Sistem Telekomunikasi

Minggu ke-02
An attenuator is an electronic device that reduces the amplitude or power of a signal without appreciably distorting its waveform.

An attenuator is effectively the opposite of an amplifier, though the two work by different methods. While an amplifier provides gain, an attenuator provides loss, or gain less than 1.

Attenuators are usually passive devices made from simple voltage divider networks.
Pi-Attenuator

\[
R_3 = \frac{1}{2} \left( 10^{\frac{L}{10}} - 1 \right) \sqrt{\frac{Z_{in} \times Z_{out}}{10^{\frac{L}{10}}}}
\]

\[
R_2 = \frac{1}{10^{\frac{L}{10}} + 1} - \frac{1}{Z_{out} \left( 10^{\frac{L}{10}} - 1 \right) \frac{1}{R_3}}
\]

\[
R_1 = \frac{1}{10^{\frac{L}{10}} + 1} - \frac{1}{Z_{in} \left( 10^{\frac{L}{10}} - 1 \right) \frac{1}{R_3}}
\]

Where \( L \) = desired loss in dB
\( Z_{in} \) = desired input impedance (ohms)
\( Z_{out} \) = desired output impedance (ohms)
T-Attenuator

\[ R_3 = \frac{2\sqrt{Z_{\text{in}} \cdot Z_{\text{out}} \cdot 10^{\frac{L}{10}}}}{10^{\frac{L}{10}} - 1} \]

\[ R_2 = \frac{10^{\frac{L}{10}} + 1}{10^{\frac{L}{10}} - 1} Z_{\text{out}} - R_3 \]

\[ R_2 = \frac{10^{\frac{L}{10}} + 1}{10^{\frac{L}{10}} - 1} Z_{\text{in}} - R_3 \]

Where \( L \) = desired loss in dB
\( Z_{\text{in}} \) = desired input impedance (ohms)
\( Z_{\text{out}} \) = desired output impedance (ohms)
Bridge T-Attenuator

\[ R_1 = Z_0 \left( 10^{\frac{L}{20}} - 1 \right) \]

\[ R_4 = \frac{Z_0}{10^{\frac{L}{20}} - 1} \]

Where:
- \( L \) = desired loss in dB
- \( Z_{in} \) = desired input impedance (ohms)
- \( Z_{out} \) = desired output impedance (ohms)
- \( Z_0 \) = Circuit characteristic impedance (ohms)
Narrow Band Active Attenuator

Minimum attenuation
\[ L = 20 \log\left(\frac{R_1}{50} + 1\right) = 20 \log\left(\frac{10}{50} + 1\right) = 1.58 \text{ dB approx} \]

Where \( L \) = desired loss in dB

Maximum attenuation
\[ L = 20 \log\left(\frac{R_1}{50} + 1\right) = 20 \log\left(\frac{1500}{50} + 1\right) = 29 \text{ dB approx} \]