Radiation Resistance

> **Q:** Does all the power absobed by R_A get radiated?
>
> **A:** Generally speaking, <u>no</u>!

✳ Ideally, <u>all</u> of the power delivered to the antenna is radiated. However, antennas are made of materials with <u>finite</u> <u>conductivity</u> – ∴ they exhibit <u>ohmic</u> <u>losses</u>!

✳ I.E., most of the power is radiated, but some is converted to <u>heat</u>.

So We represent R_A with <u>two</u> parts:

$$R_A = R_r + R_L$$

where:

$$R_r \doteq \text{Radiation Resistance}$$

$$R_L \doteq \text{Antenna Loss Resistance}$$

If we consider the ratio of the power delivered to the antenna ($P_{antenna}$) to the radiated power (P_{rad}), we define antenna efficiency as:

$$e = \frac{P_{rad}}{P_{antenna}} = \frac{R_r}{R_L + R_r} = \frac{R_r}{R_A}$$

Note **ideally**, this value is $\underline{=1}$.

Also note, if antenna is **matched**:

$$\underline{P_{antenna} = P_t}$$

But, if not:

$$\underline{P_{antenna} = P_t \left(1 - |\Gamma_A|^2\right)}$$

where Γ_A is the reflection coefficient of the antenna.

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