

**Figure 6.3**

Two antennae are shown each having the same height. Line-of-sight transmission means the transmitting and receiving antennae can "see" each other as shown. The maximum distance at which they can see each other, dLOS, occurs when the sighting line just grazes the earth's surface.

At the usual radio frequencies, propagating electromagnetic energy does not follow the earth's surface. **Line-of-sight** communication has the transmitter and receiver antennas in visual contact with each other. Assuming both antennas have height *h* above the earth's surface, maximum line-of-sight distance is



(6.19)

where *R* is the earth's radius ( 6.38 × 106 *m*).

###### Exercise 6.5.1

Derive the expression of line-of-sight distance using only the Pythagorean Theorem. Generalize it to the case where the antennas have diferent heights (as is the case with commercial radio and cellular telephone). What is the range of cellular telephone where the handset antenna has essentially zero height?

###### Exercise 6.5.2

Can you imagine a situation wherein global wireless communication is possible with only one transmitting antenna? In particular, what happens to wavelength when carrier frequency decreases?

Using a 100 m antenna would provide line-of-sight transmission over a distance of

71.4 km. Using such very tall antennas would provide wireless communication within a town or between closely spaced population centers. Consequently, **networks** of antennas sprinkle the countryside (each located on the highest hill possible) to

provide long-distance wireless communications: Each antenna receives energy from one antenna and retransmits to another. This kind of network is known as a **relay network**.