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(12) **United States Patent**  
**Walton et al.**

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(54) **METHOD AND APPARATUS FOR ALLOCATING DOWNLINK RESOURCES IN A MULTIPLE-INPUT MULTIPLE-OUTPUT (MIMO) COMMUNICATION SYSTEM**

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**Mark Wallace**, Bedford, MA (US);  
**Steven J. Howard**, Ashland, MA (US)

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(73) Assignee: **Qualcomm Incorporated**, San Diego, CA (US)

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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 143 days.

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(21) Appl. No.: **09/859,345**

*Primary Examiner*—Nguyen T. Vo

(22) Filed: **May 16, 2001**

(74) *Attorney, Agent, or Firm*—Philip Wadsworth; Kent Baker; Thomas R. Rouse

(65) **Prior Publication Data**

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(57) **ABSTRACT**

(51) **Int. Cl.**<sup>7</sup> ..... **H04B 1/38**; H04M 1/00

Techniques to schedule downlink data transmission to a number of terminals in a wireless communication system. In one method, one or more sets of terminals are formed for possible data transmission, with each set including a unique combination of one more terminals and corresponding to a hypothesis to be evaluated. One or more sub-hypotheses may further be formed for each hypothesis, with each sub-hypothesis corresponding to specific assignments of a number of transmit antennas to the one or more terminals in the hypothesis. The performance of each sub-hypothesis is then evaluated, and one of the evaluated sub-hypotheses is selected based on their performance. The terminal(s) in the selected sub-hypothesis are then scheduled for data transmission, and data is thereafter coded, modulated, and transmitted to each scheduled terminal from one or more transmit antennas assigned to the terminal.

(52) **U.S. Cl.** ..... **455/562**; 455/452

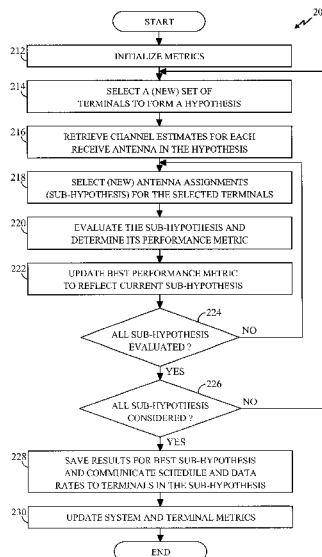
(58) **Field of Search** ..... 455/561, 562,  
455/69, 101, 103, 102, 562.1, 450, 451,  
452.1, 452.2, 509, 513; 375/347, 349

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**49 Claims, 9 Drawing Sheets**



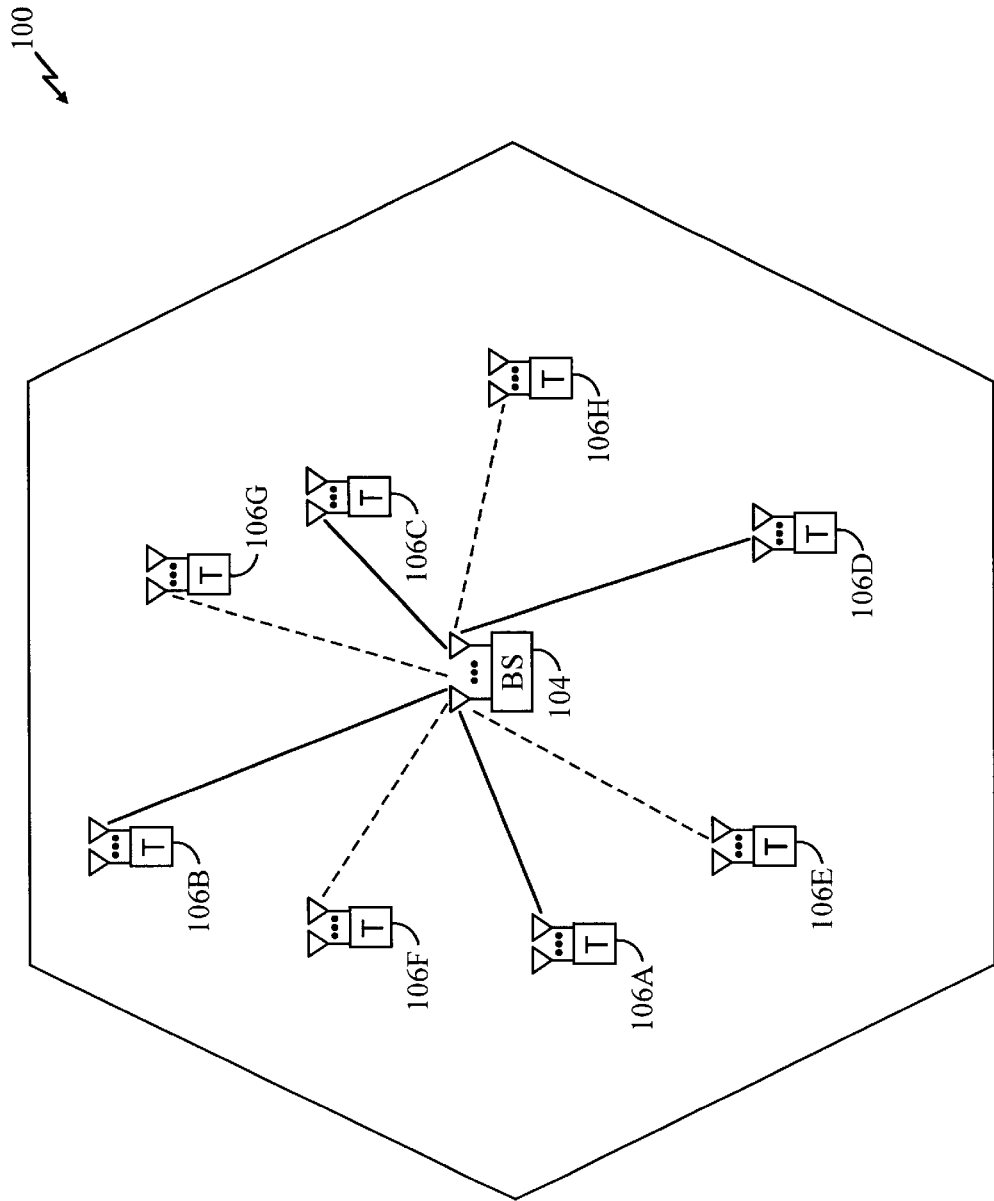


FIG. 1

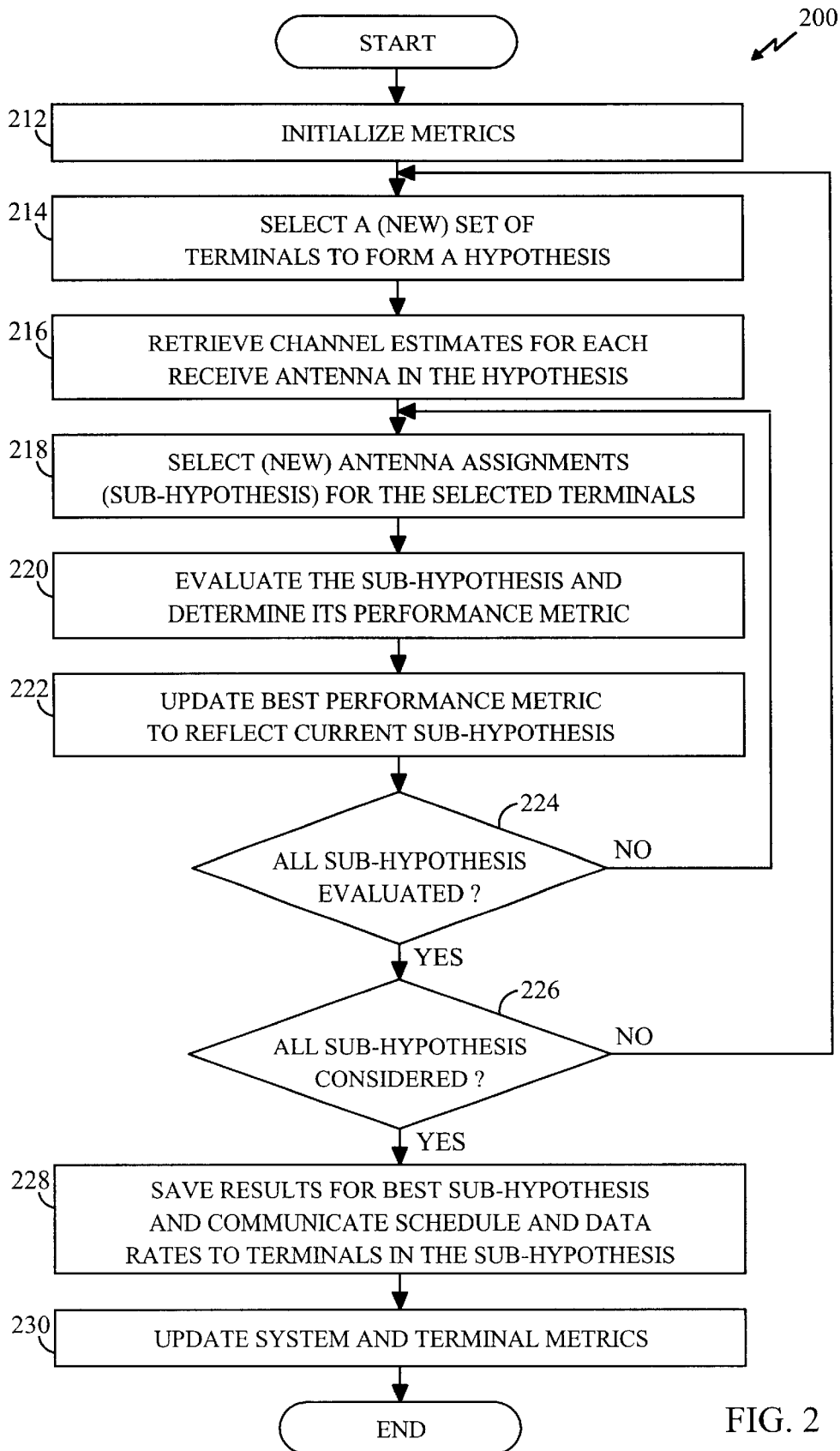


FIG. 2

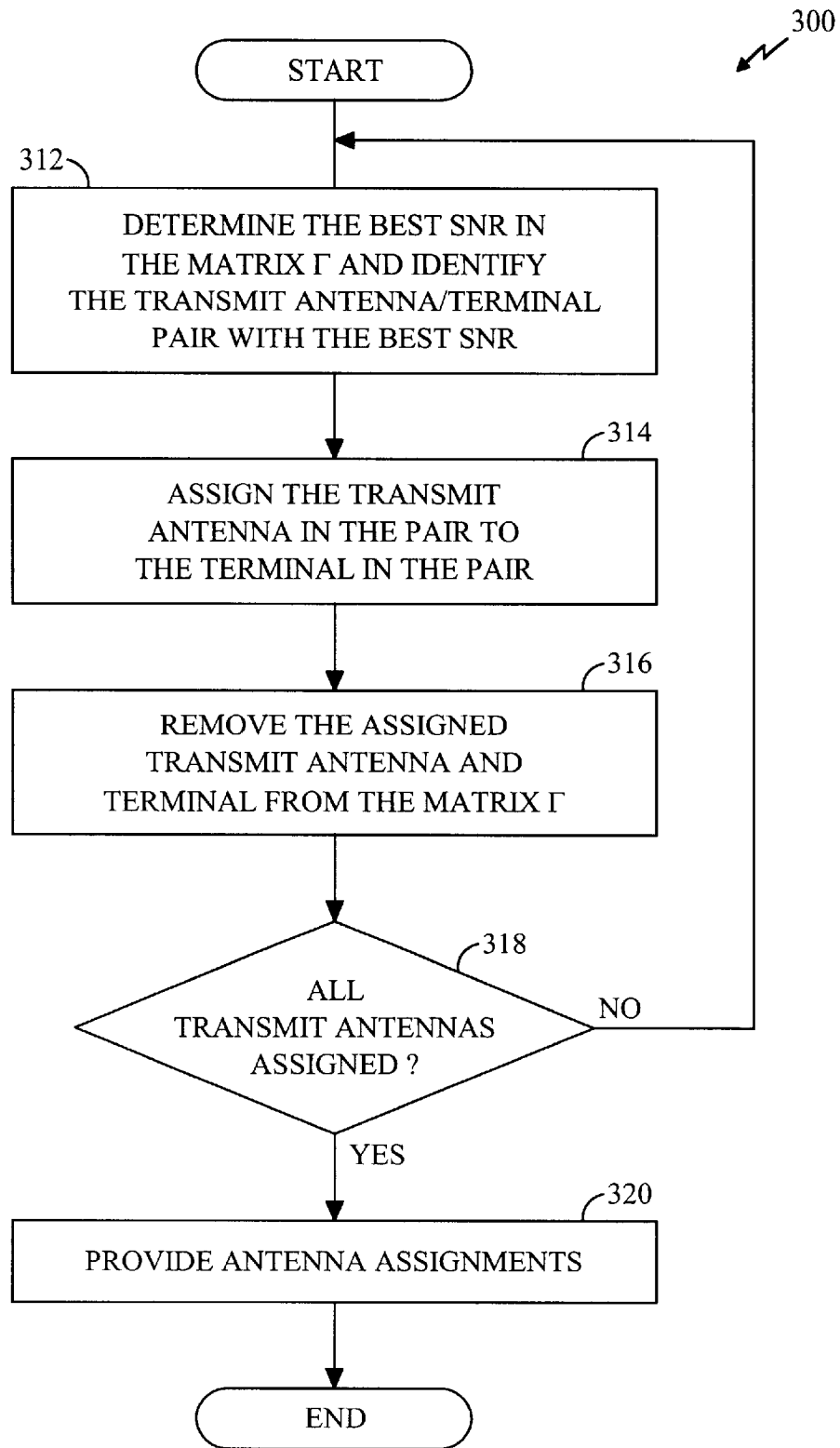


FIG. 3

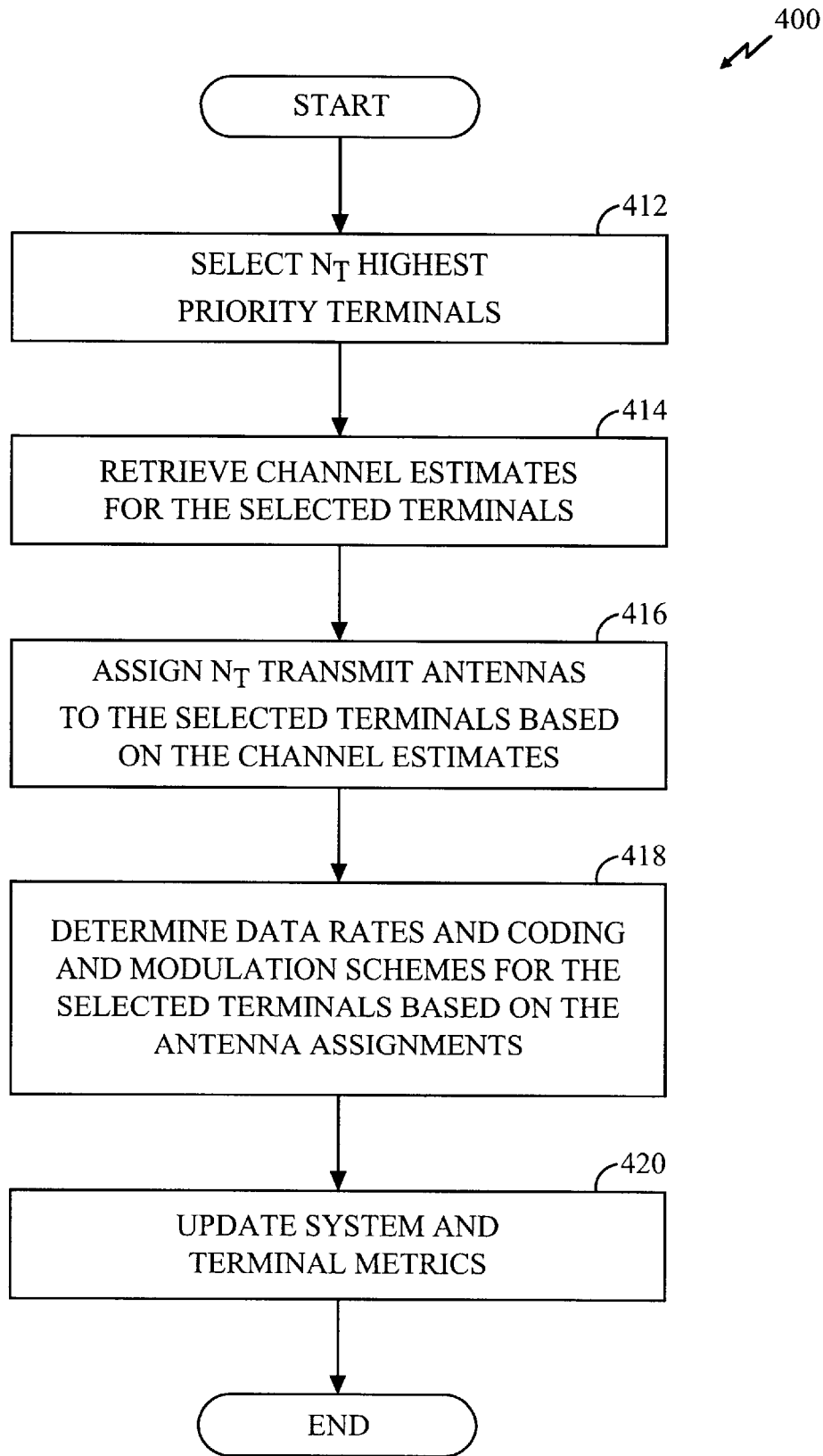


FIG. 4

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