

## In a coaxial cable, do the conductors “guide” the TEM Wave?

<http://www.k1man.com/Conf150928.mp3>

<http://www.ivorcatt.co.uk/cattq.htm> “ **Traditionally**, when a TEM step (i.e. logic transition from low to high) ( [Figures 3, 4, 5](#) from [Electromagnetism 1](#) ) travels through a vacuum from left to right, guided by two conductors (the signal line and the 0v line), ....; “

**Catt did not himself say “guided by two conductors”. Catt was "quoting" the Establishment view. He was asking a Question about classical theory, and spoke within the framework of classical theory. Classical theory is that the wires guide the TEM step. Catt discusses what actually happens in his book, recommended by Forrest.**

<http://www.ivorcatt.co.uk/24.htm>

Figure 30

Most of the energy continues to the right in the vacuum. However, a small amount turns through 90 degrees into the “conductors”. It travels very slowly into the "conductor", because  $\epsilon_0$  (dielectric constant) of copper is very high.

Velocity depends on  $1/\text{sq.rt } \epsilon_0$  .

I suggest you forward this email to those to whom you have said Catt does not explain the guidance. Catt does not say, or believe, there is guidance. Think in terms of the Huygens model, but only as illustration. In our case, the incident (air) energy travels horizontally, and the material (copper) energy is vertical.

[http://www.schoolphysics.co.uk/age16-](http://www.schoolphysics.co.uk/age16-19/Wave%20properties/Wave%20properties/text/Theories_of_light/index.html)

[19/Wave%20properties/Wave%20properties/text/Theories\\_of\\_light/index.html](http://www.schoolphysics.co.uk/age16-19/Wave%20properties/Wave%20properties/text/Theories_of_light/index.html)

When light arrives and is confronted by some space, some air, some glass, some proceeds fast in the air, and some proceeds more slowly in the glass. The contrast in velocity is far greater when the two mediums are vacuum and copper. If  $\epsilon_0$  is very high, as with copper, very little energy enters. The higher the  $\epsilon_0$  , the less energy enters.

Ivor Catt

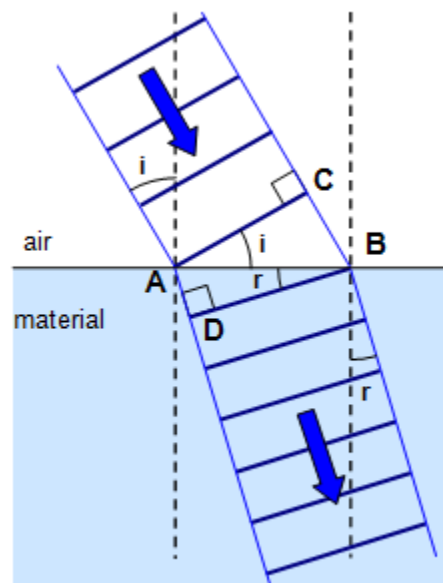


Figure 4

## Copper as a dielectric.

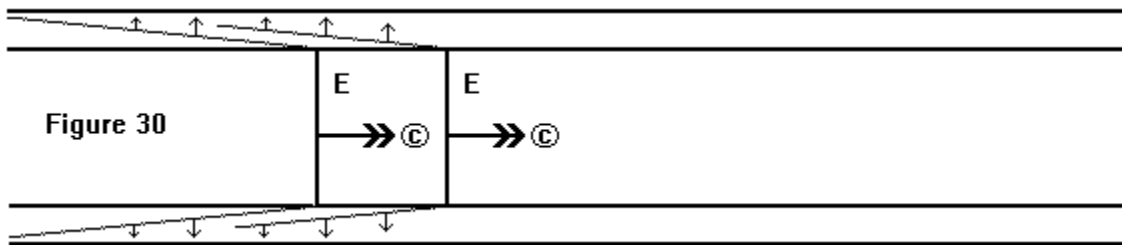
The situation is much the same as before, except that the  $Z_0 = 10 \text{ mohm}$  transmission lines have their dielectric constant  $\epsilon$  slowly increased to a higher and higher value. The effects are twofold; less of the incident 100v signal is left behind, to divert down the sideways transmission lines, and the velocity of propagation into these transmission lines decreases.

We finally reach the ultimate, copper, when

$$Z_0 = \sqrt{\frac{\mu}{\epsilon}} = 0 \quad Z_0 = \sqrt{\frac{\mu}{\epsilon}} = 0,$$

and propagation velocity  $\frac{1}{\sqrt{\mu\epsilon}} \frac{1}{\sqrt{\mu\epsilon}}$  is zero.

## Implications.



If a TEM step travels down in a dielectric between two conductors, no flow of electric current occurs in the conductors bounding the dielectric. To the extent that conductors are imperfect, part of the TEM step penetrates into them, but still no electric current is involved.