

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Mobile Satellite Communications and Navigation Technology (3)

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DESIGN AND REALIZATION OF S-BAND COAXIAL MANIFOLD MULTIPLEXER FOR SMALL  
SATELLITES**Abstract**

Microwave multiplexing networks are required to combine/separate multiple communication/data and telemetry/telecommand channels in small satellites. These satellites have stringent size, weight and power (SWaP) requirements. The multiplexers designed for such satellites should have lowest possible passband loss along with compact size and light weight. This paper describes the synthesis, full-wave electromagnetic (EM) simulation and development of a novel coaxial manifold multiplexer for a small satellite. Manifold multiplexer configuration is employed because of its compact design and superior performance in terms of insertion loss and isolation. At the synthesis stage for electrical circuit modeling of the multiplexer, channel filters are represented by coupling matrices and manifold by T-junction connected with transmission lines. Filters and manifold are realized in coaxial technology for small size and reduced weight. Full wave simulation of complete multiplexer is very complex and time consuming. To overcome this difficulty, full wave simulation of channel filters and manifold were performed separately using commercial EM simulator and then co-simulation was performed in circuit simulator. The design approach has been verified by realizing a couple of 3-channel manifold multiplexers in S-band for on-board transmit and receive chains of satellite. Each transmit channel has 20 MHz bandwidth and 10 MHz guard band. Each receive channel has 15 MHz bandwidth and 10 MHz guard band. Filters are designed to mitigate the frequency drift due to thermal expansion. Both multiplexers were manufactured with high precision numerically controlled machines (CNC) and measured results meet the specifications. Space environmental tests (thermal vacuum cycling, vibration and shock etc) were also performed and units were successfully qualified.