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(54) **WIDEBAND SYMBOL SYNCHRONIZATION
IN THE PRESENCE OF MULTIPLE STRONG
NARROWBAND INTERFERENCE**

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(51) **Int. Cl.**⁷ **H04L 7/00**

(52) **U.S. Cl.** **375/365; 375/364; 375/362; 375/260; 375/366; 370/514**

(58) **Field of Search** **375/354, 362, 375/260, 364-368, 344, 326; 370/514, 515, 509**

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(57) **ABSTRACT**

A method and apparatus for time-shift extraction in a wideband transmitted signal containing strong narrowband interference or noise. The time-shift extraction is based on the time domain and frequency domain relation of symbol misalignment. The invention uses the sign of the product of a received signal sample and a reference symbol in the frequency domain to determine the time-shift. It does not rely on the signal magnitude and is therefore less dependent on the signal gain. It also does not rely on the soft phase values, which have ambiguity for values more than three hundred sixty (360) degrees.

46 Claims, 7 Drawing Sheets

