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DESIGN & IMPLEMENTATION OF A CUSTOM TRANSCEIVER TO ESTABLISH DIGITAL COMMUNICATION WITH SATELLITES IN HAM BAND

Abstract

Cube satellite missions, developed on a low cost platform, perform innovative scientific experiments. The output power and efficiency of the on-board communication system of these satellites is limited due to structural and power constraints. So it is important to develop a wide band and generic ground station having high performance and accuracy over the amateur frequency band. Swayam is a 1U pico satellite developed by the undergraduate students of College of Engineering, Pune working in the amateur HAM frequency band, which will soon be launched by ISRO. The COEP Ground station, established for providing ground support to Swayam, is a generic ground station used for establishing communication with other amateur satellites in the VHF and UHF bands as well. The design and development of the low-cost and efficient ground-station setup is centred around a custom built transceiver. COEP ground station makes use of a simple, compact and low-cost transceiver, instead of highly expensive high-end transceivers. The major blocks inside commercially available transceivers were studied and implemented in an efficient and cost-effective manner. It serves as a viable alternative to traditional bulky transceivers. An innovative system has been developed to receive and decode data of other satellites using a simple chipcon transceiver.

The system includes a Terminal Node Controller (TNC) so as to enhance the functionality of transceiver. Alongwith the transceiver configuration, the TNC also helps the system support additional functionalities like different protocols, software implementation of hardware standards, more efficient encoding schemes etc. Automatic Doppler compensation has been incorporated in the system. Valid data from various satellites using different configurations has been received on COEP Ground Station. Owing to the cost-effectiveness and compactness of the transceiver system, it can be used as a standard design for other ground stations and help create a distributed ground station network for Swayam. The paper pertains to the design, implementation and performance evaluation of the Custom Transceiver used by COEP Ground Station to establish digital communication with Satellites.