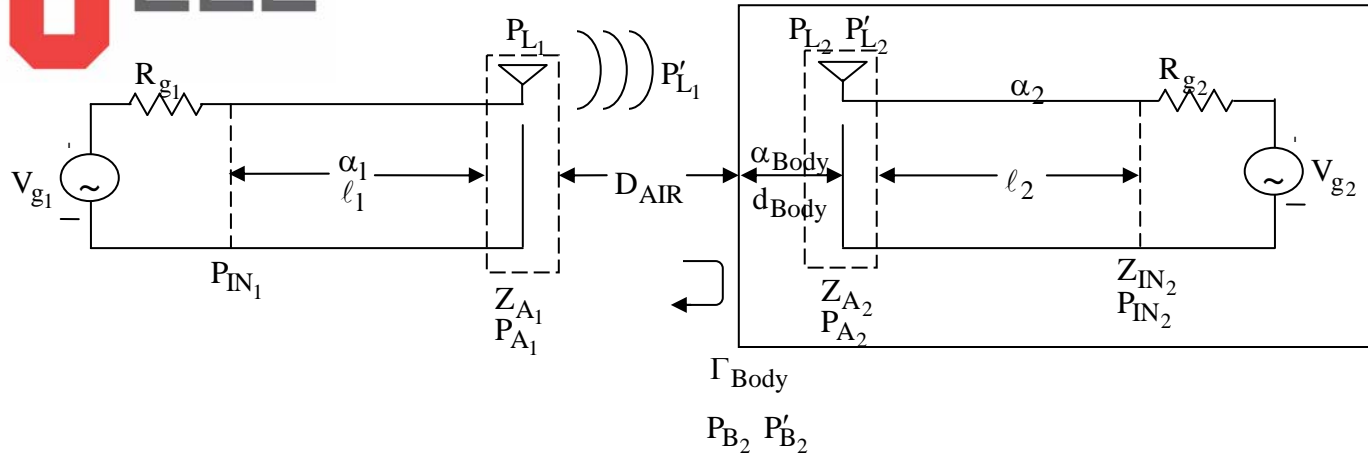


Power Link Budget: How much power reaches the receiver?



Examples of other possible losses:
Connectors, polarization, environment, "multipath fading", reflection @ receiver, etc.

Other possible gains:
Multiple antennas, amplifier, processing, etc.

$$P_{IN1} = \frac{|V_o^+|^2}{2Z_o}$$

Incident power (given)

$$P_{A1} = P_{IN1} \left(e^{-\alpha_1 \ell_1} \right)^2$$

Power reaching antenna, (attenuation in T_{L1})

$$P_{L1} = P_{A1} \left(1 - |\Gamma_{L1}|^2 \right)$$

Power TX from antenna₁, (reflection @ antenna₁)

$$P'_{L1} = G_{A1} P_{L1}$$

Power TX from ant₁ in direction of ant₂ (gain of antenna₁)

$$P_{B2} = P'_{L1} \left(\frac{\lambda_o}{4\pi D_{AIR}} \right)^2$$

Power reaching body surface (spreading in space) See Eq. 9.75

$$P'_{B2} = P_{B2} \left(1 - |\Gamma_{Body}|^2 \right)$$

Power reaching inner body surface (reflection @ surface)

$$P_{L2} = P'_{B2} \left(e^{-\alpha_{Body} D_{Body}} \right)^2$$

Power reaching antenna₂ (loss in body, approximately)

$$P'_{L2} = G_{A2} P_{L2}$$

Power available for antenna₂ (gain of antenna₂)

$$P_{A2} = P'_{L2} \left(1 - |\Gamma_{L2}|^2 \right)$$

Power RX by antenna₂, (reflection @ antenna₂)

$$P_{IN2} = P_{A2} \left(e^{-\alpha_2 \ell_2} \right)^2$$

Power @ receiver (attenuation @ T_{L2}) (min - 115 dB)

In dB:

Given

$$P_{IN1} = 10 \log_{10} (x \text{ watts}) \text{ dBW}$$

$$L_1 = \text{Loss}_{A1} = 10 \log_{10} \left[\left(e^{-\alpha_1 \ell_1} \right)^2 \right] \text{ dB}$$

$$L_2 = \text{Loss}_{L1} = 10 \log_{10} \left[1 - |\Gamma_{L1}|^2 \right] \text{ dB}$$

etc.

$$P_{IN2} = P_{IN1} + L_1 + L_2 + \dots \text{ dBW}$$

This unit is same as P_{IN1}

In linear:

$$P_{IN2} = P_{IN1} \left(e^{-\alpha_1 \ell_1} \right)^2 \left(1 - |\Gamma_L|^2 \right) \cdot G_{A1} \left(\frac{\lambda_o}{4\pi D} \right)^2 \text{ etc.}$$