

# GENERAL RADIO COMPANY

## ERRORS

In all waveguide attenuators, the excitation of modes other than the desired one distorts the theoretical attenuation characteristic, particularly at low attenuation levels. In the Type 874-GAL Attenuator, the  $TM_{0,1}$  mode (capacitive coupling) is the most serious offender. This mode is attenuated more rapidly with distance from the source end of the waveguide than is the desired mode and its intensity is proportional to the voltage across the exciting line at the coupling point, while the intensity of the desired mode is proportional to the current flowing in the exciting line at the point of coupling. The effect of the undesired mode on the attenuation characteristic therefore decreases as the attenuation increases. Since the output from the attenuator is the sum of the voltage generated in the loop by both modes, serious errors can result if the voltage in the exciting line at the coupling point is high compared to the current; that is, if the impedance is high.

If the exciting line is terminated in its characteristic impedance, for instance with a Type 874-50L Termination, the error resulting from the coupling of the  $TM_{0,1}$  mode can be corrected by using the correction chart of Figure 2. The sign of the correction depends on which end of the exciting line is connected to the source of rf power. If the source is connected to the end marked with the letter S, use the correction curve labeled NORMAL and subtract the correction found for initial setting of the attenuator from the initial scale reading. Then subtract the correction found for the final setting of the attenuator from the final scale reading. The true attenuation is the difference in the corrected values. If the source is connected to the opposite end, add to the indicated values the corrections read from the curve labeled REVERSED. When these correction charts are used, the indicated relative attenuation is accurate within  $\pm(0.015$  times the difference  $+0.2)$  db at frequencies up to 2000 Mc. For accurate results at higher frequencies for small values of attenuation, the method outlined in the following paragraph should be used.

To eliminate the correction and to make the indicated relative attenuation agree very closely with the actual attenuation between -9 and 140 db on the scale, the voltage across the line, at the minimum coupling point, should approach zero. To accomplish this, connect an adjustable short-circuiting stub (Type 874-D20L or -D50L) to the end of the main line opposite the source. Adjust the stub until a voltage minimum appears at the coupling point. To find this stub adjustment, substitute a Type 874-VR Voltmeter Rectifier and a Type 874-VI Voltmeter Indicator, or a Type 874-T Tee and