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A Review of the Major Types of RF and Microwave Coaxial Connectors

Here is a summary of coaxial connectors typically used in RF and microwave applications; which are among the most common components in the RF and microwave industry

Connectors are everywhere in the electronics industry, delivering power to equipment, providing signal and power pathways within that equipment, and connecting it to external devices.

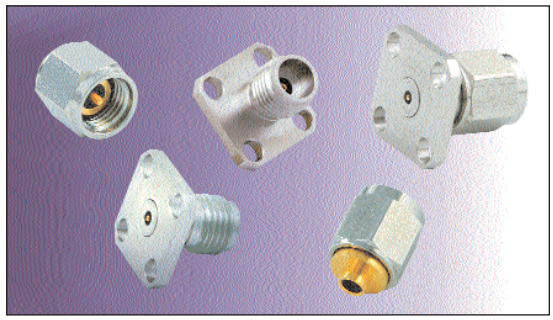
All connectors have physical requirements—size, form factor, material used, temperature and humidity behavior, mating and unmating forces, etc. RF and microwave connectors have the extra requirement of proper characteristic impedance, adequate power handling, and maintenance of that performance at the desired frequency of operation.

This tutorial presents a summary of some of the more common RF/microwave coaxial connectors in Table 1. We make no claim that this table is complete, since there are many specialized connectors with limited areas of application, obsolete connectors that still have some usage, and many uniquely-named connectors that have been adapted by the various connector suppliers to enhance specific performance features.

Connector Specifications

Selecting a connector for a specific engineering project may be simple... or not. The job is simple when the application requires compatibility with a particular type of connector. When the engineer must select a connector without such a requirement, then the various performance issues need to be identified, as well as cost and availability from suppliers.

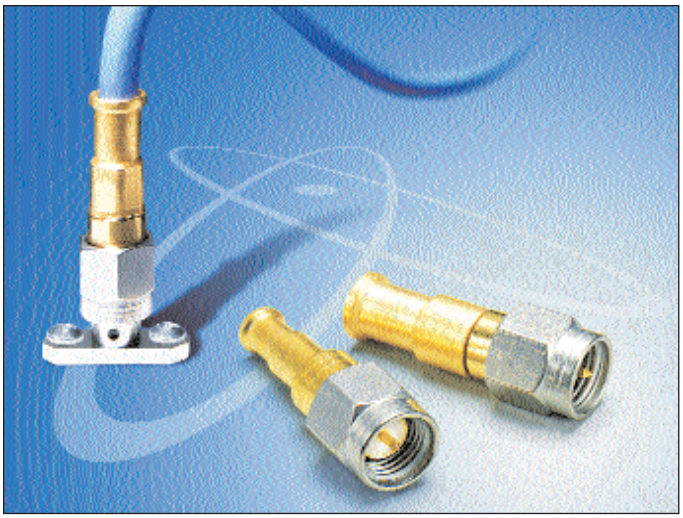
The performance factors that go into a connector choice begin with frequency of opera-



The newly-introduced SMK (2.92 mm) connector from Delta Electronics has a similar form factor to the SMA, but supports operation to 40 GHz with maximum VSWR of 1.25.

Connector Type	Max. Frequency
RCA Phono plugs and jacks	10 MHz
Not usually considered an RF connector, but common for video	
UHF	300 MHz
Low frequency use, usually as the lowest-cost option	
F	1 GHz
Industry-standard for TV, CATV and accessories	
BNC 50Ω	1-4 GHz
Used for non-critical performance, convenient reconfiguration. Enhanced versions available	
BNC 75Ω	1-2 GHz
Industry-standard video or baseband connector	

Table 1 · A list of common (and a few less-common) RF/microwave connectors, listed by the approximate maximum usable frequency ***(continued on the next page)*****.**



Santron's eSMA improves reliability of cable connections with a new extended ferrule and enhancements to the internal construction.

tion, power handling capability, and compatibility with other parts of the system. Assembly to cables or enclosures, tolerance of environmental hazards and other practical factors are also part of the decision-making process. Less common, but significant factors include the VSWR precision, availability of adapters and an estimate of the long-term availability for manufacturing and service.

Internal Interconnections

The list in Table 1 includes connectors that are almost certainly used for connection to external equipment, or perhaps between units within a modular system. It does not address the many connectors used for board-to-board or other internal connections within a product. Connectors for these uses are still largely proprietary, although some have reached more widespread use than others. At small form factors, connectors may be replaced with elastomeric pressure connections, or a designer may choose to place all RF/microwave components on a single board and eliminate the use of all internal connectors.

The same issues apply to high speed digital connectors. Decades ago, BNC and N connectors were often used for data networks using either RF carriers or simply a high speed serial data stream. Today, connectors are mainly used for board-to-board interconnection of 8-, 16-, 32- or 64-bit data buses. Like RF/microwave connectors, the same issues of frequency range (clock speed), VSWR (reflections), and standardization for brand-to-brand compatibility apply to digital systems.

As a final note, interconnections at high frequencies remains one of the most important factors that an engineer must deal with during the design, manufacture, testing, installation and operation of electronic equipment.

TNC	2+ GHz
Threaded BNC	
EIA Flange Connectors:	
7/8"	3 GHz
1-5/8"	3 GHz
3-1/2"	1.5 GHz
(plus larger sizes to 8")	
Used in ISM, mobile radio and broadcast transmitting applications	
7/16 DIN	7.5 GHz
Industry-standard for cell sites, other high-power applications	
Type N 50Ω	12 GHz
Industry-standard for many RF power and military apps.	
Type N 75Ω	12 GHz
C	12 GHz
Similar to N, bayonet locking	
SMA	12-26.5 GHz
Extremely common microwave connector, with many variations and enhanced versions	
SMB	3-4 GHz
Snap-on	
SMC	3-10 GHz
Screw-on	
QMA	6 GHz
Snap-on, similar to SMA	
SSMA	40 GHz
"Small SMA" for higher frequencies	
14 mm, GR900BT, MPC14	8.5 GHz
Older type sexless lab connector	
7 mm (APC-7)	18 GHz
Sexless, for laboratory intruments	
3. 5 mm	34 GHz
2.92 mm[1]	40 GHz
2.4 mm[2]	50 GHz
1.85 mm[3]	65 GHz
1.0 mm	110 GHz

[1]Compatible with Wiltron K Connector©
[2]Compatible with Wiltron V and Wiltron K Connectors, and with 1.85 mm
[3]Compatible with Wiltron V and Wiltron K Connectors, and with 2.4 mm

Notes—There are many variations of connectors on the above list, as well as additional proprietary connector designs. These variations are often designed to reach higher frequencies than standard connectors, or to address performance issues for specific applications.

Table 1 *(continued)* · Common RF/microwave connectors listed by maximum frrequency.