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SATELLITE-BASED SEARCH AND RESCUE SYSTEM IN THE PRESENCE OF MULTIPLE BEACONS

Abstract

COSPAS-SARSAT program is a satellite system devised to provide precise and reliable distress alert and location information to assist search and rescue (SAR) operations worldwide. The current system relies on the low Earth orbit (LEO) and geostationary (GEO) constellations to detect and locate distress beacons. However, it has limited instantaneous coverage due to the small field of view of LEO satellites. The current LEO/GEO space segment is in the process of being superseded by new Medium Earth Orbit (MEO) constellations. MEOSAR will improve the performance of SAR services provided by the COSPAS-SARSAT program. The MEOSAR satellites each have a wide field of view, which may result in a large number of visible signals at the receiver compared to its LEOSAR counterpart. Therefore, new transmit waveform for second-generation beacons is currently under development to ensure better system performance. This transmit waveform is based on a spread spectrum signal and occupies the whole bandwidth designated for COSPAS-SARSAT program. Furthermore, the transmit signal from the second-generation beacons is repeated with variable period from 5 to 120 seconds. Simultaneously activated distress beacons will lead to overlapping signals being received, resulting in mutual interference and making detection of the desired signal more challenging.

In this research, we analyse the performance of the second-generation waveform at the receiver in the presence of multiple second-generation active beacons. This performance evaluation is based on the probability of message error, which is currently being studied by simulations, and we aim for experimental demonstrations as well in near future. Based on COSPAS-SARSAT system requirements, a target message error rate for the second-generation waveform is considered. The receiver performance is analysed through simulations to generate message error rate results under a variety of interference conditions. These are constructed to reflect real measured conditions and allow direct comparison with experimental beacon test results. This research will provide performance evaluation of the satellite communications link for the MEOSAR system and also highlight some basic operational limitations of this system. It is anticipated that it will provide a valuable contribution to the emerging new SAR standard.