AN INEXPENSIVE DUAL-FREQUENCY GNSS RECEIVER FOR USE IN DENSE NETWORKS THAT REMOTELY SENSE TEC AND SCINTILLATIONS

Brent M. Ledvina[1], Todd E. Humphreys[2], Mark L. Psiaki[2]
, Thomas L. Gaussarian[1]
[1]Applied Research Laboratories, University of Texas at Austin, Austin, TX 78713
[2]Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY 14853

A new GNSS/GPS receiver is being developed for use in dense networks that remotely sense ionospheric properties. Its suitability for this application derives from its low cost and its enhanced signal tracking abilities. Networks of such receivers will be useful for investigating scintillations, the development and evolution of the associated irregularities, storm-enhanced density, and plasma flow dynamics. This receiver exploits two new technologies in order to provide performance that is superior to that of existing TEC and scintillation monitors. The first technology is the new civilian signal that is about to appear on the GPS L2 frequency. This signal allows civilian receivers to track dual-frequency signals more reliably than current civilian dual-frequency receivers and at a lower cost. Increased reliability comes about because the new signal is not encrypted. An unencrypted signal allows a tracking loop to maintain lock during power fades that are 20 dB deeper than those through which current dual-frequency receivers can maintain lock. The new signal contributes to the cost reduction of the receiver because unencrypted tracking is simpler and because the new L2 civilian signals spread spectrum bandwidth is 10 times narrower than the current L2 signal. A narrower spectrum permits the use of simpler hardware. The second enabling technology is a new type of tracking loop that has been specially designed to maintain lock in the presence of strong signal amplitude and phase fluctuations. The tracking loop uses an extended Kalman filter that automatically adapts loop bandwidth to optimally trade off measurement errors vs. signal dynamics at varying signal power levels. The performance advantage of these technologies is demonstrated using data recorded during equatorial scintillations and using a hardware GPS simulator.

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: ledvina3977

Date Received: September 16, 2005

1. (a)
   Brent Ledvina
   Applied Research Laboratories
   University of Texas at Austin
   P.O. Box 8029
   Austin, TX
   78713 United States
   bml22@cornell.edu
   (b) 512-835-3167
   (c)
2. G - Ionospheric Radio and Propagation
3. (a)
4. C - Contributed Paper, Program chair: Frank Lind and John Sahr
5. No special instructions