

Infocommunication

Guided wave channels,
radio channels

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M Ű E G Y E T E M 1 7 8 2

Overview

- PPT is for demonstration, not for learning!
- Guided wave channels
- Radio channels
 - Properties of antennas
 - Characteristics, direction
 - Gain
 - Effective area
 - Wave propagation in the air
 - Direct wave, free space propagation
 - Multipath propagation
 - Antennas & cats



Classification of communication channels

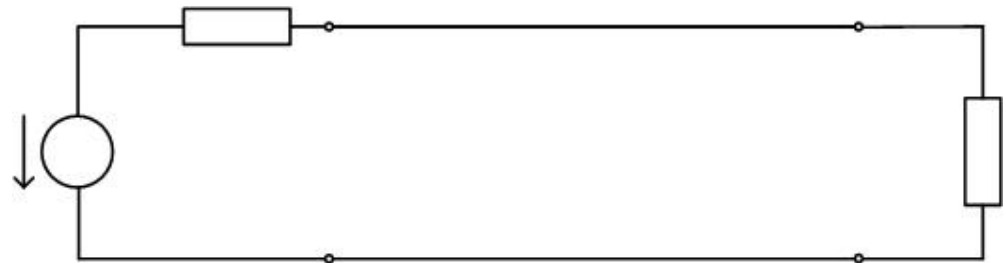
- 1) **point-point,** **point-multipoint**
- 2) **simplex,** **half-duplex,** **duplex**
directional dir. changes in time bidirectional
- 3) **wired,** **wireless**
a) metal a) directional
b) fiberglass b) omni-directional
- 4) **analog,** **digital**

Basic structure of cable connection

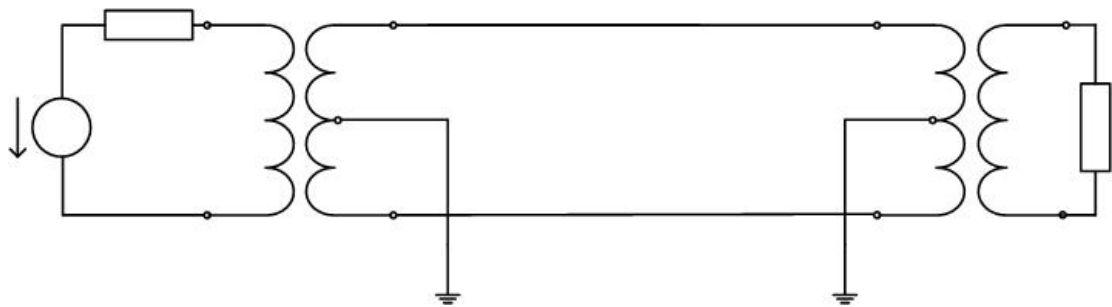
- Single wire



- Dual wires

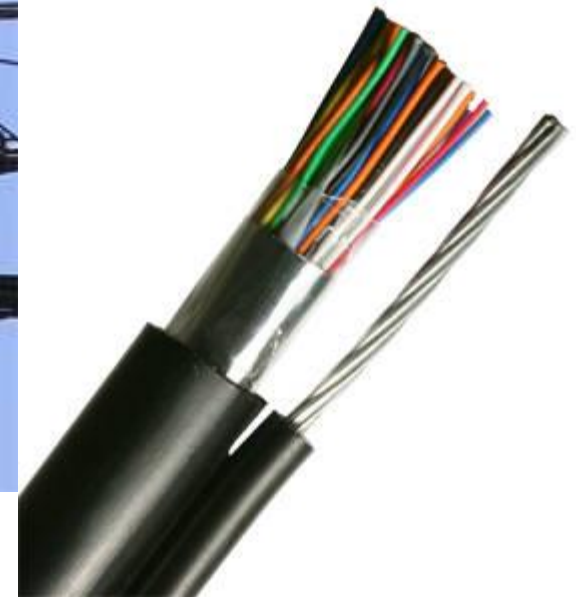


- Coupled



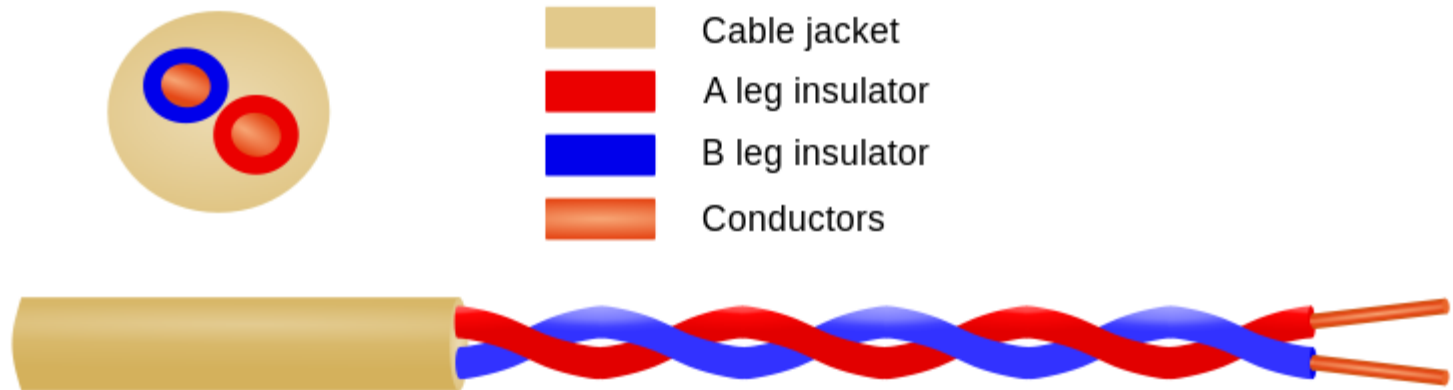
Basic types of cables 1.

- Aerial line



Basic types of cables 2.

- Symmetrical cable



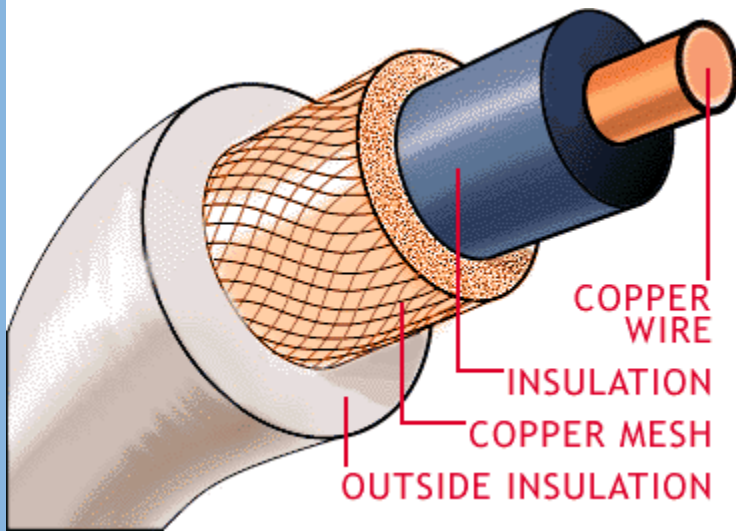
Basic types of cables 2.

- Unshielded Twisted Pair (UTP) cable (symmetrical). Eg. Ethernet cable.



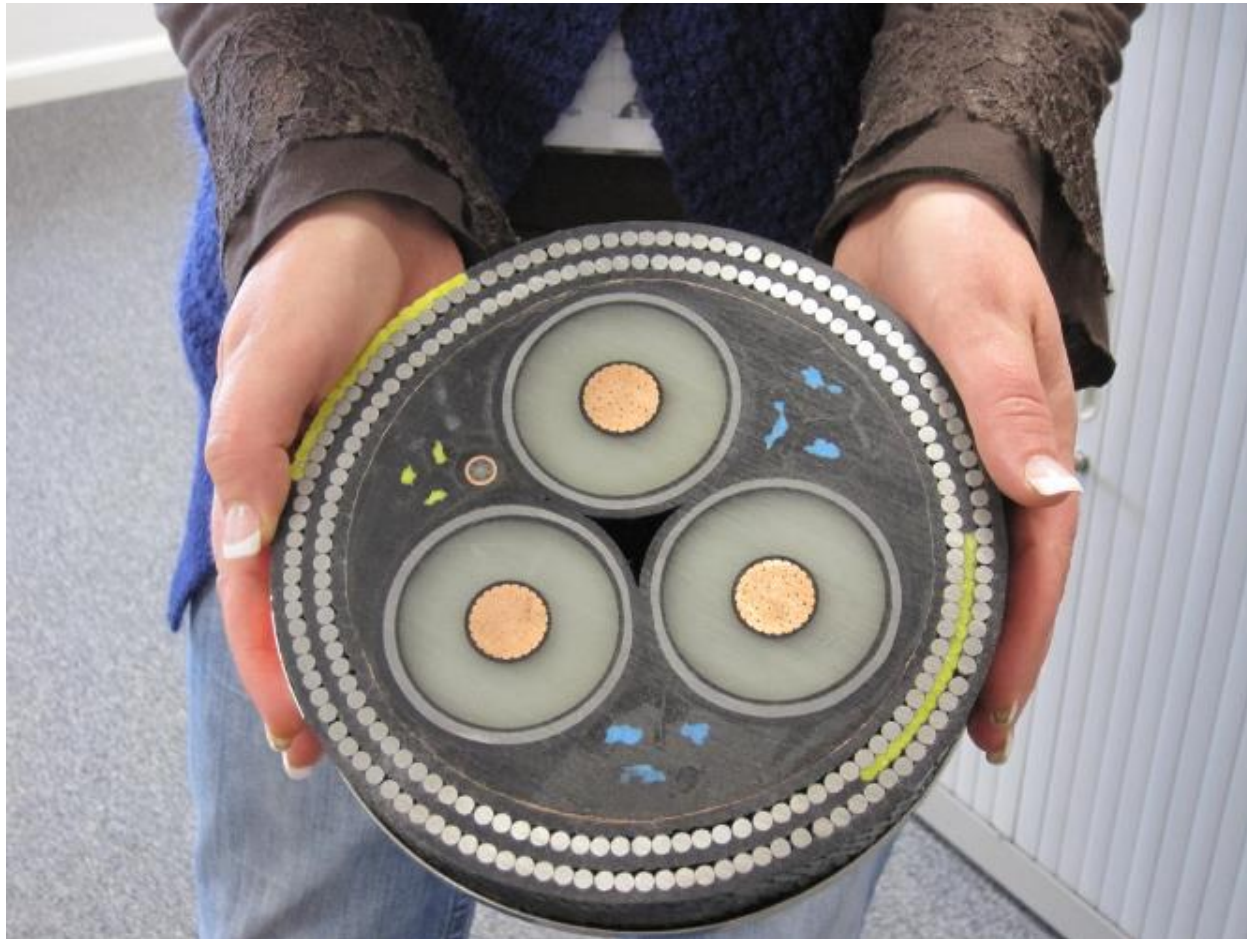
Basic types of cables 3.

- Coaxial cable



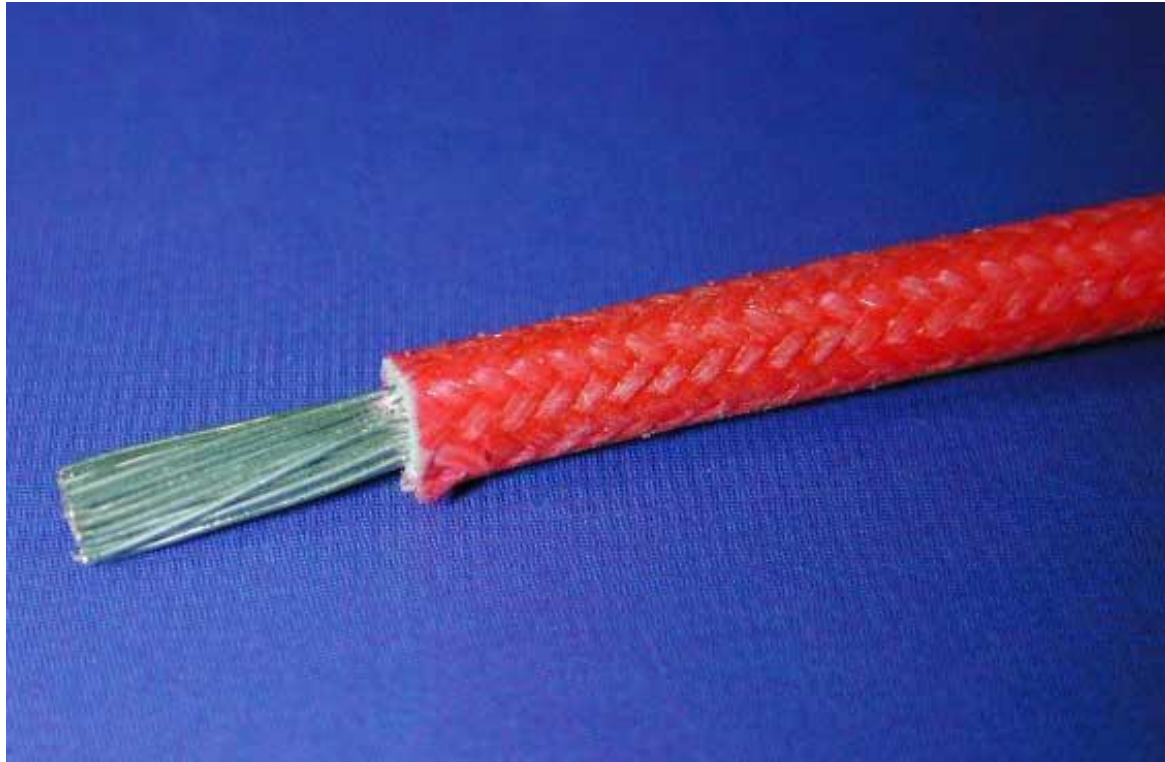
Basic types of cables 3.

- Coaxial cable



Basic types of cables 4.

- Fiberglass cable (minimal energy loss, dispersion due to the inhomogeneity)



Cable costs: Google Fiber



149000 homes

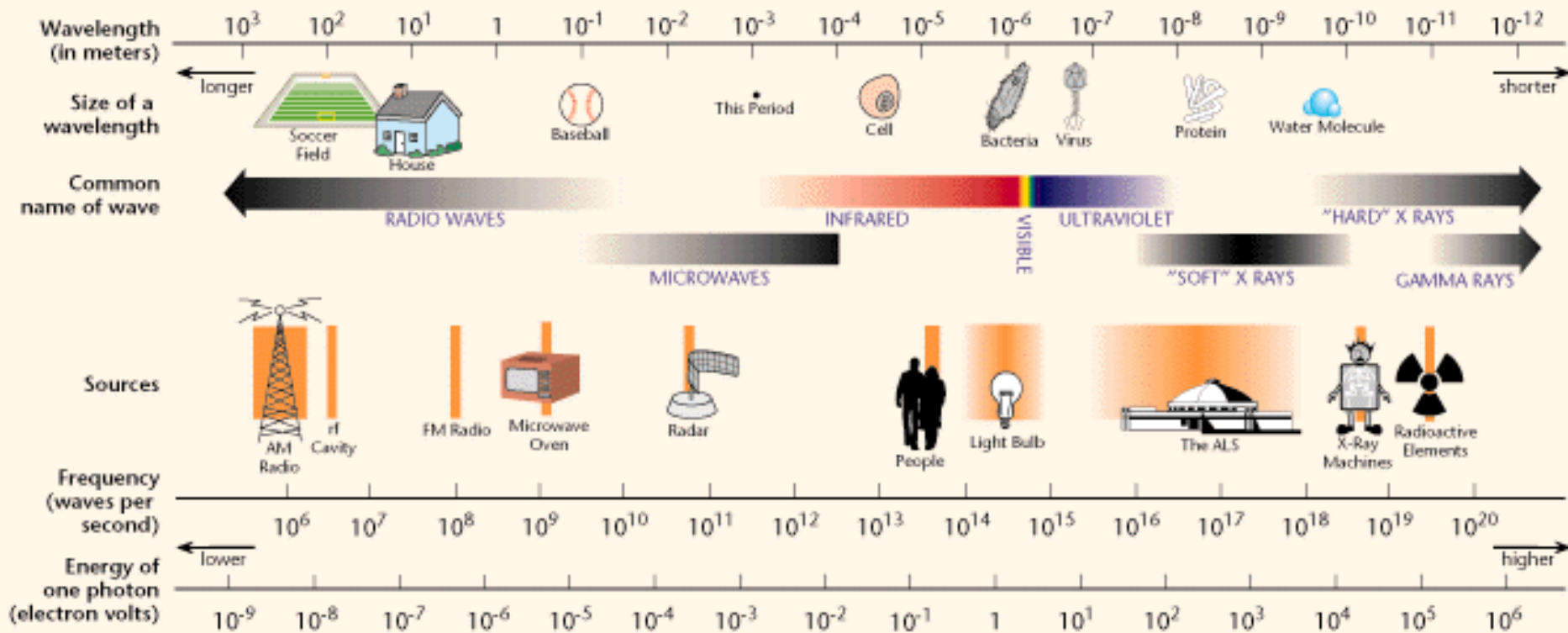
\$84 million

(before even connecting the cables to the houses)

USA: \$140 billion

The electromagnetic spectrum

THE ELECTROMAGNETIC SPECTRUM

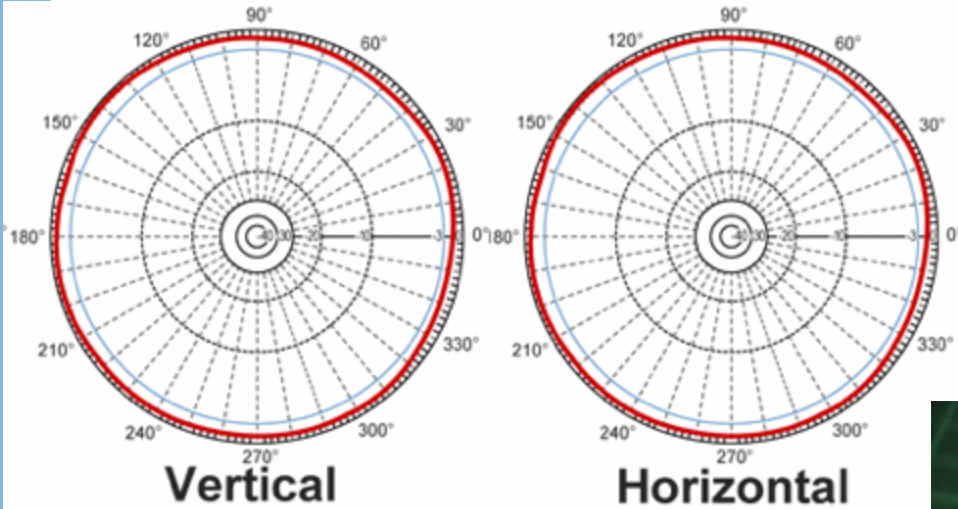


Source: <http://www.lbl.gov/MicroWorlds/ALSTool/EMSpec/EMSpec2.html>

Antennas

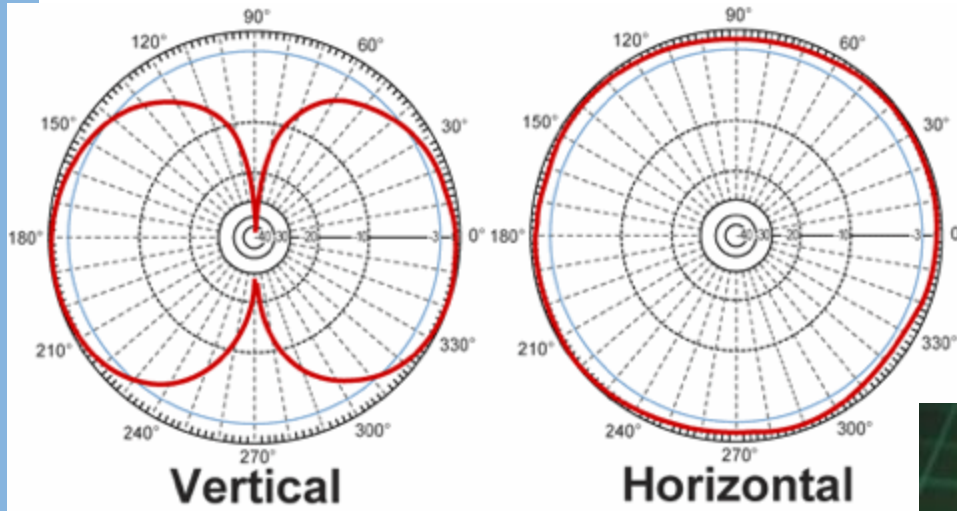
- Two judgements
 - Converters
 - Spatial filters

Isotropic antenna



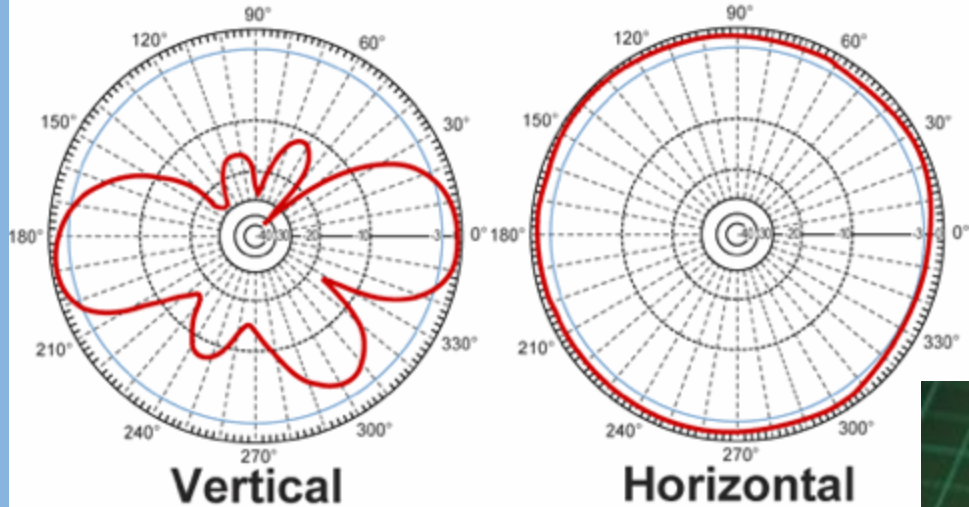
<http://www.rcexplorer.se/Educational/gain/gain.html>

Dipole antenna



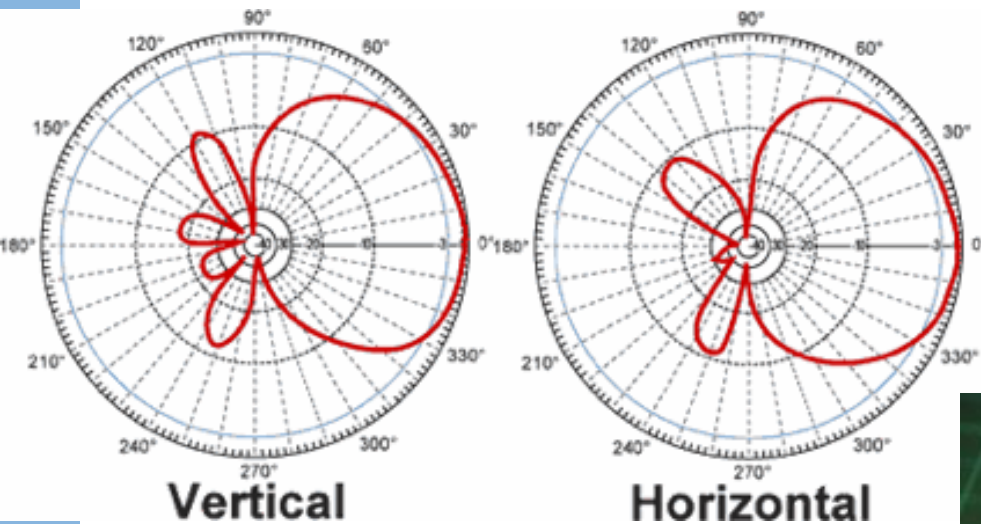
<http://www.rcexplorer.se/Educational/gain/gain.html>

Directional antenna (1)



<http://www.rcexplorer.se/Educational/gain/gain.html>

Directional antenna (2)

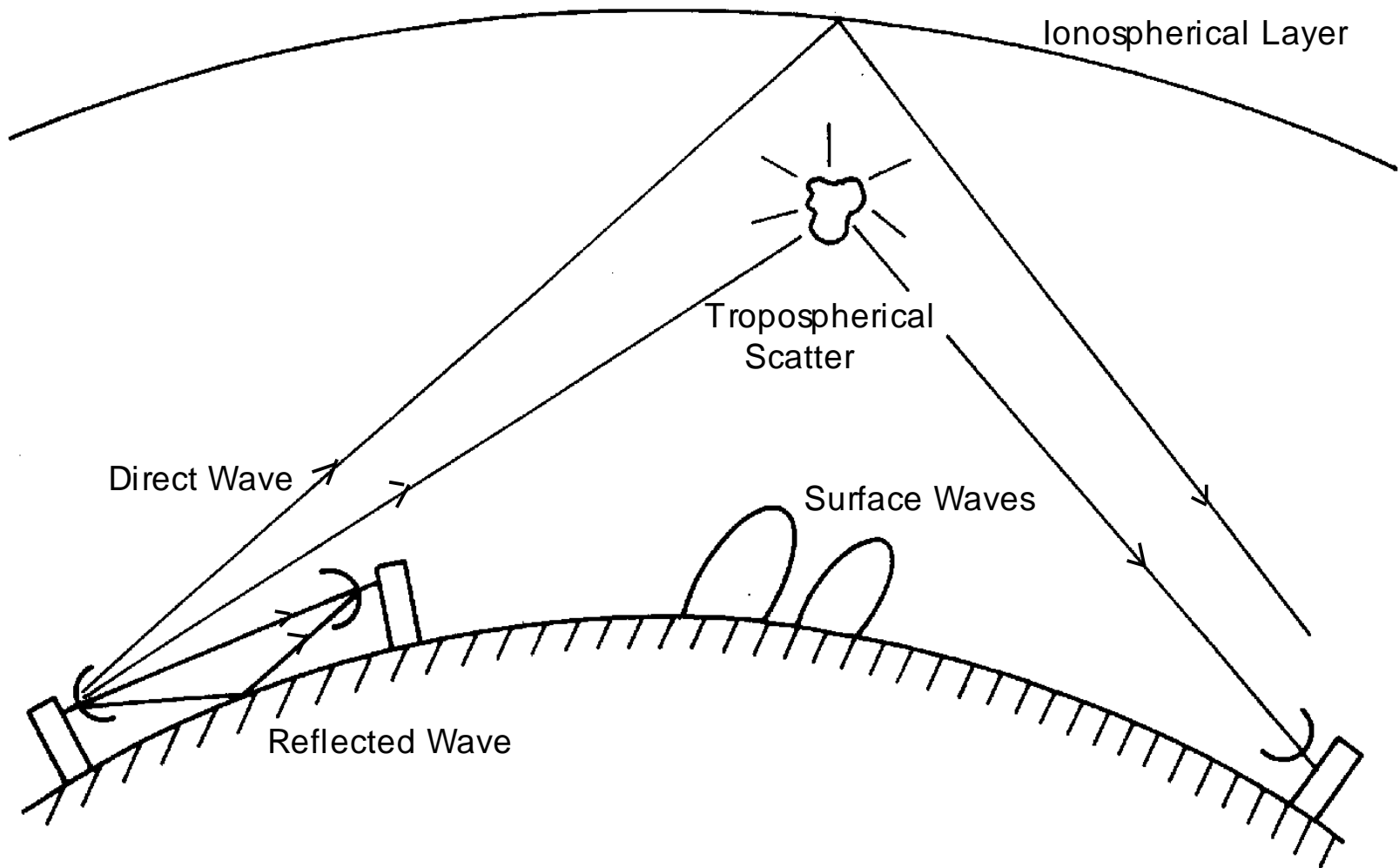


<http://www.rcexplorer.se/Educational/gain/gain.html>

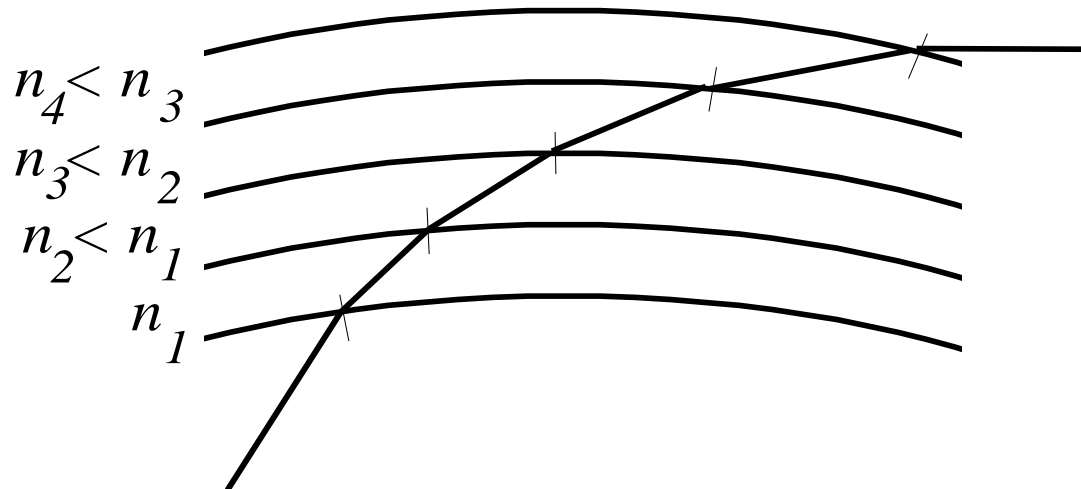
Propagation modes

- Direct wave and free field attenuation
- Ground back-scatter, reflection
 - Ground Wave Multipath Propagation
- Refraction
- Diffraction
 - Huygens-source (secondary source)
- Troposphpherical scatter
- Ionosphpherical propagation

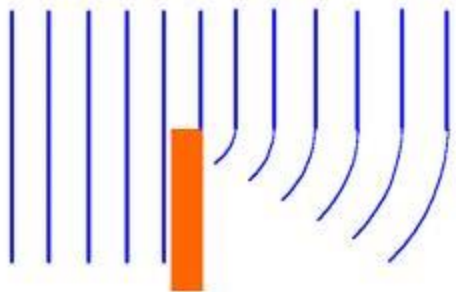
Propagation modes



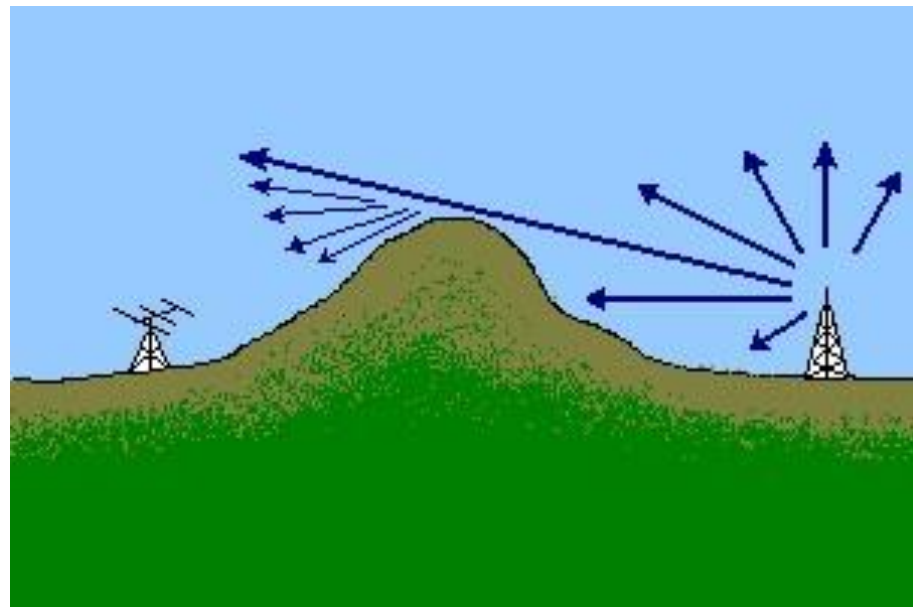
Refraction



Diffraction

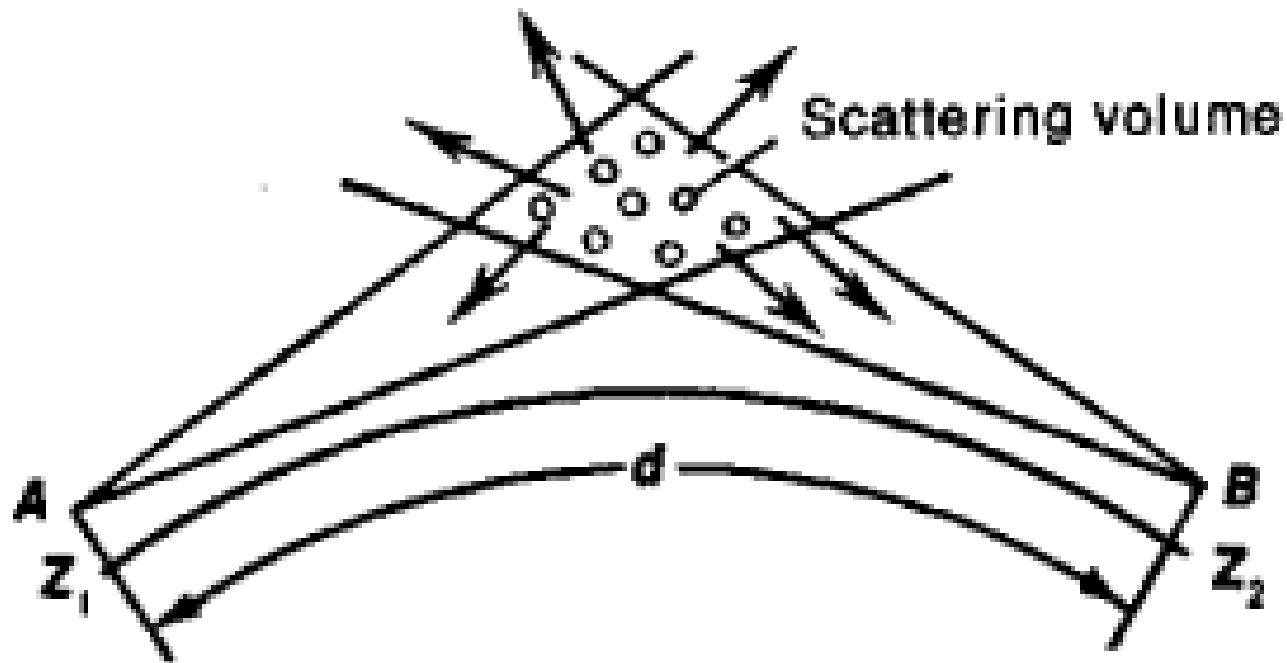


<http://www.gcscience.com/pwav44.htm>



<http://www.astrosurf.com/luxorion/qs1-propa.htm>

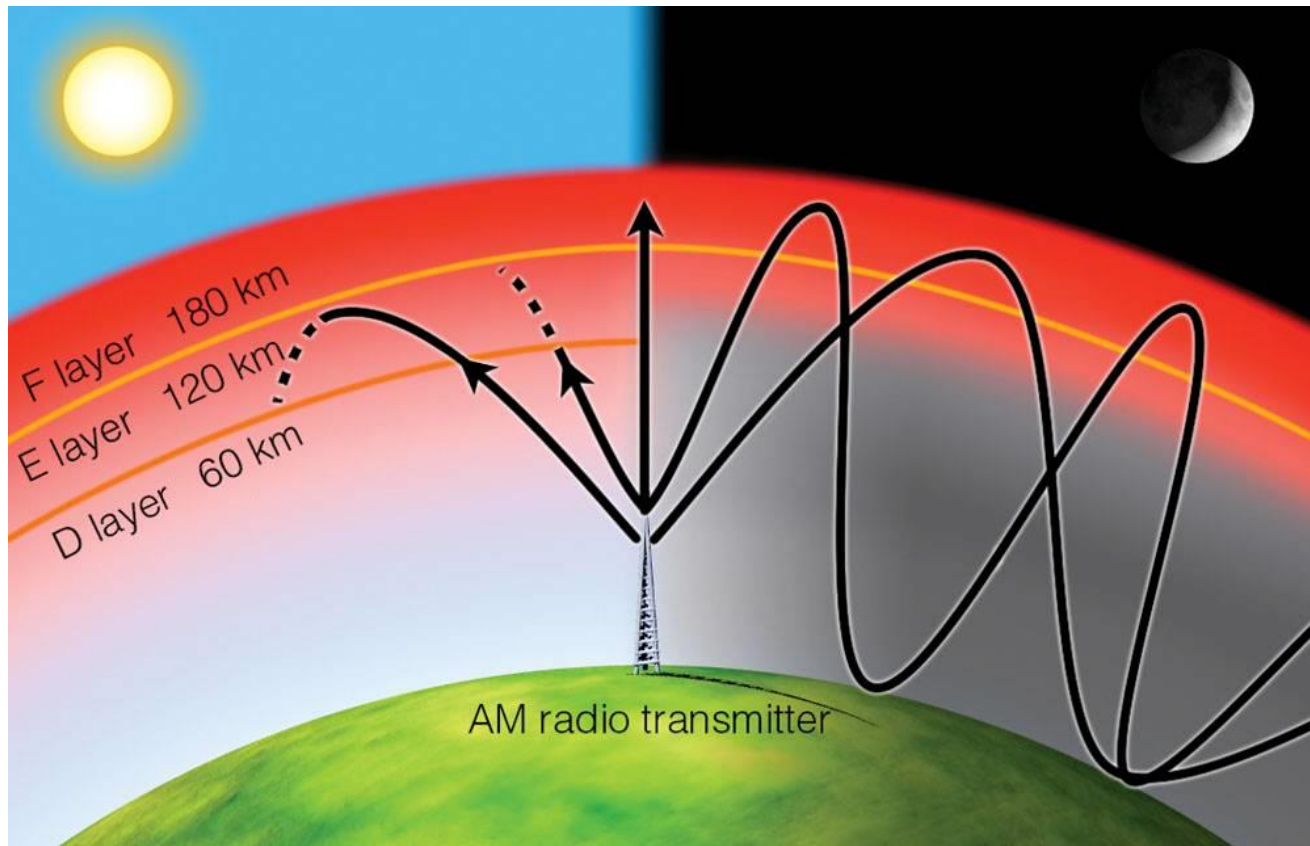
Troposphpherical scatter



<http://encyclopedia2.thefreedictionary.com/Radio-Wave+Propagation>

Ionospheric propagation

- Ionosphere: cca. 40 – 100 km above the ground
- Under a given frequency ionosphere reflects the waves



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