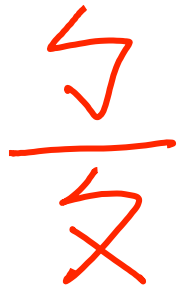


# Basics 4

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2014-03-10

dB    decibel    ratio



linear scale

in dB scale:

$$10 \log_{10} \left( \frac{5}{2} \right)$$

$$\begin{aligned} 7 \text{ dB} &= 5 \\ 3 \text{ dB} &= 2? \\ 6 \text{ dB} &= 4 \\ 3 &= 10 \log_{10} R \end{aligned}$$

33 dB

$$10 \log_{10}(100) = 20 \text{ dB}$$

$$10 \log_{10}(10) = 10 \text{ dB}$$

$$10^{\left(\frac{3}{10}\right)} = R \approx 2$$

$$27 \text{ dB} = ? \quad 20 \text{ dB} + 7 \text{ dB}$$

$\downarrow \quad \quad \downarrow$   
 $100 \times 5 = 500$

$$33 \text{ dB} = \underline{30 \text{ dB}} + 3 \text{ dB}$$

$$= 1000 \times 2 \approx 2000$$

dB     $\Rightarrow$  ratio

"dB scale"

$$20 \text{ dBm} \approx$$

$$= 10 \log_{10} \left( \frac{\text{[ ]}}{1 \text{ mW}} \right)$$

"linear scale"

$$\underline{\underline{100 \text{ mW}}}$$

$$10 \log_{10} \left( \frac{0.1}{1} \right) = -10 \text{ V}$$

dBm  $\Rightarrow$

dB(W)

有單位

(power)

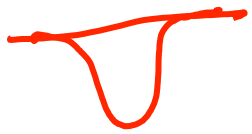
$$\left( \frac{\text{[ ]}}{1 \text{ mW}} \right)$$

$$\boxed{1 \text{ mW} = 10^{-3} \text{ W}}$$

$$\underline{\underline{-10 \text{ dBm} = 10^{-4} \text{ W}}}$$

dBW

$$500 \text{ mW} = ? \text{ dBW}$$
$$= 0.5 \text{ W}$$



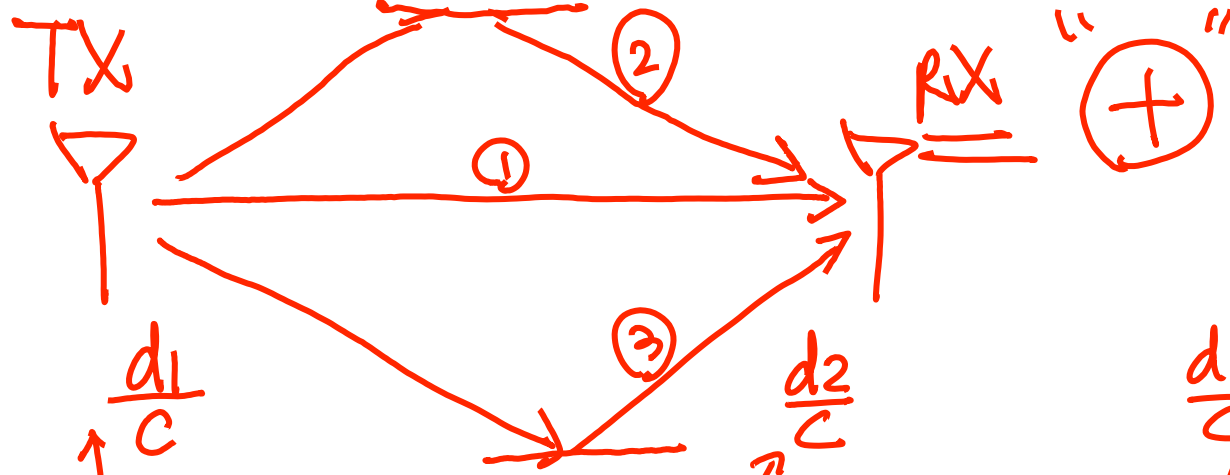
$$10 \log_{10} \left( \frac{0.5}{1} \right) = 10 \log_{10}(5 \times 0.1)$$
$$\downarrow \text{(W)} = 10 [0.7 + (-1)]$$

$$20 \text{ dBm} \downarrow = -0.3 \times 10 = -3 \text{ dB}$$

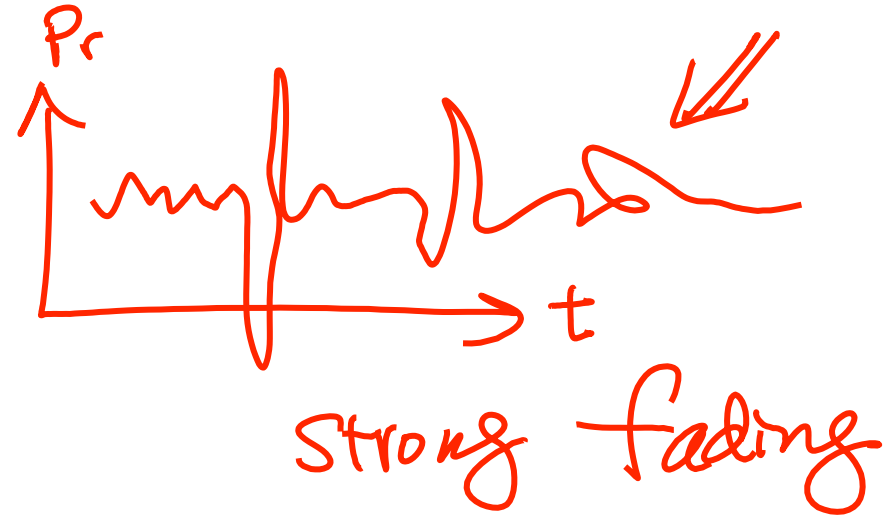
Link Budget  $\swarrow$  WLAN BS TX Power

Cellphone BS TX Power  $\swarrow$   
30 dBm  $\uparrow$

# Multipath



$$r(t) = \frac{\rho}{a_1} \cos(\omega(t - \Delta t_1)) + \frac{\rho}{a_2} \cos(\omega(t - \Delta t_2)) + \frac{\rho}{a_3} \cos(\omega(t - \Delta t_3))$$



Constructive  
or  
destructive  
self-interference

