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United States Patent [19]

Gitlin et al.

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[54] **SYSTEM AND METHOD FOR OPTIMIZING SPECTRAL EFFICIENCY USING TIME-FREQUENCY-CODE SLICING**

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[73] Assignee: **AT&T Corp**, Middletown, N.J.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **08/234,197**

[22] Filed: **Apr. 28, 1994**

[51] **Int. Cl.**[7] **H04J 4/00**

[52] **U.S. Cl.** **370/436**; 370/441; 370/468; 370/478; 370/479; 375/201

[58] **Field of Search** 370/50, 18, 19, 370/20, 330, 436, 437, 478, 329, 335, 336, 337, 342, 343, 345, 431, 441, 442, 465, 479, 480, 498, 535, 536, 537, 546, 477, 468; 375/200, 201, 202, 203, 204, 205, 206

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[57] **ABSTRACT**

A system and method for optimizing usage of a communications transmission medium. The transmission medium may be sliced into time and frequency domains so as to create time-frequency slices for assignment to users having varying access rates and user-application requirements. Through scheduling of the various speed users within the frequency and time domains, the system and method can efficiently allocate and make use of the available spectrum, thereby accommodating higher rate users requiring greater bandwidths and time slot assignments while still preserving cost-efficient access for lower speed users. Depending on the signal modulation scheme, the time-frequency slices may be allocated on non-contiguous frequency bands. The system and method is also applicable to code-division multiple access (CDMA) techniques by slicing the available code space along time-code domains, frequency-code domains or, in three dimensions, along time-frequency-code domains. Users may be efficiently scheduled based on code space requirements so as to optimize use of the communication medium.

15 Claims, 8 Drawing Sheets

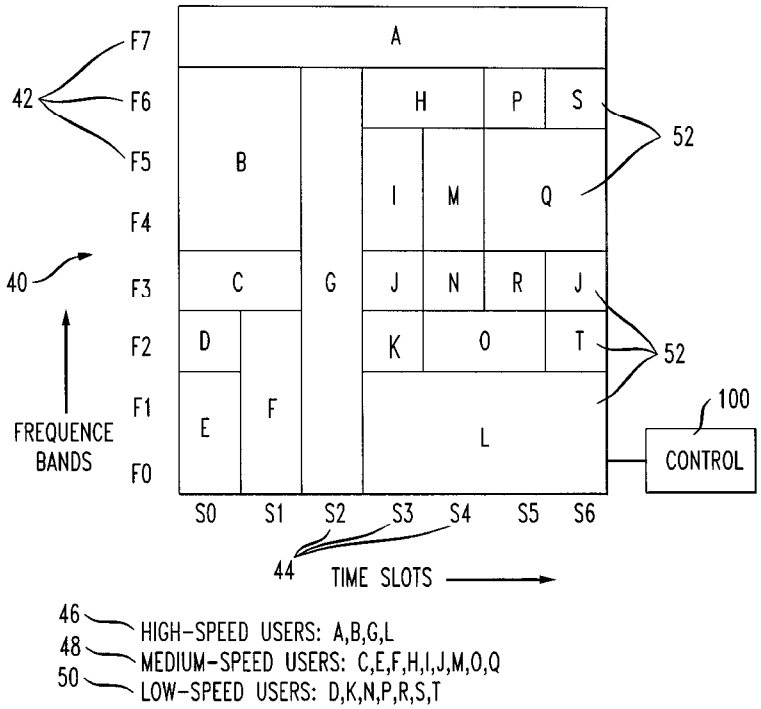

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FIG. 1

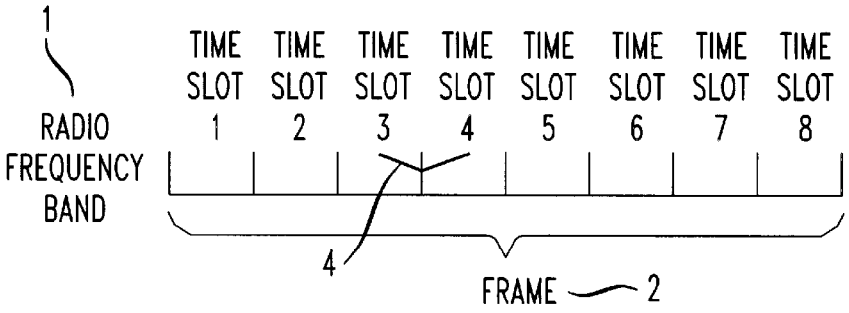

FIG. 2

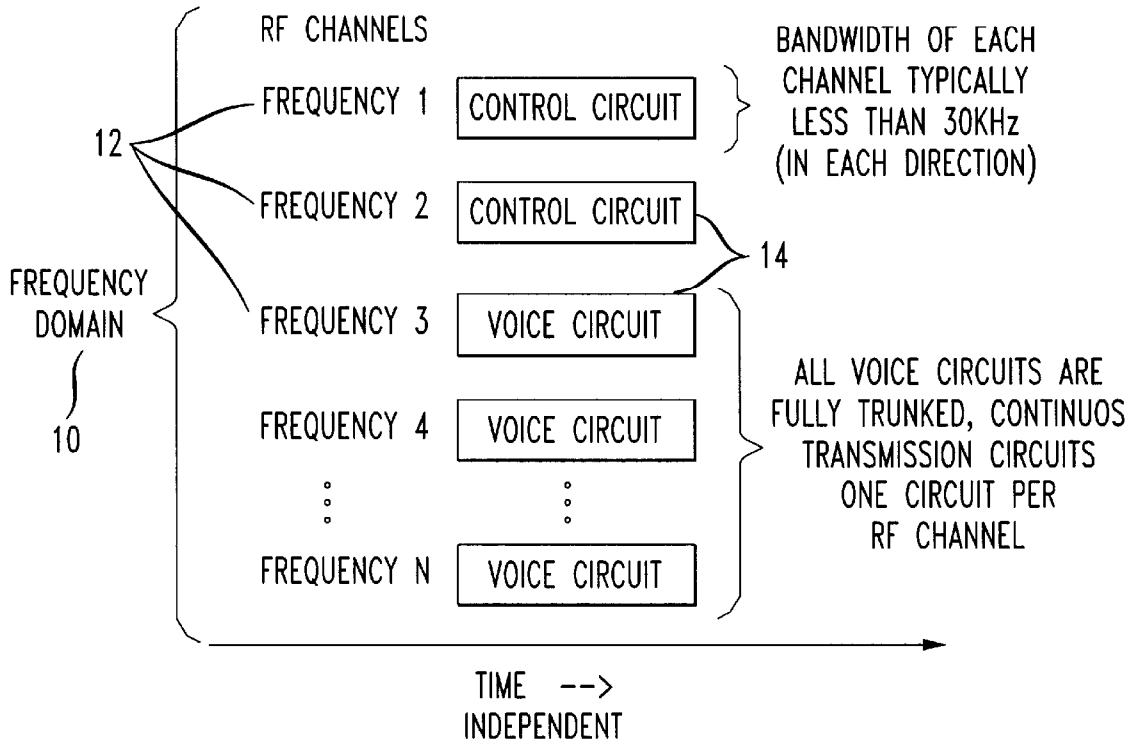

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FIG. 3

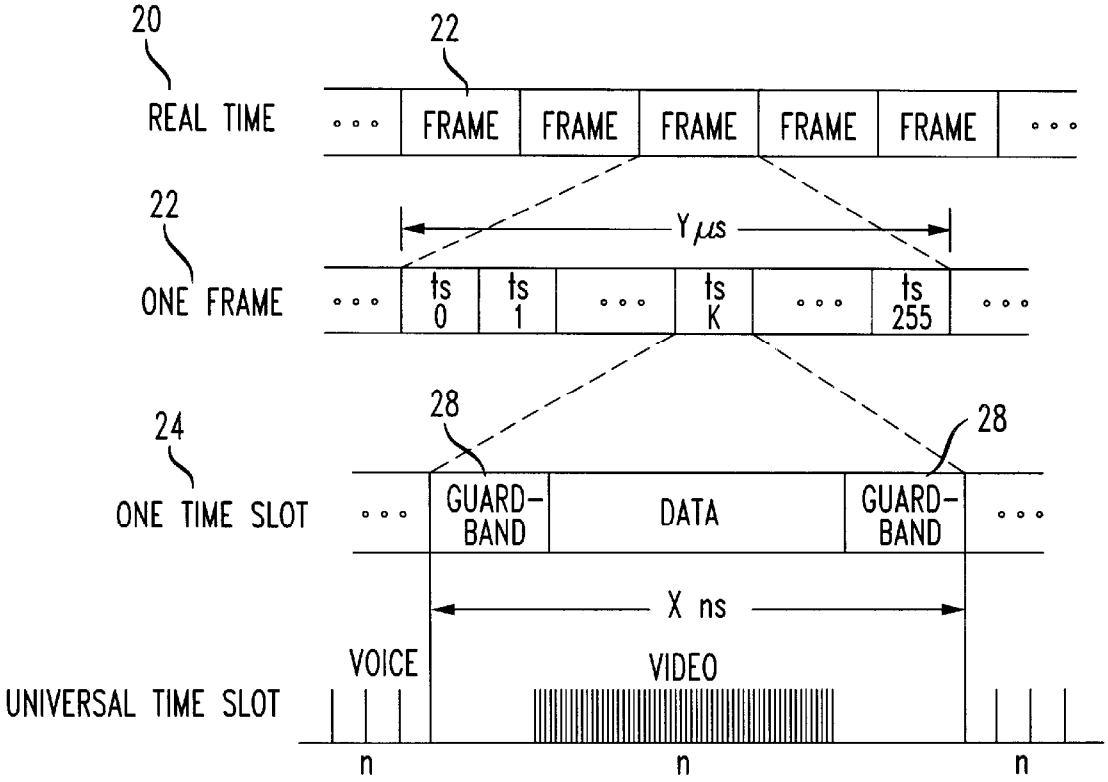

FIG. 4

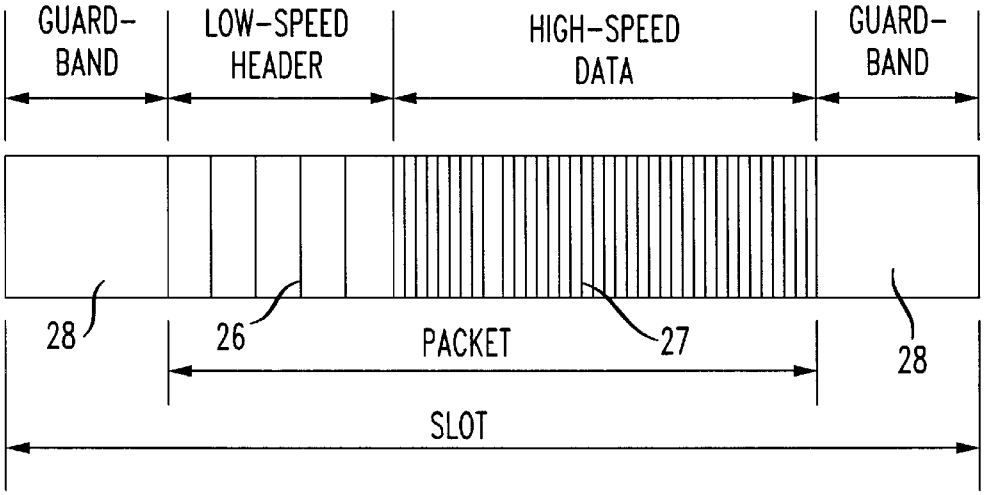

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FIG. 5

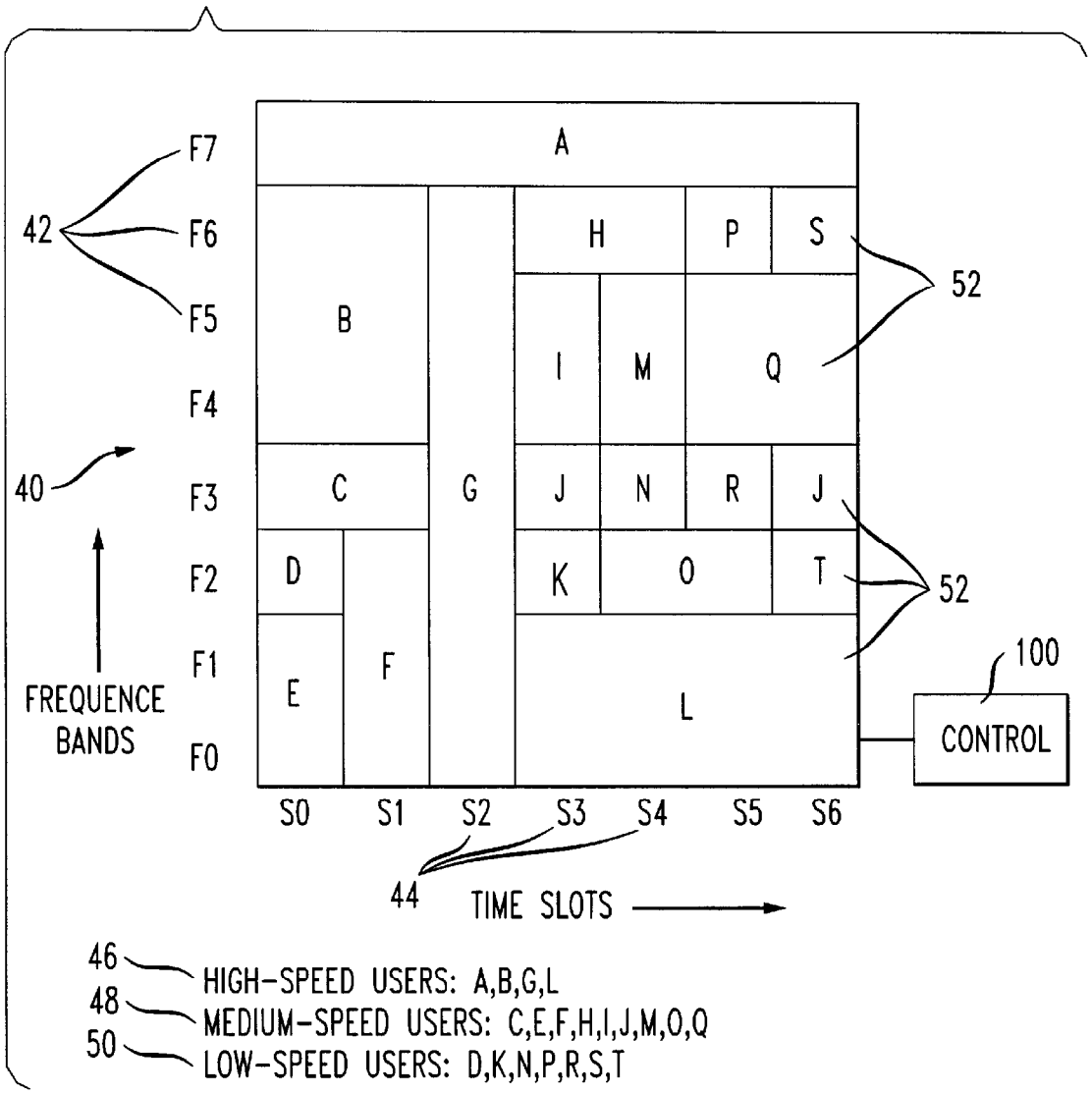

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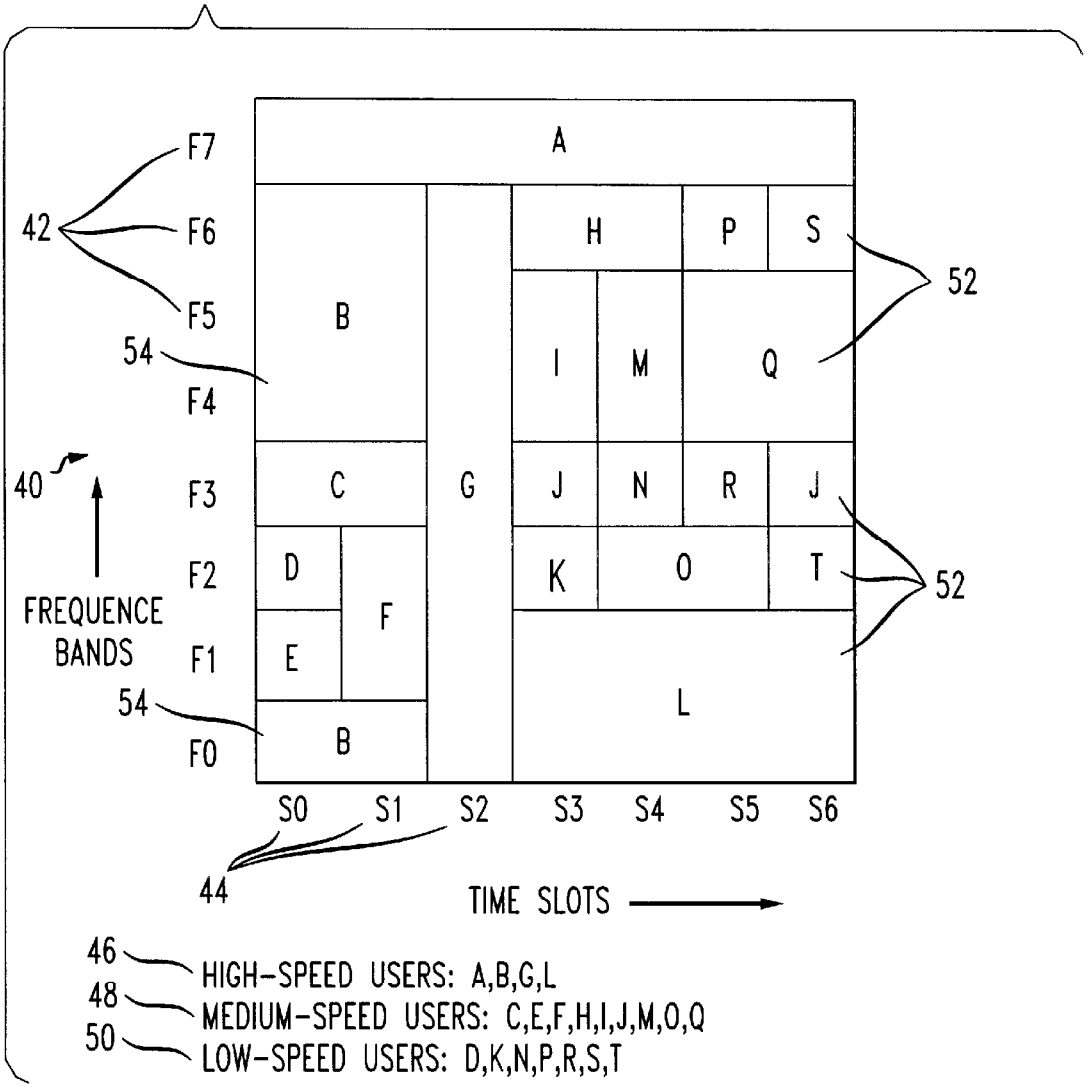
FIG. 6



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