

# Coax-to-Waveguide Adapters Meet Needs of Communications Equipment

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Coax to waveguide adapters without tuning screws were originally developed for full waveguide bandwidths with maximum VSWR specifications of 1.25. Subsequently, adapters with factory-adjusted tuning screws provided full waveguide band coverage with lower VSWR. For some satellite and terrestrial communications equipment, the need for coax-to-waveguide adapters involves smaller usable bandwidths of 500 to 800 MHz with a maximum VSWR of about 1.10. This is usually achievable via the factory-tuned configuration. This article presents approximate information for the development of coax to waveguide adapters suitable for many applications. Note that different approaches will be needed for high-power applications.

## Coax-to-waveguide adapter configuration

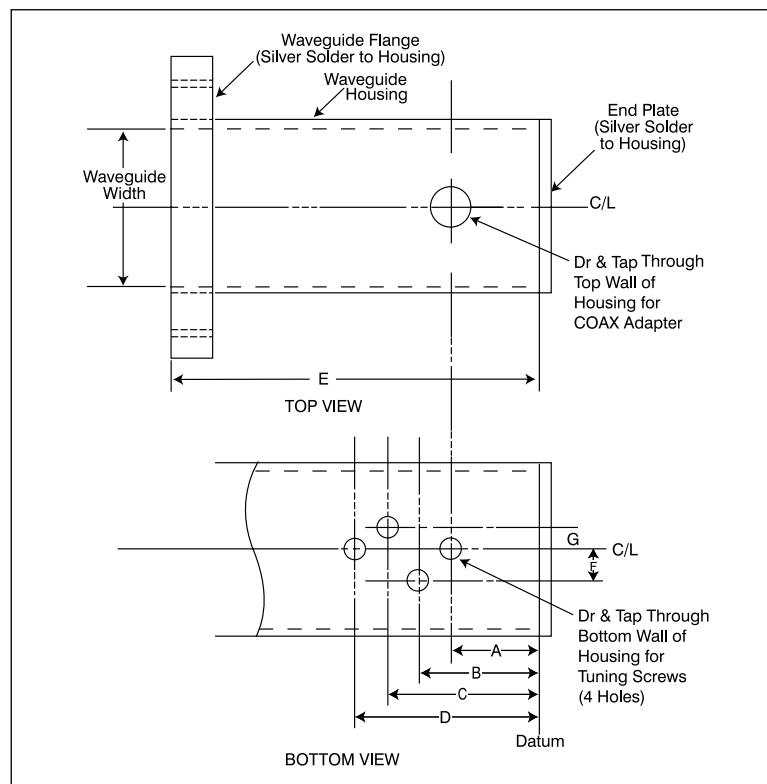
The coax-to-waveguide adapters have several significant parts:

- Housing using rectangular waveguide tubing
- Standard waveguide flange
- Metallic end plate
- Coaxial probe assembly with modified coaxial adapter, probe and hardware
- Tuning screws with hardware (except for set screws)

The coax-to-waveguide adapter design details are shown in Figure 1. The coaxial probe assembly for SMA connectors is also used in waveguide bandpass filters with coaxial interfaces [1]. Applicable details will not be repeated here. New probes must be designed when using SSMA connectors. The top broad wall of the waveguide housing is tapped for a modified female to female coaxial adapter. The bottom broad wall of the waveguide contains four tapped holes for metallic tuning screws. For small quantity fabrication, most metallic parts are of copper alloys. Stainless steel hardware is preferred for durability.

## Coax-to-waveguide adapter mechanical dimensions

Typical mechanical dimensions for various rectangular waveguide sizes are shown in Table 1. Tuning screw



▲ **Figure 1. Coax-to-waveguide adapter design details.**

sizes and recommended coaxial connectors are shown in Table 2. For the larger size waveguides, bulkhead feedthrough coaxial adapters are needed to increase the adjustment ranges. These preliminary dimensions might require modifications when design objectives include optimization.

## Coax-to-waveguide adapter alignment

Coax-to-waveguide adapter alignment uses a standard coaxial reflectometer of adequate directivity. The swept frequency input is applied to the coaxial port. The waveguide port should be terminated in a load with a VSWR that is less than 1.02. Different size probes and different probe insertion depths provide a cut and try situation when used with the tuning screw array. Typical probe depths are near one half the waveguide height while typical tuning screw penetrations are about

one quarter waveguide height. Sometimes, one or more of the tuning screws are not used. After alignment is completed, the coaxial probe assembly and the tuning screws can be staked to the housing with epoxy.

## Conclusions

Coax-to-waveguide adapters for low power communications applications can be developed readily using these recommended dimensions as a starting point. There are useful technological overlaps with some waveguide bandpass filters. For manufacturing in substantial quantities, other fabrication methods, such as dip brazed aluminum, aluminum casting, or electroforming can be used.

## Acknowledgements

The type of coax-to-waveguide adapter discussed in this article has been developed independently by other microwave engineers. It has also been integrated into various waveguide sub-assemblies.

## References

1. R.M. Kurzrok, "Waveguide Bandpass Filter with Coaxial Interfaces Reduces Equipment Costs," *Applied Microwave & Wireless*, (June 1999): 100-102.

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WG Size	A	B	C	D	E	F	G
WR-229	0.625	0.812	1.000	1.312	2.500	0.438	0.312
WR-137	0.375	0.500	0.625	0.812	2.000	0.281	0.187
WR-112	0.312	0.406	0.500	0.656	1.500	0.219	0.156
WR-90	0.250	0.340	0.475	0.610	1.250	0.187	0.125
WR-75	0.250	0.312	0.375	0.500	1.125	0.187	0.125
WR-62	0.187	0.250	0.312	0.437	1.000	0.187	0.125
WR-51	0.156	0.219	0.281	0.406	1.000	0.156	0.093
WR-42	0.125	0.187	0.250	0.375	1.000	0.125	0.093

Note: For E, tolerances are plus or minus 0.005. All other tolerances are plus or minus 0.002.

▲ **Table 1: Coax to waveguide adapter mechanical dimensions.**

Waveguide Size	Tuning Screws	Coaxial Connectors
WR-229	#10-32	SMA Bulkhead Feedthrough
WR-137	#8-32	SMA Bulkhead Feedthrough
WR-112	#6-32	SMA
WR-90	#4-40	SMA
WR-75	#2-56	SMA
WR-62	#2-56	SMA
WR-51	#1-72	SSMA
WR-42	#0-80	SSMA

Note: SMA adapters have 0.250 to 36 UNS-2A threads, and SSMA adapters have 0.190 to 36 UNS-2A threads.

▲ **Table 2: Coax to waveguide adapter tuning screws and coaxial connectors.**

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