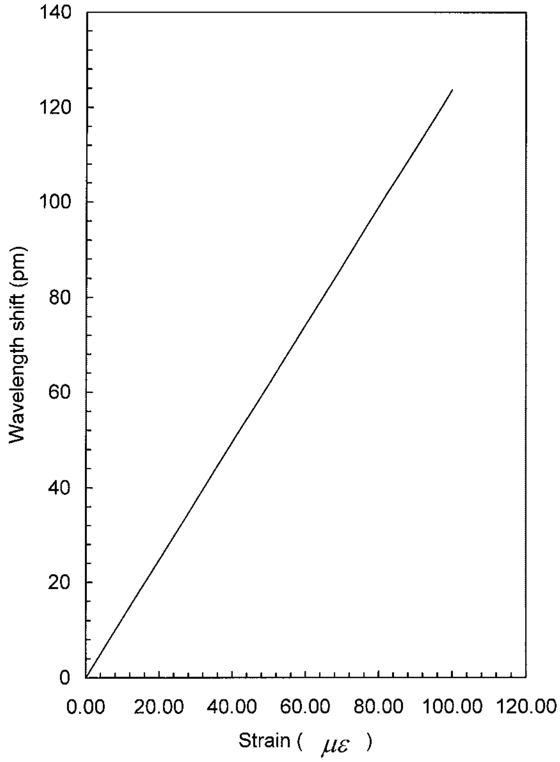

Figure 5 Transmission dip displacement as function of a static applied strain

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STRIP-LOADED HOLLOW DIELECTRIC *H*-PLANE SECTORAL HORN ANTENNAS FOR SQUARE RADIATION PATTERN

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Received 29 September 2000

ABSTRACT: *The radiation characteristics of a new type of hollow dielectric H-plane sectoral horn antenna are presented. Metallic strips of optimum length are loaded on the H-walls of the sectoral horns. The effects of strip loading for producing square patterns in the H plane are discussed.* © 2001 John Wiley & Sons, Inc. Microwave Opt Technol Lett 29: 45–46, 2001.

Key words: *antennas; dielectric horn antennas; square radiation patterns*

1. INTRODUCTION

Dielectric antennas are of great importance because of their low loss, high gain, light weight, the feasibility of obtaining shaped beams, ease of fabrication, etc. [1]. Solid and hollow dielectric horn antennas have received special attention due to their increased directivity and high gain compared to metallic horns [2–4]. Only a few attempts were noted in the literature on the study of rectangular hollow dielectric horn antennas. In this letter, we present a new hollow dielectric horn antenna capable of producing a flat-top radiation pattern with low sidelobe levels and cross polarization in the *H*-plane.

2. ANTENNA DESIGN AND EXPERIMENTAL SETUP

A schematic diagram of the strip-loaded hollow dielectric *H*-plane horn antenna is shown in Figure 1. The horn is fabricated using low-loss dielectric (polystyrene of dielectric constant $\varepsilon_r = 2.56$), and is fixed at the end of an open metallic waveguide. A properly tapered dielectric rod (launcher) is placed at the throat of the antenna for reducing the feed end discontinuity. The tapering length inside the waveguide is optimized for minimum VSWR. Two thin metal strips of length l are placed on the *H*-walls of the horn. This modifies the aperture field of the horn, changing the radiation pattern considerably. The sidelobe levels and half-power beamwidth (HPBW) of the *E*- and *H*-plane patterns can be adjusted by changing the strip length. An HP 8341B synthesized sweeper, HP 8510B network analyzer, and a plotter with the antenna under test in the receiving mode constitute the experimental setup.

3. EXPERIMENTAL RESULTS

E- and *H*-plane radiation patterns of *H*-plane sectoral horns of different flare angles and strip lengths were analyzed for different frequencies in the *X*-band. The *H*-plane patterns are found to be very broad, and the *E*-plane patterns are narrow. By adjusting the strip length and frequency, it is possible to produce flat-top (square) patterns with high HPBW in the *H*-plane. The sidelobe levels of these patterns are very low. Figure 2 shows a typical radiation pattern for a horn of flare angle 20° with a strip of length of 2λ at 10.4 GHz. The variation of HPBW with frequency and strip length is shown in Figure 3. The VSWR of the horn is very low for the entire

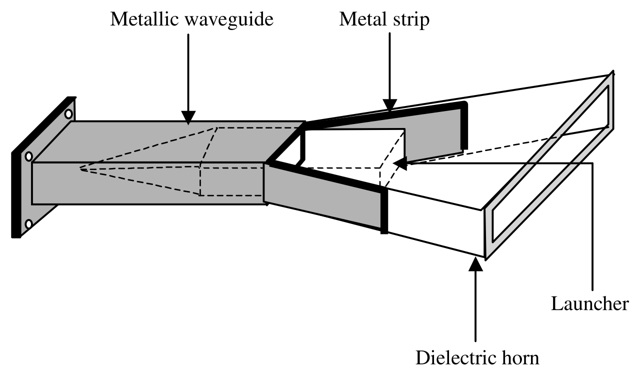

Figure 1 Schematic diagram of strip-loaded hollow dielectric *H*-plane sectoral horn antenna

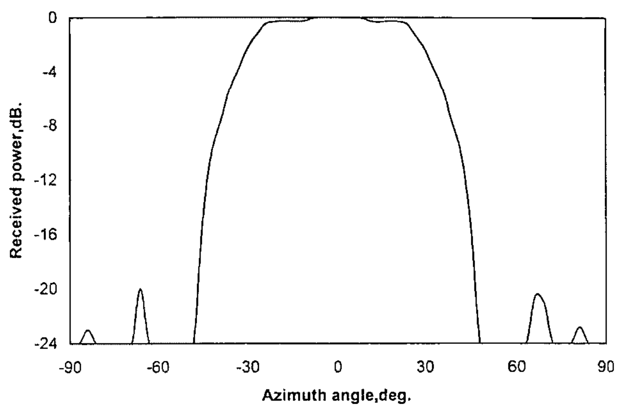

Figure 2 Square radiation pattern in the *H*-plane of the horn

TABLE 1 Radiation Characteristics of the Test Horn

Flare Angle (deg.)	Strip Length (λ)	Frequency (GHz)	HPBW (deg.)		Sidelobe Level (dB)		VSWR
			H	*E*	*H*	*E*	
10	1	8.5	41	31	−24	−16	1.06
	3	10.5	68	18	−20	−8.5	1.18
20	2	8.5	43	26	−30	−12	1.08
	3	10.4	51	22	−28	−10	1.1
30	1	8.5	65	23	−35	−11.5	1.17
	3	9.5	50	21	−32	−8	1.25
45	1	8.5	70	25	−28	−16	1.09
	2	9.5	58	27	−17	−20	1.1

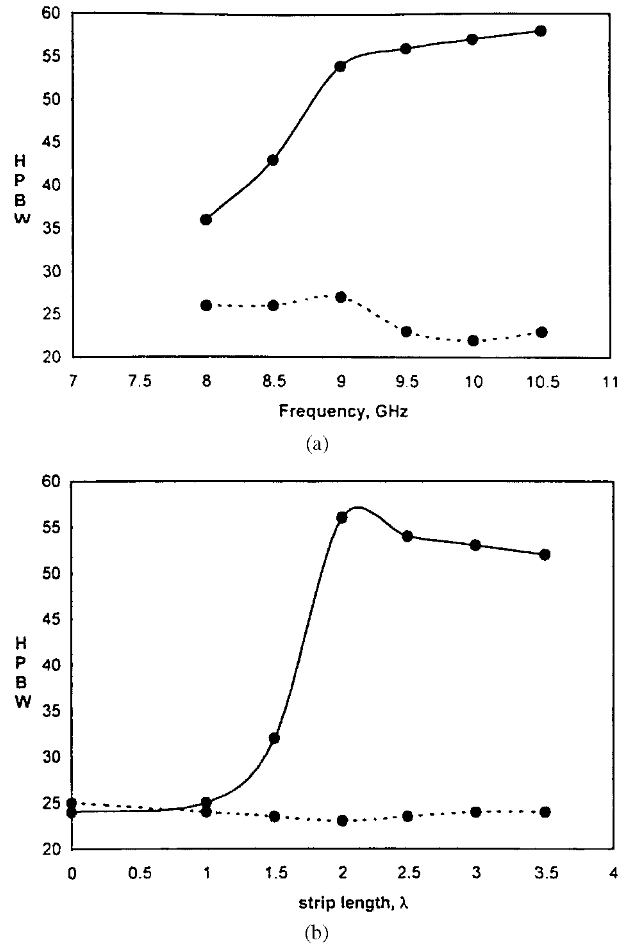

Figure 3 (a) HPBW against frequency for strip length $l = 2\lambda$. —●— *H*-plane 20°, --●-- *E*-plane 20°. (b) HPBW against strip length at frequency 9.5 GHz. —●— *H*-plane 20°, --●-- *E*-plane 20°

X-band. The radiation characteristics of the test horn are tabulated in Table 1.

4. CONCLUSIONS

The performance of a strip-loaded hollow dielectric *H*-plane sectoral horn antenna is presented. The study shows that the new horn is capable of producing a broad square pattern in the *H*-plane and a narrow pattern in the *E*-plane. It has high gain and low VSWR, sidelobe levels, and cross-polar levels. It may be an ideal feed for reflector antennas.

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