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## A Simple Method for Designing Hog Horn Antenna

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### Abstract

A simple method is developed to design the hog horn antennas. The method is based on geometrical optics and ray tracing technique. A computer program is also developed to compute the antenna dimensions such as aperture lengths and focal point of its parabolic reflectors. This program is also able to analyze the radiation pattern and the directivity of the antenna. It is shown that there is a good similarity between the simulation and experimental results at 9 Ghz with  $15^\circ$  and  $2^\circ$  half power beam widths in the H and E planes respectively. The designed hog horn antennas are potentially easy and cheaper, and have several advantages over the typical pyramidal horn and combined horn antennas.

**Key words:** Hog Horn Antenna, Geometrical Optics

( )

H E

[1]

H E

VSER

( )

[2]

( )

[3]

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( )

H E

( )

[2]

%

HP<sub>E</sub>

( : )

HP<sub>H</sub>

E

( )

H

H E

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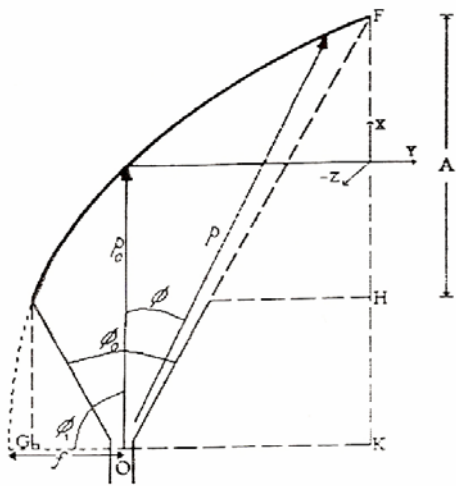
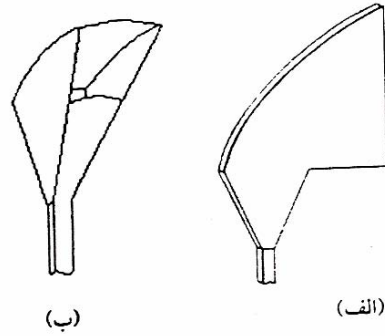
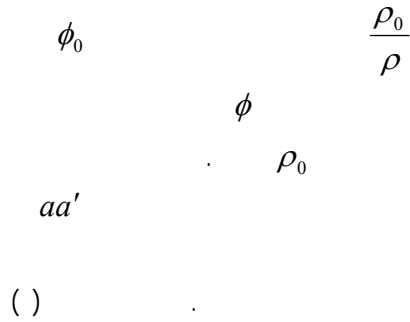
H

6- Offset feed

- 
- 1-Aperture antenna
  - 2-Low noise
  - 3-Sectoral horn antenna
  - 4-Pyramidal horn
  - 5-Compound horn antenna

$$E = E_0 \frac{\rho_0}{\rho} \cos \frac{\pi\phi}{\phi_0} \quad ( )$$

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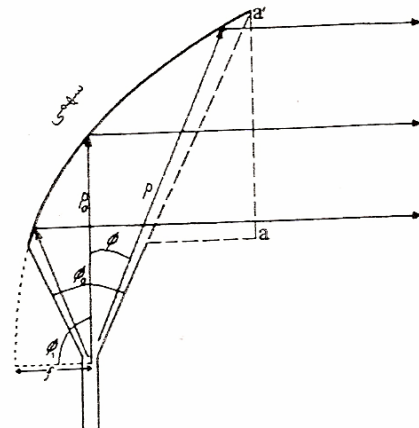


H

$$\rho_0 = \frac{2f}{1 + \cos(\phi_1)} \quad ( )$$

$$\rho = \frac{2f}{1 + \cos(\phi_1 + \phi)} \quad ( )$$

f



H

$$\frac{\rho_0}{\rho} = \frac{1 + \cos(\phi_1 + \phi)}{1 + \cos(\phi_1)} \quad ( )$$

TE<sub>10</sub> H

$$\phi_0 \quad \phi_1 \quad A \quad ( )$$

E

H

E

E

E

$$f' = B / [2 \left( \frac{\sin(\theta_1 + \theta_0 / 2)}{1 + \cos(\theta_1 + \theta_0 / 2)} - \frac{\sin(\theta_1 - \theta_0 / 2)}{1 + \cos(\theta_1 - \theta_0 / 2)} \right)] \quad ( )$$

: ( )

$$OF = \frac{2f}{1 + \cos(\phi_1 + \phi_0 / 2)} \quad ( )$$

E  $\phi_1 \quad \phi_0$   $\theta_1 \quad \theta_0$

$$FK = OF \sin(\phi_1 + \phi_0 / 2) \quad ( )$$

H E

H E

H E

$$FK = \frac{2f \sin(\phi_1 + \phi_0 / 2)}{1 + \cos(\phi_1 + \phi_0 / 2)} \quad ( )$$

$$\frac{A}{B} = \frac{\frac{\sin(\phi_1 + \phi_0 / 2)}{1 + \cos(\phi_1 + \phi_0 / 2)} - \frac{\sin(\phi_1 - \phi_0 / 2)}{1 + \cos(\phi_1 - \phi_0 / 2)}}{\frac{\sin(\theta_1 + \theta_0 / 2)}{1 + \cos(\theta_1 + \theta_0 / 2)} - \frac{\sin(\theta_1 - \theta_0 / 2)}{1 + \cos(\theta_1 - \theta_0 / 2)}} \quad ( )$$

$$OE = \frac{2f}{1 + \cos(\phi_1 - \phi_0 / 2)} \quad ( )$$

$$FK = A + OE \sin(\phi_1 - \phi_0 / 2) \quad ( )$$

$\theta_1 \quad \theta_0$   $\phi_1 \quad \phi_0$

( )

$\theta_0 \quad \phi_0$  ( )

$$Fk = A + \frac{2f \sin(\phi_1 - \phi_0 / 2)}{1 + \cos(\phi_1 - \phi_0 / 2)} \quad ( )$$

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: ( ) ( )

SWR

HP<sub>H</sub>

H

$\phi_1 = 80^\circ \quad \phi_0 = 50^\circ$

15°

$$f = A / [2 \left( \frac{\sin(\phi_1 + \phi_0 / 2)}{1 + \cos(\phi_1 + \phi_0 / 2)} - \frac{\sin(\phi_1 - \phi_0 / 2)}{1 + \cos(\phi_1 - \phi_0 / 2)} \right)] \quad ( )$$

[2]

( ) A  
 $\phi_1 \phi_0$

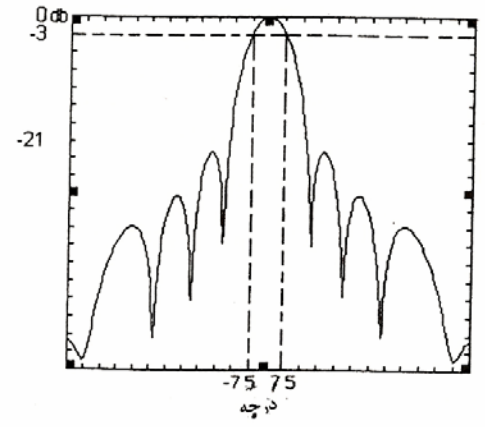
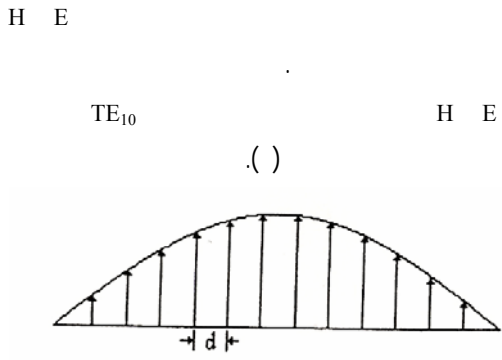
( )  
 $\phi_0$  ( )  
 $\theta_1 \theta_0$   $\phi_1$

( )  
 $HP_H = 68.2 \frac{\lambda}{A}$  ( )

( ) A  $HP_H$   
 $A = 4.547\lambda$

( )  
 ( ) 2.905  $\lambda$

( )



$\phi_0 = 50^\circ$

XZ  $HP_H = 15^\circ \phi_1 = 80^\circ$

( )

$HP_H$  ( )

9 GHz

15°

$HP_H$

- [2] ( )

( ) x

$$AF = \sum_{n=0}^{M-1} E_n e^{j\beta nd \sin \alpha} \quad ( )$$

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d n E<sub>n</sub>  
M β  
d) M (

