88 年度下半年暨 89 年度國家標準實驗室計畫執行成果摘要表

論文

計畫名稱	中文	建立及維持我國時間與頻率國家標準		
計畫編號	英文	The Maintenance and New Technology Establishment of National Standard for Time and Frequency		
計畫編號	TL-001-P301(89)			
執行單位	中華電信研究所		執行期間	88 年 7 月至 89 年 12 月
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成 果 名 稱	中文	在控制中斷下之 GPS 載波相位頻率同步。		
	英文	Synchronized Clock Using GPS Carrier Phase with Self-Calibration in Holdover Mode.		
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關鍵詞	GPS carrier phase, Frequency syntonization, Frequency stability, Frequency accuracy,			
	Holdover mode.			

內容摘要：

Synchronized clock using all-in-view GPS (Global Positioning System) carrier phase observations with self-calibration in holdover mode is presented. In order to estimate the frequency offset of the remote clock with respect to the primary clock, both clocks are connected to the Ashtech GPS receivers, G-12, respectively. However, G-12 is not designed for time and frequency applications. It has no interface port for external oscillators. Therefore, the quartz oscillators of G-12 are replaced. Through DDS (Direct Digital Synthesizer), the external clocks are connected to G-12. By performing the carrier-phase single-difference (differences between two receivers), time-difference (differences between two epochs) and weighting-least-square estimation, we can precisely estimate the frequency offset of remote clock with respect to the primary clock. The frequency offset and its change with respect to time are then fed into the controller, which automatically issues a command to keep frequency accuracy within an acceptable range. Through a D/A converter, the remote clock then can be steered to synchronize with the master clock. While the remote OCXO (Oven-Controlled Crystal Oscillator) clock is synchronized with the primary clock, the associated information regarding its aging and temperature sensitivity is computed and recorded. During the learning period data is collected and processed so that coefficients of a four degrees polynomial are computed. This polynomial characterizes the OCXO's aging and thermal sensitivity. Once the GPS signal is interrupted, the remote clock then enters the holdover mode. In this mode, the corrections of aging and thermal sensitivity are applied to the oscillator. Therefore, the frequency accuracy is improved under the absence of GPS signals.

We have conducted several experiments and obtained some excellent results. The accuracy of the remote OCXO clock can be improved from about $8?10^{?9}$ to a few parts in 10^{13} in the normal mode, while about $5?10^{?11}$ in the holdover mode for average time of one day. Experimental results show that our system is sound in the practical applications in the telecommunication network, the calibration of the frequency and the instrument for calibration laboratories. Since our method can trace the remote frequency to the national standard.