

Unique co-axial cable solutions offer high-performing flexibility

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Figure 1. flexible cables can prolong system lifetime by allowing for repeated use and long-term durability without damage or performance degradation. Source: Flexco Microwave

Flexible coaxial (coax) cables are used in several applications such as ground-based electronic warfare systems, phased array radar systems, air surveillance systems, test and measurement in laboratory or harsh environments, antennas/base stations, 5G and telecom applications, SATCOM and space environment testing, to name a few. These flexible cables can prolong the life of these systems since they allow for repeated use and long-term durability without damage or deterioration of performance. Not all flexible coax cables are equal, however; there are problems with industry-standard flexible coax cables but Flexco, a pioneer in the development and manufacturing of flexible coax cables, has successfully addressed the inherent cable problems with their patented technology.

Flexible coax cables

Coax cables are used to transmit high radio frequency (RF) signals from one point to another with low signal loss. They consist of a center conductor or core made from a single copper or copper-coated steel wire that carries the signal. A dielectric material wraps around the center conductor, which insulates it from an outer conductor. A metal shield in the form of a foil or braid wraps around the outer conductor to cancel electromagnetic interference. The coax cable assembly is then covered with an outer jacket that provides environmental protection (Figure 2).

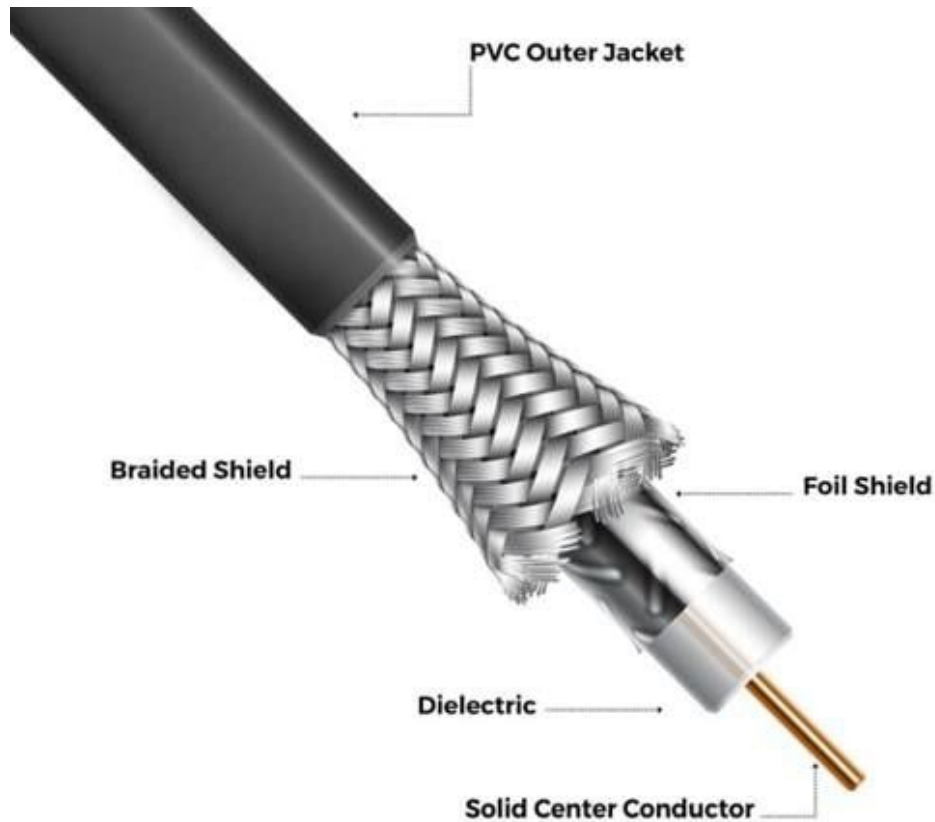


Figure 2. Detailed view of standard coax cable. Source: Flexco Microwave

Standard coax cables that consist of semi-rigid or pre-formed components are suitable for applications where the configuration is fixed, and all design parameters are known. However, flexible coax cables may be more suitable for applications where the configuration may vary or change during operation. Such might be the case for coax cables attached to equipment installed on moving mechanical assemblies or systems that must be reconfigurable during operation. While industry-standard flexible coax cables may be more durable and adaptable to a broad range of user applications than semi-rigid or pre-formed cables, they must also be engineered to address several potential challenges that may be unique to the application. These challenges might include low insertion loss, phase/amplitude stability, performance under flexure and movement or performance at elevated temperatures. These performance challenges must be addressed while maintaining a reasonable price and meeting reliability requirements.

Flexco Microwave's coax cables

Flexco Microwave, a pioneer in the development and manufacturing of flexible coax cables, has successfully addressed numerous performance challenges that are inherent problems with flexible coax cables with their unique technology. Flexco's patented design of a convoluted outer conductor (shown in Figure 3) made of strip-wound oxygen-free copper enables outstanding durability without sacrificing flexibility. The outer conductor provides standard shielding while keeping the center conductor concentric under flexural loads thereby

preventing kinking, which adversely affects the stability and repeatable performance of a coax cable.

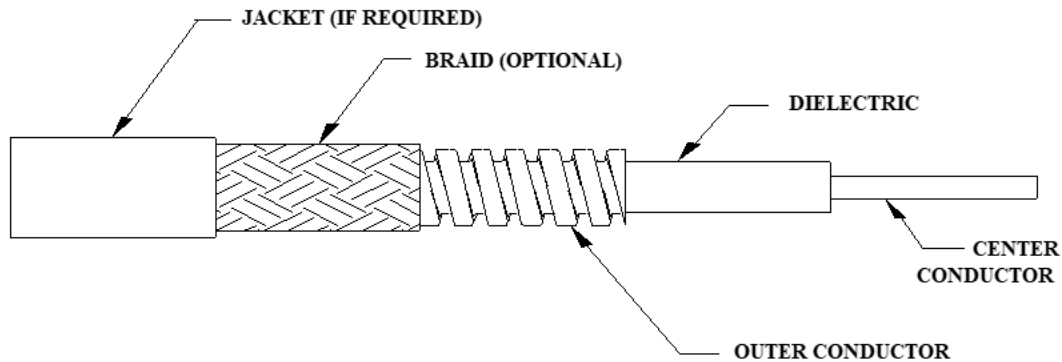


Figure 3. Variations to the Flexco design allow users to customize cable assemblies for specific needs. Source: Flexco Microwave

Flexco's unique cable design and construction techniques offer superior phase stability over a wide range of operational temperatures and bending displacements. For example, Flexco's outer conductor design, with its fine pitch and deep convolutions, remains concentric during bending. The center conductor is firmly supported by the dielectric, which also maintains its concentricity with the outer conductor during bending. Other companies typically offer foil wrapped and braided outer conductors, which become non-concentric or oval shaped during bending, causing electrical performance variations. Furthermore, most Flexco cable assemblies can be "locked" using a patented process that mechanically locks the outer conductor to the dielectric, thereby restricting any relative movement between the conductor and dielectric during bending, further minimizing phase changes.

Variations to the Flexco design provide an opportunity for users to customize and adapt cable assemblies according to specific user needs and requirements. For example, low-loss high frequency assemblies can be designed with different dielectrics for high power applications while using the same base design and ruggedization techniques. Flexco also has armored laboratory-grade test assemblies, which are similar to top brand vector network analyzer (VNA) cables.

Other variations of the Flexco flexible coax design have been successfully implemented on numerous weapon systems, such as the Patriot air defense missile, the E-2D Hawkeye tactical airborne early warning aircraft, the AEGIS command-and-control (C2) and weapons control system and numerous radar systems used for missile defense, surveillance, and early-warning, including the THAAD, TPS-78, AWACS, SBX-1, and Cobra Judy. Some of these applications have required operation from DC to 50 GHz, and with peak power ratings of over 5,000 W.

The Flexco design has also been adapted over a wide range of diameters, ranging from 0.250 inches to 1.50 inches while using the same durable convoluted copper outer conductor design. The Flexco coax cables can be outfitted with a variety of different connector combinations, including 2.4 mm, 2.92 mm, N, TNC, BNC and SMA. Flexco can also phase match or delay match assemblies ($\pm 4^\circ$ at 50 GHz), which gives consistency of knowing each cable will be electrically equal across the board.

Flexco Microwave

Flexco Microwave Inc. is a family owned and operated business headquartered in New Jersey, with more than 50 years of experience producing flexible coax cables for several industries, including military, aerospace and aeronautics. The company is compliant with and certified under the ISO 9001:2015 quality control program. Their dedicated team of applications, design and manufacturing engineers can assist customers to facilitate the rapid development, qualification, and manufacturing of specialized flexible cable designs for a wide variety of applications in several industries.

While Flexco has an extensive catalog containing a variety of designs for multiple applications, each cable series can be engineered to unique specifications that are needed for different user applications, environments, demands or performance. The company can supply cables to various depots for aftermarket spares and, if necessary, reverse engineer legacy cables if no supply is available. More information about Flexco Microwave and their products can be found on the [Flexco website](#).