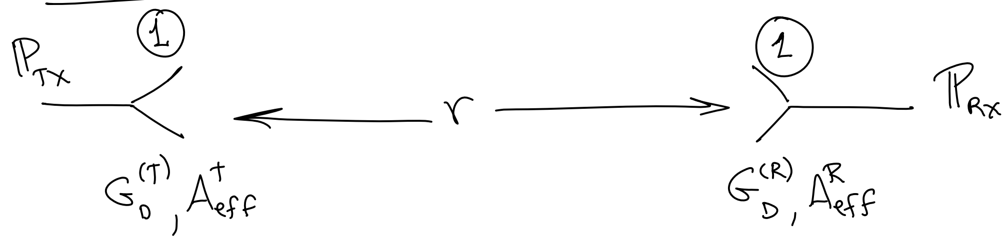
Power transfer in Communications Link



TX antenna

$$\langle P_{(R)}^{(2)} \rangle \Big|_{\text{at RX antenna}} = \frac{\mathbb{P}_{(T)}^{(1)}}{4\pi r^2} G_D^{(1)}(\theta, \phi)$$

(see p. 231)

RX Antenna

$$\mathbb{P}_{(R)}^{(2)} = A_{eff}^{(R)} \langle P_{(R)}^{(2)} \rangle = \left(\frac{\lambda^2}{4\pi} G_D^{(2)} \right) \cdot \left(\frac{G_D^{(1)} \mathbb{P}_{(T)}^{(1)}}{4\pi r^2} \right)$$

$$\therefore \quad \boxed{\mathbb{P}_{Rec} = \mathbb{P}_{Trans} \cdot \frac{G_D^{(R)} \cdot G_D^{(T)} \lambda^2}{(4\pi r)^2}}$$

Friis Transmission Formula

* Useful for estimating signal power levels needed from TX to get $\mathbb{P}_{Rec}$ > noise detection limits at the RX (receiver)!

* Assumes: matched impedances between TX circuitry & TX antenna and between RX circuitry and RX antenna.

* If TX & RX antennas positioned for maximum gain, use $D = G_D|_{max}$. Else use the (θ, ϕ) dependence in $G_D^{(R)}$ & $G_D^{(T)}$.