



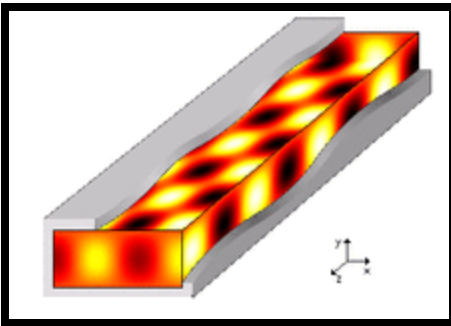
## TR Auto vs. Waveguide

### Purpose:

The purpose of this document is to explain the purpose of a waveguide setup. In addition to the waveguide, this document will cover how the TR Auto™ replaces the need for a waveguide configuration.

### What is a Waveguide?

A waveguide – like the name suggests – is a structure that guides waves, such as electromagnetic waves or sound. The waveguide does this with minimal loss of energy by restricting the expansion of this energy to one or two dimensions. This works in a similar fashion to how canals direct waterflow, by limiting the directions that the water can spread it focuses the maximum flow in a single direction.



*Figure 1*

Figure 1 shows a still-shot of a waveguide with an electric field moving throughout the hollow metal structure. The main flow of energy is moving along the z-axis as the flow in the x and y directions is limited due to the structure of the waveguide.

Once the electromagnetic wave reaches the PCB a transition must occur for the signal to be able to travel throughout the traces on the PCB. This transition between planar circuit and waveguide uses 3-dimensional complex mounting structures.

### How is TR Auto™ Beneficial?

The TR Auto™ - shown in Figure 2 - is an Amphenol Ardent Concepts product that reaches speeds in the narrow E-Band, which is for frequencies 71 – 86+ GHz. The TR Auto™ replaces the cumbersome and expensive waveguide connectors and allows for quick connection and detachment, while also allowing the connector to be closer to the DUT.

By replacing a rectangular waveguide with the TR Auto, space is saved by not having to implement rigid metal tubes from the device to the VNA, which must be routed around any hardware between the two.



*Figure 2*

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## What is the Cost of a Waveguide Setup?

The cost for setting up a waveguide system is dependent on multiple things such as the frequency, length of the waveguide segments, the routing style of the waveguide and how many channels are necessary.

Shown in Figure 3 below is the setup for a basic 24-inch waveguide that includes three bends between the DUT and the VNA. This basic setup requires:

- 12" Waveguide
- 6" Waveguide
- 3" Waveguide (x2)
- Waveguide E-Bend (x3)
- Waveguide 1.00mm Female Coax Adapter
- Waveguide SPST Switch

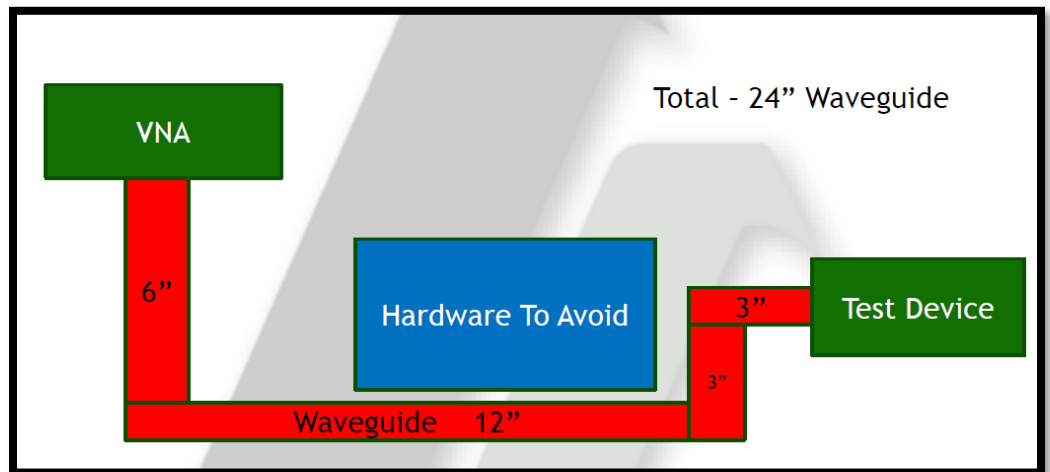


Figure 3

Based on the setup above the standard cost breakdown would be as follows:

Item	Cost*
WR-12 Waveguide 60-90 GHz 12"	\$488.44
WR-12 Waveguide 60-90 GHz 6"	\$406.38
WR-12 Waveguide 60-90 GHz 3"	\$359.02 (x2) = \$718.04
WR-12 Waveguide E-Bend 60-90 GHz	\$394.53 (x3) = \$1,183.59
WR-12 Waveguide 1.0mm Female Coax Adapter	\$5,199.79
WR-12 Waveguide SPST Switch (60-90 GHz)	\$7,640.99
<b>Total Per Channel</b>	<b>\$14,742.41</b>

\*Based on Pasternack Pricing

While this could be cut down upon depending on the length of the waveguide and how many bends need to be made to get from the DUT to the VNA, this does not remove the need for the coaxial adapter and the SPST switch.

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## Application Note Summary:

The TR Auto™ is a cost-effective, space saving and time saving replacement for a waveguide setup.

Total waveguide setup costs upwards of \$14,500

## Who is Amphenol Ardent Concepts?

Amphenol Ardent Concepts is a leading designer and manufacturer of high performance multicoax and coaxial assemblies, connectors, and sockets used in the development of next generation semiconductors and electronics systems. Our core technology is the smallest, fastest, most electrically efficient compression mount connector technology worldwide. As data rate requirements increase and devices and systems shrink, Ardent's products deliver superior signal integrity in a dense footprint that can be reusable across programs to maximize cost savings.

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