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Teder et al.

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[54] **TIME ALIGNMENT OF TRANSMISSION IN A DOWN-LINK OF CDMA SYSTEM**

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Related U.S. Application Data

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[52] **U.S. Cl.** **370/328**; 370/342; 370/350; 370/441; 370/519; 375/356; 455/67.6

[58] **Field of Search** 370/503, 504, 370/505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 350, 441, 342; 375/354, 356, 357, 358, 359, 362, 364, 368, 371; 455/13.2, 18, 440, 500, 502, 524, 67.1, 67.6, 69

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,472,802	9/1984	Pin et al.	370/95.3
5,042,082	8/1991	Dahlin	455/33
5,128,925	7/1992	Dornstetter et al.	455/502
5,151,919	9/1992	Dent	375/1
5,164,958	11/1992	Omura	375/1
5,175,867	12/1992	Wejke et al.	455/33.1
5,179,559	1/1993	Crisler et al.	455/33.2
5,293,380	3/1994	Kondo	370/95.3
5,293,423	3/1994	Dahlin et al.	455/33.1
5,309,439	5/1994	Roos	370/95.3
5,345,467	9/1994	Lomp et al.	375/1
5,423,067	6/1995	Manabe	455/67.7
5,617,410	4/1997	Matsumoto	455/502

FOREIGN PATENT DOCUMENTS

0 335 846	10/1989	European Pat. Off.	H04H 3/00
0 437 835	7/1991	European Pat. Off.	H04B 7/26
0 522 772	1/1993	European Pat. Off.	H04Q 7/04
WO91/15061	10/1991	WIPO	H04B 1/00

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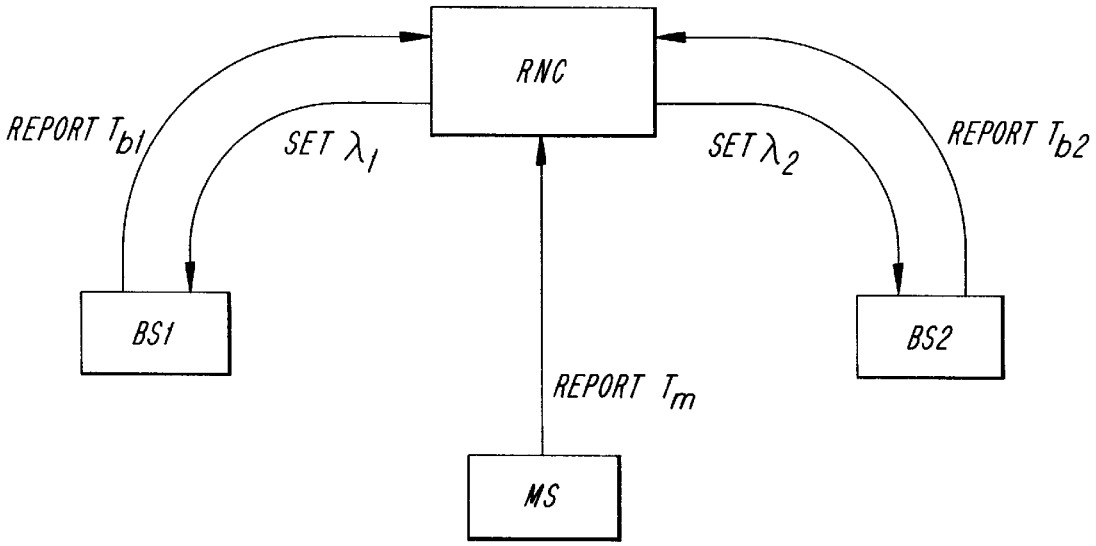
[57] **ABSTRACT**

A mobile station can be connected to more than one base station in a procedure known as macro-diversity. In order to synchronize the signals for a specific cellular call connection, the time difference between the connected base station's signal and a macro-diversity candidate base station's signal is measured by a mobile station. This measurement is then transmitted to the network. The measurements can be used to achieve synchronization via frame staggering.

33 Claims, 7 Drawing Sheets