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ORIGINAL ARTICLE

On the improvements of the single point positioning accuracy with Locata technology

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Abstract This work focuses on the performances of Locata technology in single point positioning using different firmware versions (v2.0 and v4.2). The main difference is that the Locata transmitters with firmware v2.0 are single frequency, whereas in the v4.2, they are dual frequency. The performance of the different firmware versions has been measured in different environments including an urban canyon-like environment and a more open environment on the roof of the Nottingham Geospatial Building. The results obtained with firmware v4.2 show that with more available signals, cycle slips can be more easily detected, together with the improvement of the detection of multipath fading on the received signal. As a result, the noise level on the carrier phase measurements recorded with firmware v4.2 is equal on average to a third of the level of noise on the measurements recorded with firmware v2.0. In addition, with either firmware, the accuracy of the position is at the sub-centimeter level on the East and North coordinates. The Up coordinate accuracy is generally less accurate and more sensitive to the geometry of the network in our experiments. We then show the importance of the geometry of the Locata network on the accuracy of Locata positioning system through the demonstration of the relationship between the dilution of precision value and the confidence ellipse. We also demonstrate that the model of the noise on the Locata coordinates is a white Gaussian noise with the help of the autocorrelation function. To some extent, this technique can help to detect whether the Wi-Fi technology is interfering with the Locata technology and degrades the positioning accuracy.

Keywords GNSS · Locata technology · Single point positioning · Carrier phase signal · Wi-Fi · Dilution of precision · Statistics

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Introduction

Since the beginning of the global positioning system (GPS) concept (1978), ground-based transmitters (or pseudolites) have been under development to compliment satellite constellations. They have been used to test GPS system elements and enhance GPS in certain applications by providing better accuracy, integrity, or availability through the use of pseudolite signals in addition to the GPS signals. Since then, numerous pseudolite applications have been attempted: local area augmentation system (LAAS), plane landing, bridge deformation monitoring, open pit mining, and reducing street works (Bartone and Graas 2000; Meng et al. 2003; Pervan et al. 1998; Barnes et al. 2006; Montillet et al. 2007). However, there are many fundamental issues that limit the effectiveness of a pseudolite system using C/A code on L1/L2. They include the illegality of transmitting on L1/L2, cross-correlation between pseudolites

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