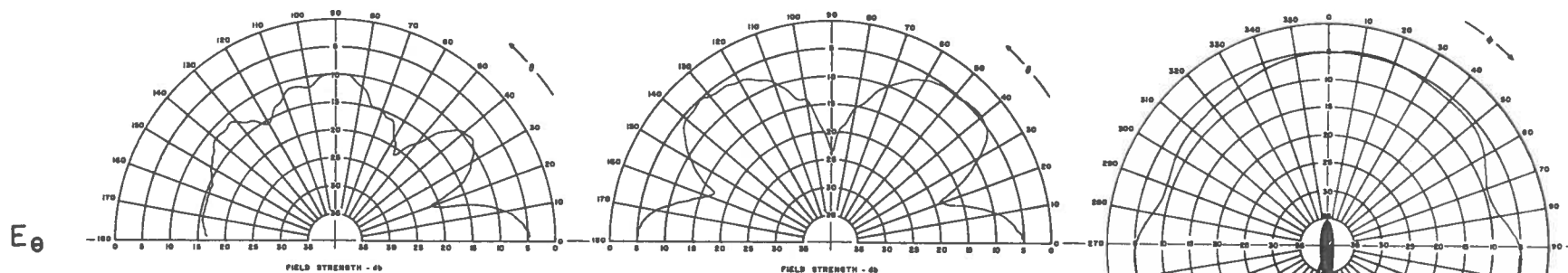
PORT-STBD

 E_{ϕ} 

ANTENNA : GOAL POST WHIP

FREQ. : 5 MHz

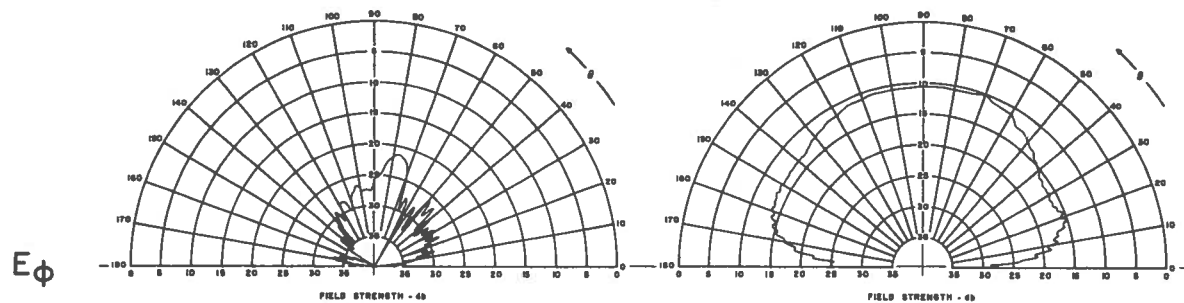
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω



FWD-AFT

PORT-STBD

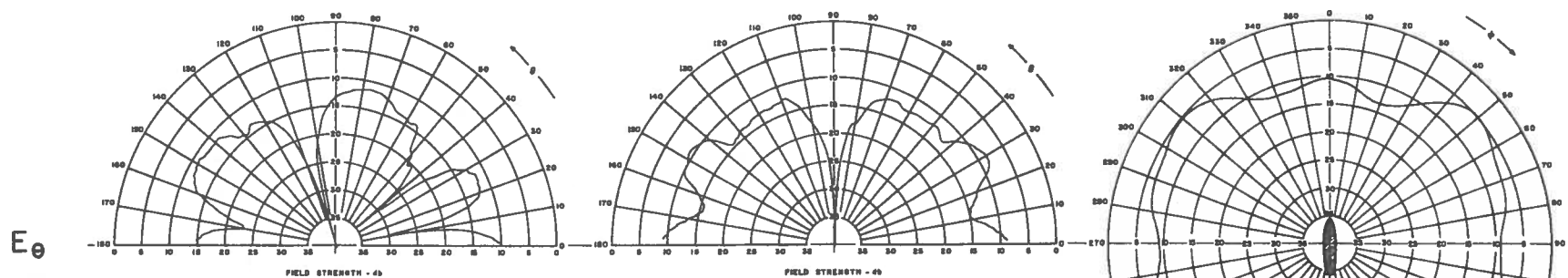
$\theta = 0^\circ$



ANTENNA : GOAL POST WHIP

FREQ. : 6 MHz

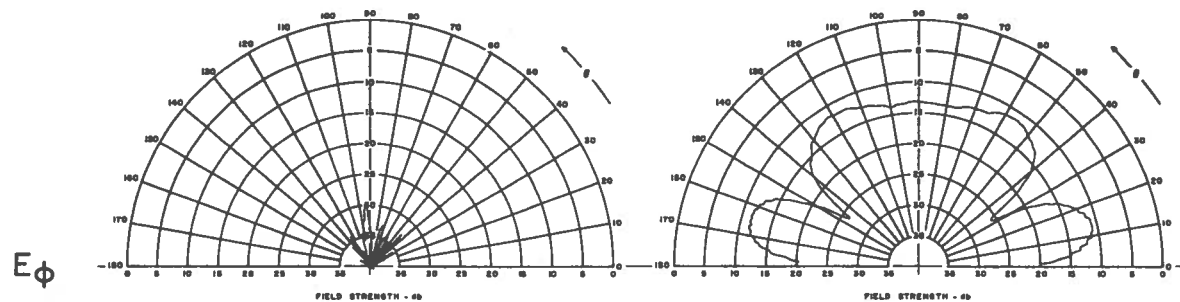
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω



FWD-AFT

PORT-STBD

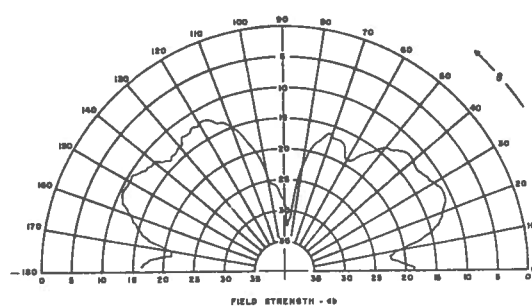
$\theta = 0^\circ$



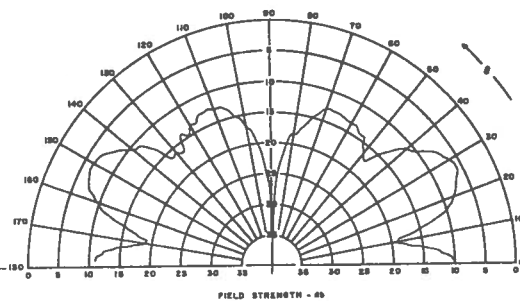
ANTENNA : GOAL POST WHIP

FREQ. : 8 MHz

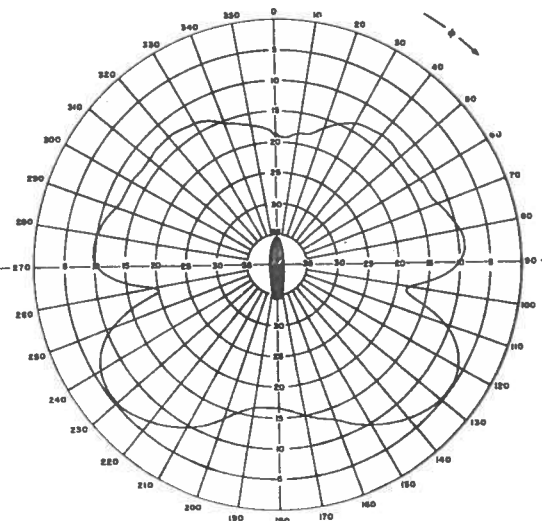
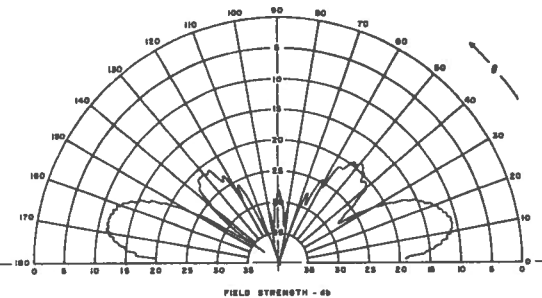
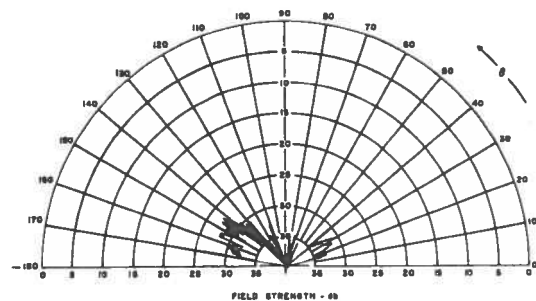
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω

E_{θ} 

FWD-AFT



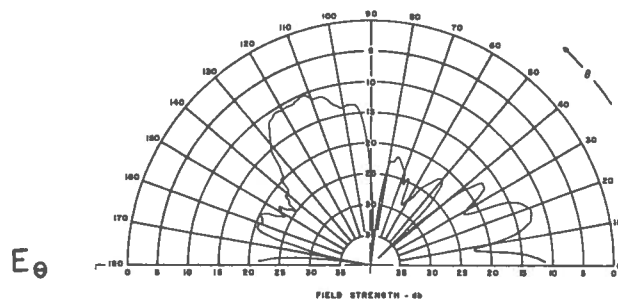
PORT-STBD

 E_{ϕ} 

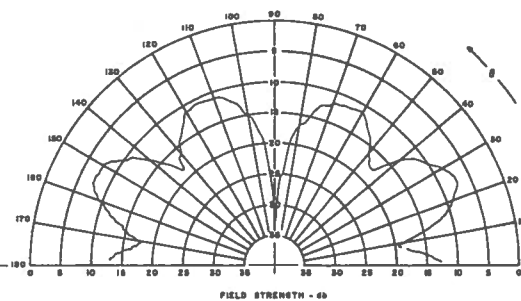
ANTENNA : GOAL POST WHIP

FREQ. : 10 MHz

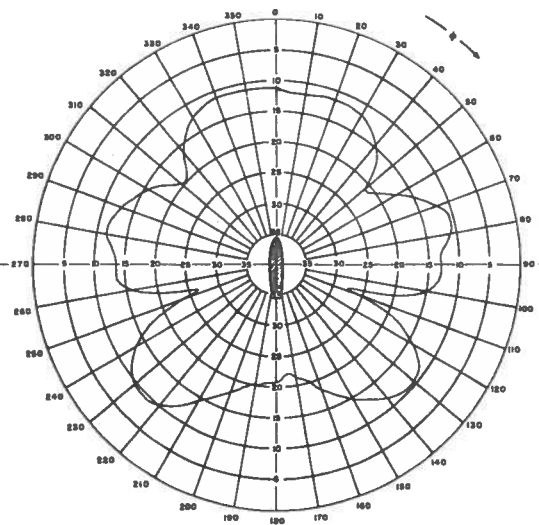
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω



FWD-AFT



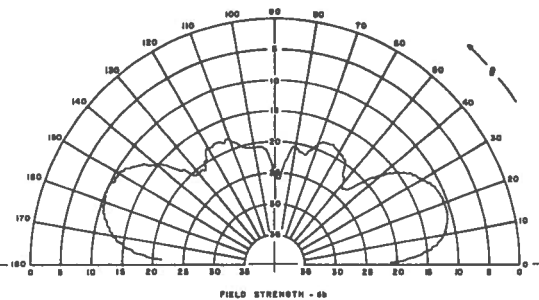
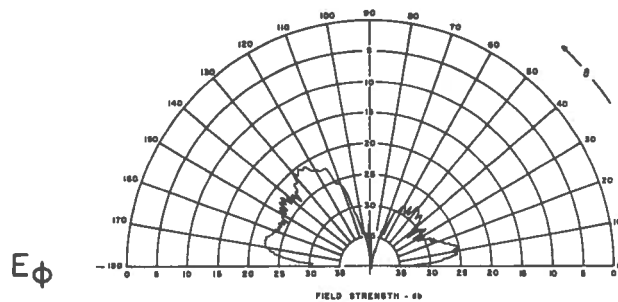
PORT-STBD

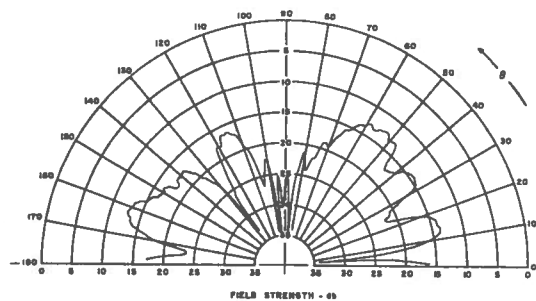


ANTENNA : GOAL POST WHIP

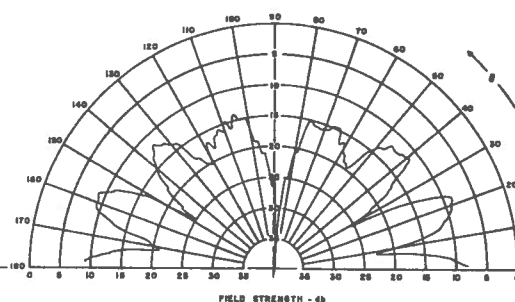
FREQ. : 12 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω

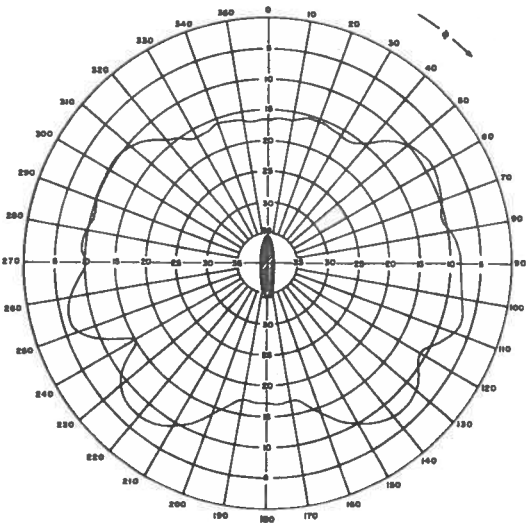


E_{θ} 

FWD-AFT

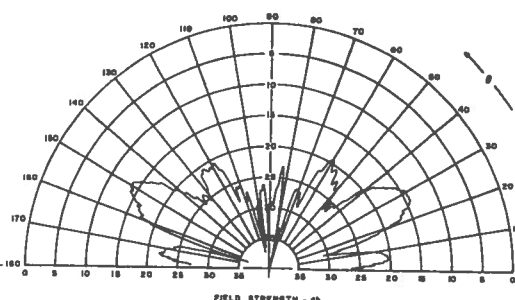
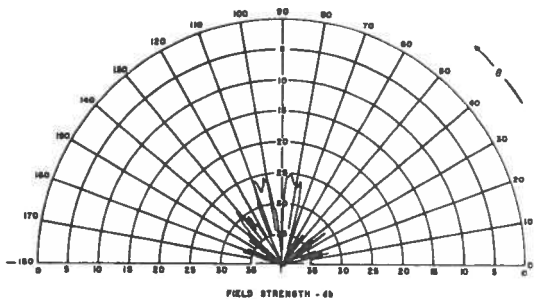


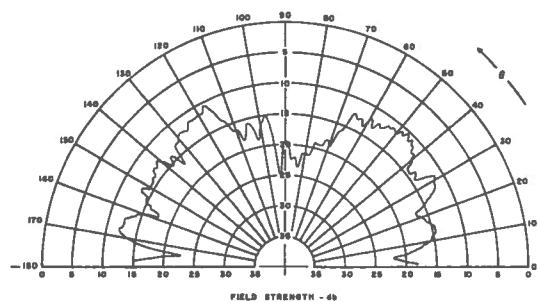
PORT-STBD

 $\theta = 0^\circ$

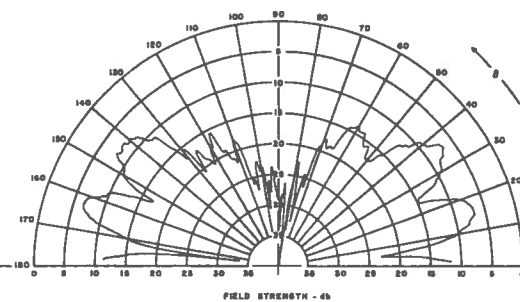
ANTENNA : GOAL POST WHIP

FREQ. : 14 MHz

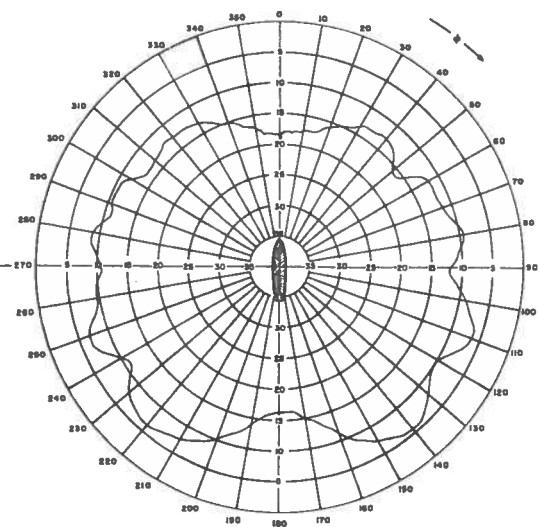
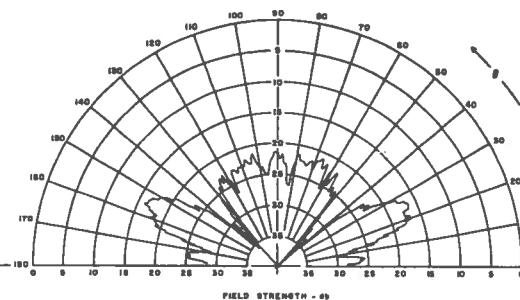
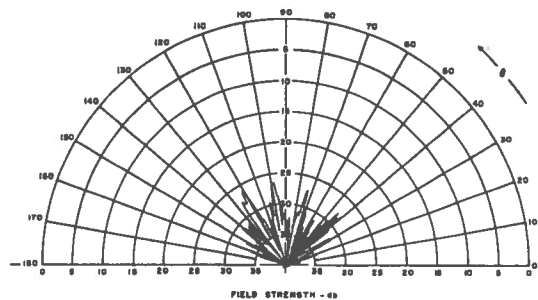
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω E_{ϕ} 

E_{θ} 

FWD-AFT



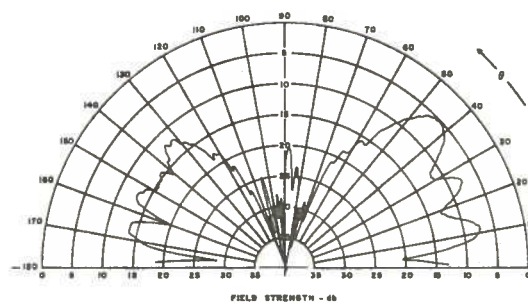
PORT-STBD

 E_{ϕ} 

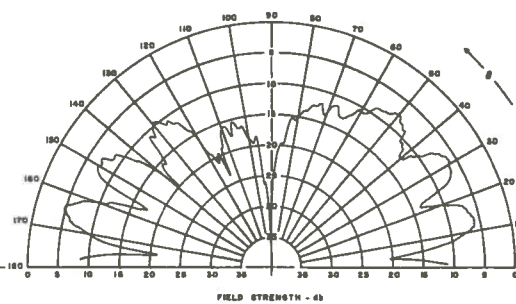
ANTENNA : GOAL POST WHIP

FREQ. : 16 MHz

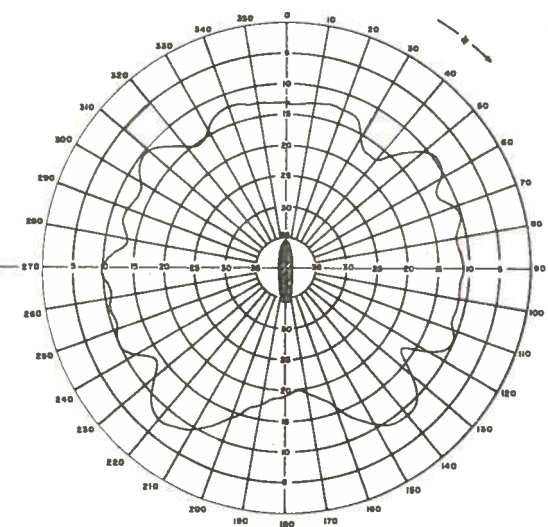
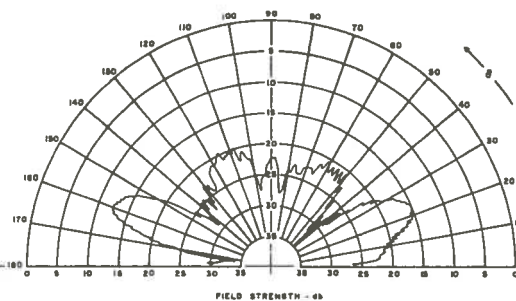
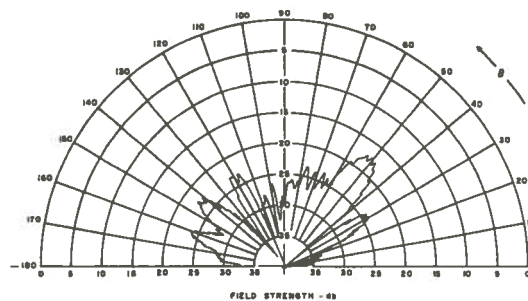
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω

E_{θ} 

FWD-AFT



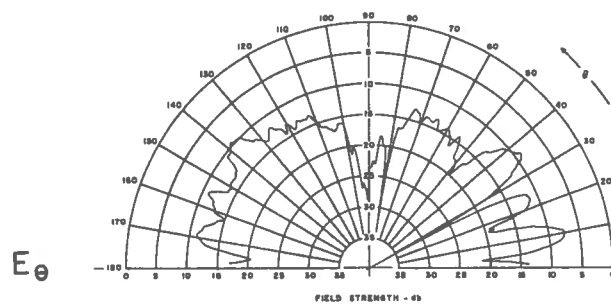
PORT-STBD

 $\theta = 0^\circ$ E_{ϕ} 

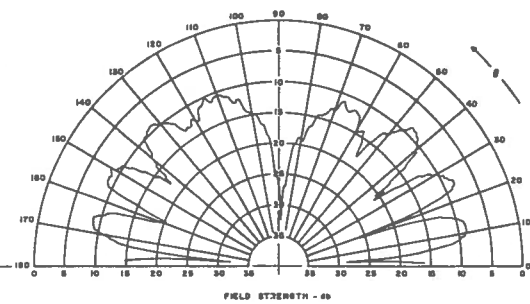
ANTENNA : GOAL POST WHIP

FREQ. : 18 MHz

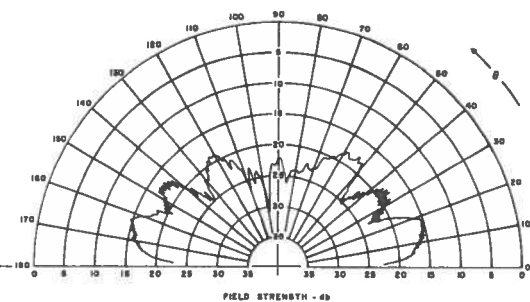
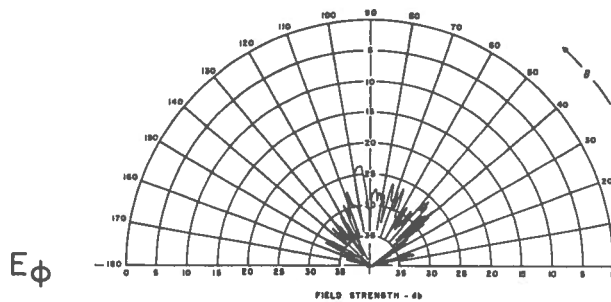
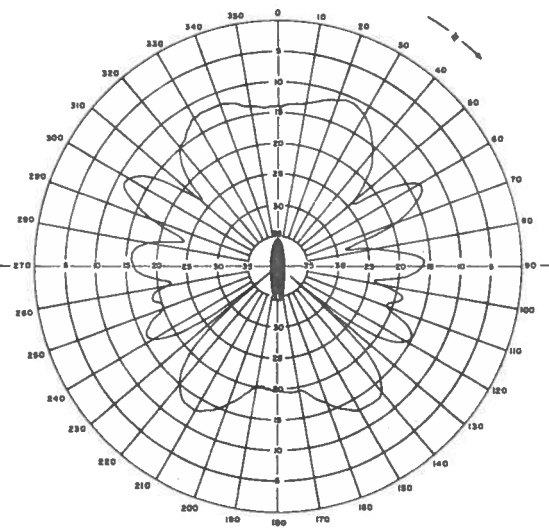
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω



FWD-AFT



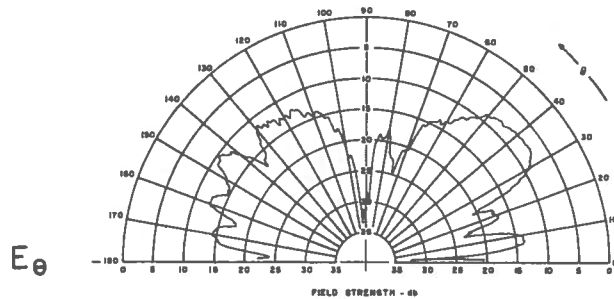
PORT-STBD



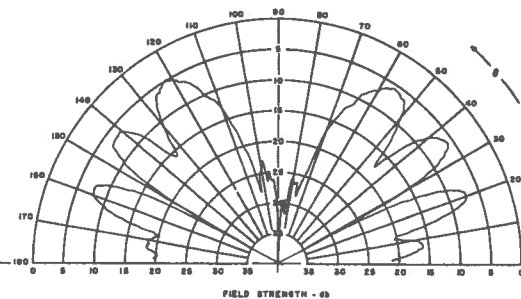
ANTENNA : GOAL POST WHIP

FREQ. : 20 MHz

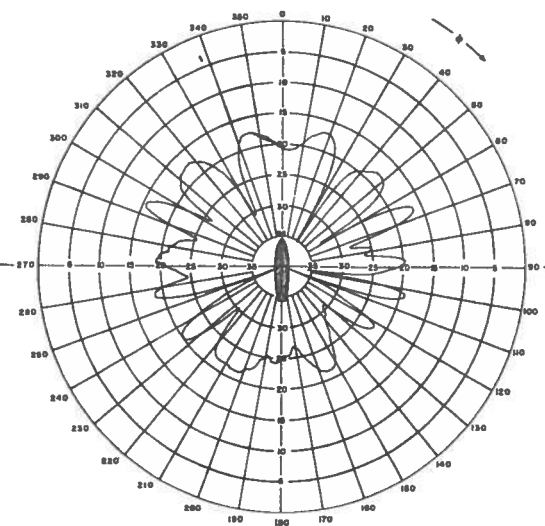
REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω



FWD-AFT



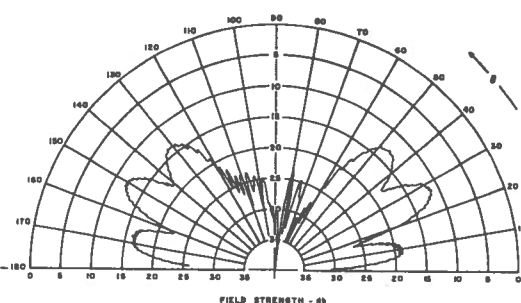
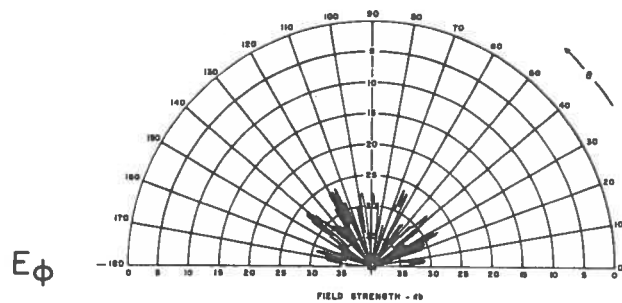
PORT-STBD

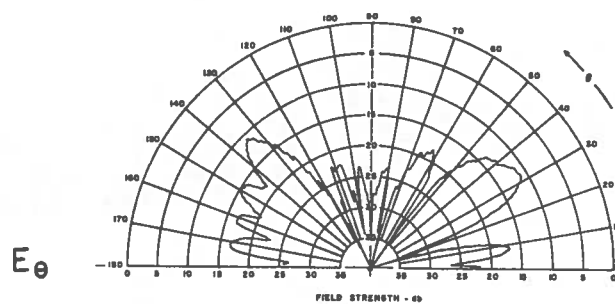


ANTENNA : GOAL POST WHIP

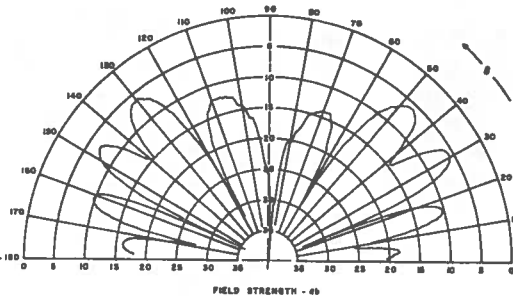
FREQ. : 22 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50 Ω

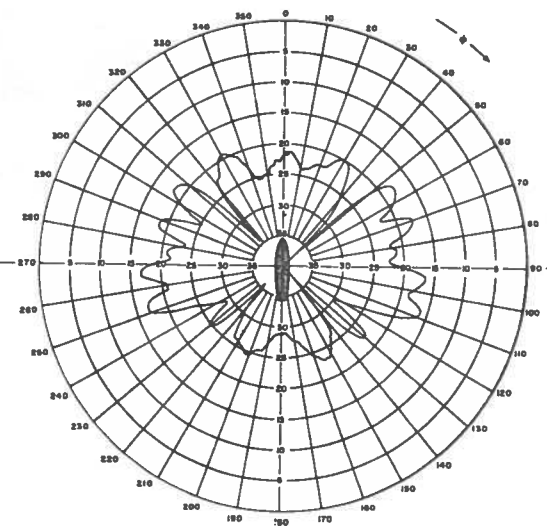




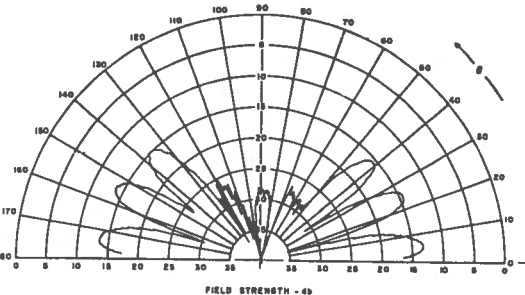
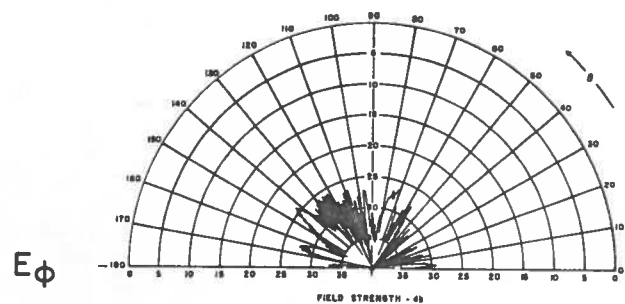
FWD-AFT



PORT-STBD



$\theta = 0^\circ$



ANTENNA : GOAL POST WHIP

FREQ. : 24 MHz

REMARKS : ALL OTHER ANTENNAS
TERMINATED IN 50Ω



PLATE I $\frac{1}{48}$ scale model of OSS-509 used in radiation pattern measurements