In the wide strip approximation \((w/h \gg 1)\), field fringing at the edges of the strip can be neglected, so the only important fields are underneath the strip and above the ground plane, and we have:

\[
\mathcal{E} \simeq -u_y \frac{V}{h} \quad \text{and} \quad \mathcal{H} \simeq u_x \frac{V}{h\zeta}
\]

(*)

within the rectangle \(-w/2 < x < w/2\), \(0 < y < h\), while the mode field can be approximated by zero elsewhere. Here \(\zeta = \sqrt{\mu/\epsilon}\) is the wave impedance of the substrate, while \(V\) is the voltage of the normalized mode at \(z = 0\), determined such that the oscillatory power is 1 watt:

\[
1 = \frac{1}{2} \frac{V^2}{Z_c} \quad \Rightarrow \quad V = \sqrt{2Z_c}
\]

where in the wide strip approximation,

\[
Z_c \simeq \frac{\zeta h}{w}
\]

either by approximating (8.129) for small \(h/w\), or directly from the fields (*).

From these results, the short circuit fields at the aperture are determined to be zero below the ground plane (at \(y = 0^-\)), and are obtained from (*) at \(y = 0^+\). Thus,

\[
[D^\infty]^0_{y=0^+} = -u_y \epsilon \sqrt{\frac{2\zeta}{wh}}; \quad [H^\infty]^0_{y=0^+} = u_x \sqrt{\frac{2}{wh\zeta}}
\]

From Table 10.1.3 with \(w = l = a\),

\[
\alpha_E = \frac{a^3}{6\sqrt{2}} \quad \text{and} \quad \alpha_M = (u_x u_x + u_z u_z) \frac{2a^3}{9 \ln(1 + \sqrt{2})}
\]

where we have used the fact that \(\sinh^{-1}(1) = \ln(1 + \sqrt{2})\). At \(y = 0^+\) (in the substrate above the ground plane), by (10.32), we have the dipoles

\[
p_+ = \frac{2\epsilon_r}{\epsilon_r + 1} \frac{a^3}{6\sqrt{2}} u_y \epsilon \sqrt{\frac{2\zeta}{wh}}
\]

\[
m_+ = \frac{2a^3}{9 \ln(1 + \sqrt{2})} u_x \sqrt{\frac{2}{wh\zeta}}
\]

while at \(y = 0^-\) (below the ground plane), by (10.30) and (10.31) we have

\[
p_- = -\frac{1}{\epsilon_r} p_+; \quad m_- = -m_+
\]