

A Low Power Beacon for Transmitting Location Data
via the Globalstar Satellite System

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ABSTRACT

Many industries are turning to wireless communication systems to track their assets. One example of such an industry is the shipping industry, where – under the growing emphasis on homeland security – tracking cargo containers and their contents has become a high priority. There are several beacons on the commercial market that will meet this need if the required beacon does not need to be independently powered or to have global coverage. This thesis attempts to find a design solution for a beacon that transmits location data, is battery powered, and has world-wide coverage. The beacon is intended to be a low power, transmit only device, and the receiver will not be designed to operate in real-time. Several communication systems were evaluated on these conditions, and the Globalstar Satellite System was selected to use as the communication system for the beacon.

The Globalstar Satellite System is a low earth orbiting (LEO) satellite system and uses Code Division Multiple Access (CDMA) to allocate system resources to the maximum number of users possible. Discussions of spread spectrum techniques and theory, Rake receivers, and error correction codes are included as a background for the design. This thesis examines the initial steps in the design of the transmitter beacon and aims to determine the minimum required beacon transmit power for good receiver performance. A portion of the correlator in the Globalstar receiver is simulated for several scenarios: a single user case with varying transmit power, and a multiple user case with fixed transmit power. Although not likely to occur, the single user case was used to baseline system performance and to verify the multi-user case results. The simulated correlator employed a parallel search strategy and used a truncated version of the Globalstar system code sequence. Finally, a threshold analysis was performed to determine if better receiver performance could be obtained.

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List of Abbreviations

CDMA	Code Division Multiple Access
C/I	Carrier-to-Interference Ratio
C/N	Carrier-to-Noise Ratio
DS-SS	Direct Sequence – Spread Spectrum
FCC	Federal Communications Commission
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
GPS	Global Positioning System
GSM	Global System for Mobile Communications
ICO	Intermediate Circular Orbit
ITU	International Telecommunications Union
LEO	Low Earth Orbit
MAI	Multiple Access Interference
PCS	Personal Communication Services
PDF	Probability Density Function
PN	Pseudo-random Noise
PSTN	Public-switched Telephone Network
TDMA	Time Division Multiple Access