

TEK 5110

$$dB [W] = 10 \log \frac{P}{1W}$$

$$dB_m = 70$$

$$0 \text{ dB} = 30 \text{ dB}_m$$

1 dB ~ 1.5 W(?)  
3 dB

$$\log \frac{P}{1W}$$

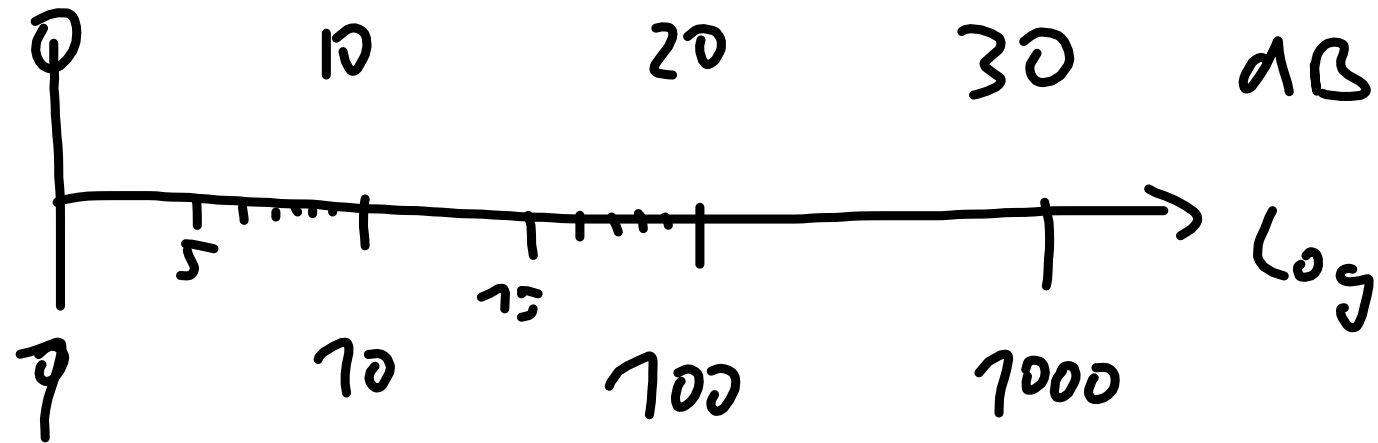
$$\log \frac{P}{1mW}$$

$$\approx 1W$$

$$2W$$

Mobile  
handset: 2W  
1W = 30 dB<sub>m</sub>  
2W = 33 dB<sub>m</sub>

1000  
E3



$$0 \text{ dB} \equiv 10 \log 1$$

$$E-9 \text{ W} \rightarrow -90 \text{ dB} \quad E-9$$

$$\text{Capacity } C = B \log_2(1 + \text{SNR})$$

Example:

$T$  [K]

$$\text{Noise} = kTB$$

Boltzmann

Bandwidth

Thermal

↑  
Signal  
/  
Noise

Mobile  
IN  
35°C

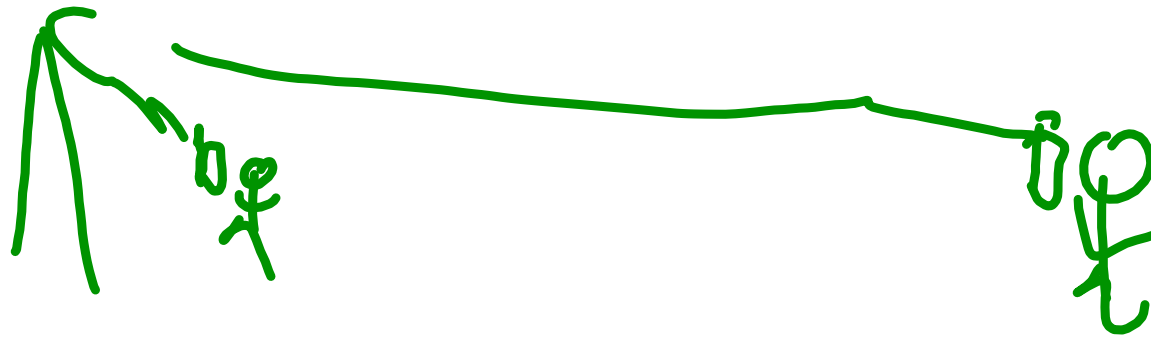
Network Quality

$$P_T \text{ handset} = 2W = \underline{33 \text{ dBm}}$$

$NO < 4 \text{ mV} \approx$  max  
5 dBm

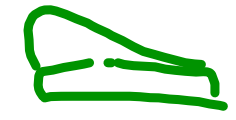
70°C

50% RF  
50% heat





Hertz



$$\lambda/2 = 1.5 \text{ m}$$

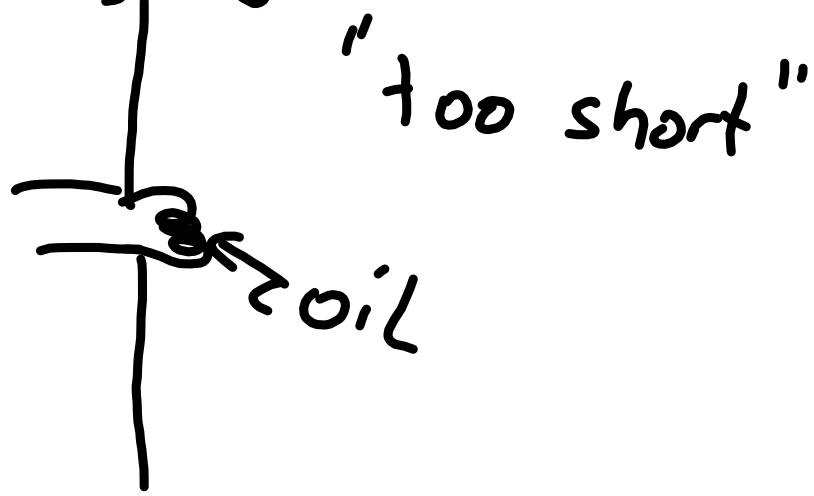
FM ~ 100 MHz

$$\lambda = \frac{c}{f} = \frac{30 \text{ cm}}{f [\text{GHz}]}$$

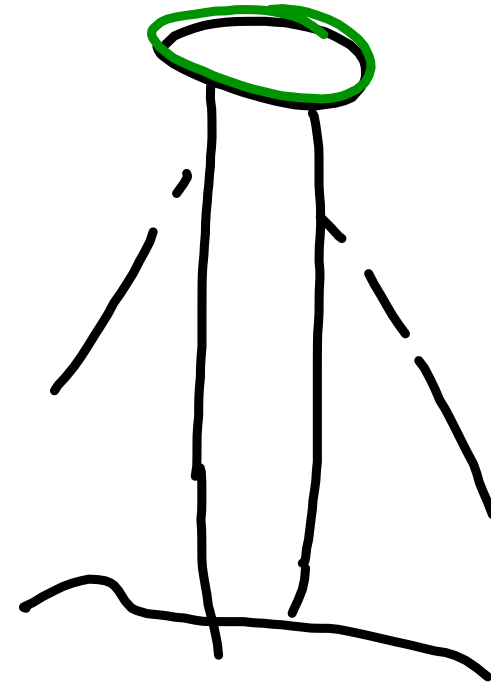
DAB+ ~ 20 MHz

$$\lambda/2 \sim 7.5 \text{ cm} \sim 1.4 \times 6.19$$

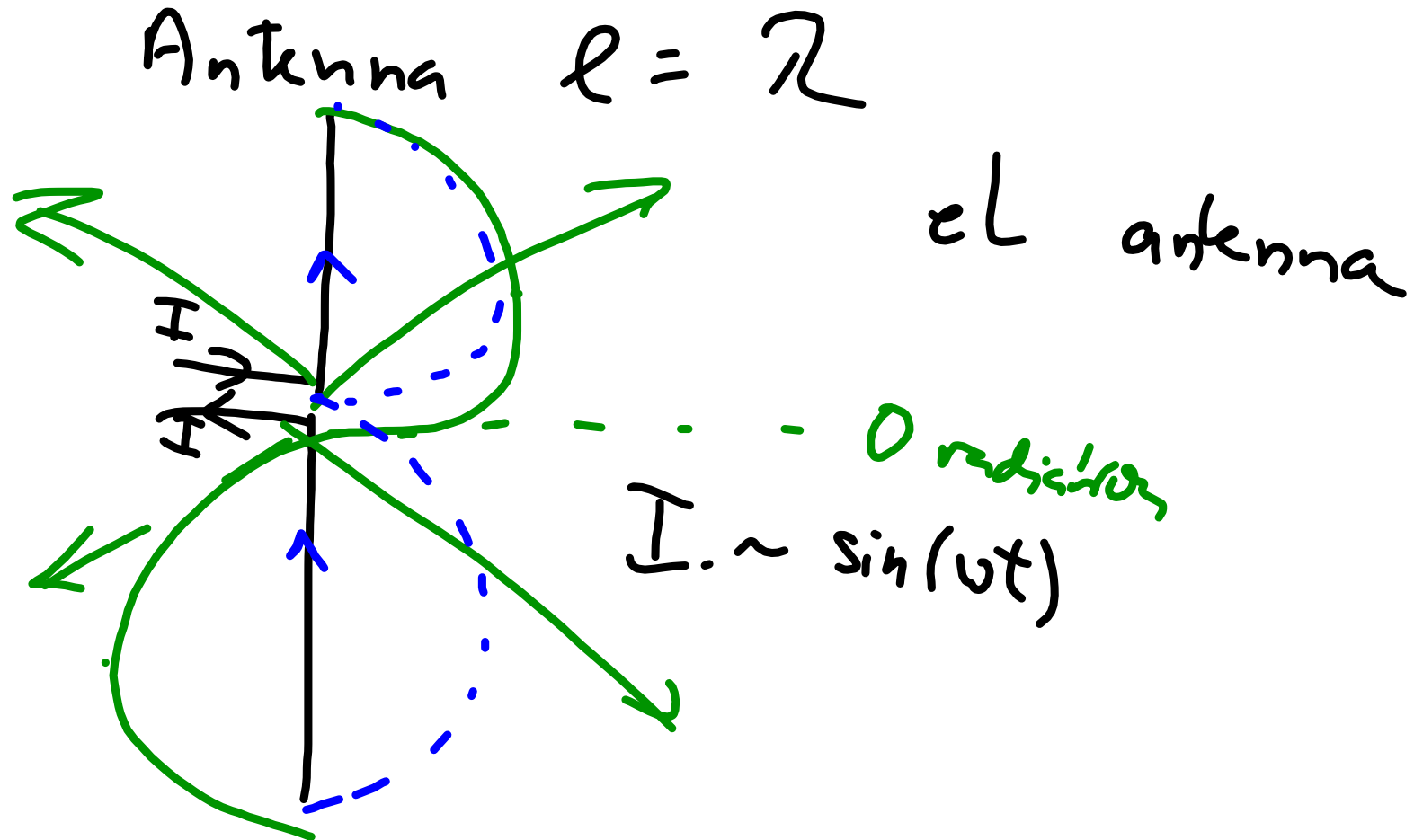
Lower freq. AM



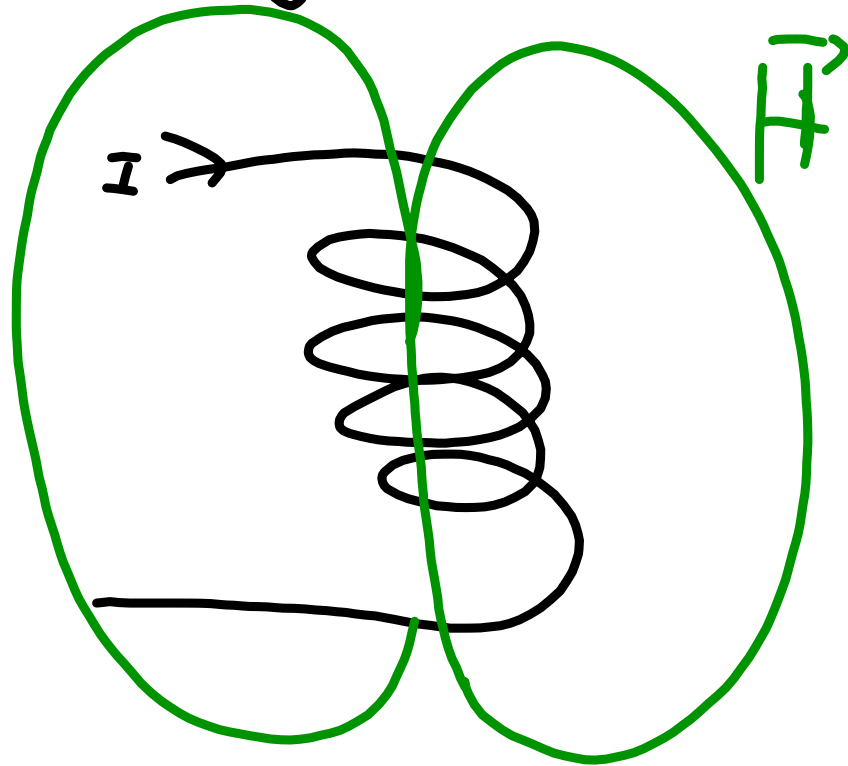
Mast



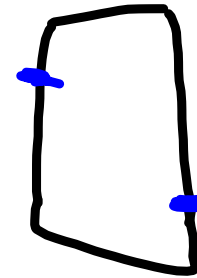
Wiggles



Magnetic antenna



slot antenna





Bandwidth  $N \sim B$   
WIFI

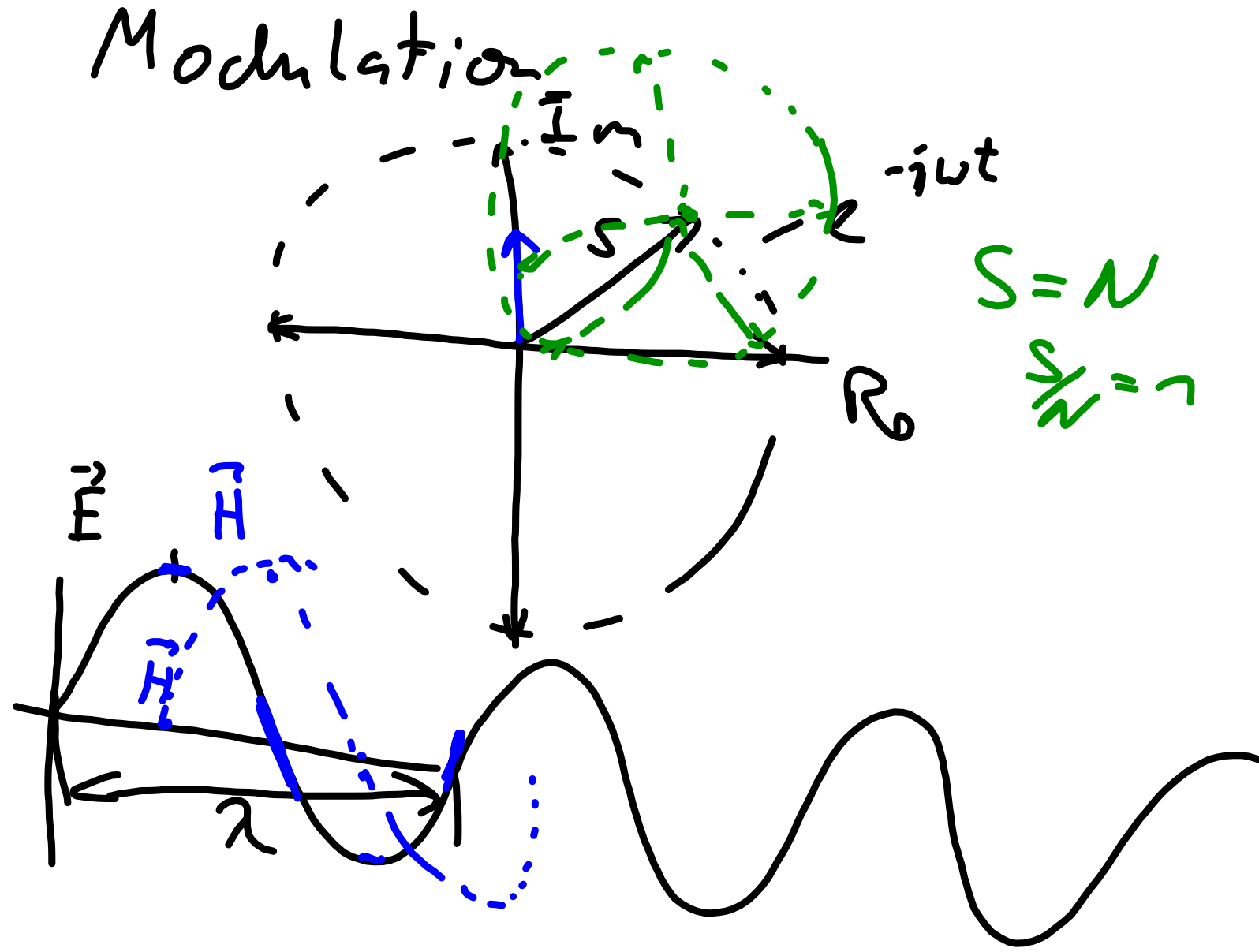
6SM  $B = 2004 \text{ Hz}$

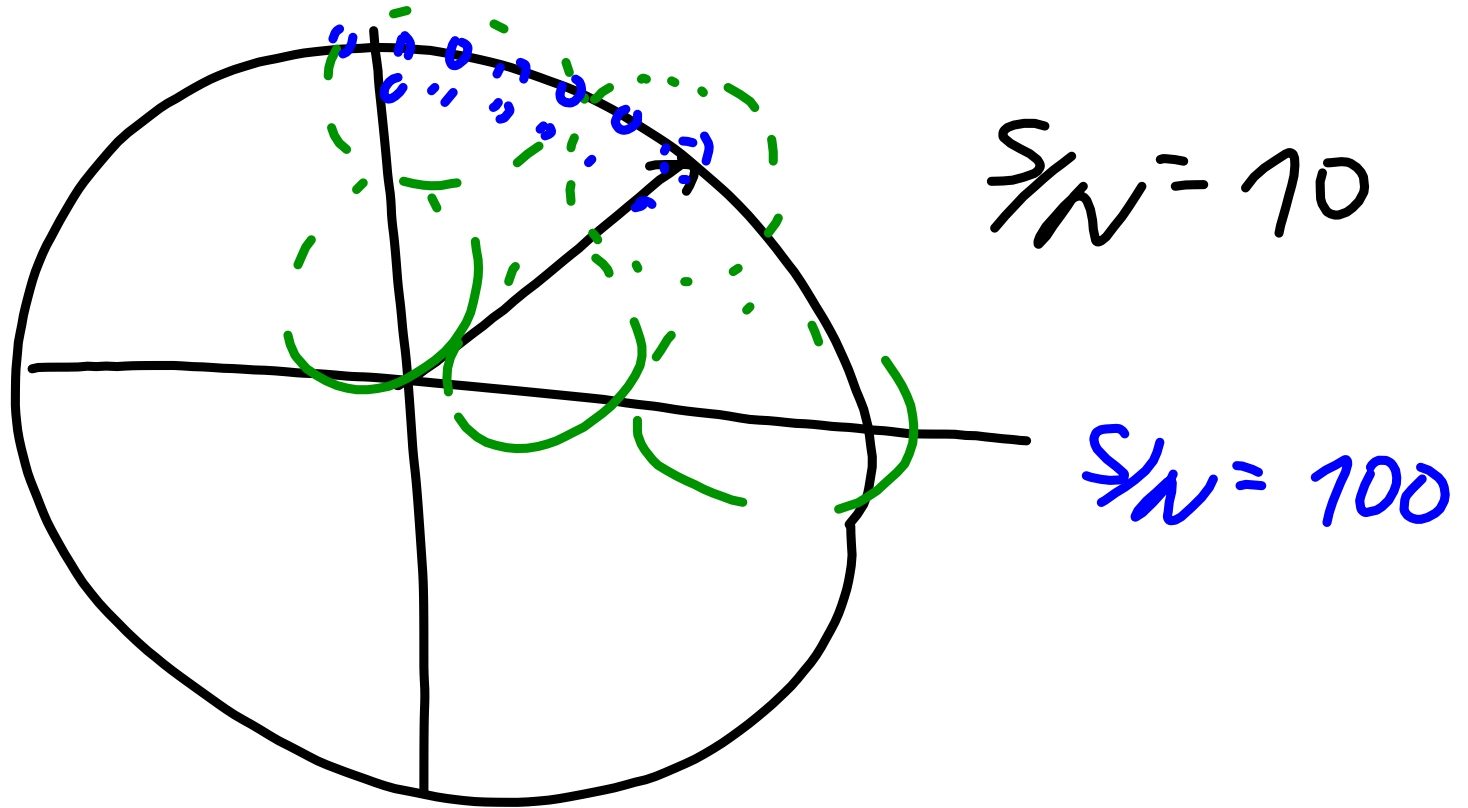
3G/WMTS  $B = 3.8 \text{ MHz}$

4G

5 - 20MHz

g  $B = 10 \text{ MHz}$   
a+ 20, 40, 80,  
160MHz





$l > 2 \lambda \rightarrow$  reflection (metall)

$f$        $\lambda$

1 GHz      30cm branches

70

3cm leaves

700

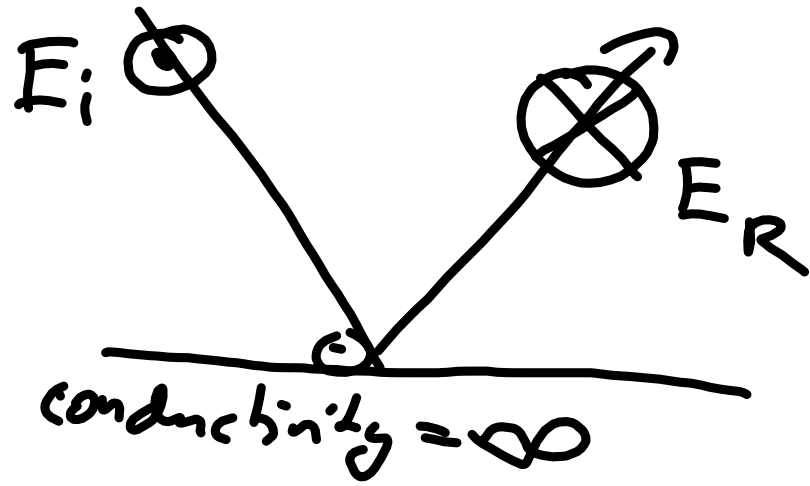
0.3cm

$l < \frac{\lambda}{70}$  "no" interaction

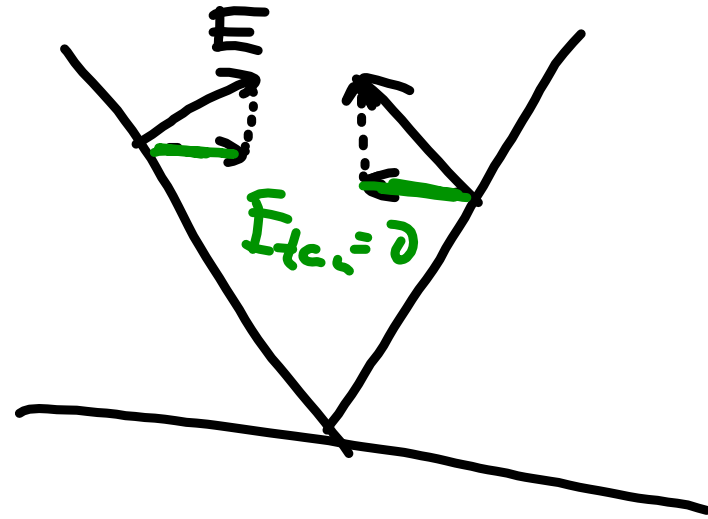
Microwave  $\sim 2.46$  GHz "water absorption"

Water  $\epsilon_r \sim 80$

$$\lambda_{\epsilon} = \frac{\lambda_0}{\sqrt{\epsilon_r}} = \frac{30\text{cm}}{9} = 0.3\text{cm}$$



$$E_{tan} = 0$$



el. tilt antenna

