IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

Author: Mr. Jia Tian
China Academy of Space Technology (Xi'an), China

Prof. Xiaoxu Liu
China Academy of Space Technology (CAST), China
Prof. Daqing Wang
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China
Prof. Xiongfei Li
China Academy of Space Technology (Xi'an), China

THE HIGH SENSITIVITY GPS L1 DECODING METHOD BASED ON MOON NAVIGATION MISSION

Abstract

As we all know that current GPS constellation has been proved to be a very efficient system for terrestrial services and Low Earth Orbit (LEO) applications, such as location determination and time synchronization. However, for very High Earth Orbit (HEO) up to the moon altitude, the application based on GPS is still at research stage. There are many reasons which restrict the extension of space application, one of them is the decoding problem. In HEO case, the spacecraft is far from the constellation and it could only receive the side-lobe signals in most of time, which means that the received signal power is very low and the bit error rate is quite high. Therefore, the ephemeris and the almanac couldn't be decoded correctly and the navigation results couldn't be obtained. To solve this problem, the normal method is to use the modernized GPS signals (e.g. L5), which use extra code to protect the ephemeris, such as convolutional code. But the drawbacks are obvious: 1) not all the GPS satellites could send the modernized signal, which means that if only modernized signal is used, the number of visible satellites will decrease significantly; 2) without L1 band, it is difficult to receive 2 GPS signals with different frequency bands simultaneously, the position accuracy will deteriorate if only 1 modernized GPS signal is used. In this paper, the high sensitivity decoding method of GPS L1 is presented, which could decode the signal with -159dBm (15dBHz), solve the decoding problem of L1 signal in very high sensitivity situation. By using the GPS simulator "Spirent GSS8000" which is very accurate for space simulation, real data is saved by the Fraunhofer front-end and processed by MATLAB software receiver. The simulation result shows that the ephemeris and almanac could be decoded correctly when the received L1 signal power is -159dBm.