



(54) **LOW-COMPLEXITY ANTENNA DIVERSITY RECEIVER**

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(\*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

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(56) **References Cited**

**U.S. PATENT DOCUMENTS**

- 3,934,204 \* 1/1976 Hill ..... 455/138
- 4,450,585 \* 5/1984 Bell ..... 455/135
- 4,972,434 \* 11/1990 Le Polozec et al. .... 375/347

- 5,031,193 \* 7/1991 Akinson et al. .... 375/347
- 5,203,024 \* 4/1993 Yamao ..... 455/277.1
- 5,263,180 \* 11/1993 Hiramaya et al. .... 455/139
- 5,390,166 \* 2/1995 Rohani et al. .... 455/137
- 5,530,926 \* 6/1996 Rozanski ..... 370/347
- 5,796,777 \* 7/1998 Terlep et al. .... 455/67.1

\* cited by examiner

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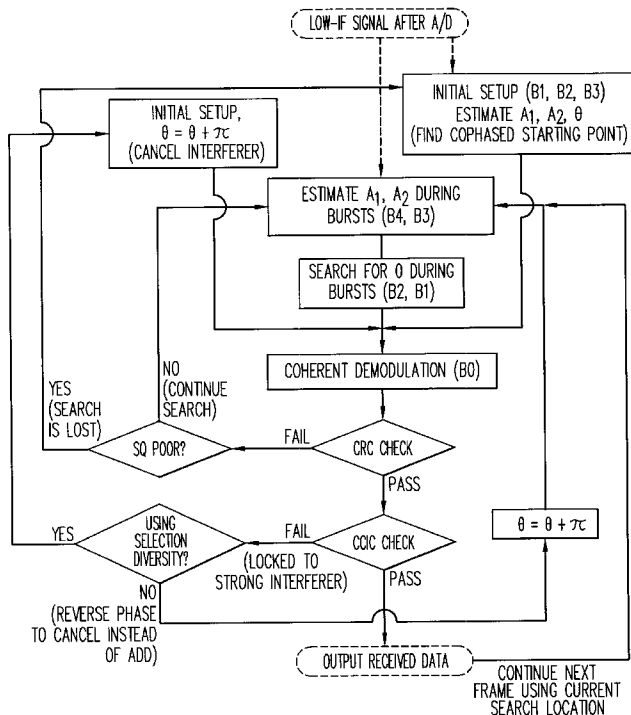
(74) *Attorney, Agent, or Firm*—Burns, Doane, Swecker & Mathis, L.L.P.

(57) **ABSTRACT**

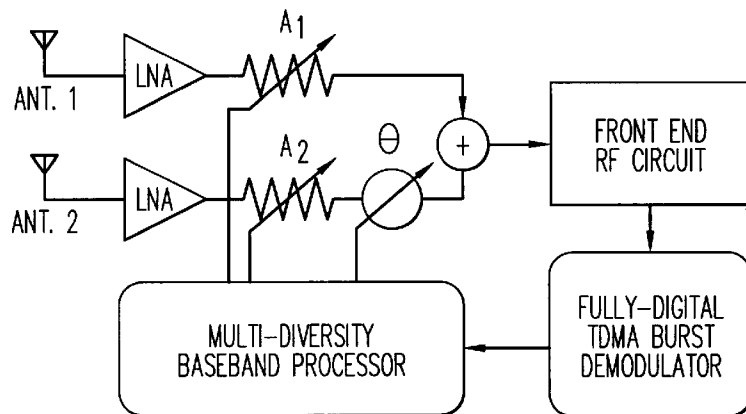
A low-diversity antenna diversity receiver suitable for TDMA PCS handset implementation employing two diversity branches. The receiver is capable of selecting a diversity scheme which is anticipated to give optimum signal reception among a plurality of diversity schemes installed on the receiver. This receiver, more conveniently termed multi-diversity receiver comprises a single conventional wireless digital receiver chain augmented with a few additional low-cost passive RF components and minor control circuits. A plurality of diversity algorithms, for example, selection diversity (SD), equal-gain combining (EGC) or interference-reduction combining (IRC) scheme, which are suitable for implementing on this multi-diversity receiver are also described. Simulation results showing performance of this multi-diversity receiver are also presented.

**16 Claims, 5 Drawing Sheets**

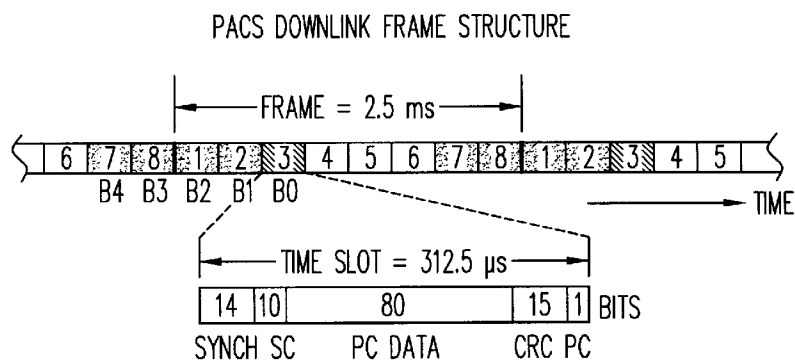
THE IRC ALGORITHM WITH TWO ANTENNAS



BLOCK DIAGRAM OF THE TWO-BRANCH ANTENNA MULTI-DIVERSITY RECEIVER.



**FIG. 1**



SYNCH: SYNCHRONOUS BITS    SC: SYSTEM CONTROL AND SUPERVISORY BITS    FC: FAST CHANNEL DATA  
 CRC: ERROR DETECTION    PC: POWER CONTROL

**FIG. 2**

THE IRC ALGORITHM WITH TWO ANTENNAS

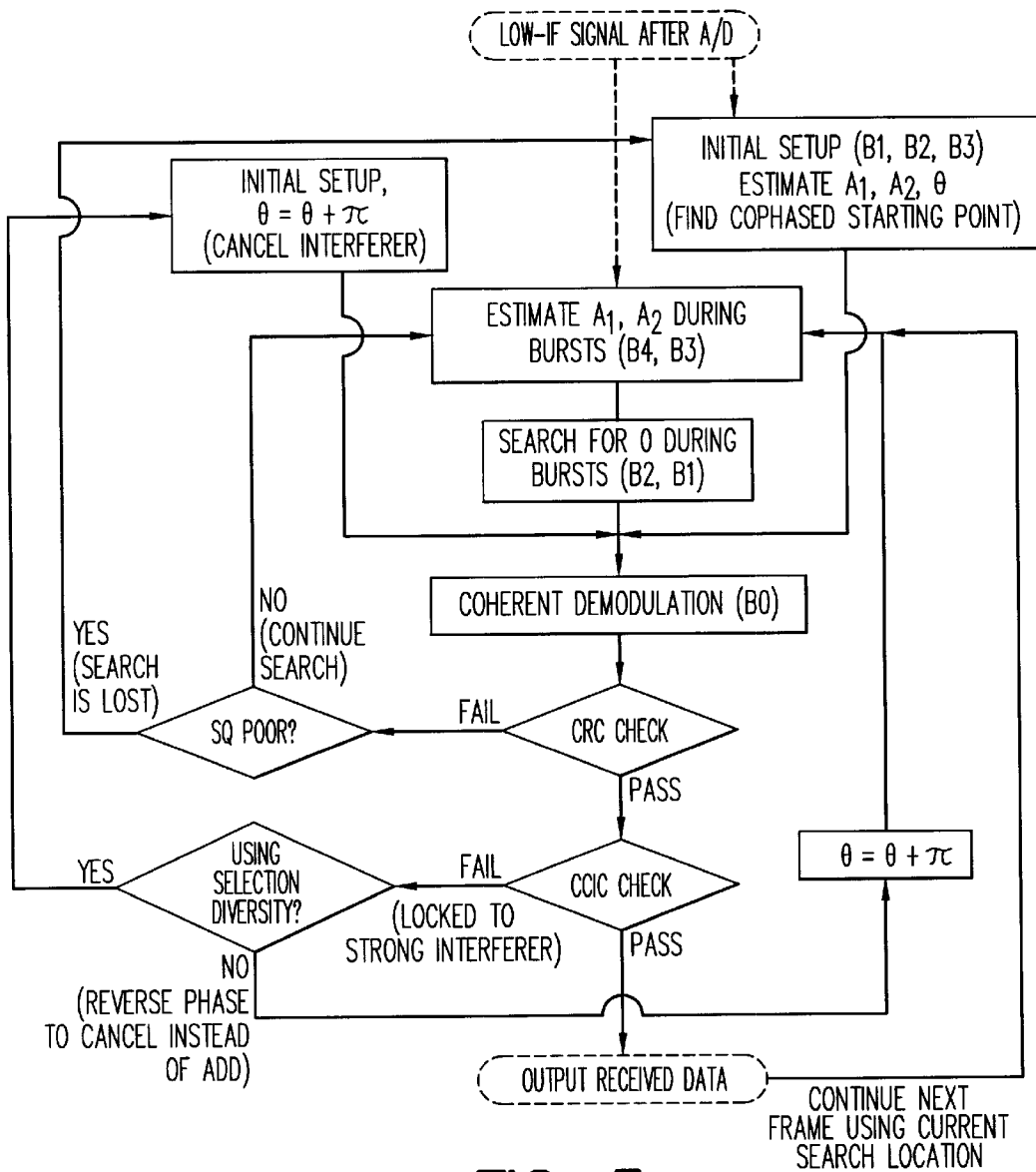
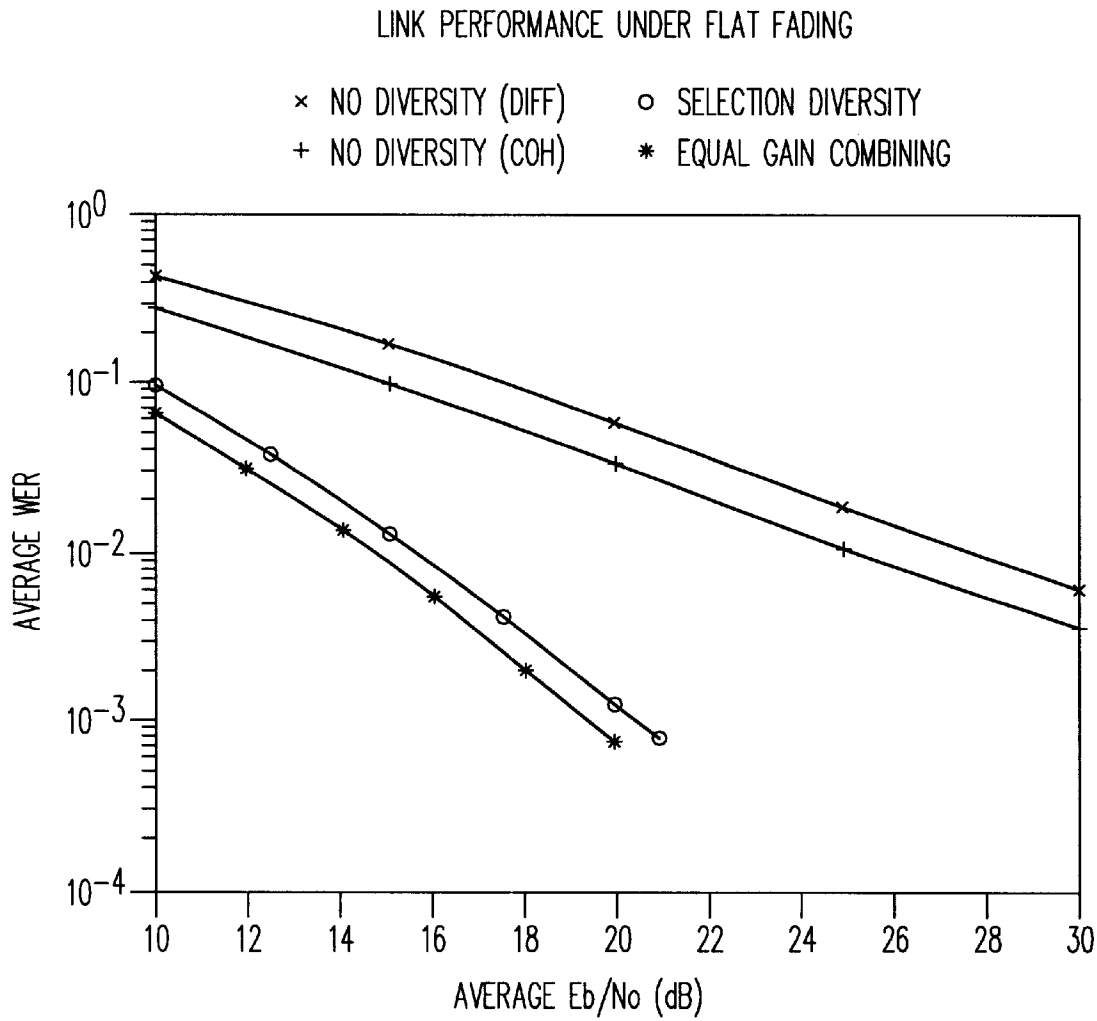
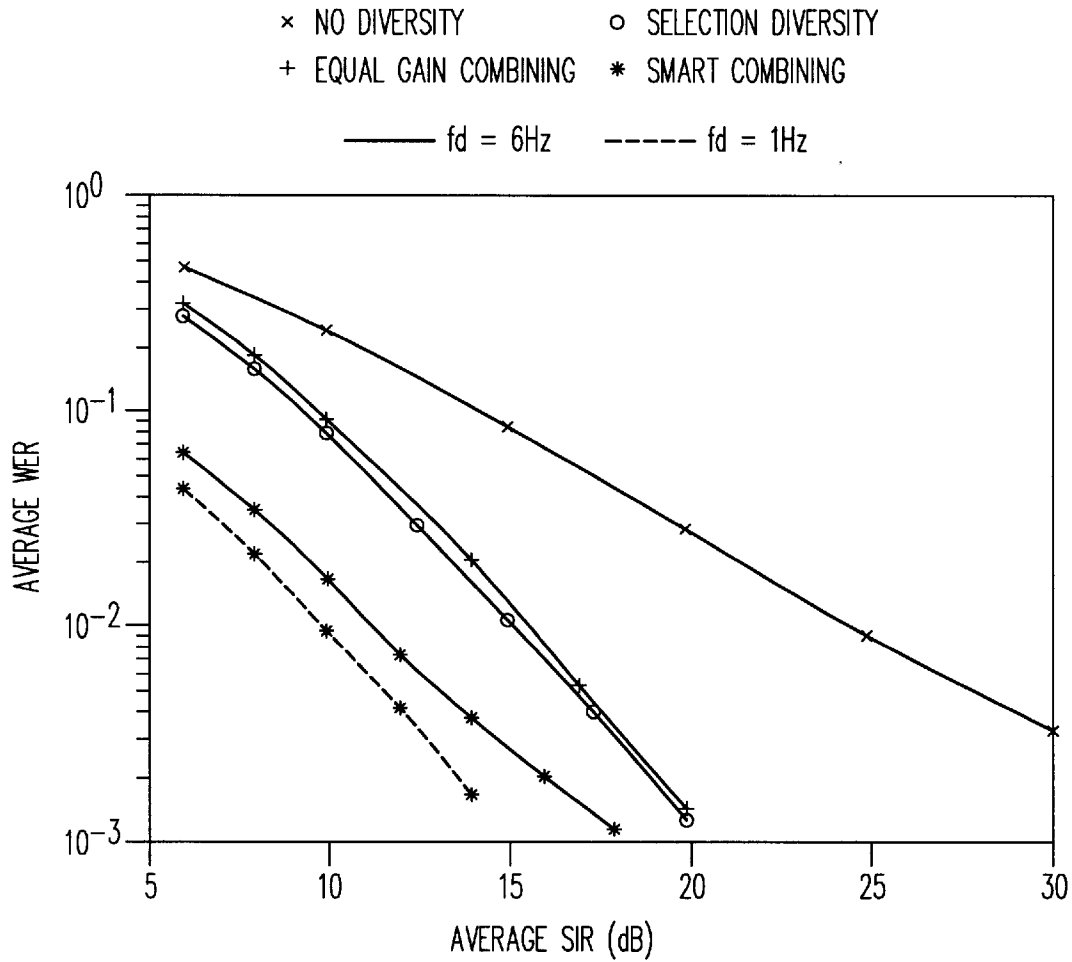


FIG. 3



**FIG. 4**

LINK PERFORMANCE UNDER FLAT FADING WITH CO-CHANNEL INTERFERENCE



**FIG. 5**

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