

GPS System Enhancement with GEO Mobile Satellites

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INTRODUCTION

An enhancement of GPS with GEO satellites is proposed. It can enhance the availability of GPS by additional satellites paths and the measurement precision by additional bandwidths. The additional GEO paths signals are precisely synchronized with GPS. The basic requirement for the proposed system is to provide additional positioning links through the earth stations with distance precision better than one meter without causing any serious degradation to the communication services provided by those GEO systems. Those requirements necessitate very narrow band DLL receivers both at the earth station (ES) and mobile terminal (MT).

1. Introduction

The remaining problems of GPS are; (1) Control by USA,. (2) The C/A codes open to the public is only 1.023MHz, (3) No communication service.

On the other hand, Inmarsat, Thuraya, NSTAR, OPTUS, AMSC/TMI and other global and regional systems provide mobile satellite communication services for mobile terminals (MT). In this paper a method is proposed to add positioning services through those satellites to enhance the GPS availability with additional satellite links, improve the performance with the broader bandwidths, combine positioning and communication services and without causing any serious degradation to the existing services provided by those geo-synchronous earth orbit (GEO) sat systems.

2. Configuration of the proposed system

As shown in Figure 1, an additional positioning link is provided for the mobile users. The positioning signal is sent from existing GEO earth stations, superimposed on the communication signals. The positioning signal is synchronized with GPS so the Mobile Terminals (MT) can establish an additional

distance measurement links to those of GPS. The power of the superimposed positioning signal is set at least 15dB below that of the communication signals to avoid causing any serious performance degradation for the existing services. Two positioning signals are transmitted; one is Rate P PN code with chip rate of 10.23Mc/s and the other is Rate C/A PN code with chip rate of 1.023Mc/s corresponding to the P and C/A codes in GPS. The spectrum of the GEO transmit signal is depicted in Figure 2.

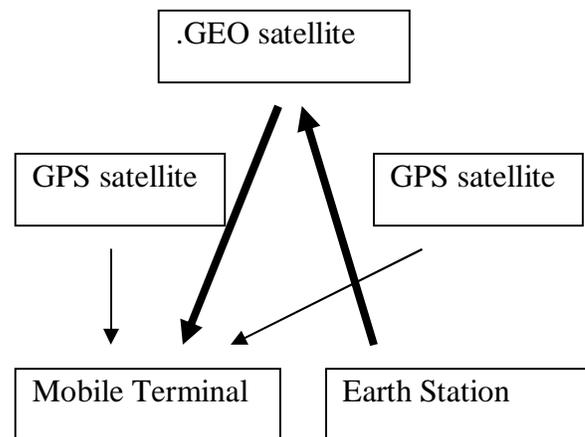


Figure 1 Overall System Configuration

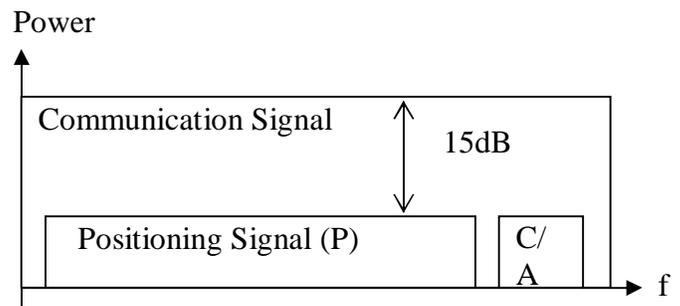


Figure 2 Positioning signals superimposed on communication signals

3. Features

The above cited remaining problems of GPS are solved and a communication can be also added to the expanded GPS.

The system expansion is made most effectively by fully utilizing the existing systems.