Critical Demands on Ruggedized Wireless Systems for Today and Tomorrow

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Wireless systems are now fully mainstream in our lives, not only in the consumer world of cell phones, Wi-Fi enabled laptops and satellite television, but also in the mission and life critical world of aerospace and defense. Recent applications such as ADS-B (Automatic Dependant Surveillance - Broadcast) managed commercial airline flight, software defined radios, and UAVs (unmanned aerial vehicles) bristling with sensors, all depend heavily on the electromagnetic spectrum to interact with the world, demand the highest in reliability, and are driving new and innovative solutions relative to electrical interconnect.

Figure 1. SMPM contacts.

The electronic intensity of these emerging wireless systems is increasing dramatically and impacting system design, including architectures. In line with systems manufacturers' goals of reducing SWaP (size, weight and power), the miniaturization of electronics has led to an escalation in embedded computing. Large racks holding LRUs (line replaceable units) are being replaced by smaller cabinets housing LRMs (line replaceable modules). This architectural evolution further drives the shift in paradigm to higher density LRM style connectors featuring a variety of interface technologies, including coaxial connectors as one of the direct enablers to wireless functionality. In response to these market and technical drivers, packaging engineers are continually striving for elegant and user-friendly designs.

Interconnect Evolution for the Designer

In support of these requirements, Tyco Electronics has developed of a new family of multiposition coaxial interconnects referred to as multiposition RF modules. Based on the rugged, yet high density SMPM contact, these interconnects are quickly proliferating into both standard and application-specific architectures.

SMPM contacts are very appealing to both packaging and systems engineers. At approximately 0.125” in diameter, they are quite small, providing high density, yet not sacrificing robustness. They have a high reliability pedigree and are very application flexible. In cable applied form, the contacts can support up to 40 GHz. In compliant pin board attach, they support up to 6 Ghz. Surface mount varieties are also available, offering up to 20 GHz. As a result, the contact family provides the designer with a number of implementation options, allowing for an optimization of manufacturability and performance. If power is a concern, a variety of larger high performance blind mate contacts are also available, such as SMP, OSSP, OSP, etc.

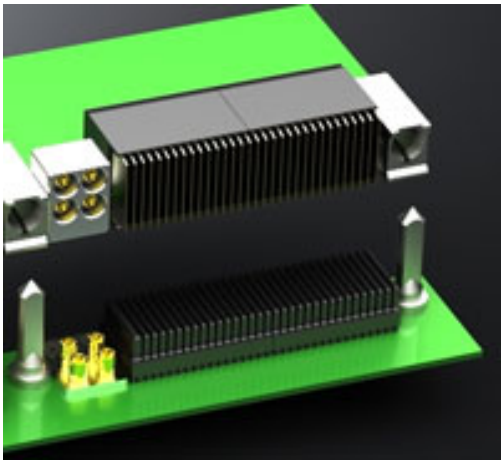
[1]

In multiposition module configuration, these new contacts provide a blind mate, ganged backplane disconnect, making them very architecture, configuration and maintenance friendly. In the past, individual connectors and cable assemblies would need to be installed and routed in a somewhat ad hoc fashion throughout or outside the chassis to reach the appropriate destination. Installation, maintenance and troubleshooting proved to be very problematic. The new approach is one of modularity. Now RF-equipped cards and their cables can be cleanly installed in segments, with coaxial cables routed behind the chassis backplane to other cards or to chassis input/output connectors. Short cables confined to the RF-equipped cards can be routed from the multiposition module or a site on the card to the front panel, enabling mission configurable applications especially suited to defense and instrumentation. The realized benefits? Speed, user-friendliness and configuration control. If the RF-based card needs examined, modified or replaced, it is simply removed like any of the other cards, with the user greatly benefitting from the rear blind mate disconnect.

Today’s Implementation

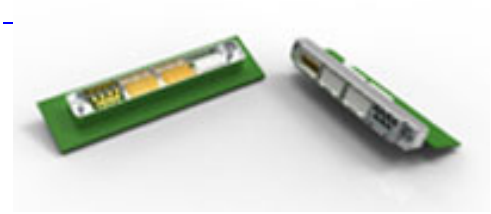
The technical community is driving to bring these improved packaging techniques to market. A recent industry standard initiative involving the SMPM-based multiposition RF modules has been in support of VPX architectures. The foundation of many defense-embedded computing platforms, the prolific VITA 46-based VPX architecture is now supplemented by VITA 67: Coaxial Interconnect on VPX. The standard multiposition modules house four or eight cable-mounted SMPM contacts and are compatible with a variety of VPX profiles. An additional benefit is that the modules are compatible with architectures similar to VPX, like VXS (VITA 41), other

Eurocard-based systems and a number of nonstandard architectures.



A second example of multiposition RF module implementation is found in Tyco Electronics' High Speed Ruggedized (HSR) backplane connector. The ruggedized COTS (commercial-off-the-shelf) connector is based on the highly successful concept of common form factor inserts. It is user-configurable and length scalable, with the SMPM-based RF module housing up to seven contacts. It also houses a derivative of Tyco Electronics' 10+Gb/s Z-Pack HMZd and Universal Power Module to address digital and power applications, with an option for MT-based fiber optic modules.

Completing Tomorrow's Solutions



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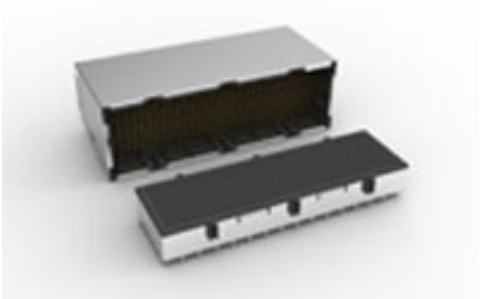
As exemplified by the VPX standard VITA 46 MULTIGIG RT2 and the HSR backplane connectors, rugged digital connectors are needed to enable complete wireless system functionality. They allow implementation of high power processors for the data gathered by radar, imaging, communication, and sensor suites. Given their high frequency performance, they can also carry a number of signals previously routed through coaxial connectors, saving size, weight and reducing cost.



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The most significant announcement in the high reliability backplane connector arena is the new Fortis Zd backplane connector from Tyco Electronics. Made public June 1, 2010, the Fortis Zd elevates the digital market-space for the most challenging of mechanical and electrical environments. With a super-redundant separable interface based on the Mini-Box M55302 style contact, the Fortis Zd features 10+ Gb/s differential speeds with mechanical performance suited to the most adverse applications. Modularity, high density, protected backplane side, two level maintenance ESD (electro-static discharge) features and three shell options make the user-configurable connector a complete package, providing the design engineer with a stratified solution set. Coupled with the multiposition RF modules, the Fortis Zd leads the way for next-generation high reliability embedded computing in wireless applications.

Conclusion

As the defense world delves further into embedded computing and wireless system functionality, it is expected that commercial aerospace and other high reliability markets will follow. Reduced SWaP is a common goal across the aerospace and defense marketplace, and will serve to further strengthen the business case for continued evolution. Advanced hardware solutions, such as Multiposition RF Modules and the new Fortis Zd backplane connector, are the cutting edge of this evolution and are poised to enable the next generation of critical systems.

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