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McGibney

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(54) **CENTRALIZED SYNCHRONIZATION FOR WIRELESS NETWORKS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1190 days.

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(57) **ABSTRACT**

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This invention synchronizes the sample clocks of an entire wireless network from a single central base station. Unlike a conventional digital radio network where every terminal must have a synchronization circuit in its receiver to adjust the sample clock, each of the radio terminals in this network is clocked from an independent free-running oscillator. For each terminal, the base station learns the frequency and phase of the oscillator by exchanging a special set of signals: first a vernier signal to determine the initial time and frequency offset, and then an early-late signal to track changes in the oscillator. Once the base station is synchronized to the terminal's oscillator, it can determine the absolute path delay between itself and the terminal and correct for the delay using an equalizer. Signals received from the terminal are corrected after the signal arrives at the base station. Signals sent to the terminal are corrected within the base station before they are transmitted so they arrive at the terminal at the precise time that the terminal's free running oscillator takes a sample.

(51) **Int. Cl.**

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H04B 7/14 (2006.01)

H04Q 7/20 (2006.01)

(52) **U.S. Cl.** **370/509**; 370/315; 370/503; 455/462; 455/517

(58) **Field of Classification Search** 370/315–350, 370/503–509, 514–516, 536; 375/133–150, 375/229–347, 356, 354, 371–376; 455/188, 455/259–428, 462, 517–524, 130, 132, 255; 709/223, 236; 327/261–294

See application file for complete search history.

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17 Claims, 13 Drawing Sheets

