Measuring Characteristic Impedance of Coax Cable in the Shack

"The technique presented here is based on a well-known property of transmission lines (see John D. Kraus, *Electromagnetics*, 1953, pp. 433ff.)". This reference is the same as Table 10-3, John D. Kraus, *Electromagnetics, Third Edition*, 1984, p. 406. The earlier reference is out of print. We are referring to the equation in the third row and third column of Table 10-3, reproduced below.

**Table 10-3 Input impedance of terminated transmission line†**

| Load condition | General case ($\alpha \neq 0$) | Lossless case ($\alpha = 0$) |
|---|---|---|
| Any value of load $Z_L$ | $Z_x = Z_0 \dfrac{Z_L + Z_0 \tanh \gamma x}{Z_0 + Z_L \tanh \gamma x}$ | $Z_x = Z_0 \dfrac{Z_L + jZ_0 \tan \beta x}{Z_0 + jZ_L \tan \beta x}$ |
| Open-circuited line ($Z_L = \infty$) | $Z_x = Z_0 \coth \gamma x$ | $Z_x = -jZ_0 \cot \beta x$ |
| Short-circuited line ($Z_L = 0$) | $Z_x = Z_0 \tanh \gamma x$ | $Z_x = jZ_0 \tan \beta x$ |

† $\gamma = \alpha + j\beta$, where $\alpha$ = attenuation constant in nepers per meter and $\beta = 2\pi/\lambda$ = phase constant in radians per meter, where $\lambda$ is the wavelength.

Specifically, when length $x = \lambda/8$, then $\beta x = \pi/4$ (45 degrees), and $|Z_x| = Z_0$.

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