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ADVANCED MCM TECHNOLOGY FOR INTER-SATELLITE LINK (ISL) SPACE COMMUNICATION

Abstract

It is proposed that future global telecommunication network would be most possibly facilitated by a hybrid space communication network of GEO satellite constellation and LEO satellite constellation.

GEO satellite constellation can provide an over 80% of global coverage and high-capacity services, while LEO satellite constellation is able to make a global seamless coverage service and convenient for personal mobile terminals. As the amount of satellites on both GEO and LEO constellation is greatly increasing, an inter-satellite link (ISL) transmission for satellite communication has been developed in the past decades, which boosted to make reducing ground station facilities and promoting satellite self-management. In the future, these ISLs would be more likely applied broadly to a GEO-GEO satellite link, and a LEO-LEO satellite link, as well as a GEO-LEO or LEO-GEO satellite link, rather than a mono-link within a single satellite constellation. Hence, the traditional modulation scheme, such as identical single carrier modulation or fixed modulation scheme, might be necessarily improved.

This paper studies and presents an advanced multi-carrier modulation (MCM) technology for ISL communication. The MCM is designed with self-adapting feature for various ISL transmissions by consideration of diverse multi-carrier modulation scheme and varied transmitting data rate requirement. A global space communication network is modeling by a hybrid of NG GEO satellites and NL LEO satellites; MCM is based upon an OFDM scheme with M orthogonal sub-carrier, where NG, NL and M are integer. It modulates a maximum total number of NGxNLxM sub-carrier inner the whole network. Each single of the sub-carrier can be grouped with each other flexibly to satisfy a specific transmission service or data rate requirement on some certain ISL. It is also capable of adjusting the modulation scheme for a specific ISL, for instance, an OFDM symbol on LEO-LEO ISL can be modulated with QPSK scheme, or else 8PSK for LEO-GEO or GEO-LEO ISL, or 16/32/64QAM for GEO-GEO ISL as well. A simulation work, including multi-element emulation such as sub-carrier grouping and assigning, modulation scheme self-adapting algorithm, data rate with a variety of service requirement, receiving BER against SNR figure analysis, and QoS evaluation would be researched as a result.