Why MIL-C-17 Coax Cables With PTFE Dielectrics Should Be Specified For Commercial and Military Applications

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Recently, Harbour Industries was asked to evaluate samples of "RG178" and "RG316" coax cables that were supposedly manufactured in accordance with the MIL-C-17 specification. At the very least, the cables were reported to perform with the same electrical characteristics as the MIL-C-17 specification. One manufacturer was located in North America, the other was located in Asia. Here's what we discovered.

Silver Plating Thickness

The RG178 under evaluation did not conform to the MIL-C-17 standards. The center conductor should have been annealed with a minimum of 40μ" of silver plating. However, it was hard tempered and had only 29μ" of silver. This is typically done for cost cutting purposes. The hard wire can be processed somewhat faster but it is also brittle, less flexible and susceptible to breakage under flexure. A reduced silver plating thickness makes the conductor susceptible to copper migration and galvanic corrosion. We were unable to prepare a sample of braid wire for a silver plating test. It proved impossible to disassemble the braid without breaking the strands. We couldn't determine if the braid wire was brittle or just difficult to disassemble. However, since the center conductor had an insufficient silver content, it is likely the braid wire was manufactured under the same guidelines.

Electrical Performance – PTFE vs. FEP

Per MIL-C-17, the dielectric material for M17/93-RG178 is specified as PTFE (polytetrafluoroethylene). The sample under evaluation was made with FEP (Fluorinated Ethylene Propylene). FEP is an inferior dielectric relative to temperature rating and dissipation factor. FEP has a relatively high dissipation factor which adversely effects high frequency performance. This was evident in the fact that the sample under evaluation failed to meet the requirement for attenuation at 3 GHz. If the cable is used at frequencies above 3 GHz, the performance will be further compromised.

All that was non-compliant relative to the RG178 sample held true for the "RG316" cable. The exception was the high frequency attenuation. While the principle and resulting effects of using FEP in lieu of PTFE remains the same, the specification was written to leave a significant amount of room for error. In addition, the "RG316" sample under evaluation failed to meet the MIL-C-17 requirements for VSWR at low frequencies. The discrepant cable was marked with the M17/113-RG316 designation even though the manufacturer's name printed on the cable was not an approved source of supply for this cable.

Electrical Performance – PTFE vs. PFA

On a third sample from another manufacturer, the center conductor met the MIL-C-17 specification, but the braid wire tested low for plating thickness. If there is not sufficient sil-

MIL-C-17 Coax	Generic description	Other MIL-C-17 Coax	MIL-C-17 Rev. D Coax
		M17/93-00001	RG188A/U
M17/93-RG178	RG178	M17/110-RG302	RG189A/U
M17/94-RG179	RG179	M17/111-RG303	RG195A/U
M17/95-RG180	RG180	M17/131-RG403	RG196A/U
M17/113-RG316	RG316	M17/158-00001	
M17/152-00001	RG316DS	M17/169-00001	
M17/60-RG142	RG142	M17/170-00001	
M17/128-RG400	RG400	M17/172-00001	
M17/127-RG393	RG393	M17/174-00001	
		M17/175-00001	
		M17/176-00001	

ver plating, problems with corrosion and copper migration could occur. The dielectric used in this coax cable was PFA (perfluoroalkoxy). The diameter varied significantly with a .001" variance observed within a 6-inch specimen. While PFA has a temperature rating comparable to PTFE, its dissipation factor is similar to that of FEP. Consequently, it is prone to the same high frequency performance problems as an FEP dielectric. This was evidenced by the fact that the cable sample under evaluation not only didn't meet the attenuation at 3 GHz. The cable also failed VSWR at 1 GHz from one end of the sample length.

The MIL-C-17 Specification As An Industry Standard

In summary, the importance of MIL-C-17 QPL (Qualified Products List) approval cannot be overemphasized. Qualified approval ensures: (a) the cable is manufactured using only qualified, high quality materials, (b) the cable conforms to all test requirements through a series of rigorous quality control tests and (c) the cable has gone through an annual governmental review of test data. Because these standards exist, there is little room for data manipulation and material substitution to compromise quality. A product made today will be constructed of the same materials and to the same high standards as it was in the past, and will be in the future. Falsely labeling cable as if it were on the QPL list is illegal in the United States. While certainly the laws of the USA do not necessarily extend beyond its borders, mislabeling of product is not only dishonest but will guarantee neither quality nor consistency. In addition, misrepresentation of a product's component parts can lead to liability concerns if said product fails and is found to be contrary to specification requirements.

Harbour Industries is proud to be a qualified supplier of MIL-C-17 coax cables since 1975. In addition to military applications, Harbour's MIL-C-17 coax cables are frequently selected for use in commercial communication systems, antenna systems and RF instrumentation. Many of these applications have electrical performance requirements even more demanding than the MIL-C-17 specification, but the requirements present no problem for Harbour due to years of engineering and manufacturing experience. As of October 2002, Harbour is QPL approved to manufacture the cables in the above table.

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