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United States Patent [19]

Shively et al.

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[54] **SPREAD SPECTRUM BIT ALLOCATION ALGORITHM**

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[73] Assignee: **AT&T Corp.**, New York, N.Y.

[21] Appl. No.: **09/000,842**

[22] Filed: **Dec. 31, 1997**

[51] **Int. Cl.**[7] **H04B 1/38**

[52] **U.S. Cl.** **375/222**; 375/225; 370/391; 370/358

[58] **Field of Search** 375/222, 219, 375/225; 455/127, 509; 370/391, 358

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Primary Examiner—Stephen Chin
Assistant Examiner—Mohammad Ghayour

[57] **ABSTRACT**

High transmission capacity in a twisted pair signal line, where power is limited by a power spectral-density mask and an aggregate signal power constraint, is obtained by: (1) allocating data to multitone sub-bands according to a lowest marginal power-cost per bit scheme and (2) in an environment where an aggregate power budget remains after all bits have been allocated to all sub-bands with sufficient margins to carry a bit, assigning additional bits to sub-bands with otherwise insufficient power margins to carry a single bit, by frequency-domain-spreading a single bit across several sub-bands at correspondingly reduced power levels, to permit the otherwise unacceptable noise levels to be reduced on average by despreading at the receiving end. Another feature of the invention, applicable in an environment in which multiple interfering channels are employed, provides increased signal throughput by (3) transmitting coherently in a number of multitone sub-bands, identical blocks of data, with the number of multitone sub-bands being equal to a number of interfering channels and multiplying the signal carried by corresponding sub-bands in the separate interfering channels by a different respective vector from an orthonormal basis set so that near-end cross-talk is eliminated upon despreading at the receiving end.

7 Claims, 5 Drawing Sheets

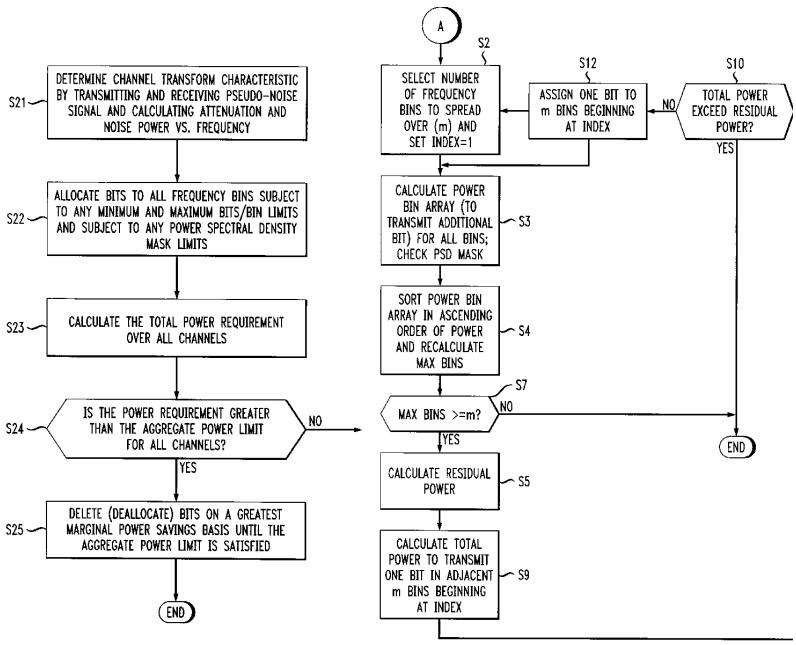


FIG. 1

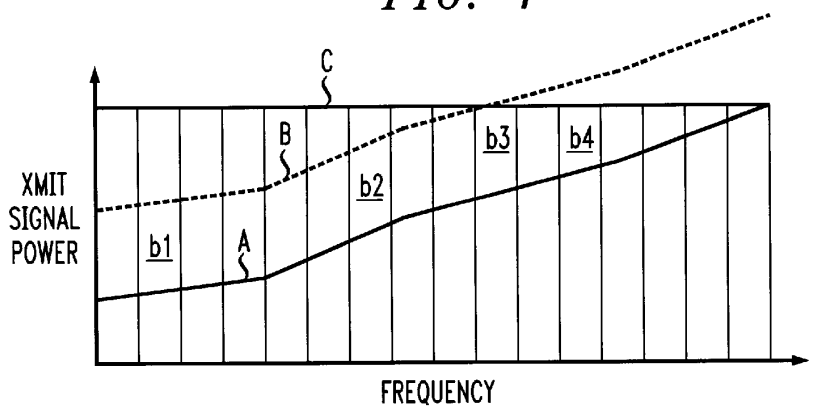


FIG. 2

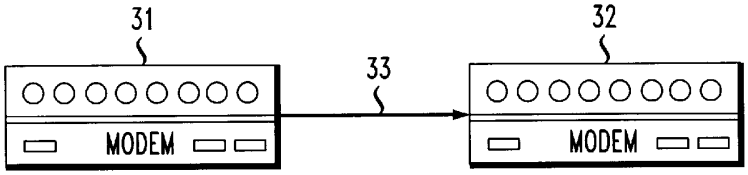


FIG. 3

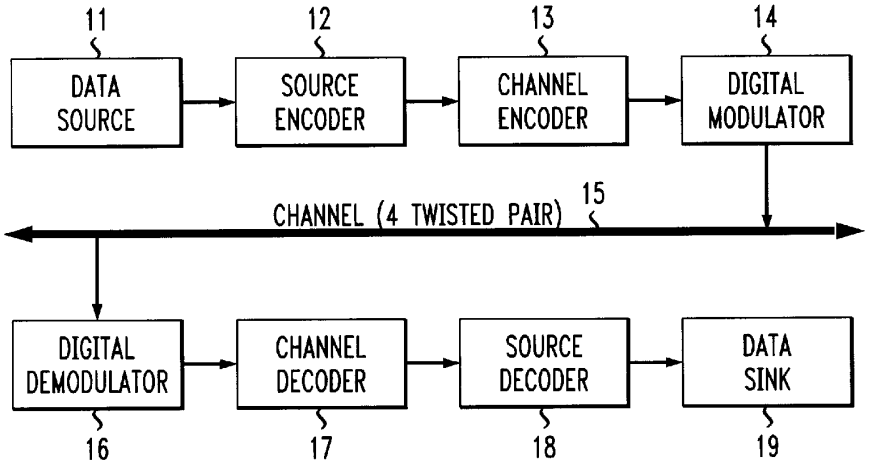


FIG. 4

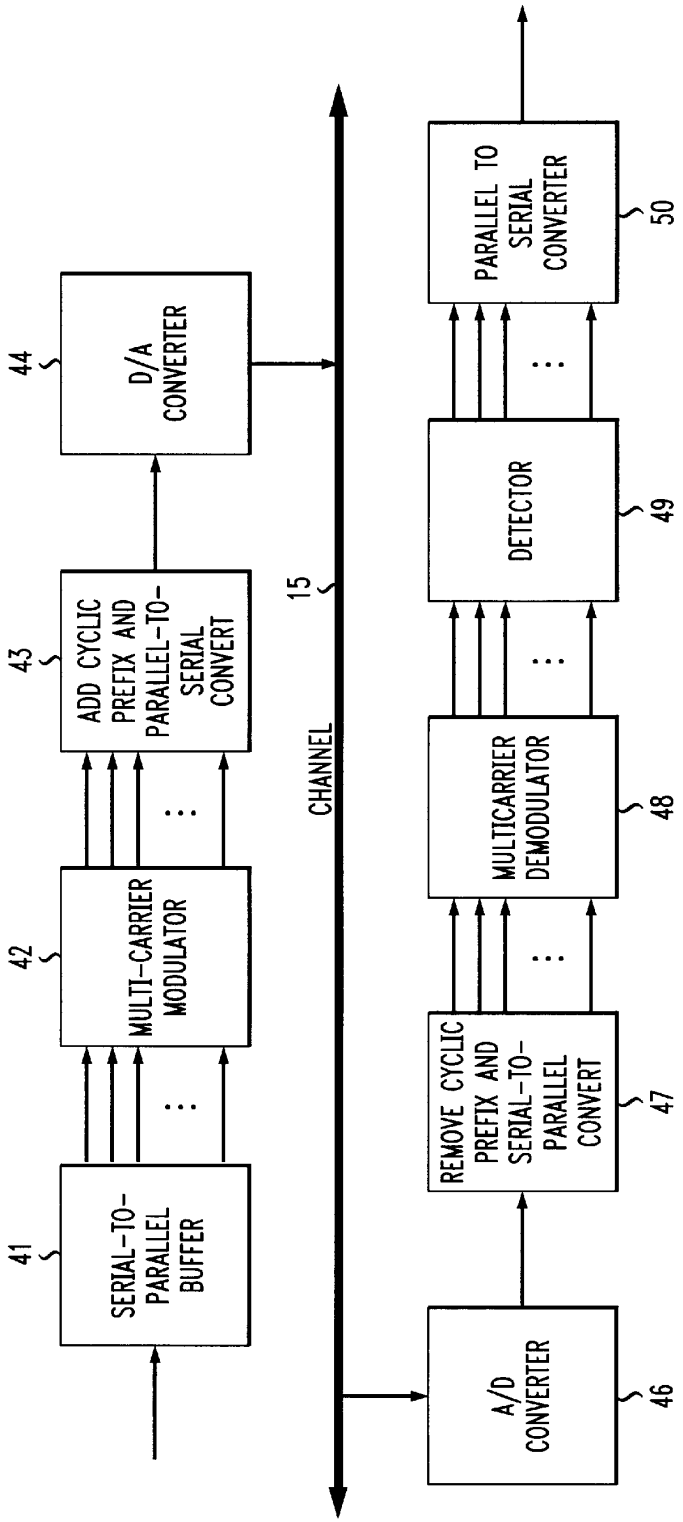


FIG. 5

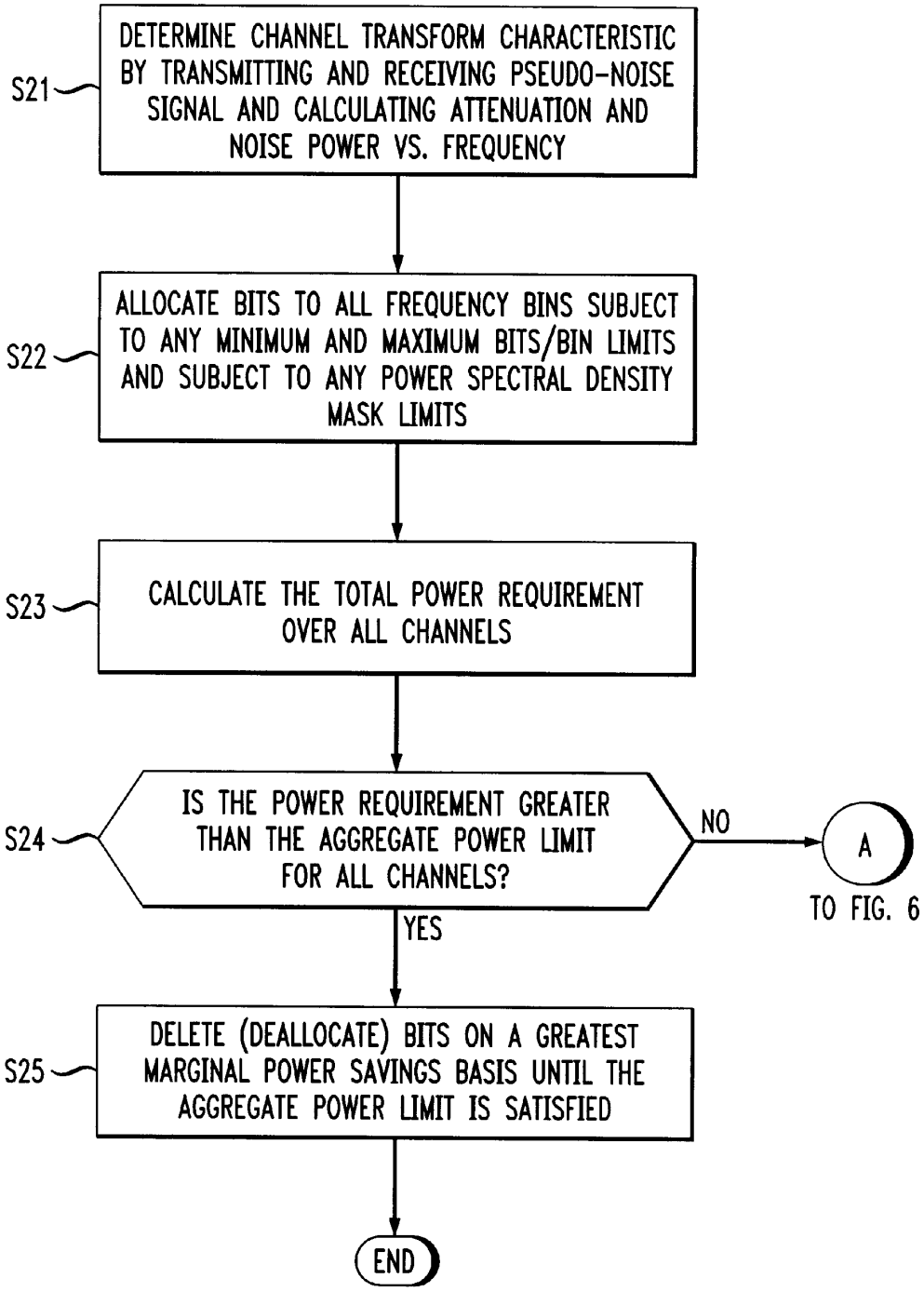
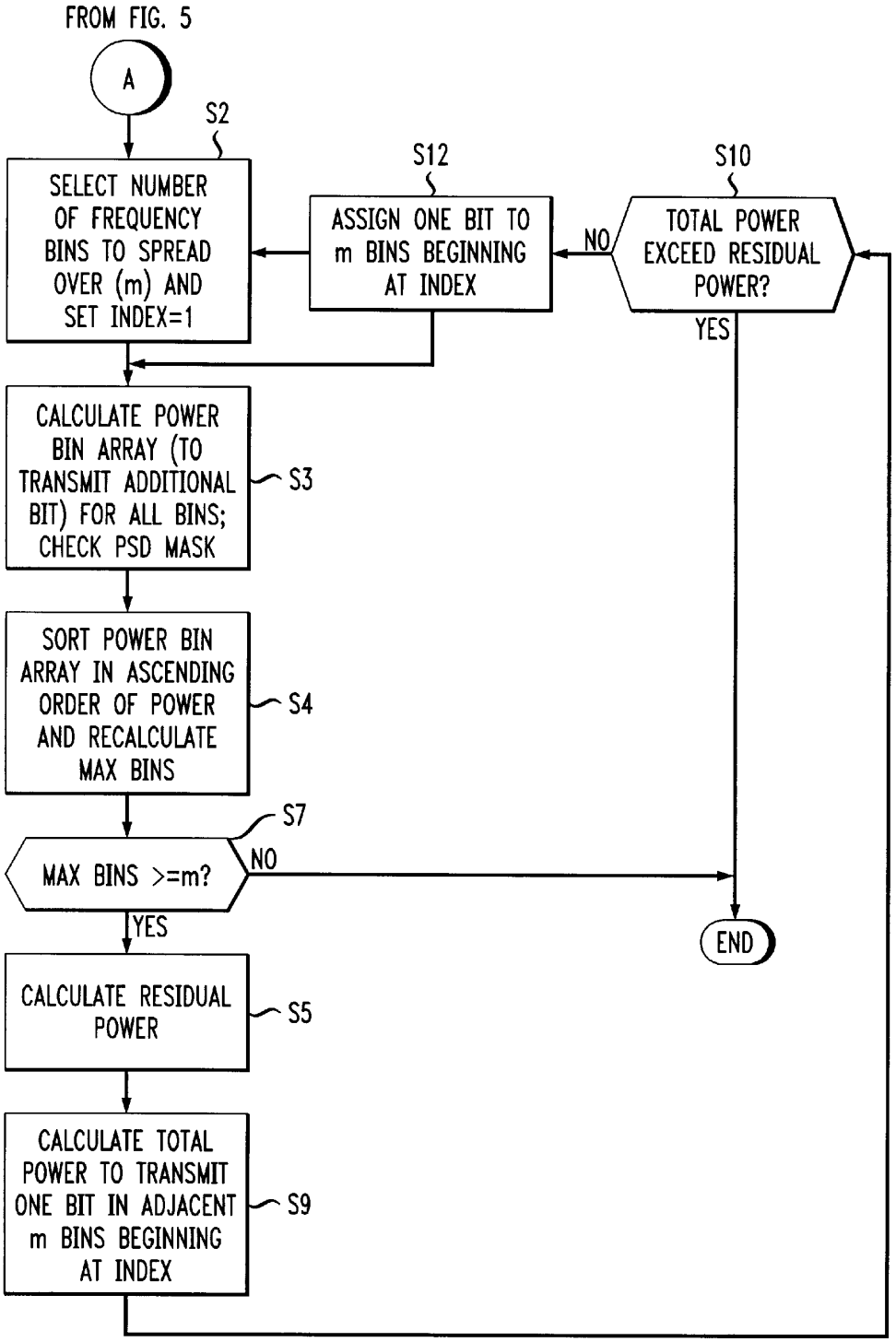


FIG. 6



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