

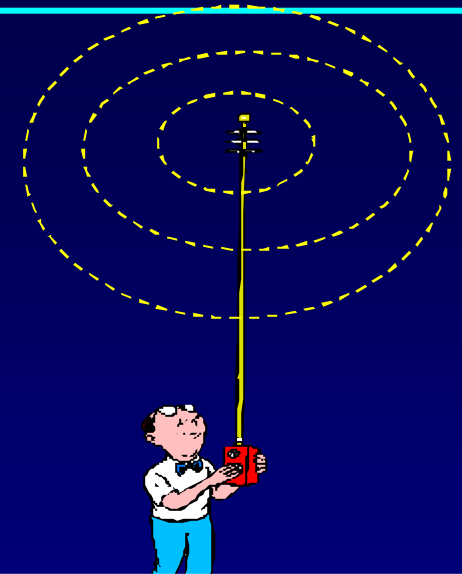
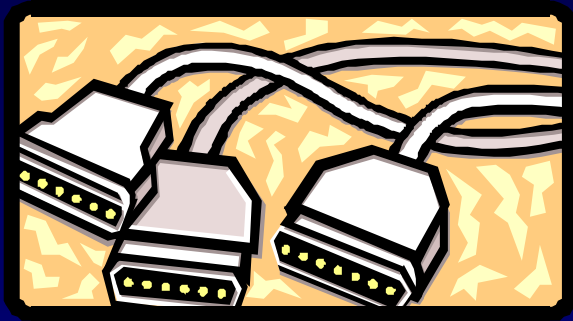
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***Wireless  
Communication:  
Overview of basic concepts***

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# Wired Vs. Wireless Communication

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Wired	Wireless
Each cable is a different channel	One media (cable) shared by all
Signal attenuation is low	High signal attenuation
No interference	High interference noise; co-channel interference; adjacent channel interference

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# Why go wireless ?

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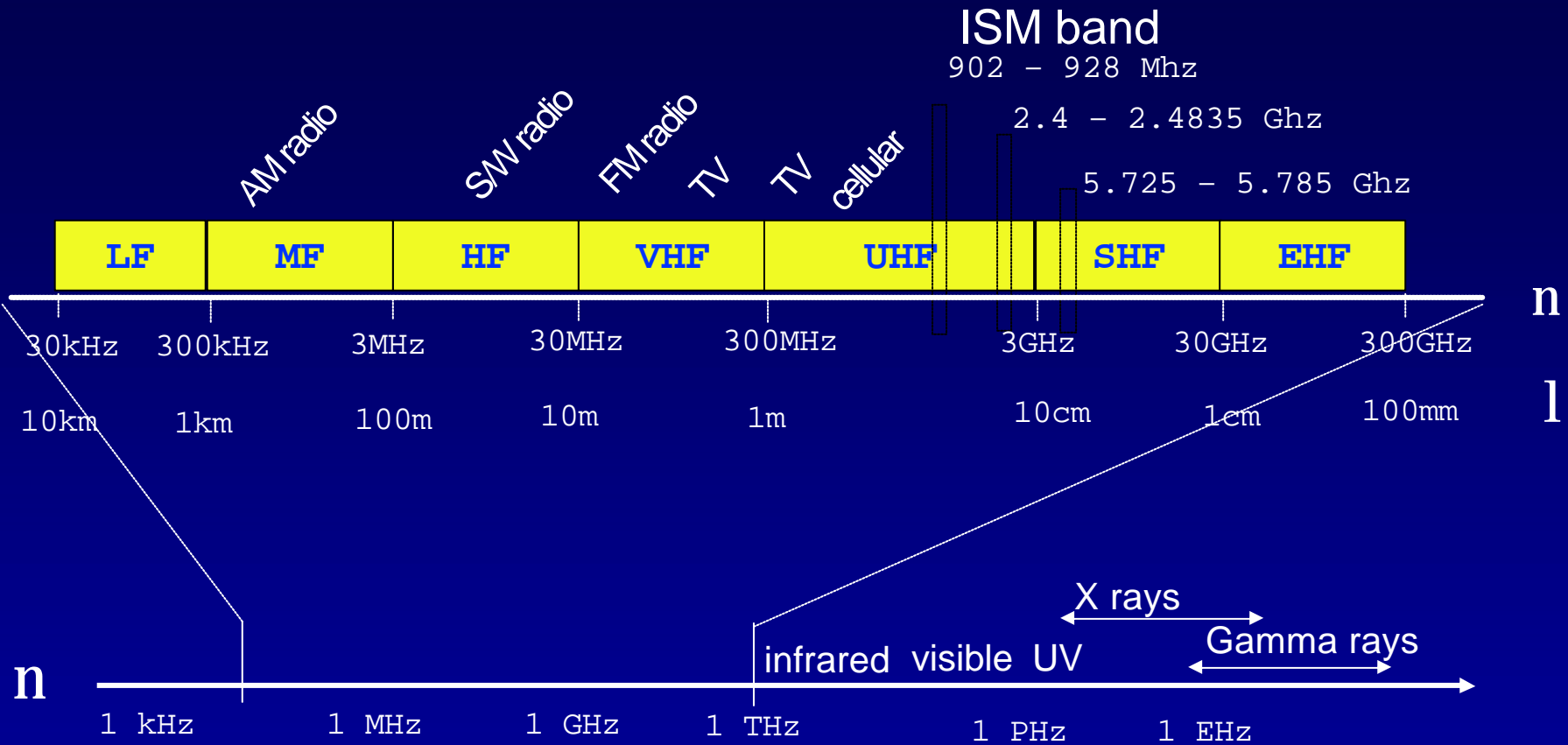
## Advantages

- Sometimes it is impractical to lay cables
- User mobility
- Cost

## Limitations

- Bandwidth
  - Fidelity
  - Power
  - (In)security
-

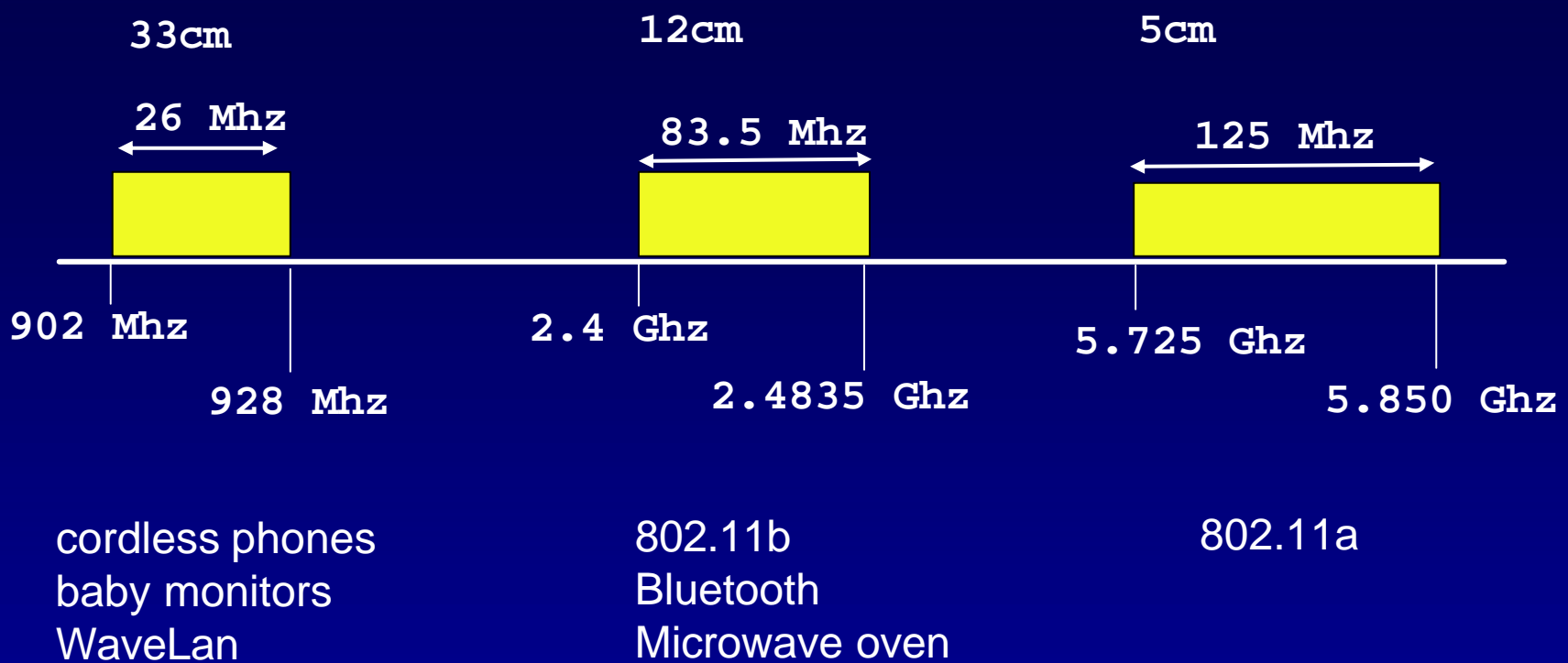
# EM Spectrum



Propagation characteristics are different in each frequency band

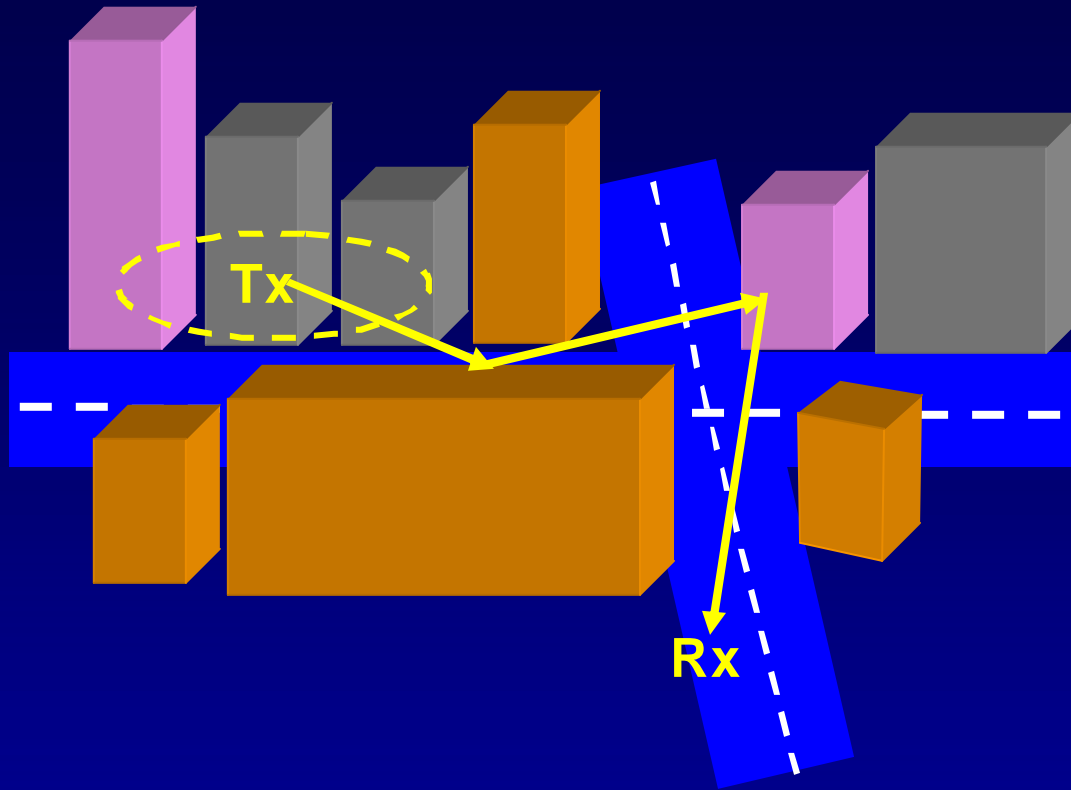
# Unlicensed Radio Spectrum

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# Understanding wireless communication

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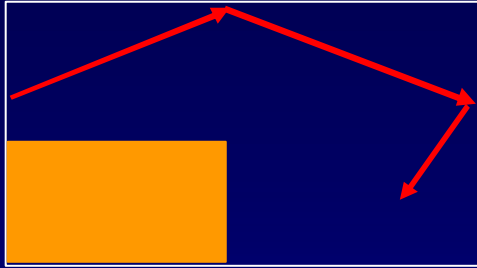


- How does signal propagate ?
  - How much attenuation take place ?
  - How does signal look like at the receiver ?
-

# Radio Propagation

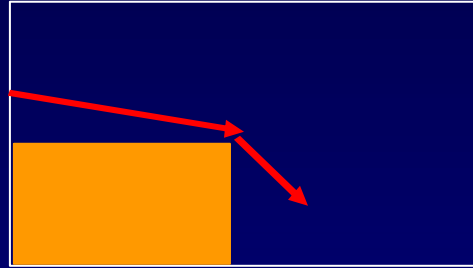
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## Three basic propagation mechanisms



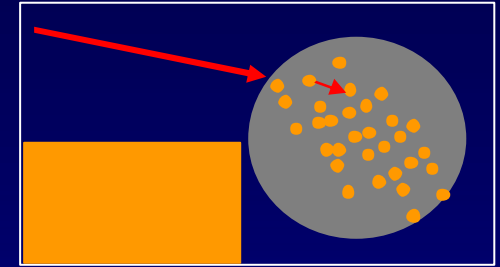
Reflection

$$? \ll D$$



Diffraction

$$? \approx D$$



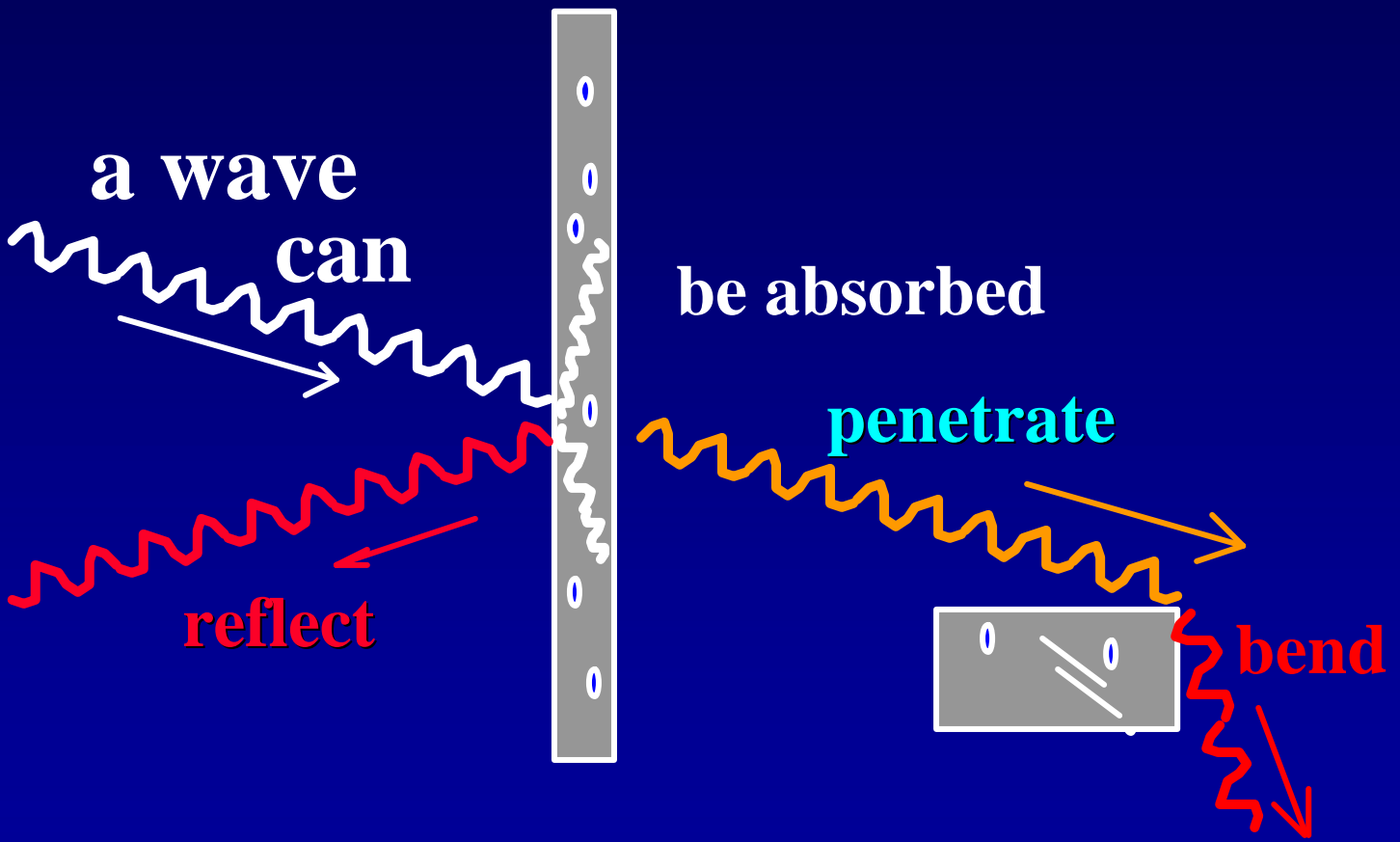
Scattering

$$? \gg D$$

- Propagation effects depend on not only on the specific portion of spectrum used for transmission, but also on the bandwidth (or spectral occupancy) of the signal being transmitted
  - Spatial separation of Tx-Rx
-

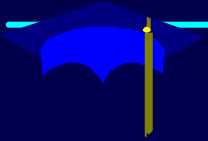


# Propagation in the "Real World"



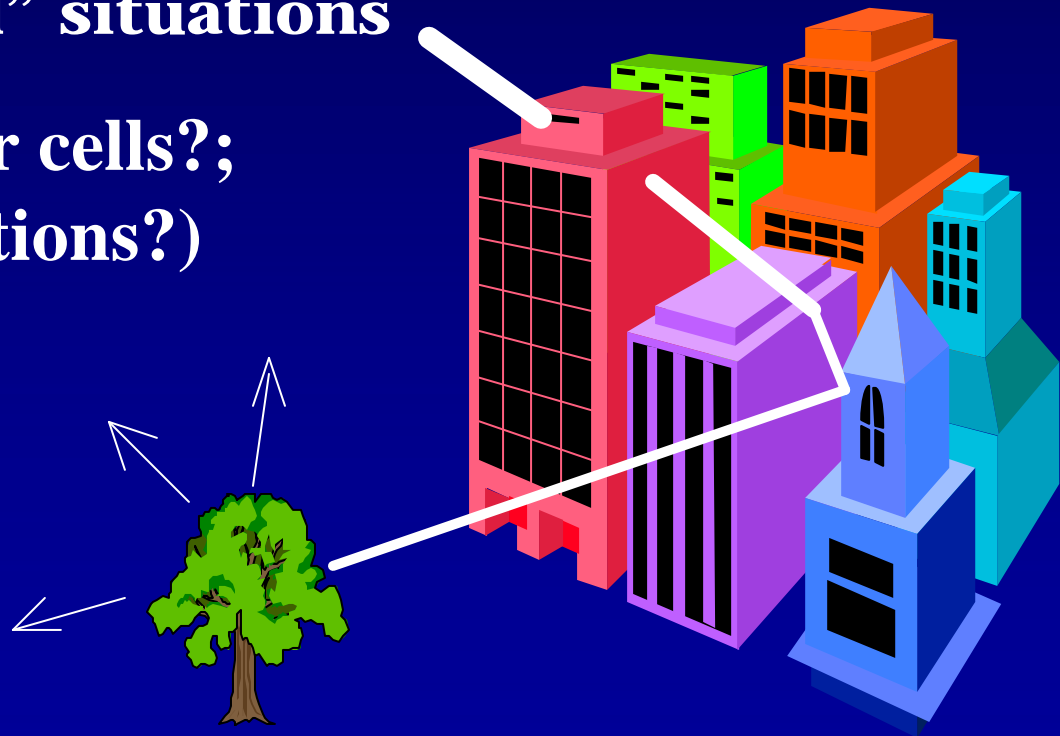


# Propagation

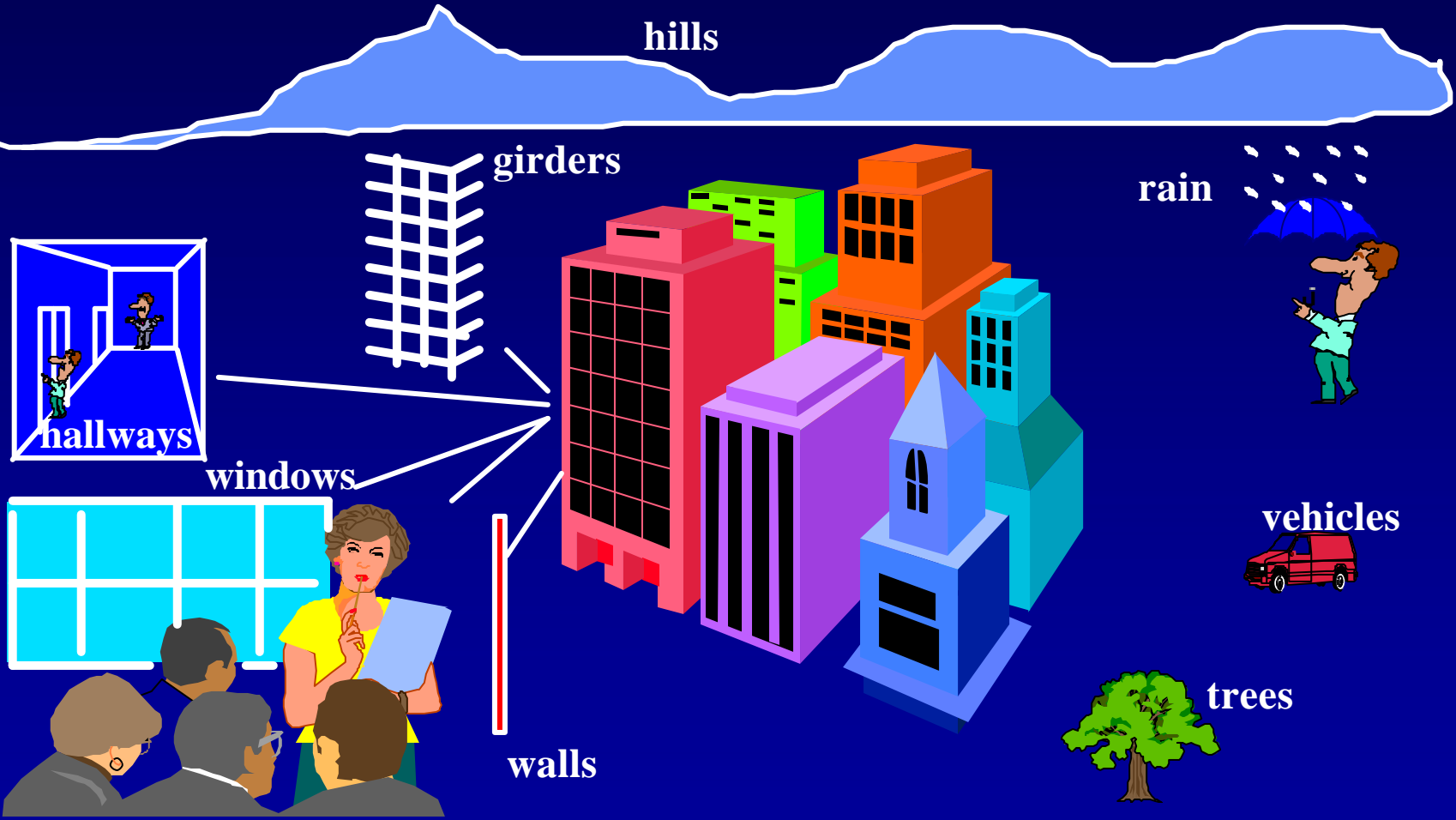


And, the higher frequencies will usually encounter more “loss” in “real world” situations

(again, smaller cells?; more base stations?)



# The Cluttered World of Radio Waves

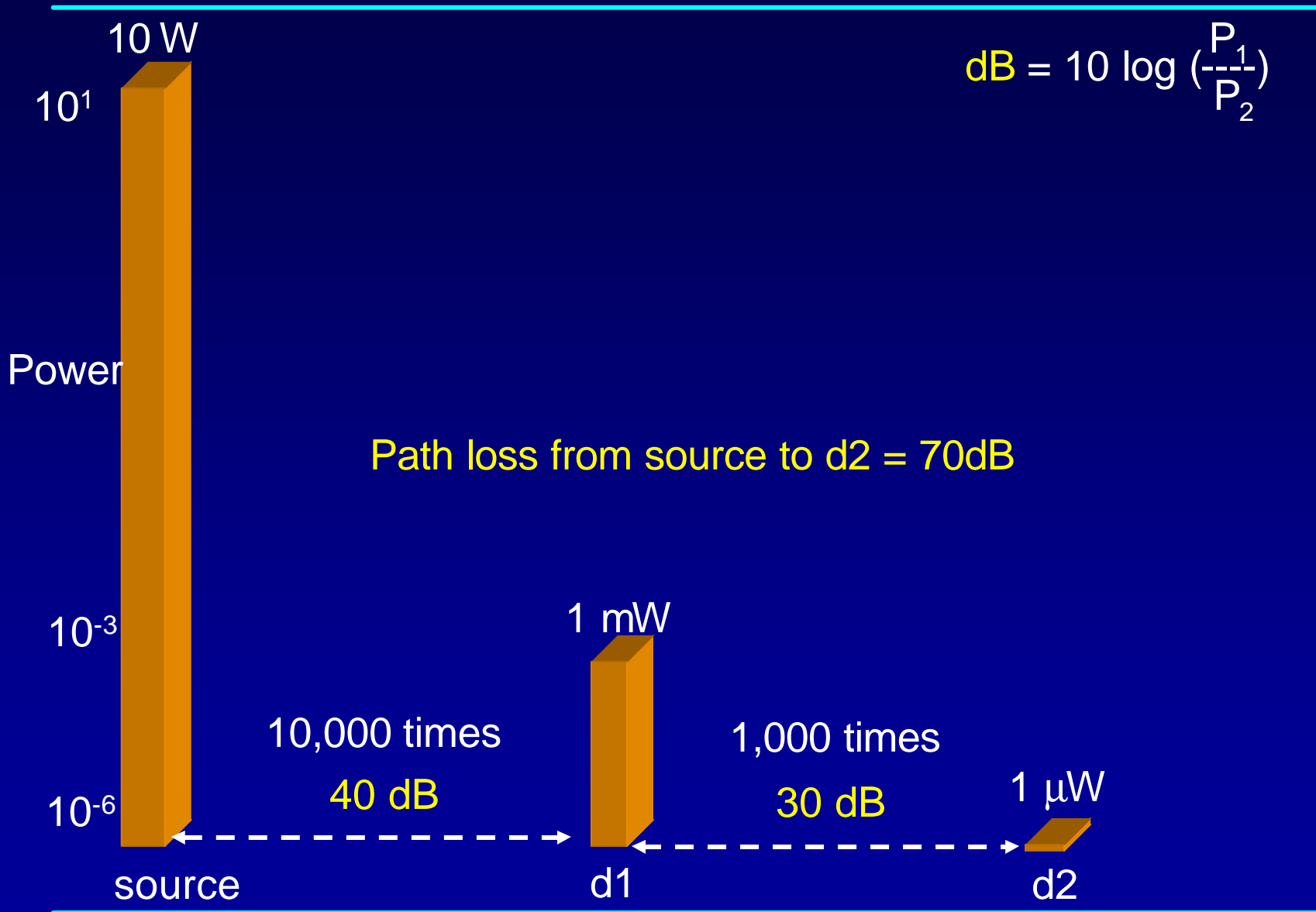


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## *Evaluating Frequencies*

- 50 MHz- Good for range outdoors (antenna size, bending and penetrating), no foliage problems. “Sees” metallic building structures, doesn’t pass through windows or down corridors, needs large antenna (2 meter). TV?
  - 450 MHz to 2 GHz - Good compromise for cellular-type systems. Antenna small, but big enough for outdoor range. Minor foliage effects. OK for windows walls and corridors. (450 might be best, but ...) (Range issue for 2 GHz systems- more bases)
  - 5-20 GHz- Antenna too small for range. Foliage and rain effects. Indoor microcells? Point-to-point? Satellites to ground stations?
-

# Path loss in dB



# *dBm ( absolute measure of power)*

