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CANDIDATE MODULATION DESIGNS FOR INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM

Abstract

Indian Regional Navigation Satellite System (IRNSS) is being planned as a core satellite based navigation system to provide Position, Navigation and Time (PNT) information to the users over the Indian region. IRNSS constellation consists of 3 GSO and 4 NGSO satellites and will transmit signals in L band and S band.

Ionospheric delay variations are large over the Indian region and contribute majority of the range error. It is planned to use S-band for IRNSS signals to provide moderate accuracy for single frequency civil users. Signals transmission in S-band will result in lesser ionospheric delay effects but will require higher on board power. For high accuracy services dual frequency signal transmission is required to correct for ionospheric delay. This can be achieved by providing dual frequency services using S-band and L-band.

Trade-off studies for various modulation techniques, for the given frequency plan and target services for the IRNSS signals, have been presented based on the following criteria: (a) EPFD at the receiver input should not exceed the limit set by ITU (-121.5 dBW/m2/MHz for L5 band and -154 dBW/m2 in any 4 kHz for L1 band); (b) Minimization of the level of interference induced by the IRNSS signals in GNSS (GPS, GLONASS, Compass and Galileo) receivers; (c) Maximization of the power efficiency in the IRNSS satellites and (d) Optimization of receiver performance.

This paper describes particular Binary Offset Carrier (BOC) modulation designs attractive for IRNSS signals to ensure compatibility and interoperability with other GNSS at L5 (1176.45 MHz) frequency band. It also presents important characteristics of IRNSS modulation designs and achievable code and carrier tracking accuracies. Finally, simulation results of the interference analysis for candidate options are presented along with the associated design implementation issues. The proposed modulation techniques provide improved performance and the opportunity for spectrum sharing while retaining implementation simplicity.