



# Certificate of Calibration

## Standard Reference Materials

1504                      1505                      1506

For

Permittivity

(7940 Fused Silica)

These Standard Reference Materials were cut from a mass of 7940 Fused Silica and are intended for the following uses:

No. 1504—A rough-cut blank for making a 2 inch disk for a low-frequency, capacity-type holder.

No. 1505—A rough-cut blank for a 0.4 inch by 0.9 inch rectangular x-band waveguide.

No. 1506—A rough-cut blank for a nominal one-inch diameter cylindrical waveguide.

The permittivity of these materials relative to vacuum (not air) is given in the following table.

Frequency Hz	Relative Permittivity	Loss Tangent $\times 10^4$
$10^2$	$3.8350 \pm 0.30\%$	$1.86 \pm 0.84$
$10^4$	$3.8317 \pm .30\%$	$1.14 \pm .79$
$10^6$	$3.8265 \pm .31\%$	$0.33 \pm .69$
$10^8$	$3.8255 \pm .31\%$	$0.34 \pm .74$
$10^7$	$3.8258 \pm .37\%$	$0.20 \pm .86$
$10^9$	$3.83 \pm .67\%$	$1. \pm 1.20$
$10^{10}$	$3.8315 \pm .37\%$	$1.46 \pm 0.84$

Each value in the above table is an average of several measurements made by the National Bureau of Standards and at most frequencies also by the National Physical Laboratory of England and the National Research Council of Canada. In forming the average, each laboratory's result has been weighted inversely to the uncertainty quoted by that laboratory. The uncertainty given in the table represents the uncertainties normally quoted by the several laboratories, suitably combined and then increased to allow for possible inhomogeneity of the material from which this specimen was cut. For additional information, see paper on "International Comparison of Dielectric Measurements" by H. E. Bussey, J. E. Gray, E. C. Bamberger, J. Rushton, G. Russell, B. W. Petley, and D. Morris, IEEE Transactions on Instrumentation and Measurement, Volume IM-13, pp 305-311 (1964).