



[54] TRANSMITTER ANTENNA DIVERSITY AND FADING-RESISTANT MODULATION FOR WIRELESS COMMUNICATION SYSTEMS

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[57] ABSTRACT

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The present invention provides a bandwidth-efficient fading-resistant transmission scheme where a base station implements transmitter diversity using L antennas or L carrier frequencies or L time slots, regardless of the use of frame oriented power control. When the antennas or carriers are spaced sufficiently far apart, or when a different power is used for each power control frame, the transmission from each antenna or carrier or time frame undergoes independent fading. These transmissions are coordinated to mitigate the effects of Rayleigh fading and the mobile receiver can recover the entire L-dimensional transmitted vector as long as the signal energy of at least one coordinate is large enough. L-dimensional fading-resistant signal constellations are generated by maximizing a figure of merit for the Rayleigh fading channel. This scheme offers a significant performance improvement over a conventional single-antenna or single-carrier narrowband BPSK scheme when coding is ineffective due to slow fading. When there is background white Gaussian noise, the fading-resistant scheme has a significant energy savings advantage over an uncoded BPSK scheme, for a given bit error rate. In the forward link of a cellular network, where cochannel interference is the dominant source of noise, the fading-resistant scheme results in a significant capacity increase over uncoded BPSK, for a given bit error rate. Both coherent and differentially coherent systems are disclosed.

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[22] Filed: Sep. 27, 1996

[51] Int. Cl.<sup>6</sup> ..... H04B 7/10; H04B 11/12; H04L 27/10; H04L 27/04

[52] U.S. Cl. .... 375/347; 375/280; 375/281; 375/299; 455/132

[58] Field of Search ..... 375/347, 299, 375/267, 286, 200, 222, 279-281, 308; 455/101, 132, 277.1, 277.2

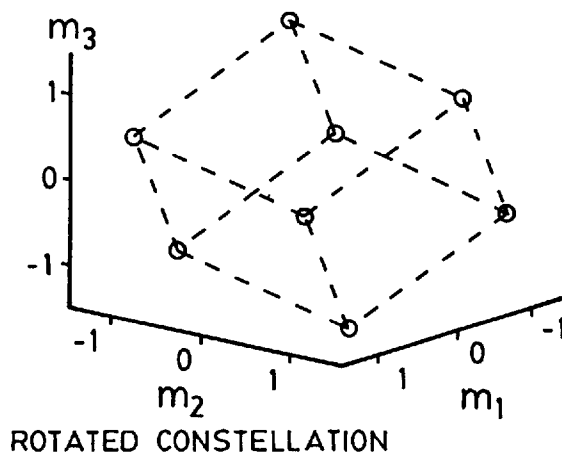
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Primary Examiner—Chi H. Pham  
Assistant Examiner—Khair Tran

25 Claims, 5 Drawing Sheets



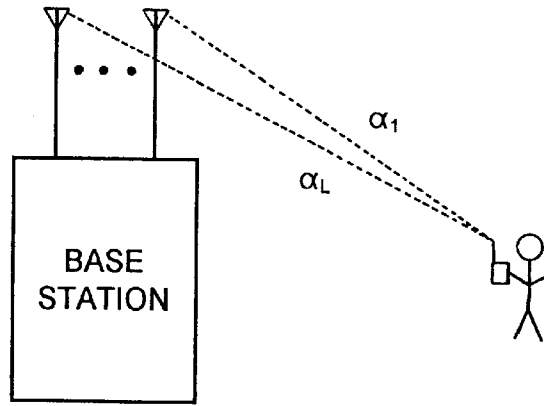


FIG. 1

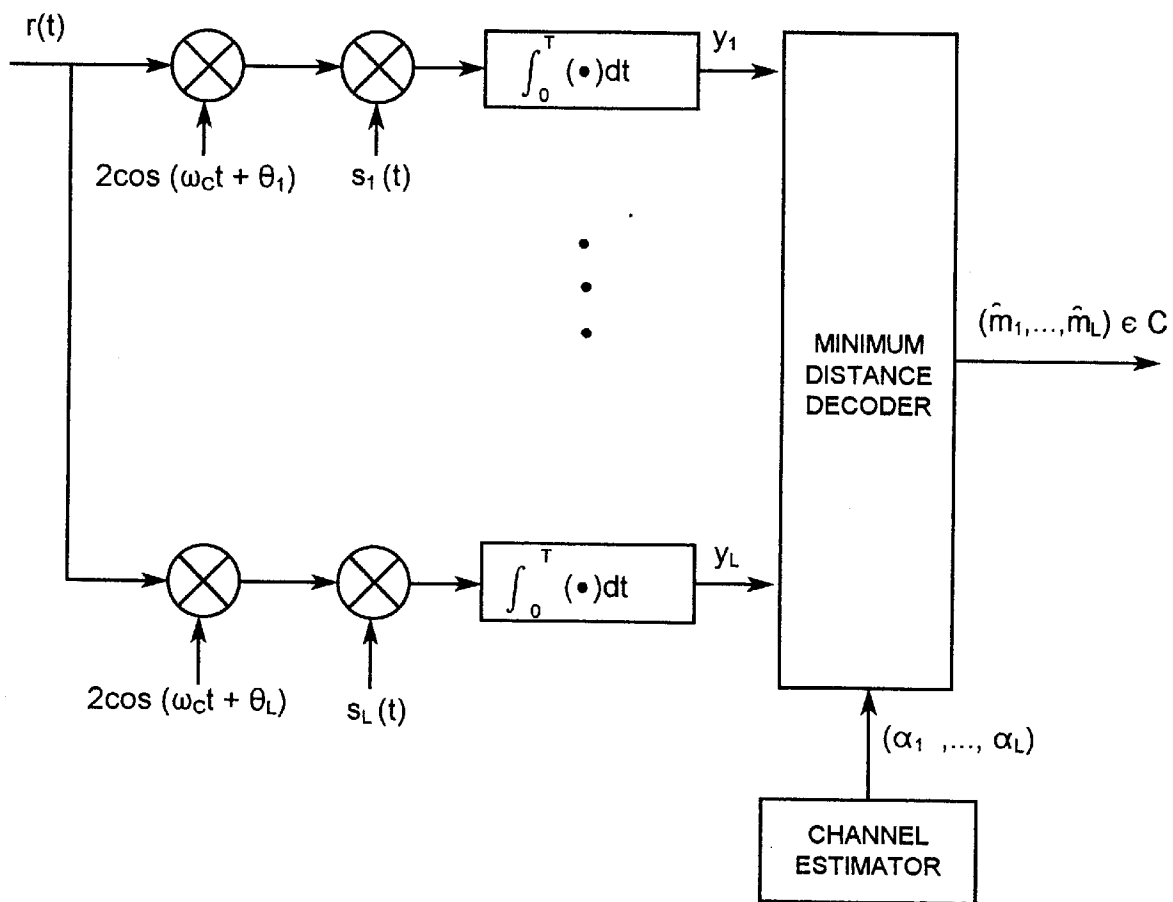
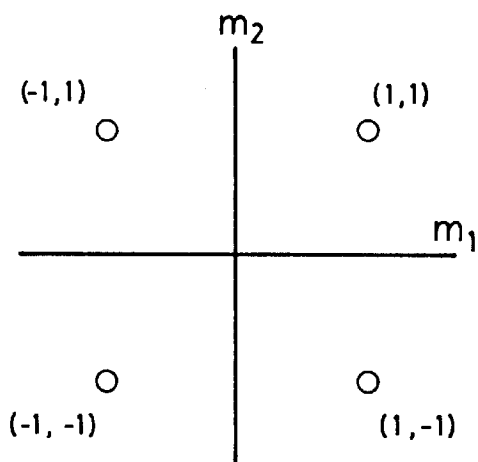
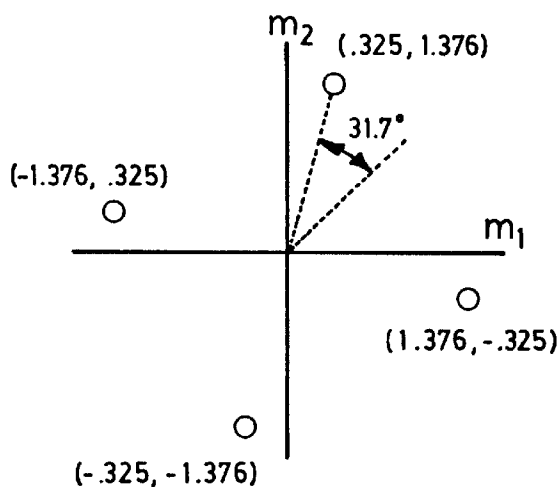


FIG. 2



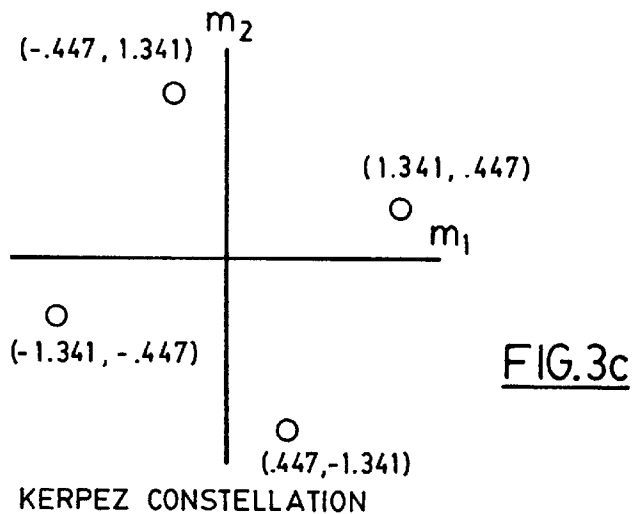
BASELINE CONSTELLATION

FIG. 3a  
(PRIOR ART)



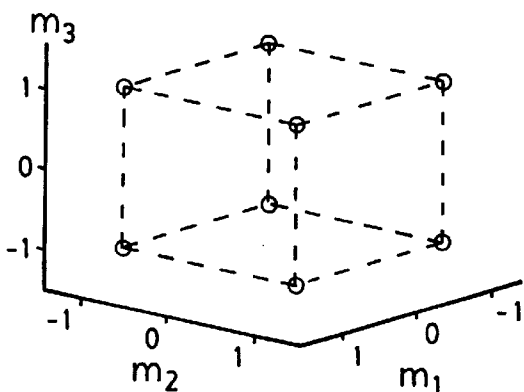
ROTATED CONSTELLATION

FIG. 3b



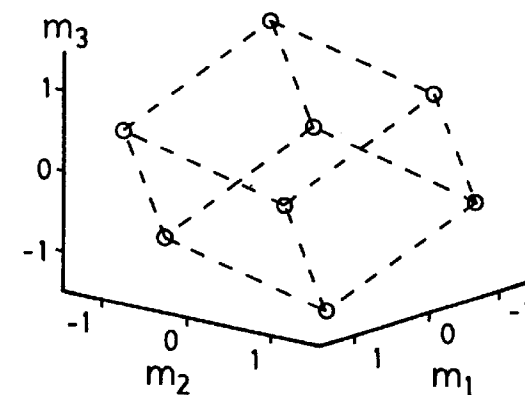
KERPEZ CONSTELLATION

FIG. 3c



BASELINE CONSTELLATION

FIG. 4a  
(PRIOR ART)



ROTATED CONSTELLATION

FIG. 4b

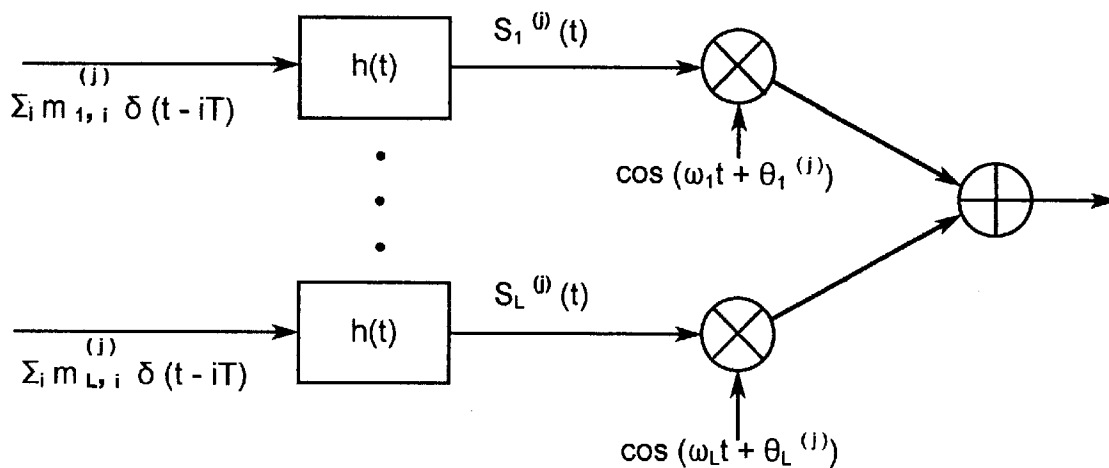


FIG. 5

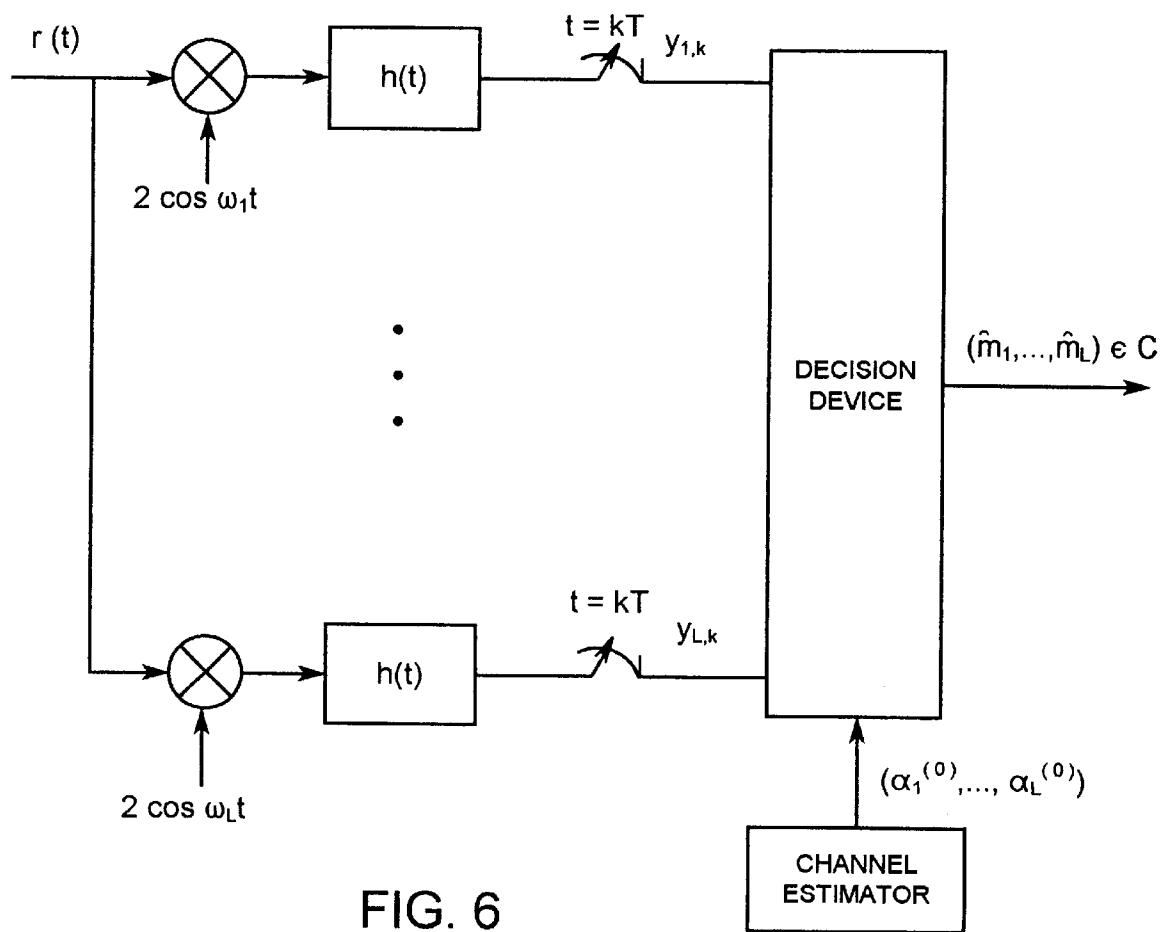


FIG. 6

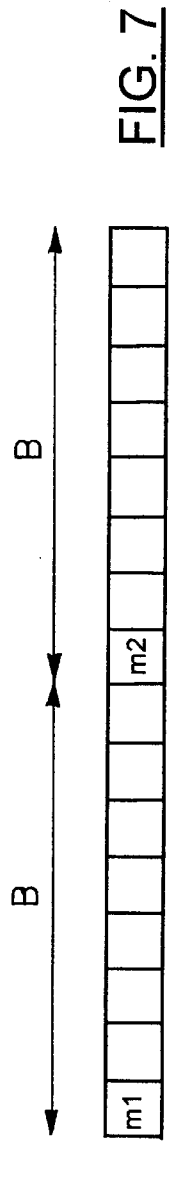


FIG. 7

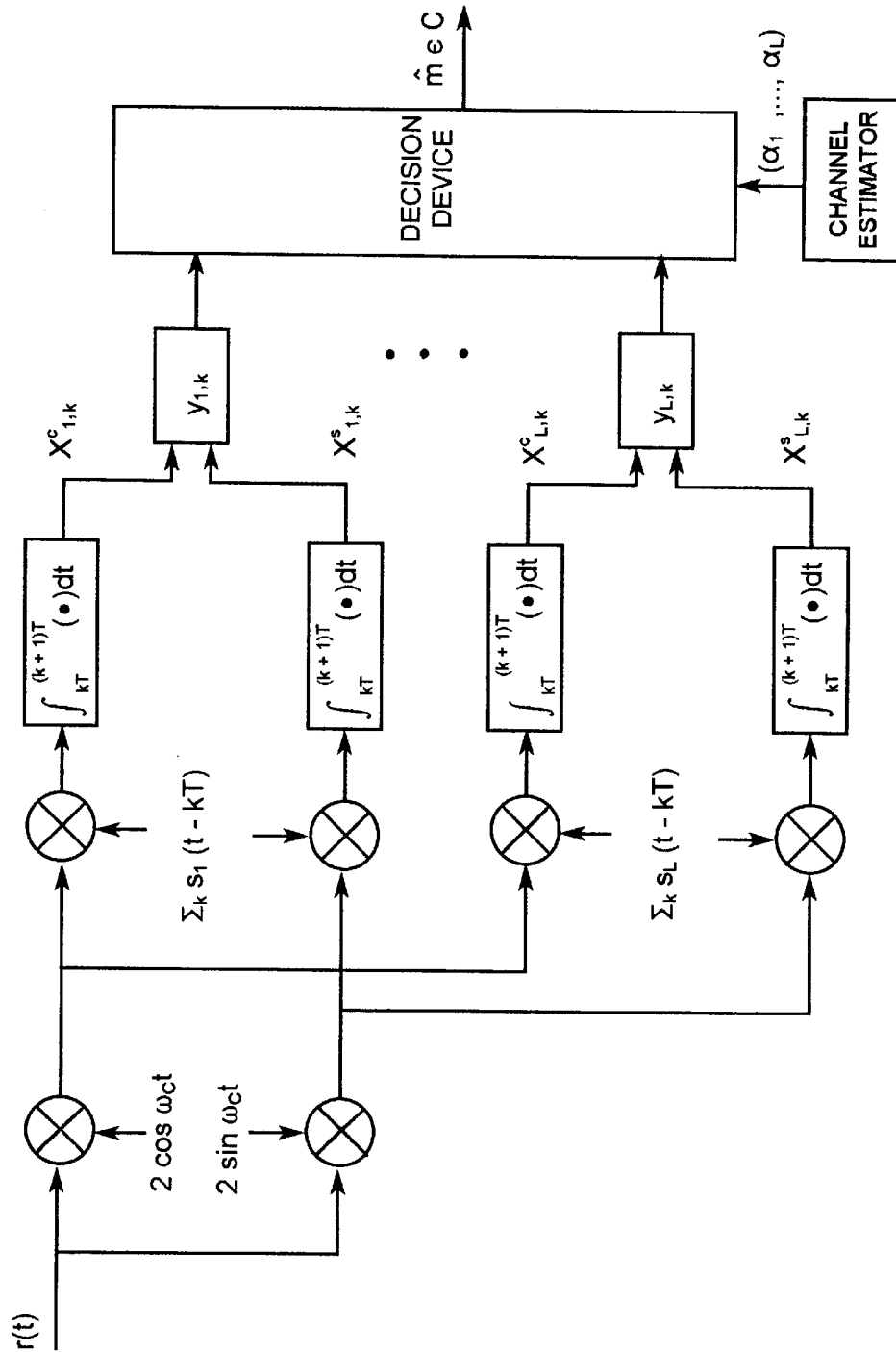


FIG. 8

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