



## Measurement Matters

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# RF Connector Care

When working at frequencies above a few tens of megahertz, more attention should be paid to the quality and reliability of connections than at lower frequencies. A good connection at low frequencies simply means that the conductors should make contact. At radio frequencies (RF), and above, the integrity of the transmission line must be maintained right through the connection, which means that electrical and mechanical considerations are more important. Damaged or dirty connectors and cables can significantly degrade measurements of RF power and other quantities. The manufacturers of RF test equipment know this and take particular care in choosing connectors. To continue to get the best performance from your equipment, regular inspection and cleaning of RF connectors is needed, and this will also help to prolong the connectors' life.

RF connectors are designed to join sections of a transmission line together as seamlessly as possible. To mate properly, the outer conductor mating surfaces must be clean and flat and the inner conductor surfaces should come very close together, but avoid a collision that could damage whatever lies behind the connector. Collision avoidance is the reason why it is important to gauge the mechanical tolerances of a connector. This should be done when a connector is new and at regular intervals thereafter.

Connector families have standard tolerances, which give good performance but avoid damage in use. Better grades of connector have tighter mechanical tolerances (and cost more). No connector should be used if it is found to be out of specification. Connectors do have a limited service life and can become defective due to wear with normal use, but regular inspection and cleaning will help to prolong their life. A connector gauge measures the inner conductor pin depth relative to the outer conductor mating plane. A torque wrench is recommended for tightening connections, as this creates a roughly reproducible strain that helps to reposition the mating surfaces accurately.

Connectors need to be handled carefully. They should be stored in a safe environment –

always use a plastic end-cap for protection so the contact end is not exposed – and, when handling them, do not put a connector down contact-end first on a hard surface. Avoid touching the connector mating surfaces.

Clean and inspect connectors before use. A magnifying glass (> 10X), or microscope, is recommended. Check for scratches in the plating or worn mating surfaces, metal particles in the threads or on the mating surfaces, and bent or misaligned centre conductors. This is very important: a damaged or out-of-spec connector can destroy another good connector in just one connection.

To clean connectors, low-pressure air can be used to remove loose particles from threads and mating surfaces. If further cleaning is required, a lint-free cleaning swab can be moistened with isopropyl alcohol and applied lightly. Avoid too much pressure on the centre conductor and be careful of swab fibres that can become tangled in a centre female conductor. When the alcohol has evaporated, air can again be used to blow surfaces clean.

When making and breaking connections, connector mating surfaces should not rotate. The axes of both connectors should be aligned, so that the male centre pin slips concentrically into the centre female contact. (If this is not done carefully, a male pin can cause serious damage to the fingers of the female centre conductor – see figures.) Make sure that, as they are pushed together, the connectors engage smoothly. Then, keeping the device steady, tighten the connector nut by hand initially and finish the connection with a torque wrench. At all times prevent the devices from turning. A second spanner can be used for this if necessary. When breaking a connection, again avoid any twisting or bending action on the connectors and prevent rotation by holding the device body with a spanner.

The RF and microwave group at the Measurement Standards Laboratory has facilities for inspecting and cleaning a number of types of RF connector. Please feel free to contact us for help or advice.



**Figure 1: Damaged female centre conductor fingers on a 1.85 mm connector (photo courtesy of Jürg Rüfenacht, METAS, Switzerland).**



**Figure 2: A bent 3.5 mm female centre conductor finger. The centre conductor has been removed here for replacement (photo courtesy of Jürg Rüfenacht, METAS, Switzerland).**



**Figure 3: A bent female centre conductor finger on an N-type connector (photo courtesy of Tuomas Haitto, Finnish Defence Forces).**