OPERATING INSTRUCTIONS

TYPE 874-W100

100-OHM COAXIAL STANDARD

Serial No. _____

The Type 874-W100 Coaxial Standard (Fig. 1) produces a 100-ohm resistive termination at a known point on a 50-ohm coaxial line. It consists of a metallic film-type cylindrical resistor mounted in a tapered section of line and is fitted with a Type 874 Coaxial Connector. It can be used to produce a known VSWR on a 50-ohm line or to produce the range of known impedances (Fig. 3) by adding various lengths of Type 874-L Air Line ahead of the unit. The actual impedance at any point on the line can be calculated from the VSWR and electrical length of line between the pure resistive termination and the point in question using transmission-line equations or a Smith Chart.

A calibration curve of VSWR vs frequency is plotted in Figure 2. The magnitude of the terminating resistance is 50 x VSWR ohms.

The location of the pure resistive termination is indicated in Figure 1. As shown it is 3.2 + d centimeters from the front face, A, of the insulator in the Type 874 Connector. (The value of d is plotted in Figure 2.) The Type 874-WN and -WO Short- and Open-Circuit Termination Units produce short or open circuits at the front face of the insulating bead, A, and the electrical length of 50-ohm line between the front face of the bead and any point on the 50-ohm line ahead of the termination can be measured using a procedure similar to that outlined in Paragraphs 4.12 and 4.5 in the Type 874-LBA Slotted Line Operating Instructions or in Paragraph 2.3125 in the Type 1602-B Admittance Meter Operating Instructions.

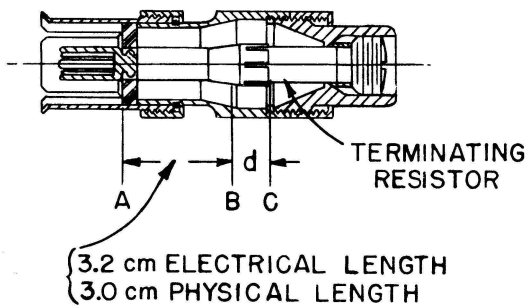

Figure 1.

Cross-sectional view of Type 874-W100 Coaxial Standard. The effective position of the pure resistance termination is at C.

The Type 874-WN3 and -WO3 3-cm Short- and Open-Circuit Termination Units produce short and open circuits at B in Fig. 1. The pure resistive termination is d centimeters away from the terminations produced by these units. They may be used as previously outlined in measurements of the electrical length of line between the termination and points on the 50-ohm line.

The distance d varies somewhat from unit to unit. A calibration curve of d vs frequency is plotted in Figure 2.

The impedance at any point on the 50-ohm line to which the termination is attached can be calculated from the VSWR of the termination and the electrical length of line between the location of the pure resistive termination and the point in question using transmission-line equations or a Smith Chart (see Paragraph 2.3 in the Type 874-LBA Slotted Line Operating Instructions or Paragraphs 2.3124 in the Type 1602-B Admittance Meter Operating Instructions. Here the load impedance is known and the impedance at some other point on the line nearer the generator is desired. Therefore, ℓ in Equations (11) or (12) in the Type 1602-B instruction book should be negative and the WAVELENGTHS TOWARD GENERATOR scale on the Smith Chart should be used. When calculating θ or ℓ, remember to consider the difference in the locations of the resistance termination and any short- or open-circuit termination used.

For example, at 300Mc the VSWR is 2.0, and if d=0.71cm, the impedance at A, the front face of the bead, can be determined using transmission-line equations as follows:

$$\ell_e = 3.2 + 0.71 = 3.91 \text{ cm.}$$

$$\theta = \frac{\ell_e}{\lambda} = \frac{3.91}{100} = .0391 \text{ wavelengths} = 14.08°$$

$$Z_p = Z_o \times \frac{Z_s + jZ_o\tan\theta}{Z_o + jZ_s\tan\theta} = 50 \times \frac{100 + j\,50 \tan 14.08°}{50 + j\,100 \tan 14.08°}$$

$$= 84.0 - j29.7 \text{ ohms}$$

If admittance is desired,

$$Y_p = Y_o \times \frac{Y_s + jY_o\tan\theta}{Y_o + jY_s\tan\theta} = 20 \times \frac{10 + j20\tan 14.08}{20 + j10\tan 14.08}$$

Equation (10b) from 874-LBA Instruction Book

$$= 10.46 + j3.71 \text{ mmhos}$$

The same calculation using the Smith Chart is shown in Figure 3 along with the calculated impedance 20 cm farther along the line.

SPECIFICATIONS

D-C Resistance: 100 ohms ± 1%
Maximum Power: 1/3 watt
Net Weight: 3 ounces (90 g)

U. S. Patent Number: 2, 548, 457

CALIBRATION CURVES FOR SERIAL NO. _____

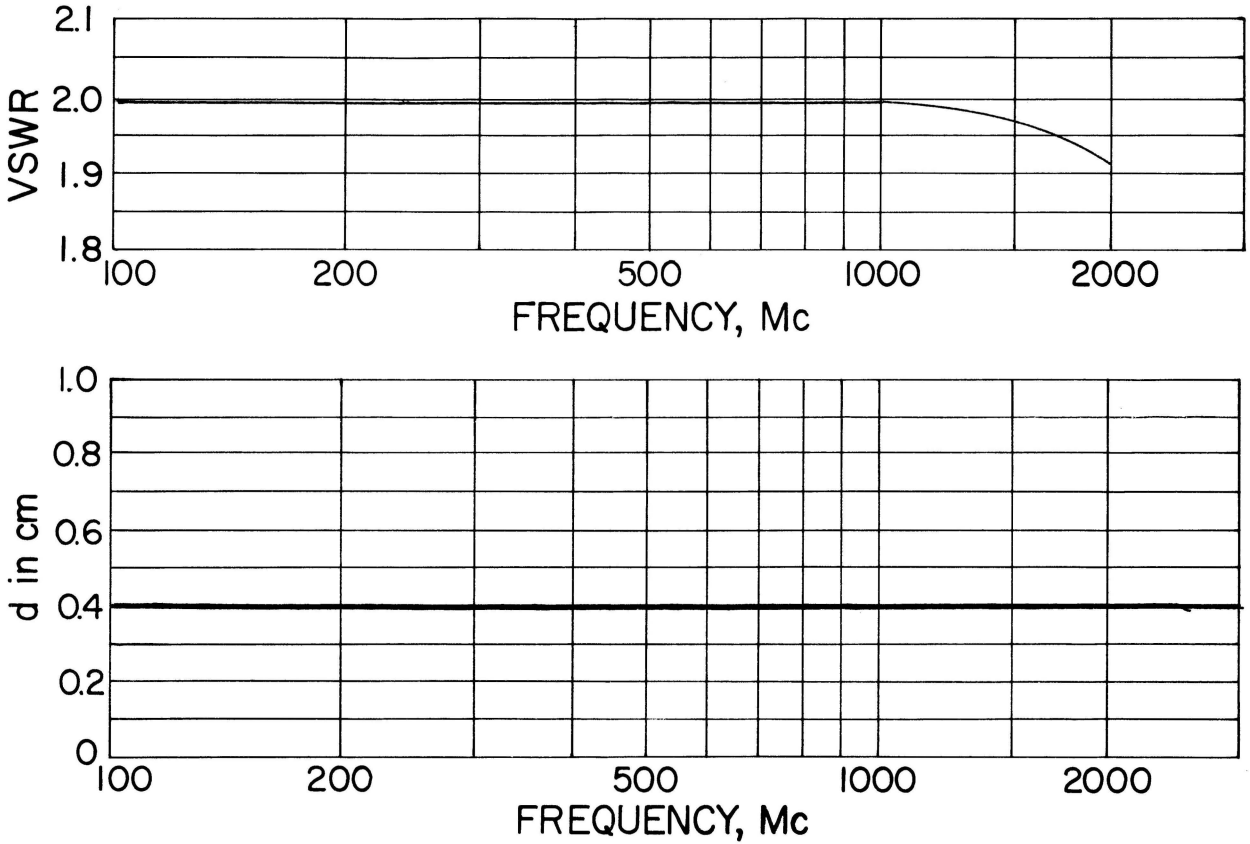

Figure 2. Type 874-W100 Coaxial Standard.

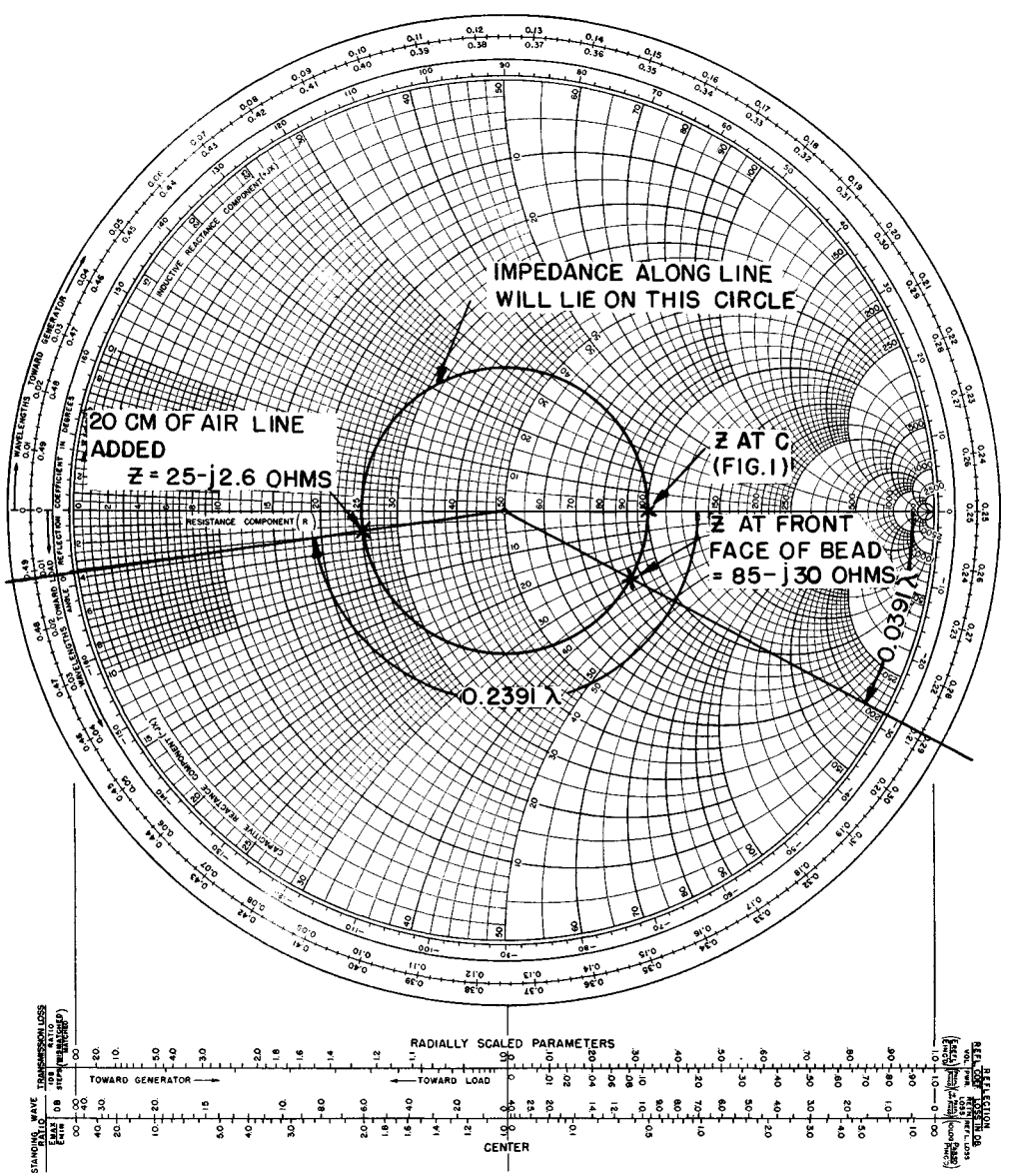

Figure 3. Determination by means of a Smith Chart of the impedance at various points along a 50-ohm line terminated in a Type 874-W100 100Ω Coaxial Standard.

G E N E R A L R A D I O C O M P A N Y

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