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NOVEL X-BAND ACTIVE ANTENNA DESIGN ENHANCES LEO TO GROUND COMMUNICATION

Abstract

The X-Band active antenna (XBAA) is an Electronic steering antenna designed and developed by AIRBUS Italia for supporting LEO Earth Observation Missions. The development of this active antenna has been financed by ASI in the context of PLATiNO program and will fly on PLATiNO2 mission for the first time. The antenna is a combination of 8x8 dual feed circular patches in triangular lattice to reduce secondary lobe levels. Each patch is fed by an active channel that provides phase and amplitude control and a passive network that filters and splits the signal into quadrature components. In order to steer the antenna, as well as comply with ITU standards, the unit implements a microcontroller able to control each channel in terms of amplitude and phase. To reduce cost and complexity the active section has been designed considering up-screened commercial SMD components. Two amplification sections are foreseen to ensure 25 dB gain that, combined with antenna gain, achieves high EIRP, which in turn permits high bit rates and an extended downlink window. Channel equalization is guaranteed by a closed loop bias network that individually sets working points of the 64 channel amplifiers, by levelling output power and reducing nonlinearity in every thermal environment or operative condition. Moreover, the bias control network can be continuously optimized to reduce total power consumption, as well. The Microcontroller associated with a static memory can perform calculus to implement complex features. Transmission nulling and multi-beam algorithms are just some of the algorithms that can be implemented on board. For example: XBAA can load a nulling algorithm in order to improve DSN (Deep Space Network) protection from interferences when they are in the field of view of the LEO satellite during the downlink contact activities. Though complex, high reliability is possible because all the digital and power sections are redundant and “graceful degradation” of RF performance is intrinsic to the design.