Waveguide

A waveguide is not considered to strictly be a transmission line, as it is **not** constructed with **two** separate conductors. As such, it can **not** support a TEM wave!

Instead, a waveguide will propagate "higher-order" **modes**, which are classified as either transverse magnetic (**TM**) or transverse electric (**TE**).

There are **two** problems with propagating higher-order modes!

1. TE and TM modes have a **limited bandwidth**. In fact, none of these modes can propagate at frequencies below a minimum frequency known as the **cutoff** frequency.

2. TE and TM modes are **dispersive**. That is, the phase velocity is dependent on frequency—for some modes highly dependent!

Q: *Yikes! So why would we ever use a waveguide?*

A: A waveguide likewise has **two** important **advantages**!

1. It can typically handle very **large power** (e.g., kilowatts).

2. It can have very **low loss** (low value of α).

Thus, waveguide is typically used for **high-power** applications, such as high-power microwave **transmitters**.

Waveguide appears at first to simply be a **pipe** (either circular or rectangular), and effectively it is—an **electromagnetic** pipe!