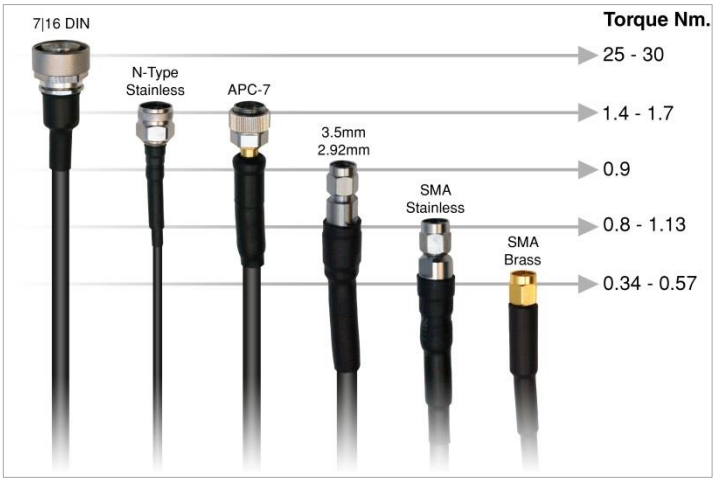
STRAIGHT TALKING ON TORQUE



Anyone who has worked in an electronics measurement lab and used coaxial connectors will know the importance of mating torque.

Valid, repeatable test results rely on a constant mating torque. The correct torque also ensures the longest life of your expensive measurement standard connectors, cables and adaptors, especially considering the repeated connect /disconnect cycles many go through during their life.

RF & microwave equipment typically relies upon an RF connector pair when it comes to connecting one part of the system to the other. This might be via a coax cable, a pair of back to back connectors or different connector types via a coaxial adaptor. The system designer, and those responsible for system installation and maintenance, has to consider an increasing array of differing connector types.

Varying Connectors

Over the past few years we have seen an increase in the types of connectors used, plus the range of uses. Industry standards such as the BNC, TNC, N-type and SMA have seen numerous alternatives, each offering some technical advantage.

In wireless applications the N-type was the “industry standard”, but we have seen the 7/16 DIN become the preferred connector, especially where low PIM needed to be achieved. However, the 7/16 DIN is now seeing the 4.1-9.5 DIN being proposed due to its smaller size and increased frequency performance whilst maintaining its good PIM performance. In high frequency applications the SMA has been complimented by the 3.5, 2.92, 2.4, 1.85 and 1.00mm connectors as microwave systems get ever closer to 110GHz.

A similar situation applies on the production line, where certain tests need a specified coupling torque to be used during the measurement process. A good example is when using a PIM tester, as the handbook will always specify a torque setting for the connectors used in the measurement system. However, the correct mating torque is also just as important in the field as it is in the lab, but for slightly different reasons. Whilst any wireless system that is designed to ensure a specified PIM performance will need to follow the same guidelines as used in production test, one might think that because the connection is only being made once it is less important, however this is not the case.

Connector Pressure

Under-tighten a connector and you get a high loss or intermittent contact which might not reveal itself for some time. Worse still is over tightening a connector pair. To understand why, we need to look at the way coax connectors actually meet. Typically the male/female centre contacts have a mating plane that is specified in the connector design reference drawing. During connector production and/or assembly the centre contact is positioned with reference to the plane within a set dimension, typically a few 10ths of a millimetre (or 100ths of an inch). This ensures that when connectors are correctly mated the centre pins mate without damage.

Over tightening coax connectors has the effect of compressing the internal components and in severe cases causing pressure on the mating centre pins, which in turn can lead to failure of the joint between the centre pin and whatever it is connected to. In the case of cables, this might be the cables centre conductor, although this is relatively rare given the flexibility of coax cables. This problem can be mitigated by using a connector with a “captive centre contact” design.

Experience has shown the real problem comes when you are connecting to a system component such as a load, attenuator or coupler. These components typically have a connector centre contact soldered directly to a pcb or internal component such as a resistor. Compression on this joint will probably lead to failure. The solder joint between centre contact and internal component will have the minimum of solder used to ensure as good an RF performance as possible, as “over engineering”, where excessive use of solder might result in poor VSWR.