Whenever a gap, even a very narrow one, is present between dielectric and metal at the slab ends, the boundary condition on the normal electric field component specifies that this component is K' times larger in the air than in the dielectric. As a result, electrical breakdown in small voids can be expected to occur at a power level smaller than the one calculated by Findakly and Haskal by a factor of the order of $1/K'^2$.

The occurrence of gaps can, to some extent, be avoided by introducing low viscosity dielectric, such as silicone grease, within all cracks or crevices appearing at the dielectric-to-metal joint. However, dielectric losses within the filling material would increase somewhat the attenuation. On the basis of the theoretical analysis, loading a rectangular waveguide with a dielectric slab may look like a promising way to increase its power-handling capacity; considerable precautions would be required in practice to obtain a performance approaching the predicted one.

Reply[2] by H. M. Haskal[3] and T. K. Findakly[4]

The point raised by Prof. Gardiol is an important one. Intimate contact must be insured between the dielectric slab and the bottom and top walls of the waveguide to avoid local breakdowns. The contact surface which is critical for breakdown also carries an appreciable fraction of the microwave current so that greater attention to skin resistivity will be necessary than in microwave tube fabrication; long-term vacuum-tight seals are not required, however.

In the view of the authors it is useful to point out the high-power carrying capacity of the dielectric loaded waveguide in order to stimulate the development of fabrication techniques which can realize the full potential of the waveguide.

[2] Manuscript received December 10, 1976.
[3] H. M. Haskal is with the Department of Electrical Engineering, Tufts University, Medford, MA 02155.
[4] T. K. Findakly is with the Department of Electrical Engineering, Purdue University, Lafayette, IN 47906.

Discussion of "The Resonant Frequency and Tuning Characteristics of a Narrow-Gap Reentrant Cylindrical Cavity"

J. R. M. VAUGHAN

After programming the working equations given in the Appendix to this paper,[1] and finding that I could not reproduce the numerical results given in Table I, I have corresponded directly with the author. He informs me that there are four errors in the equation given on p. 187.

1) In the top line of the right-hand column, the sign preceding $\sin^2$ should be $-$ not $+$.

2,3) In the next line, $\pi - c$ should be $\pi - 2c$ in both places.

4) In the fourth line, the coefficient 0.01765 should be 0.03529.

With these corrections, I find that the computed frequency for case 1 of Table I agrees with Williamson's value within 0.6 percent. This is still some way from the claimed accuracy of 0.01 percent for the expression in the Appendix, but would be acceptable for most purposes.

I suggest that it is in any case more satisfactory to solve Williamson's (7) directly, rather than to use the complicated expressions in the Appendix, which have no apparent functional relation to the problem.

I find that about 25 terms of (7) are required, but this is less work than at first appears: After only 2 terms, x_m can be reduced to

$$-\frac{2}{q_m}\frac{K_1(q_m ka)}{K_0(q_m ka)}.$$

Then, when mc exceeds 10, the two Bessel functions of order 1/6 and 5/6 reduce to

$$J_{1/6}(mc) = \sqrt{2/\pi mc}\,\{(1 - 5/(9mc)^2)\cos(mc - \pi/3) + (1/9mc)\sin(mc - \pi/3)\}$$

$$J_{5/6}(mc) = \sqrt{2/\pi mc}\,\{(1 + 7/(9mc)^2)\cos(mc - 2\pi/3) - (2/9mc)\sin(mc - 2\pi/3)\}.$$

Using a computer, and these approximations for the higher terms, evaluation of (7) is quite straightforward.

Manuscript received January 20, 1977.
The author is with the Linear Beam Department, Electron Tube Division, Litton Industries, San Carlos, CA 94070.
[1] A. G. Williamson, *IEEE Trans. Microwave Theory Tech.*, vol. MTT-24, pp. 182–187, Apr. 1976.

Reply[2] by A. G. Williamson[3]

Because of circumstances at the time, the corrections were not immediately communicated and unfortunately the matter was subsequently unwittingly overlooked. I should like to thank Dr. Vaughan for remedying my oversight.

The aim of the Appendix expression was to provide a method suitable for the general narrow-gap case including the case where c is very small for which the direct solution of (7) requires a large number of terms. In specific cases, the parameters of the problem may be such that the direct solution of (7), incorporating the approximation mentioned for x_m, is quite satisfactory, as Dr. Vaughan correctly points out.

[2] Manuscript received February 3, 1977.
[3] A. G. Williamson is with the Department of Electrical Engineering, University of Auckland, Auckland, New Zealand.