Selection of an antenna site for a 35-foot whip on OSS-509 for project TOBACCO

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RADIO AND ELECTRICAL ENGINEERING DIVISION

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

- J. Y. WONG AND G. GIBSON -

OTTAWA

DECEMBER 1970

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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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 ζ 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.

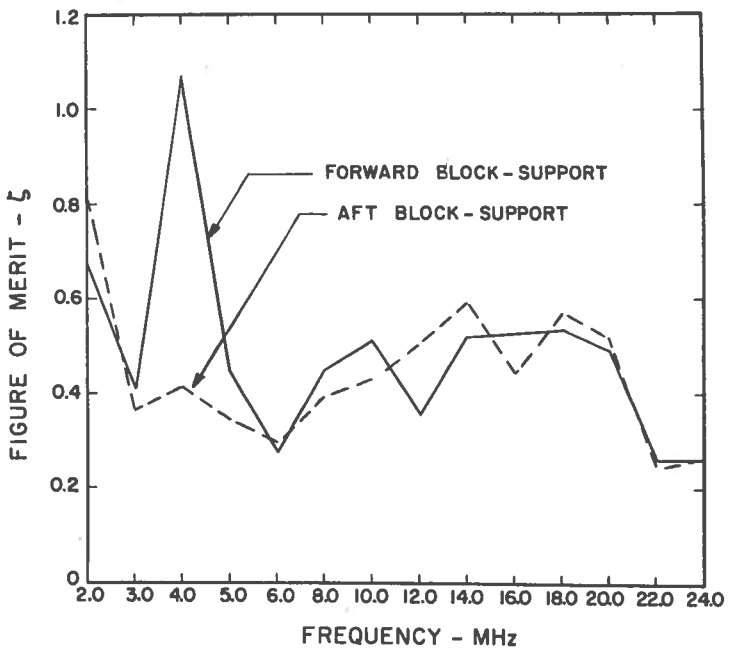


Figure 1 Figure of merit of 35-foot whip mounted on top of the block-support

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.

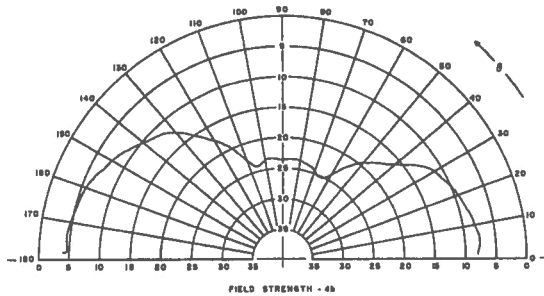
Reference

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.

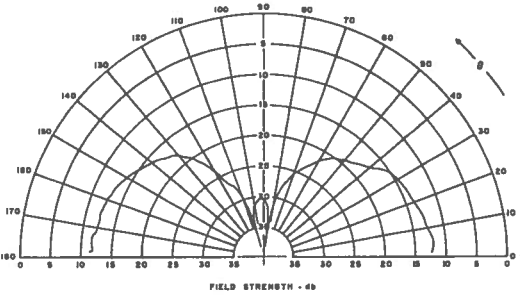
RADIATION PATTERNS

Aft block-support whip – patterns 1–14

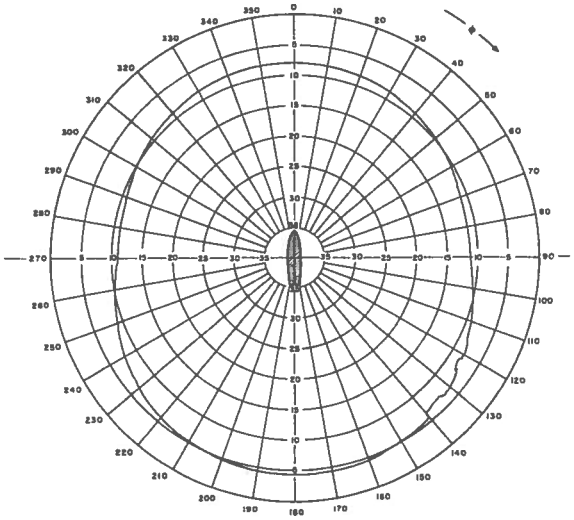
E_θ



FWD - AFT

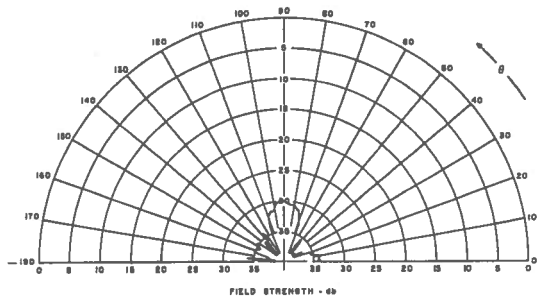


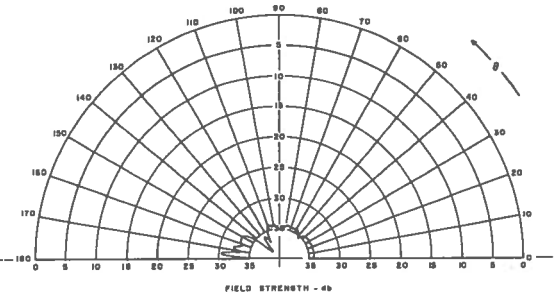
PORT - STBD



$\theta = 0°$

E_ϕ



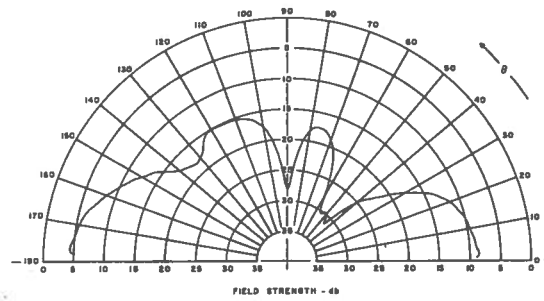


ANTENNA : AFT BLOCK - SUPPORT WHIP

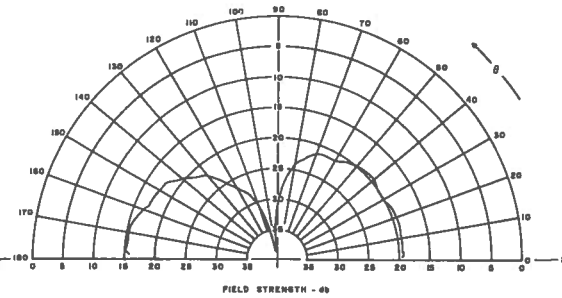
FREQ. : 2 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

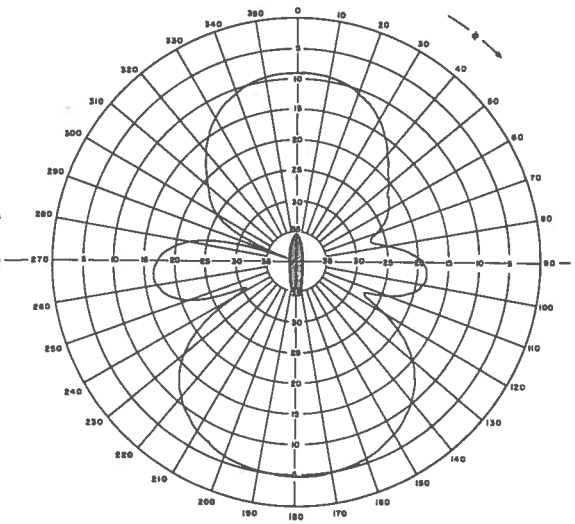
E_θ



FWD-AFT

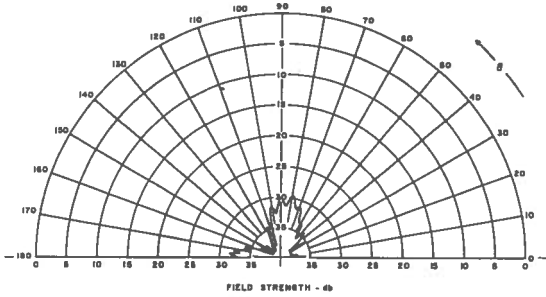


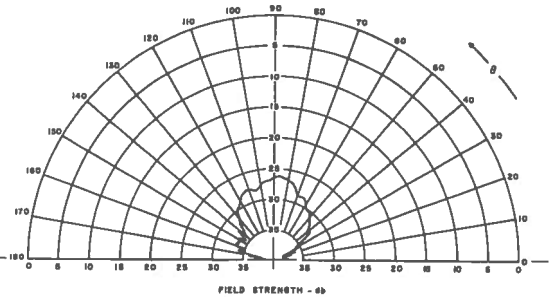
PORT-STBD



$\theta = 0°$

E_ϕ



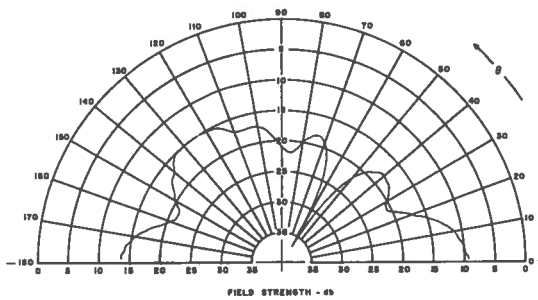


ANTENNA : AFT BLOCK - SUPPORT WHIP

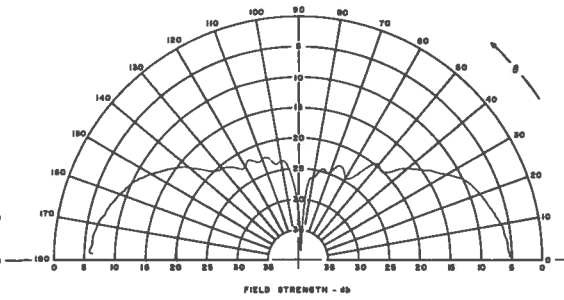
FREQ. : 3 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

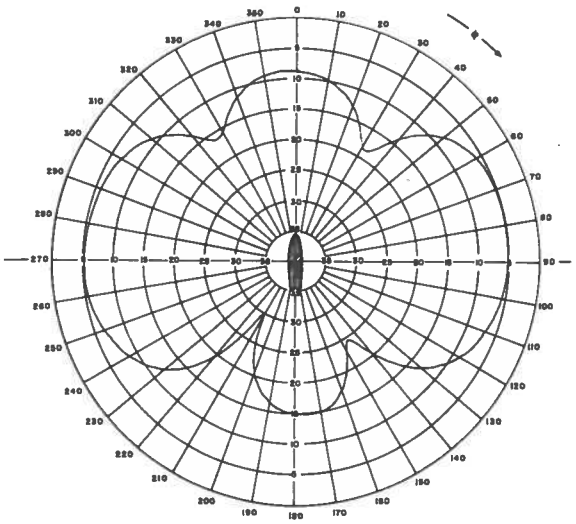
E_θ



FWD-AFT

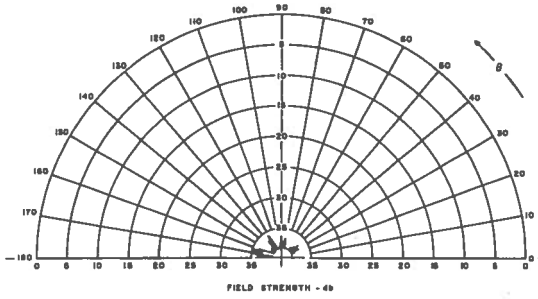


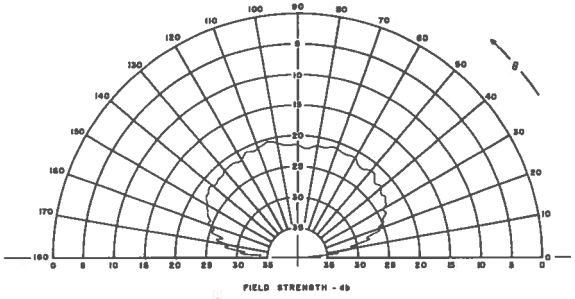
PORT-STBD



$\theta = 0°$

E_ϕ



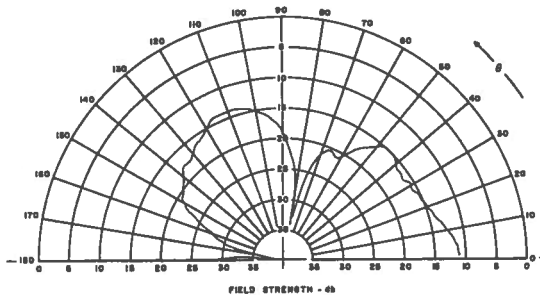


ANTENNA : AFT BLOCK - SUPPORT WHIP

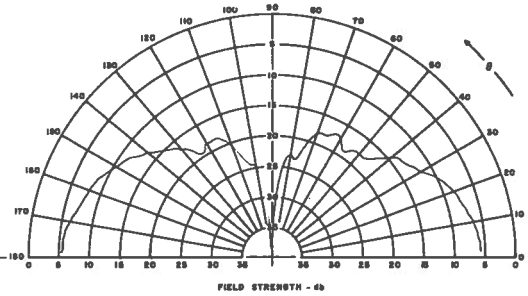
FREQ. : 4 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

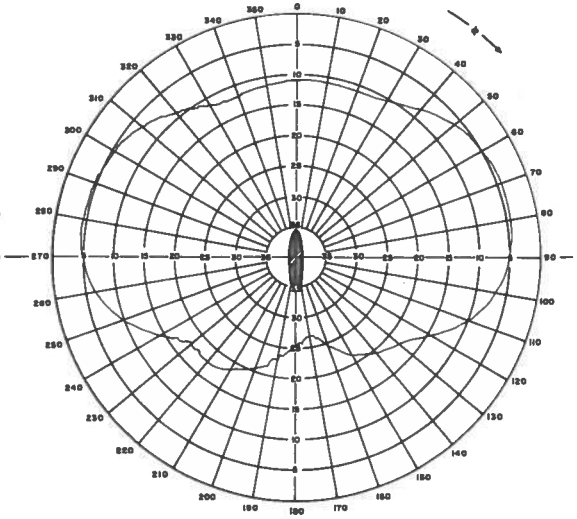
E_θ



FWD-AFT

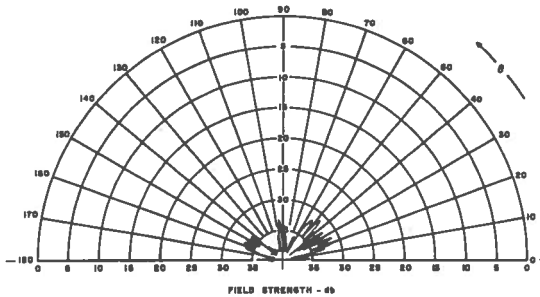


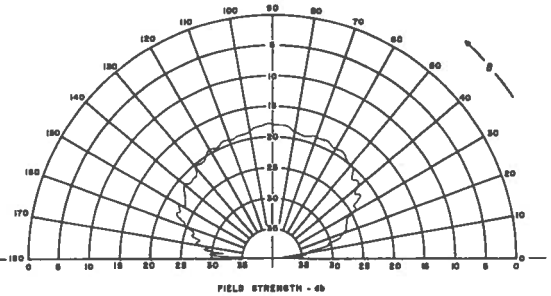
PORT-STBD



$\theta = 0°$

E_ϕ



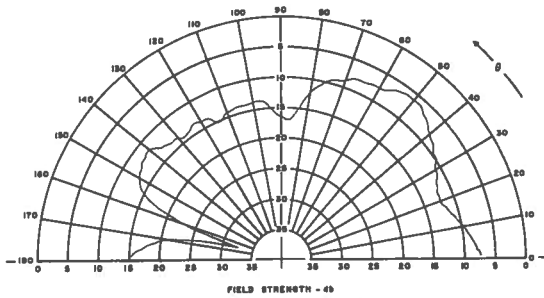


ANTENNA : AFT BLOCK - SUPPORT WHIP

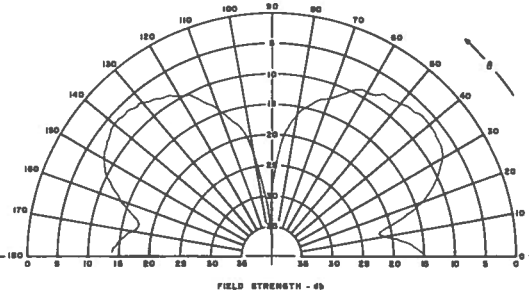
FREQ. : 5 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

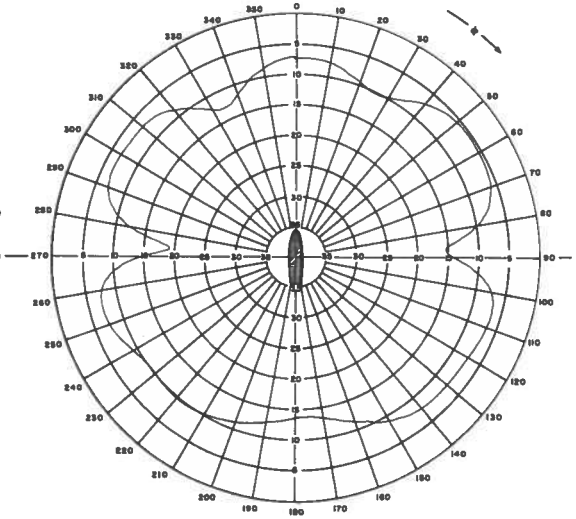
E_θ



FWD - AFT

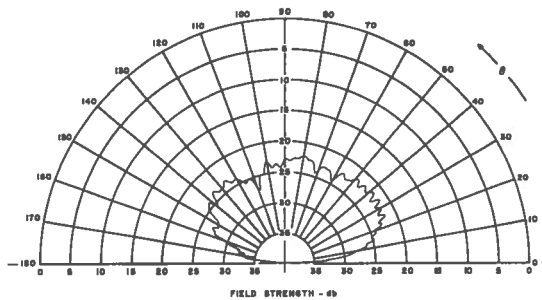


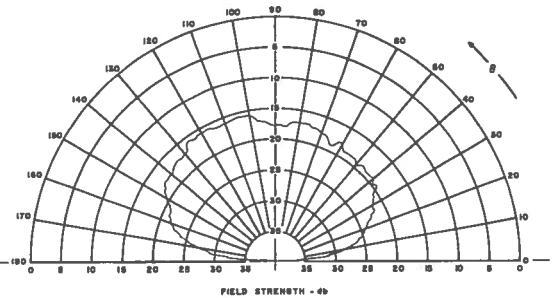
PORT - STBD



$\theta = 0°$

E_ϕ



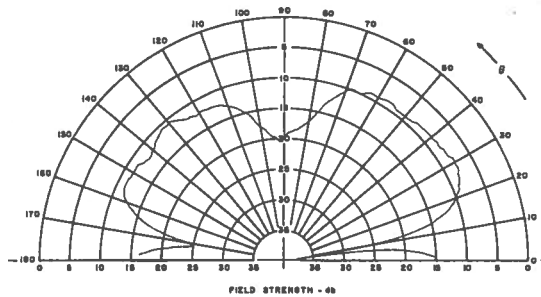


ANTENNA : AFT BLOCK - SUPPORT WHIP

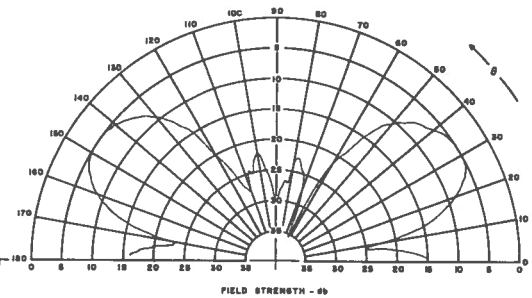
FREQ. : 6 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

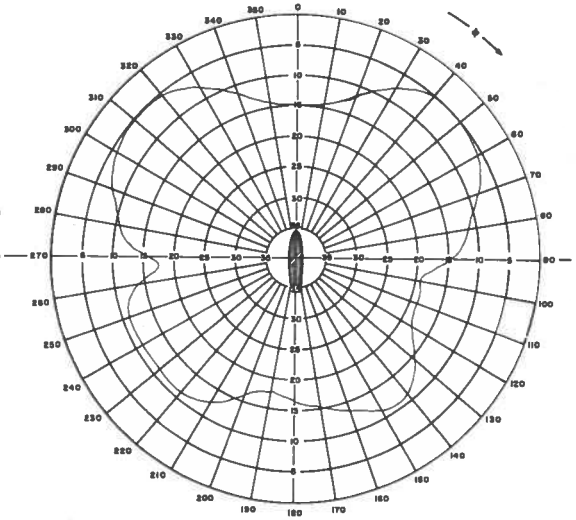
E_θ



FWD-AFT

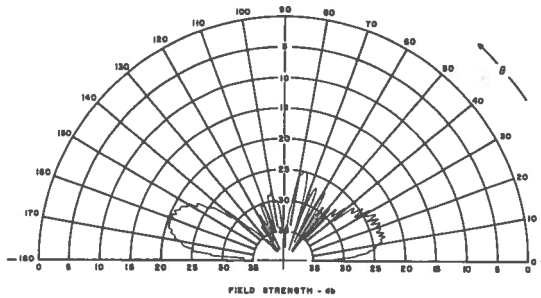


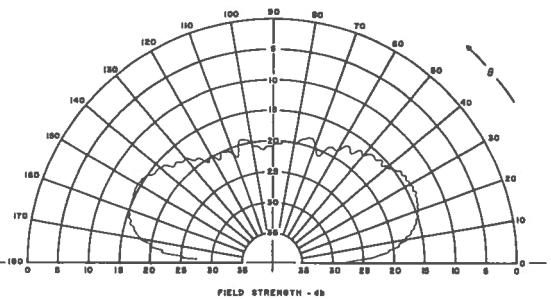
PORT-STBD



$\theta = 0°$

E_ϕ



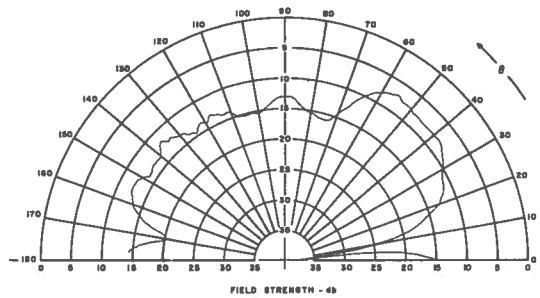


ANTENNA : AFT BLOCK - SUPPORT WHIP

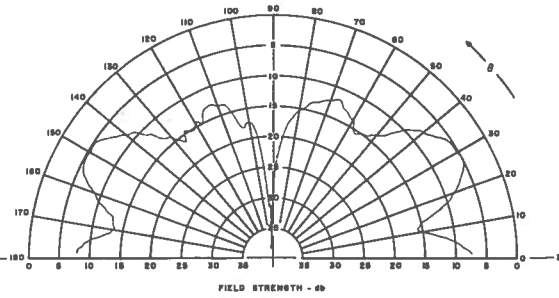
FREQ. : 8 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

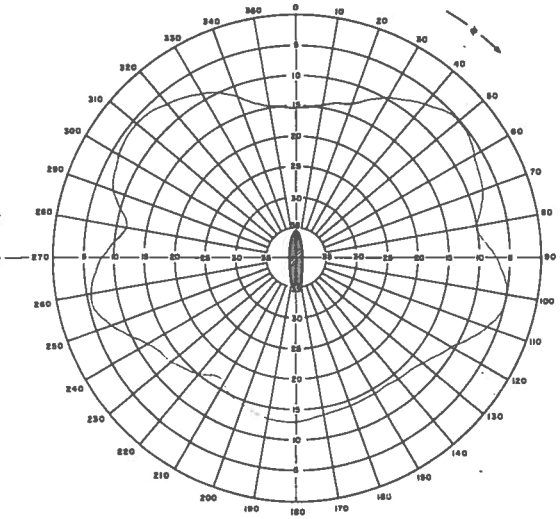
E_θ



FWD-AFT

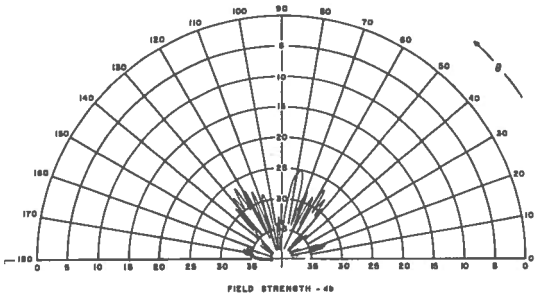


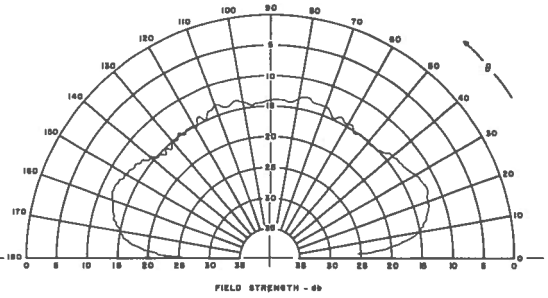
PORT-STBD



$\theta = 0°$

E_ϕ



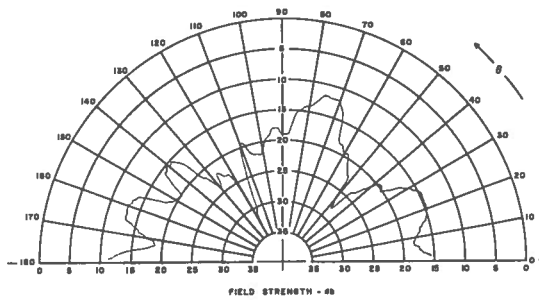


ANTENNA : AFT BLOCK-SUPPORT WHIP

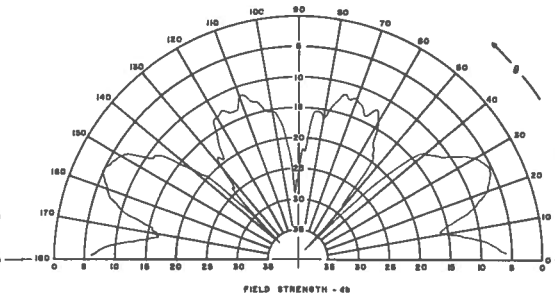
FREQ. : 10 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

E_θ



FWD-AFT



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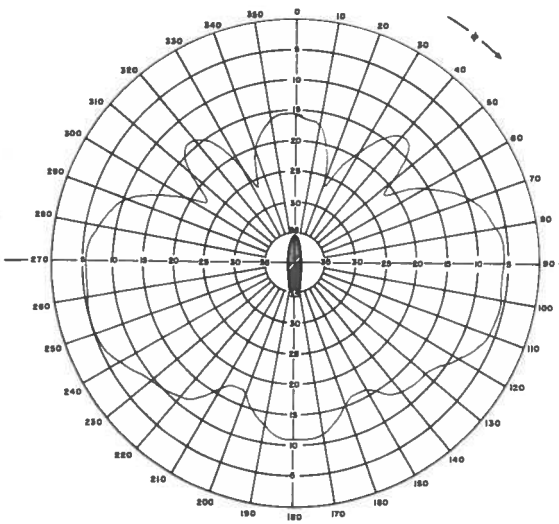
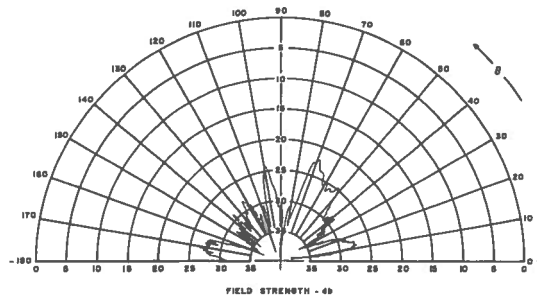
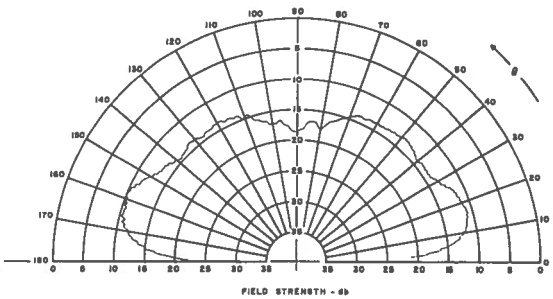


$\theta = 0°$

E_ϕ



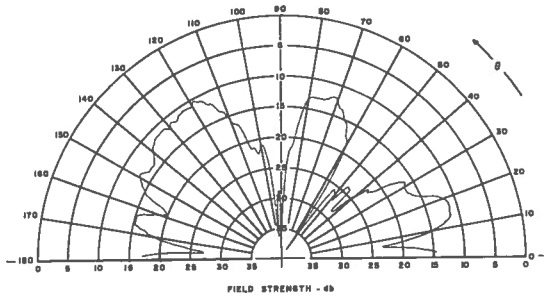


ANTENNA : AFT BLOCK - SUPPORT WHIP

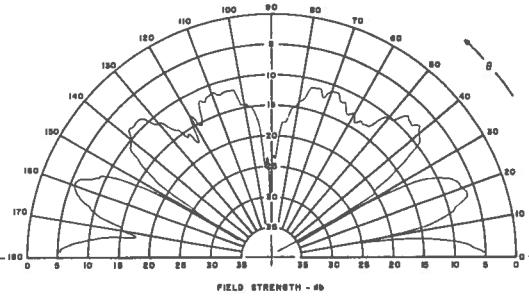
FREQ. : 12 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

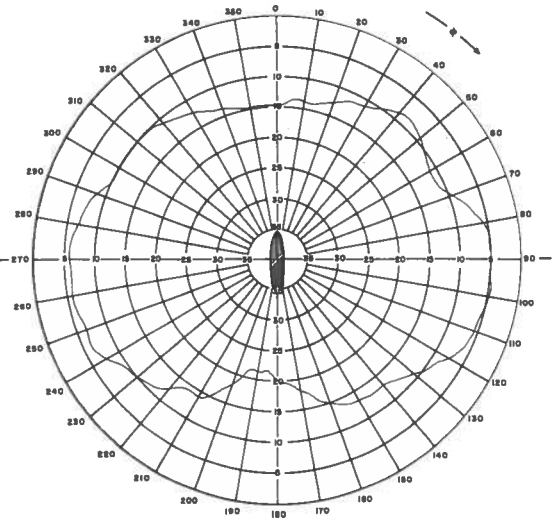
E_θ



FWD-AFT

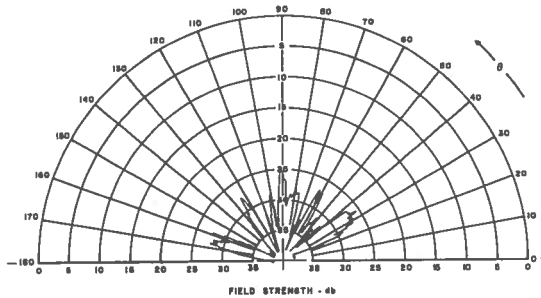


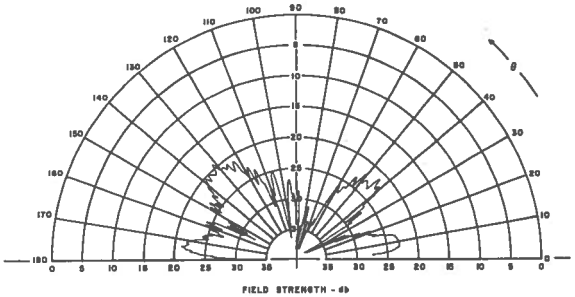
PORT-STBD



$\theta = 0°$

E_ϕ



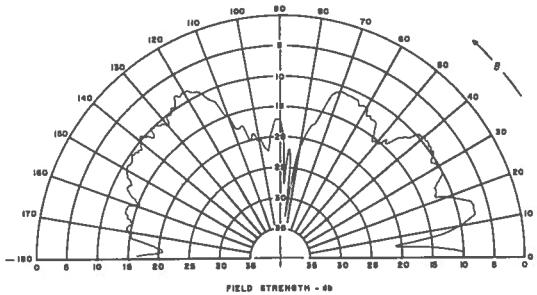


ANTENNA : AFT BLOCK - SUPPORT WHIP

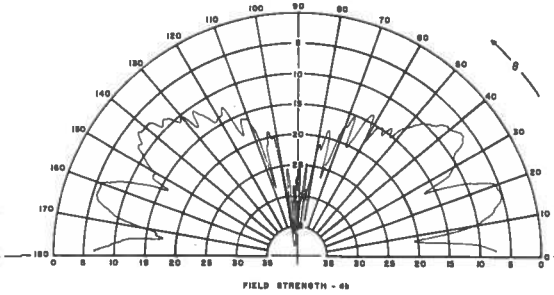
FREQ. : 14 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

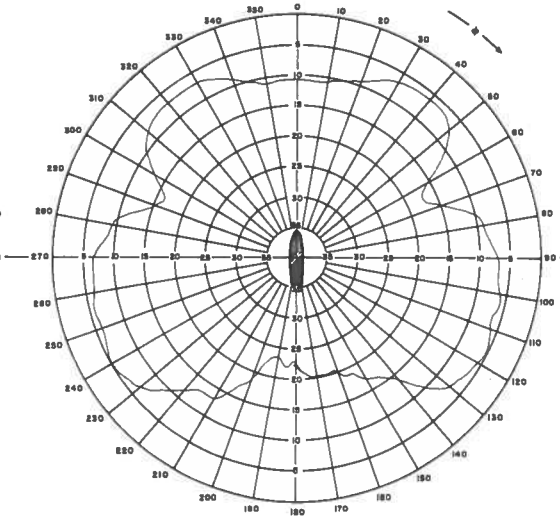
E_θ



FWD-AFT

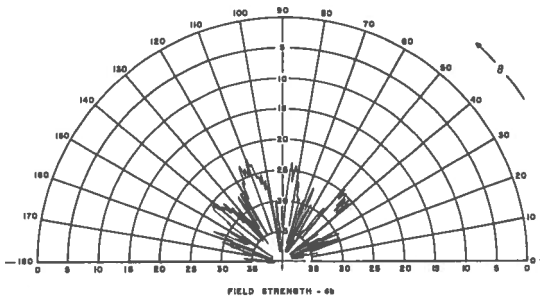


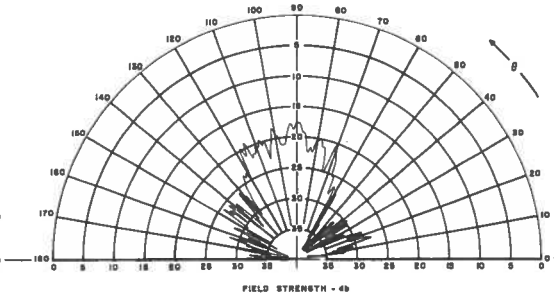
PORT-STBD



$\theta = 0°$

E_ϕ



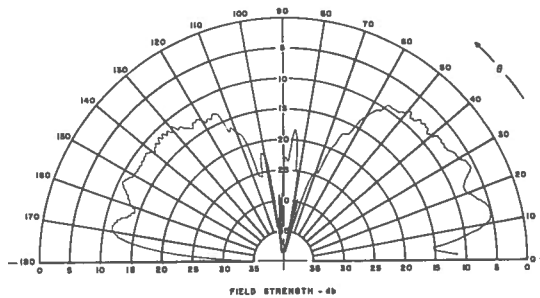


ANTENNA : AFT BLOCK - SUPPORT WHIP

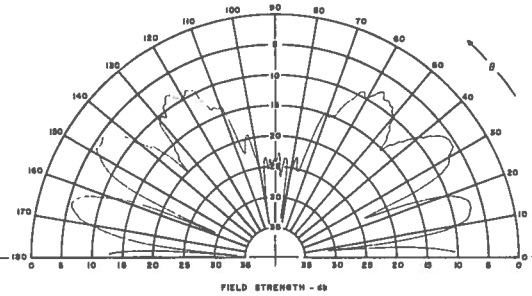
FREQ. : 16 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

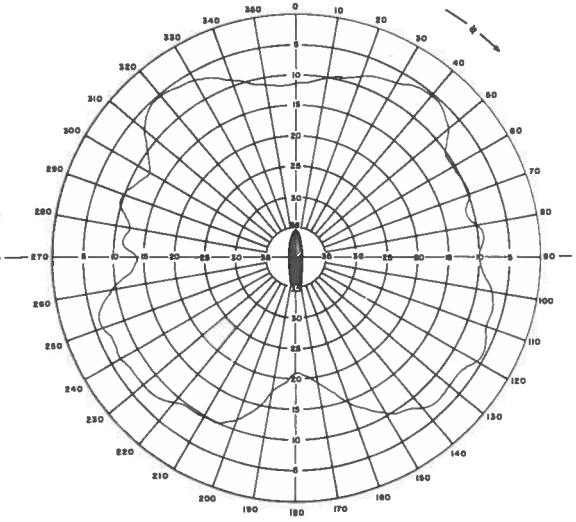
E_θ



FWD-AFT

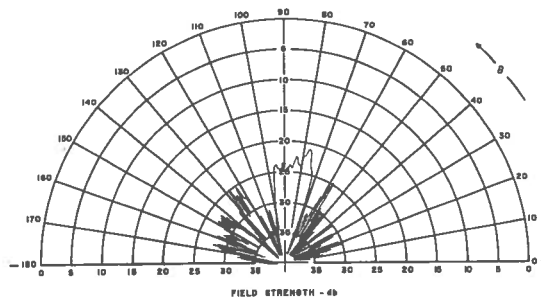


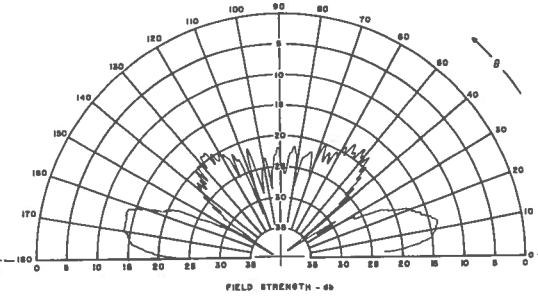
PORT-STBD



$\theta = 0°$

E_ϕ



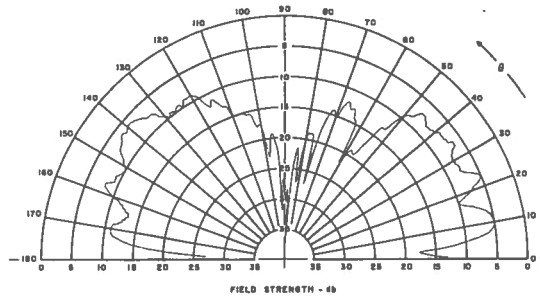


ANTENNA : AFT BLOCK - SUPPORT WHIP

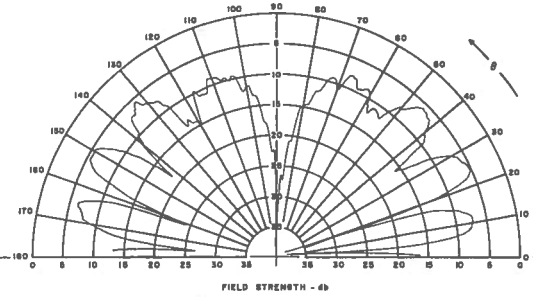
FREQ. : 18 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

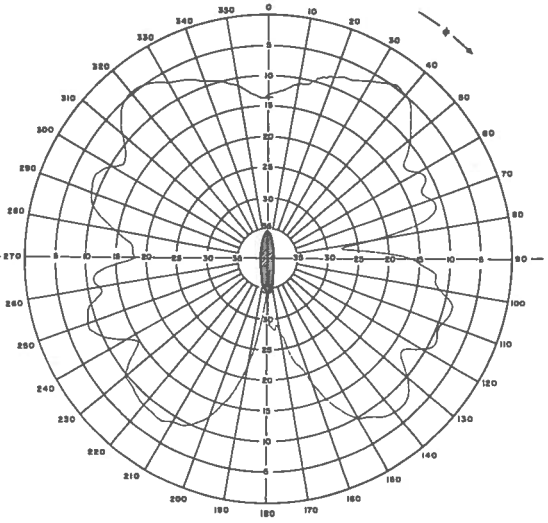
E_θ



FWD-AFT

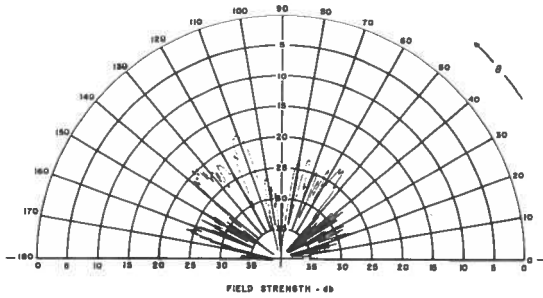


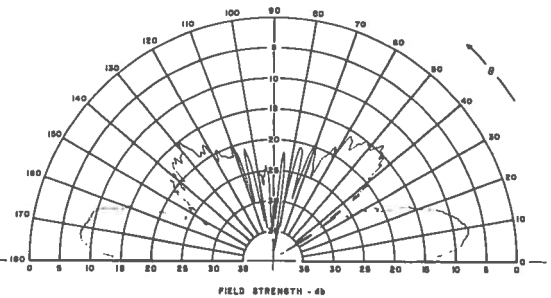
PORT-STBD



$\theta = 0°$

E_ϕ



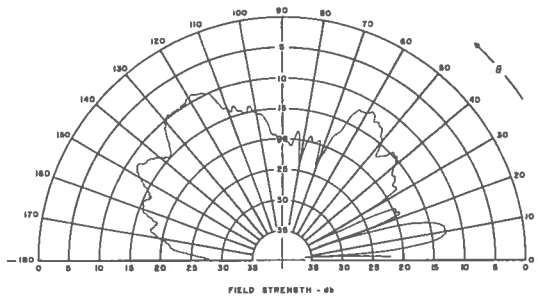


ANTENNA : AFT BLOCK - SUPPORT WHIP

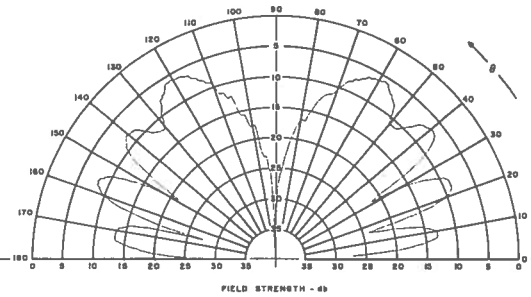
FREQ. : 20 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

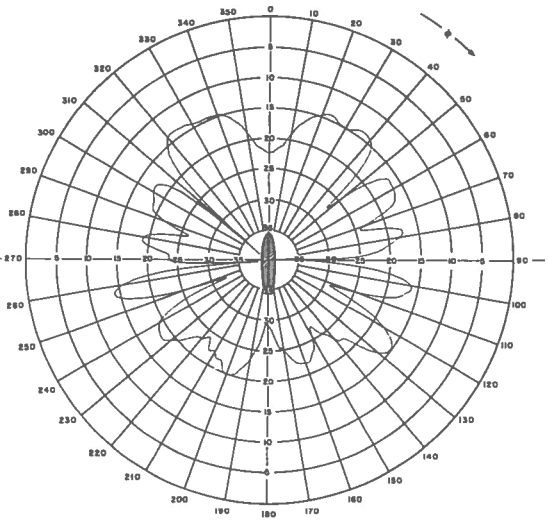
E_θ



FWD-AFT

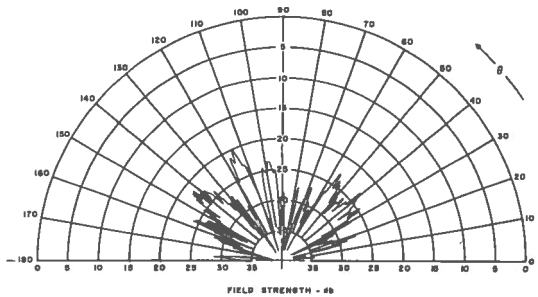


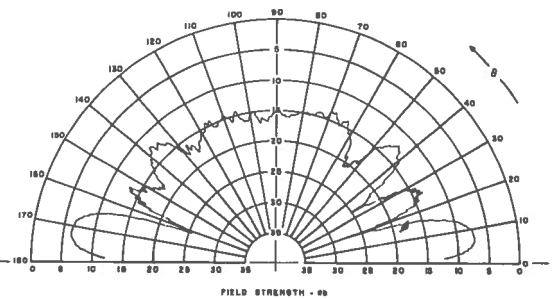
PORT-STBD



$\theta = 0°$

E_ϕ



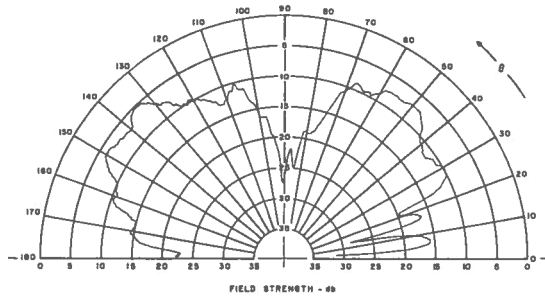


ANTENNA : AFT BLOCK - SUPPORT WHIP

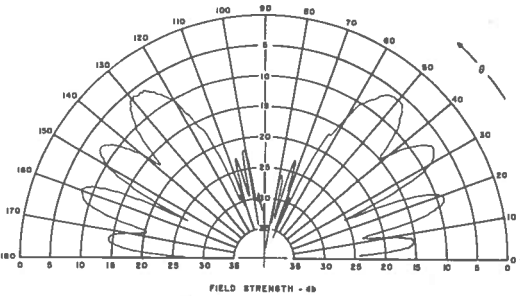
FREQ. : 22 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

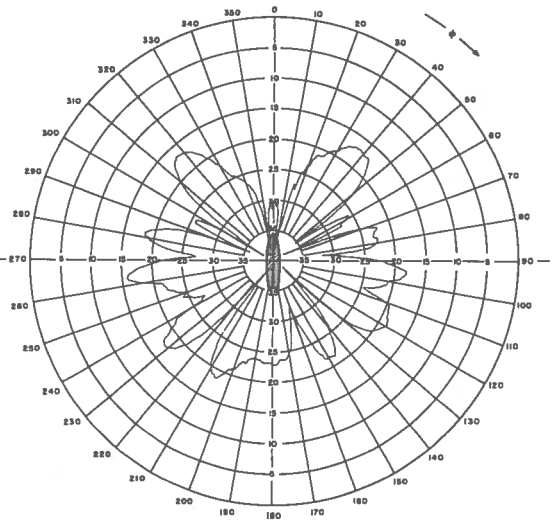
E_θ



FWD - AFT

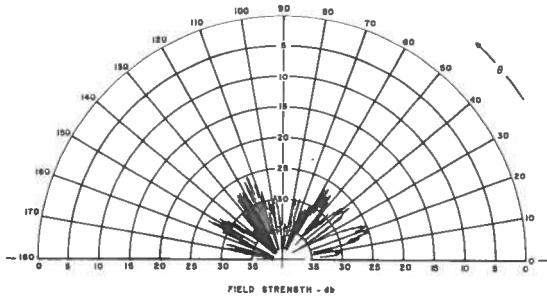


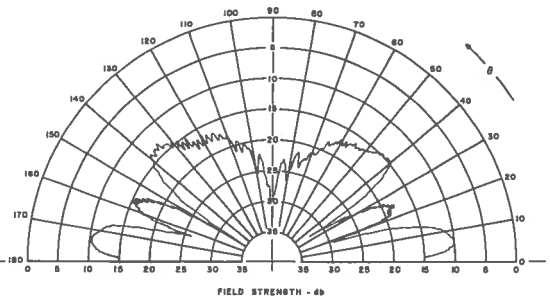
PORT - STBD



$\theta = 0°$

E_ϕ





ANTENNA : AFT BLOCK - SUPPORT WHIP

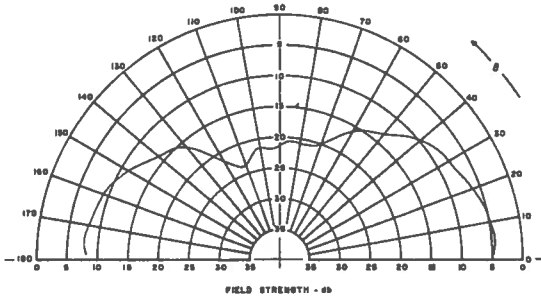
FREQ. : 24 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

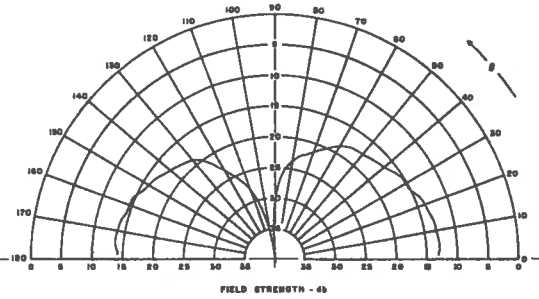
RADIATION PATTERNS

Forward block-support whip – patterns 15–28

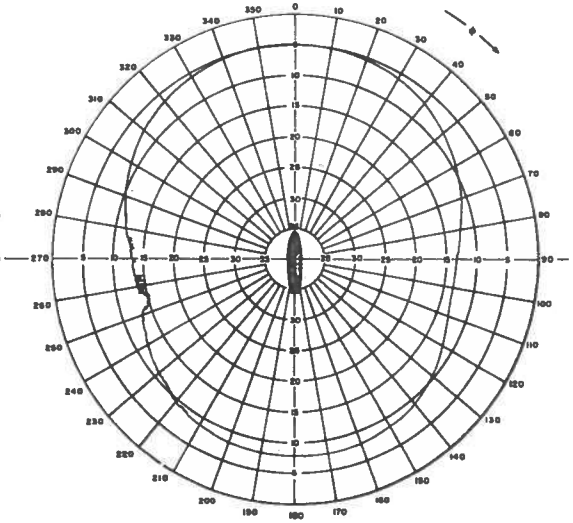
E_θ



FWD-AFT

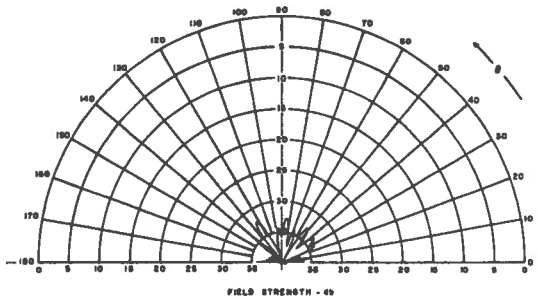


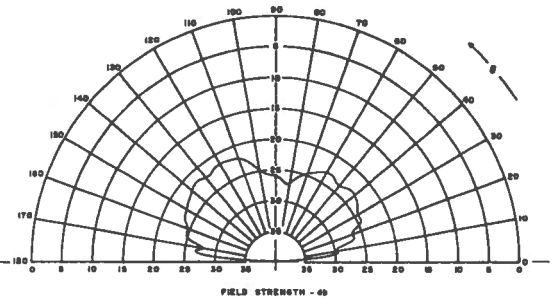
PORT-STBD



$\theta = 0°$

E_ϕ



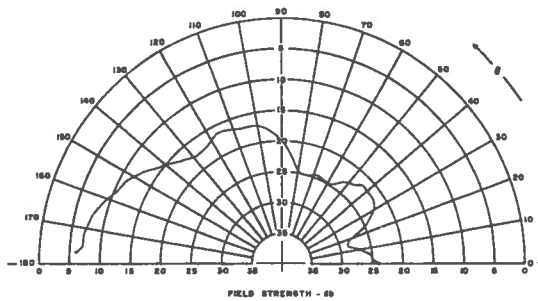


ANTENNA : GOAL POST WHIP

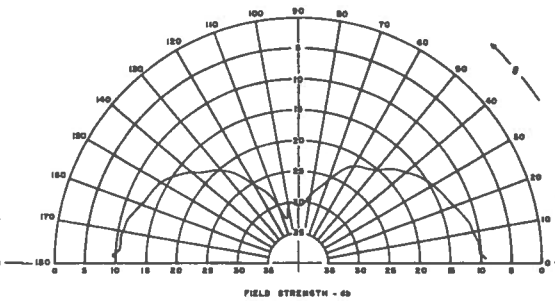
FREQ. : 2 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

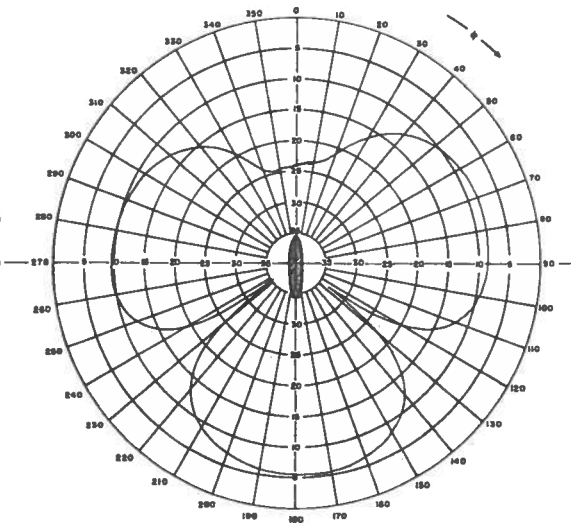
E_θ



FWD - AFT

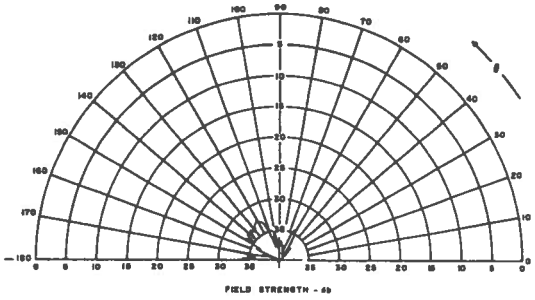


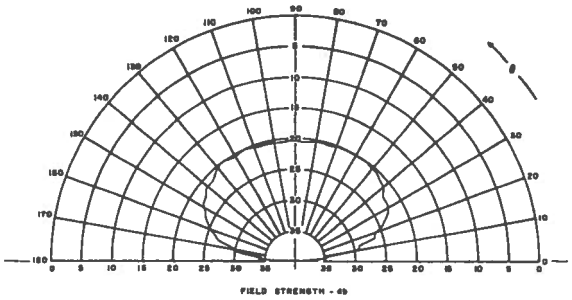
PORT - STBD



$\theta = 0°$

E_ϕ



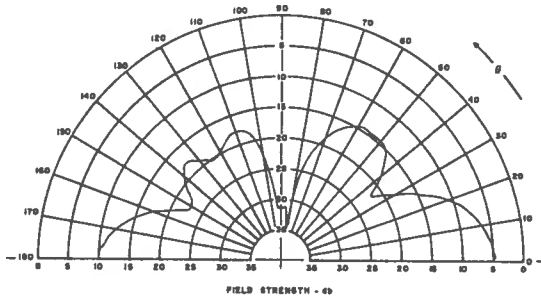


ANTENNA : GOAL POST WHIP

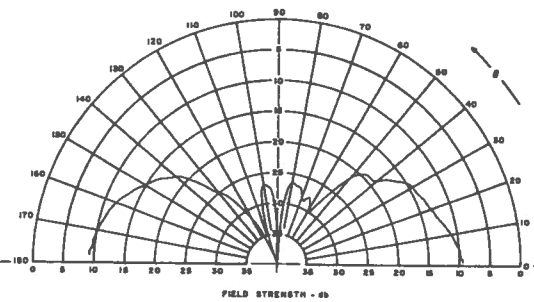
FREQ. : 3 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

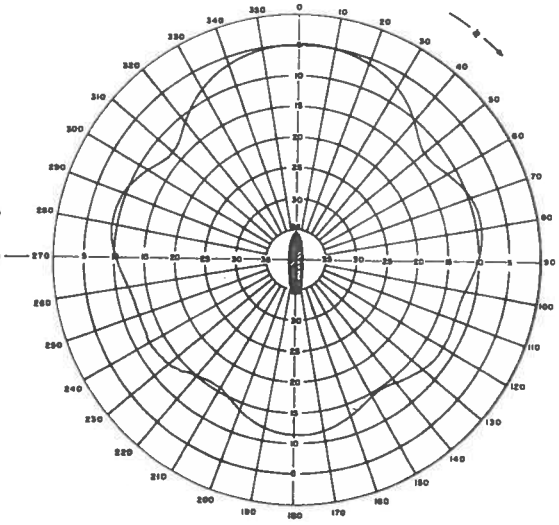
E_θ



FWD-AFT

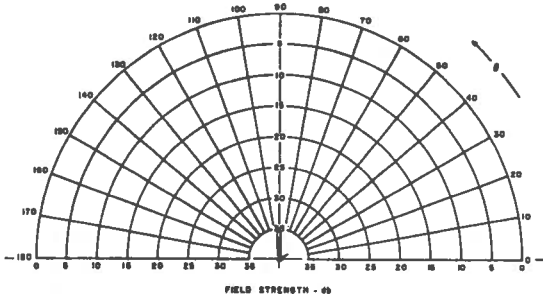


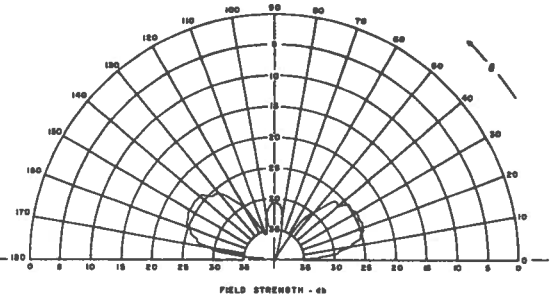
PORT-STBD



$\theta = 0°$

E_ϕ



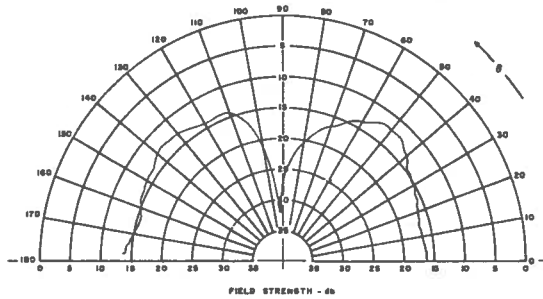


ANTENNA : GOAL POST WHIP

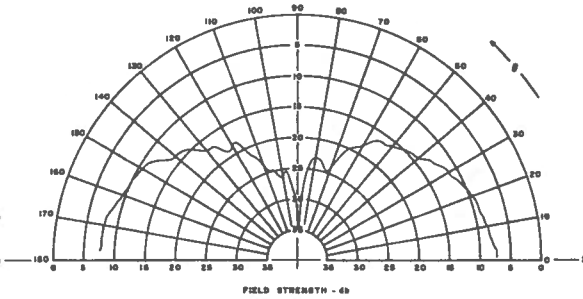
FREQ. : 4 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

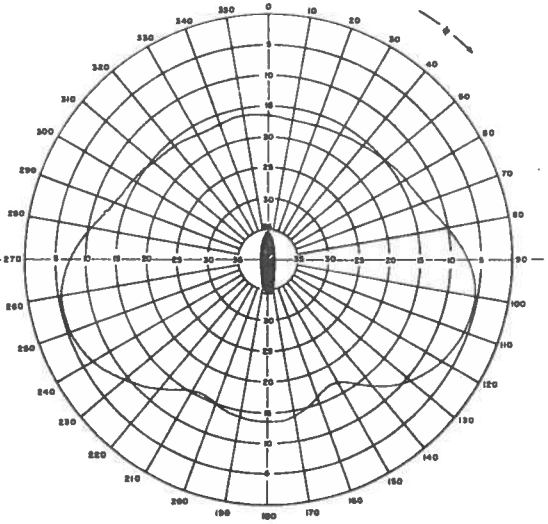
E_θ



FWD-AFT

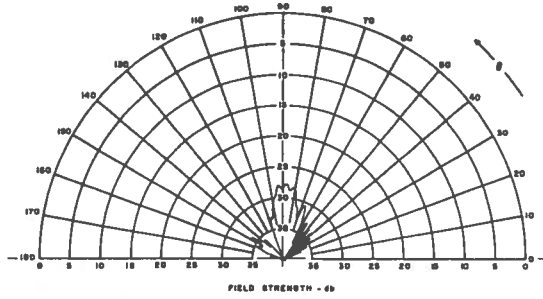


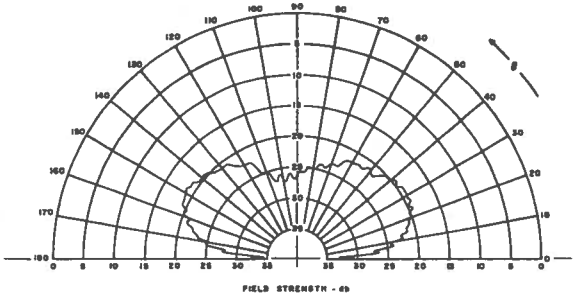
PORT-STBD



$\theta = 0°$

E_ϕ



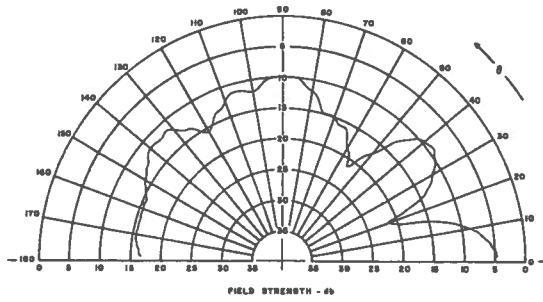


ANTENNA : GOAL POST WHIP

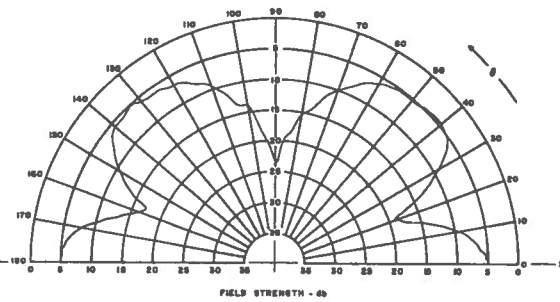
FREQ. : 5 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

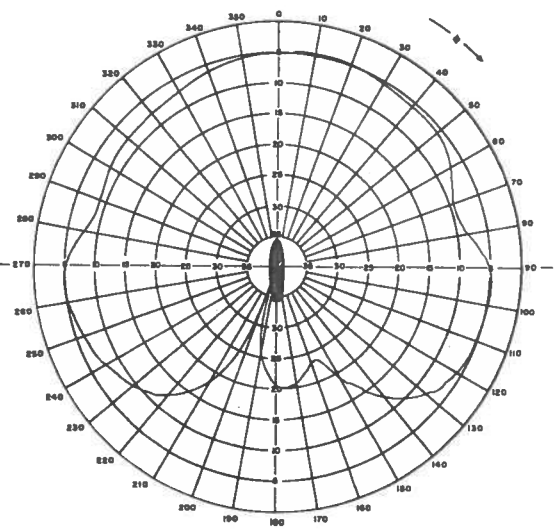
E_θ



FWD-AFT

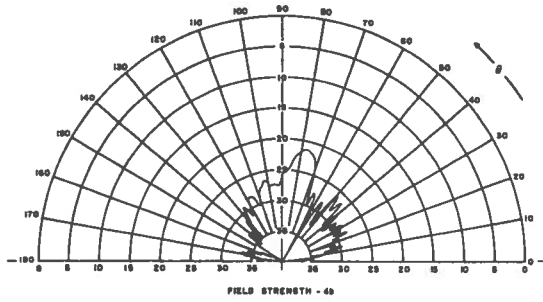


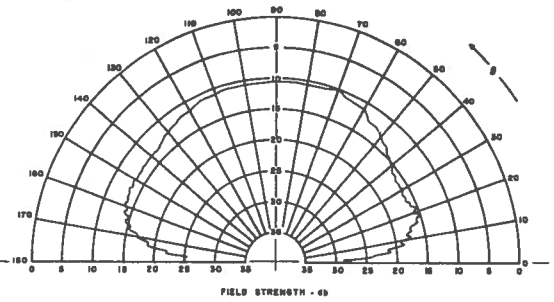
PORT-STBD



$\theta = 0°$

E_ϕ



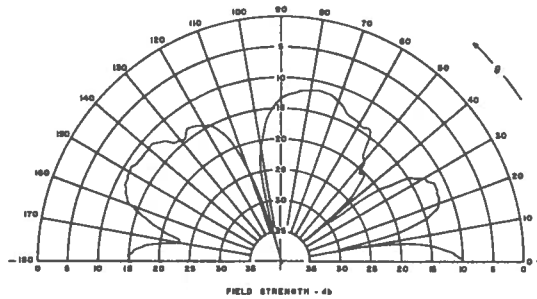


ANTENNA : GOAL POST WHIP

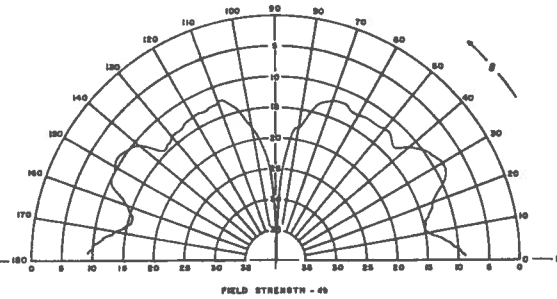
FREQ. : 6 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

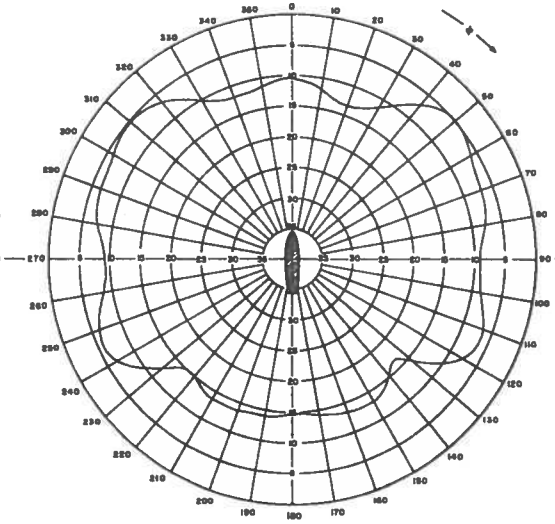
E_θ



FWD-AFT

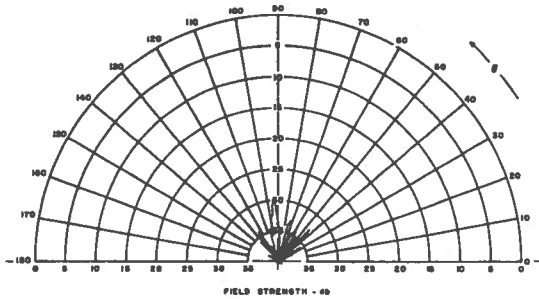


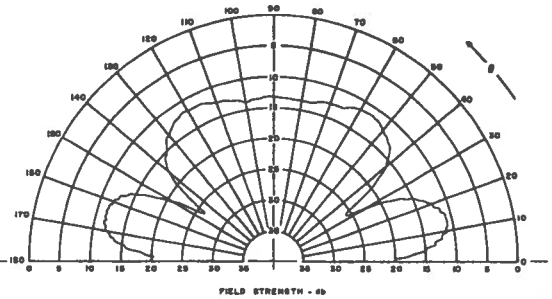
PORT-STBD



$\theta = 0°$

E_ϕ



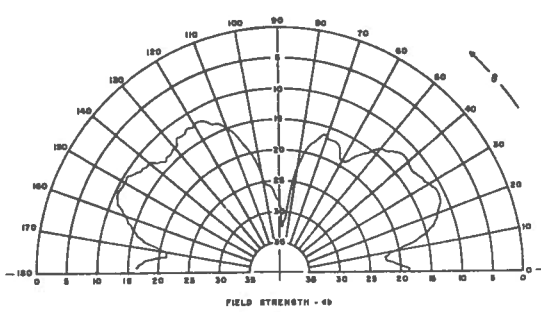


ANTENNA : GOAL POST WHIP

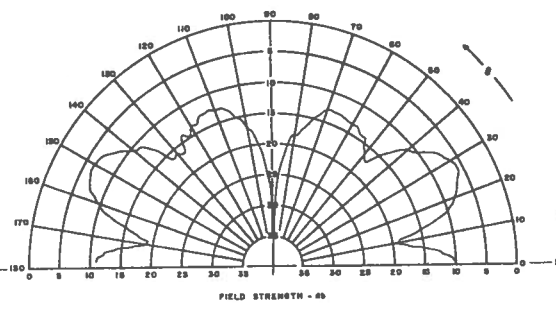
FREQ. : 8 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

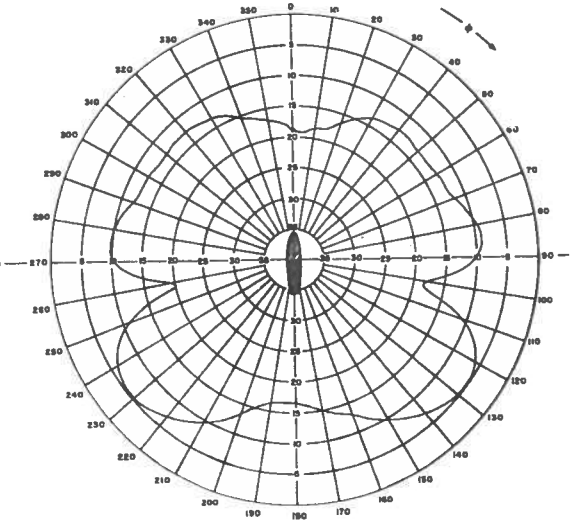
E_θ



FWD - AFT

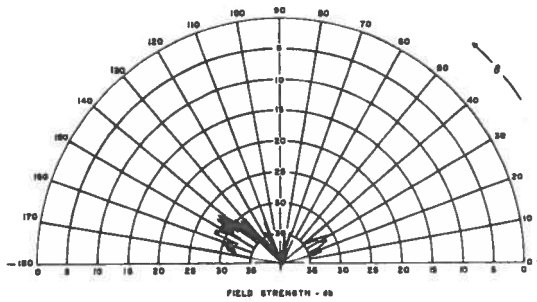


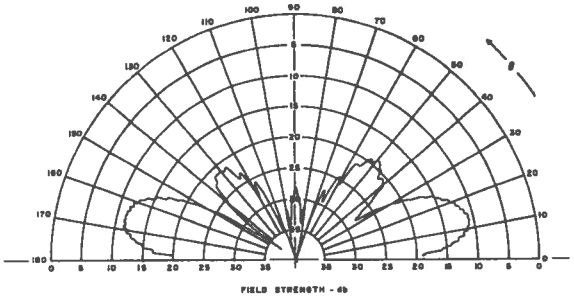
PORT - STBD



$\theta = 0°$

E_ϕ



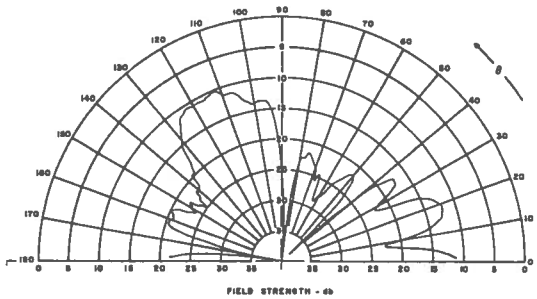


ANTENNA : GOAL POST WHIP

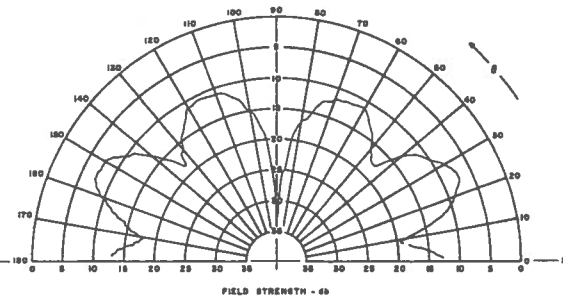
FREQ. : 10 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

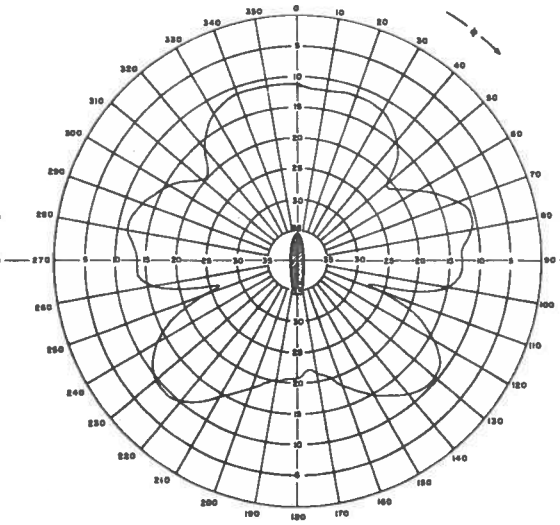
E_θ



FWD-AFT

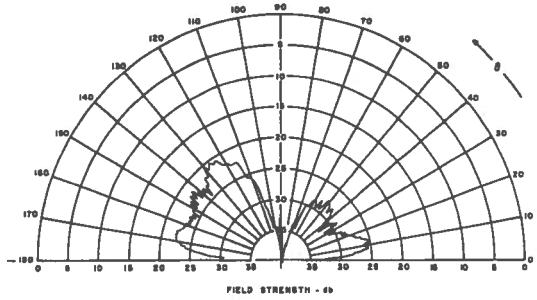


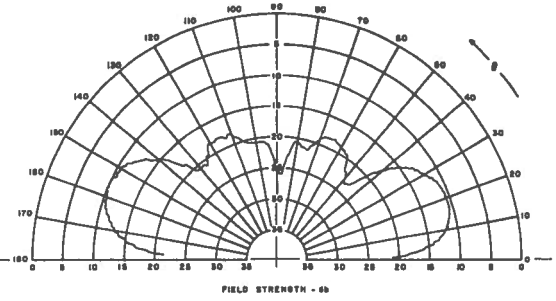
PORT-STBD



$\theta = 0°$

E_ϕ



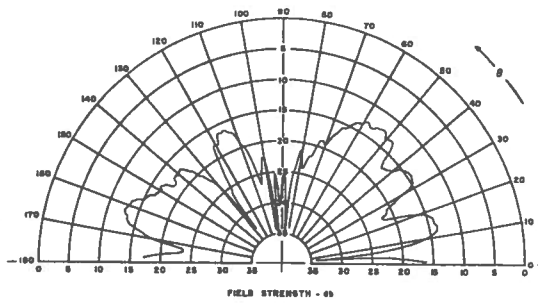


ANTENNA : GOAL POST WHIP

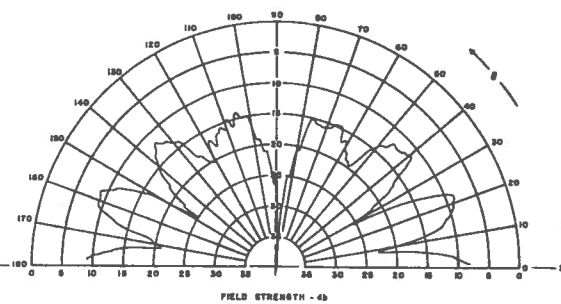
FREQ. : 12 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

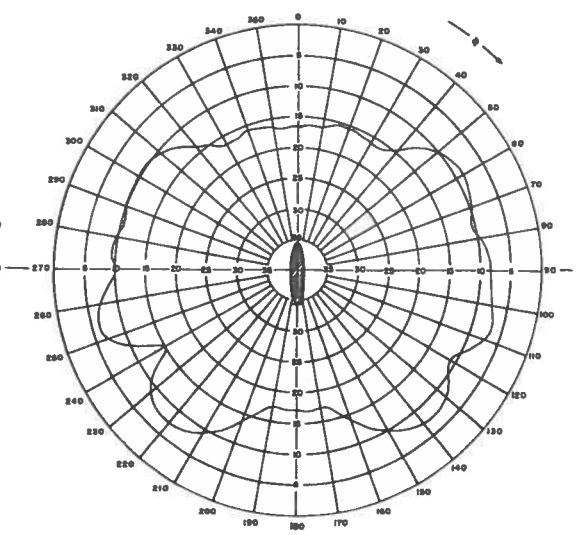
E_θ



FWD-AFT

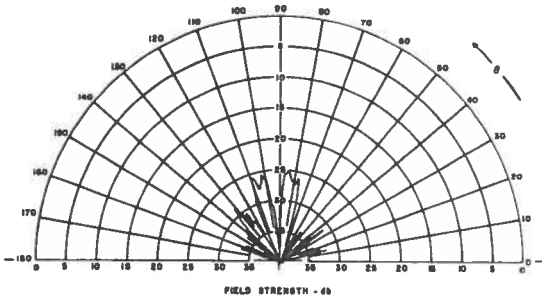


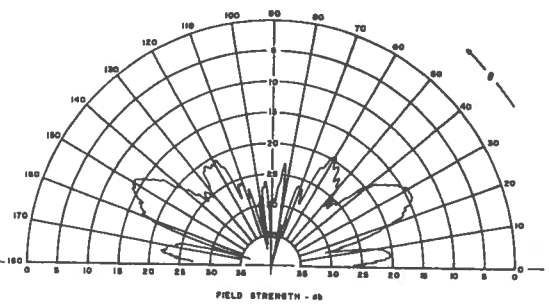
PORT-STBD



$\theta = 0°$

E_ϕ



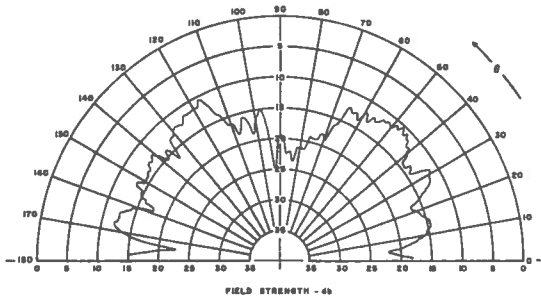


ANTENNA : GOAL POST WHIP

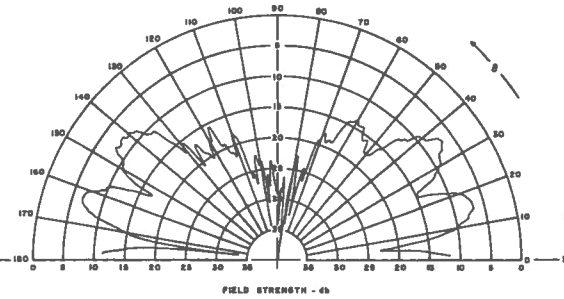
FREQ. : 14 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

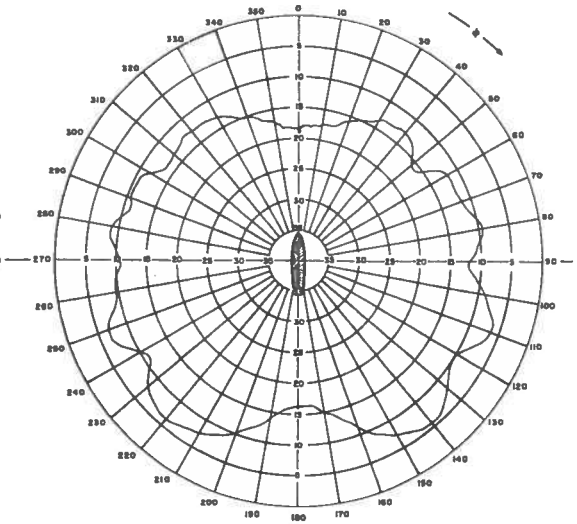
E_θ



FWD-AFT

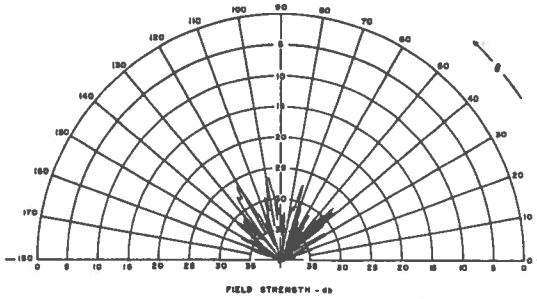


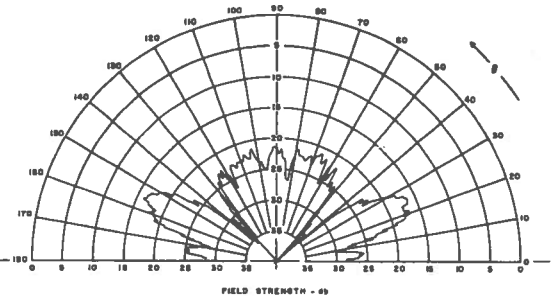
PORT-STBD



$\theta = 0°$

E_ϕ



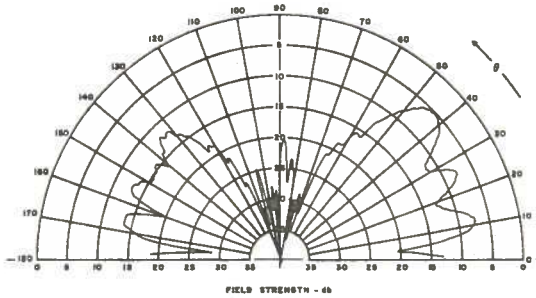


ANTENNA : GOAL POST WHIP

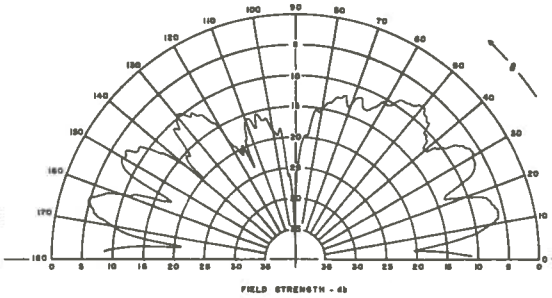
FREQ. : 16 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

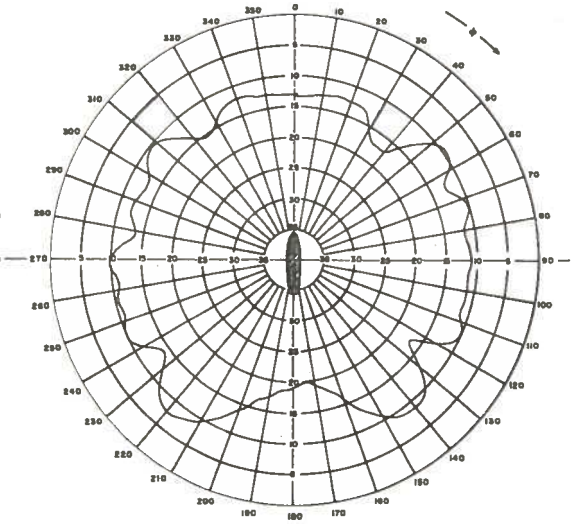
E_θ



FWD - AFT

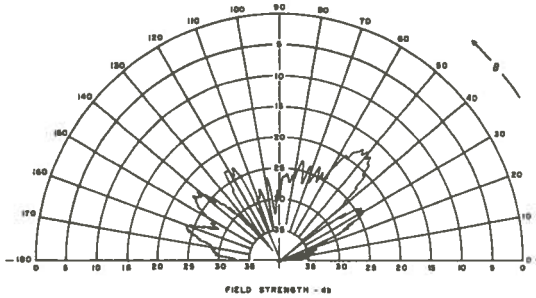


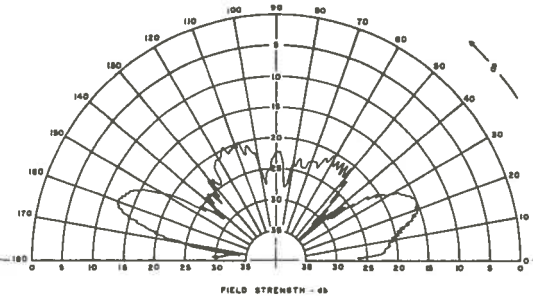
PORT - STBD



$\theta = 0°$

E_ϕ



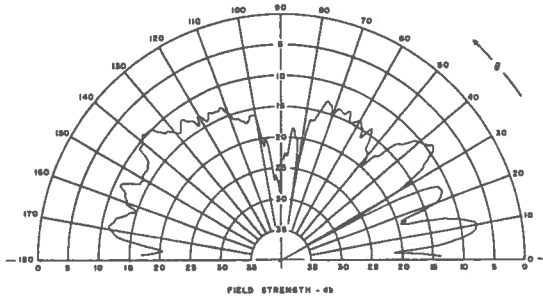


ANTENNA : GOAL POST WHIP

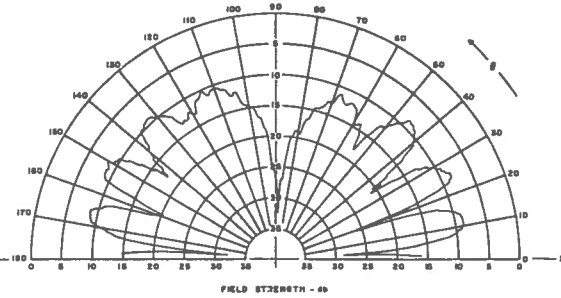
FREQ. : 18 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

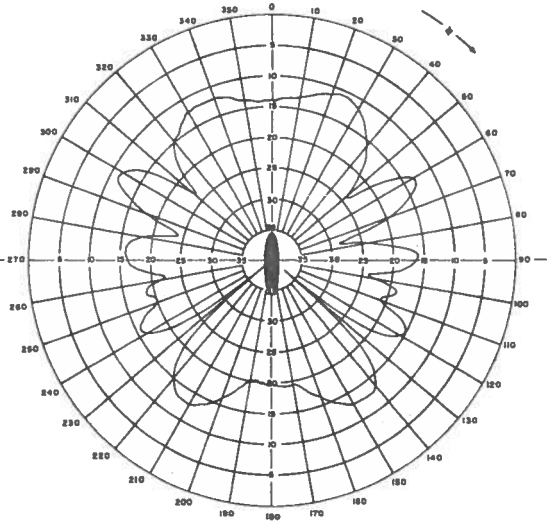
E_θ



FWD-AFT

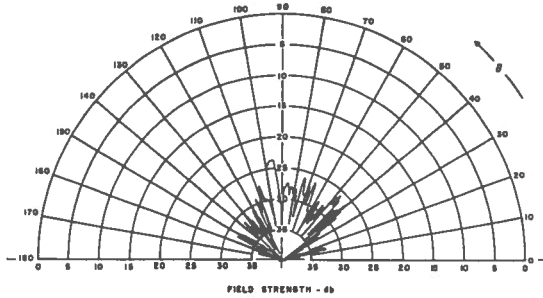


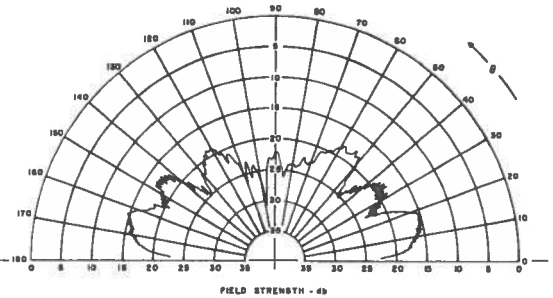
PORT-STBD



$\theta = 0°$

E_ϕ



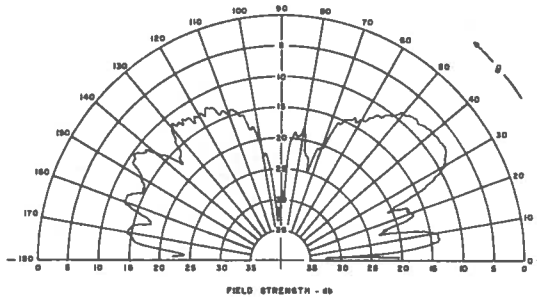


ANTENNA : GOAL POST WHIP

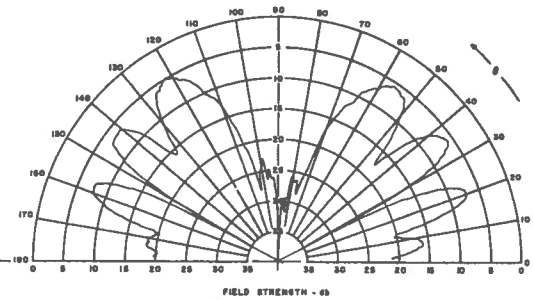
FREQ. : 20 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

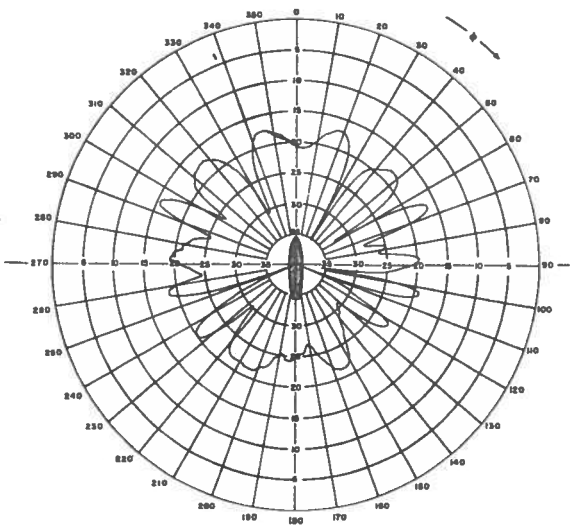
E_θ



FWD-AFT

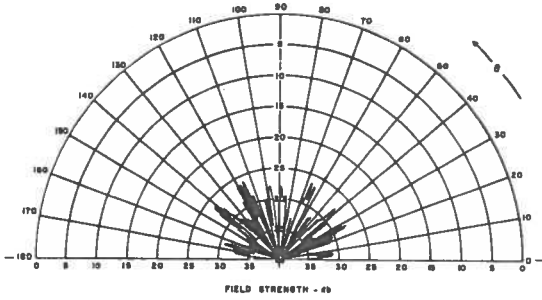


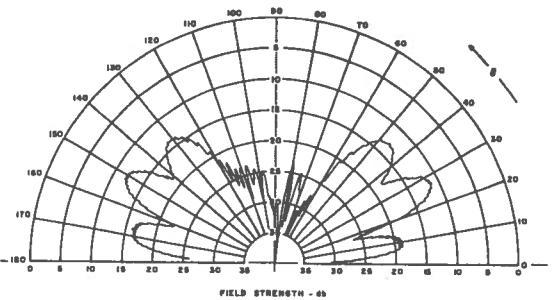
PORT-STBD



$\theta = 0°$

E_ϕ



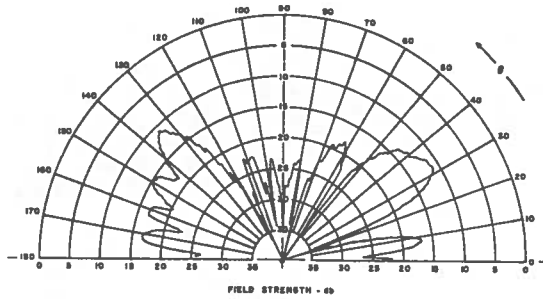


ANTENNA : GOAL POST WHIP

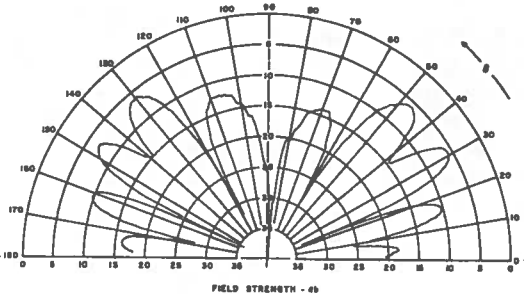
FREQ. : 22 MHz

REMARKS : ALL OTHER ANTENNAS TERMINATED IN 50Ω

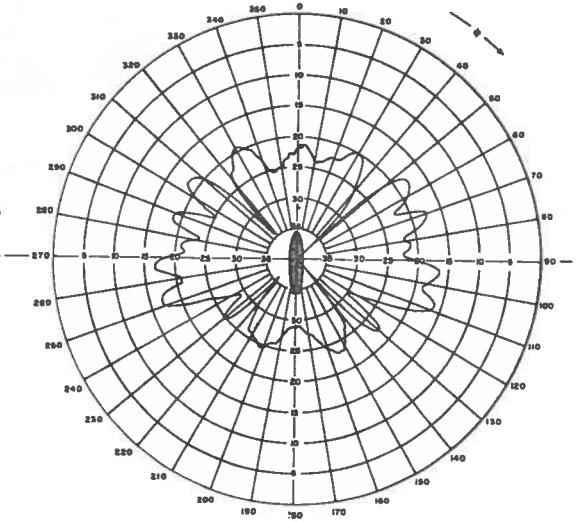
E_θ



FWD-AFT

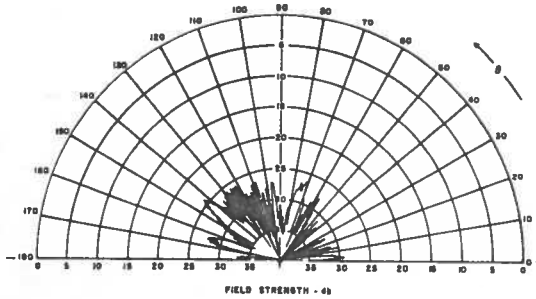


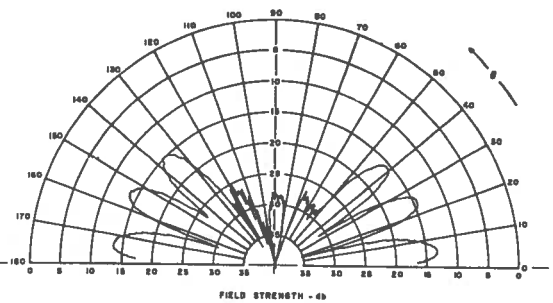
PORT-STBD



$\theta = 0°$

E_ϕ





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