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POWER, TRANSDUCER, AVAILABLE AND INSERTION GAINS DEFINED

Power

Power gain is the ratio of the power delivered to an arbitrary load (P_{dl}) to the power delivered to the network by the source (P_{ds}). It is a function of the load reflection coefficient (Γ_l) and the s-parameters of the network. It is independent of source reflection coefficient. This can be expressed as shown in the following formula:

Power Gain (G):

$$G = \frac{P_{dl}}{P_{ds}}$$

$$G = |S_{21}|^2 \frac{1-|\Gamma_l|}{|1-\Gamma_l S_{22}|^2 (1-\Gamma_l|^2)} \qquad \Gamma_1 = S_{11} + \frac{S_{12} S_{22}\Gamma_l}{1-\Gamma_l S_{22}}$$

Transducer

Transducer gain is the ratio of the power delivered by a network to a load (P_{dl}) to the power available from the source (P_{as}). Transducer gain is a function of the source and load reflection coefficients and the network s-parameters. This can be expressed as shown in the following formula:

Transducer Gain (G_t):

$$G_t = \frac{P_{dl}}{P_{as}}$$

$$G_t = |S_{21}|^2 \frac{(1-|\Gamma_s|^2)(1-|\Gamma_l|^2)}{|1-\Gamma_s S_{11}|^2 |1-\Gamma_l \Gamma_2|^2} \qquad \Gamma_2 = S_{22} + \frac{S_{12} S_{21}\Gamma_s}{1-S_{11}\Gamma_s}$$

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Available

Available gain is the ratio of the power available at the output of a network (P_{ao}) to the power available from the source to the source (P_{as}). Available gain is a function of the network s-parameters and the source reflection coefficient (Γ_s). It is independent of the load reflection coefficient (Γ_l). This can be expressed as shown in the following formula:

Available Gain (G_a):

$$G_a = \frac{P_{ao}}{P_{as}}$$

$$G_a = |S_{21}|^2 \frac{1-|\Gamma_s|^2}{|1-\Gamma_s S_{11}|^2 (1-|\Gamma_2|^2)} \qquad \Gamma_2 = S_{22} + \frac{S_{12} S_{21} \Gamma_s}{}$$

Insertion

Insertion gain is the ratio of the power delivered to a load (P_{dl}), with a device inserted between the source and the load, to the reference power of the source connected directly to the load (P_r). This can be expressed as shown in the following formula:

Insertion Gain (G_i):

$$G_i = \frac{P_{dl}}{P_r}$$

$$G_i = |S_{21}|^2 \frac{|b_d|^2}{|b_r|^2} \frac{|1-\Gamma_l \Gamma_{sr}|^2}{|1-\Gamma_{sd} S_{11}|^2 |1-\Gamma_l \Gamma_2|} \qquad \Gamma_2 = S_{22} + \frac{S_{12} S_{21} \Gamma_{sd}}{1-\Gamma_{sd} S_{11}}$$

r denotes the source characteristics when establishing power reference.

d denotes source characteristics when DUT is inserted.

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