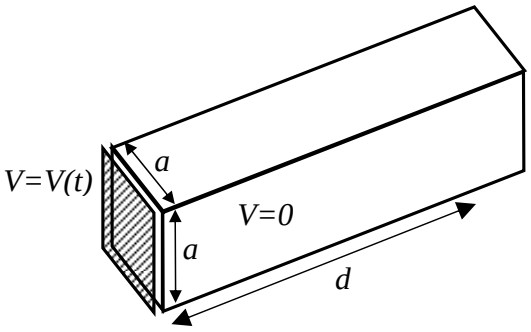
3. **Waveguide transmitter**

A long square perfectly conducting waveguide with sides of width a is driven by a conductive plate near one of its ends as shown in the figure below. The plate is very close to the waveguide, but it is not touching its walls. The potential on the plate is given by $V(t) = V_0 \cos(\omega t)$ and is uniform across the surface of the plate. The interior of the waveguide is empty.



(a) Find the range of frequencies ω for which only one mode excited by the plate will propagate in the waveguide.

(b) If the frequency is in this range, find explicitly the electric field of the wave as a function of position in the waveguide at a distance d from the plate, for $d \gg a$.