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Performance Demonstration of Extendable NSPO Space-Borne GPS Receiver

Authors : Hung-Yuan Chang, Wen-Lung Chiang, Kuo-Liang Wu, Chen-Tsung Lin

Abstract : National Space Organization (NSPO) has completed in 2014 the development of a space-borne GPS receiver, including design, manufacture, comprehensive functional test, environmental qualification test and so on. The main performance of this receiver include 8-meter positioning accuracy, 0.05 m/sec speed-accuracy, the longest 90 seconds of cold start time, and up to 15g high dynamic scenario. The receiver will be integrated in the autonomous FORMOSAT-7 NSPO-Built satellite scheduled to be launched in 2019 to execute pre-defined scientific missions. The flight model of this receiver manufactured in early 2015 will pass comprehensive functional tests and environmental acceptance tests, etc., which are expected to be completed by the end of 2015. The space-borne GPS receiver is a pure software design in which all GPS baseband signal processing are executed by a digital signal processor (DSP), currently only 50% of its throughput being used. In response to the booming global navigation satellite systems, NSPO will gradually expand this receiver to become a multi-mode, multi-band, high-precision navigation receiver, and even a science payload, such as the reflectometry receiver of a global navigation satellite system. The fundamental purpose of this extension study is to port some software algorithms such as signal acquisition and correlation, reused code and large amount of computation load to the FPGA whose processor is responsible for operational control, navigation solution, and orbit propagation and so on. Due to the development and evolution of the FPGA is pretty fast, the new system architecture upgraded via an FPGA should be able to achieve the goal of being a multi-mode, multi-band high-precision navigation receiver, or scientific receiver. Finally, the results of tests show that the new system architecture not only retains the original overall performance, but also sets aside more resources available for future expansion possibility. This paper will explain the detailed DSP/FPGA architecture, development, test results, and the goals of next development stage of this receiver.

Keywords : space-borne, GPS receiver, DSP, FPGA, multi-mode multi-band
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