



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

[75] Inventors: Elvino S. Sousa, 425 Glencairn Avenue, North York, Ontario, Canada, M5N 1V4; Victor M. DaSilva, Morris Plains, N.J.

[73] Assignee: Elvino S. Sousa, North York, Canada

[21] Appl. No.: 721,966

[22] Filed: Sep. 27, 1996

[51] Int. Cl.⁶ 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

[56] References Cited

U.S. PATENT DOCUMENTS

5,048,057	9/1991	Saleh et al.	375/267
5,088,113	2/1992	Wei	375/280
5,216,694	6/1993	Wei	375/286
5,289,501	2/1994	Seshadri et al.	375/286
5,636,242	6/1997	Tsujimoto	375/200
5,640,417	6/1997	Barabash et al.	375/222

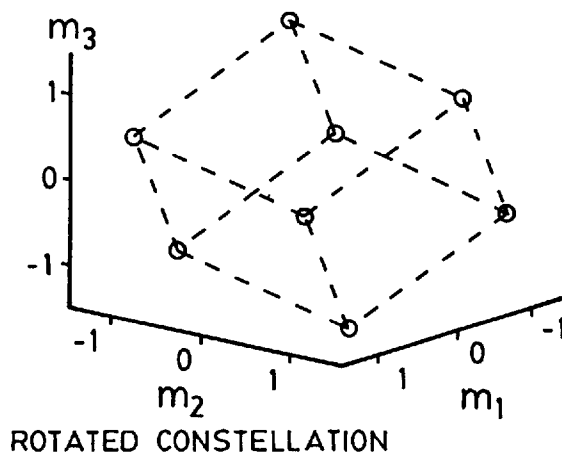
Primary Examiner—Chi H. Pham
Assistant Examiner—Khair Tran

Attorney, Agent, or Firm—Lynn C. Schumacher; Hill & Schumacher

[57] ABSTRACT

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.

25 Claims, 5 Drawing Sheets



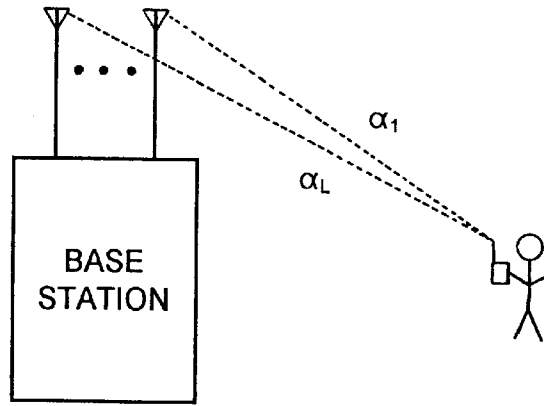


FIG. 1

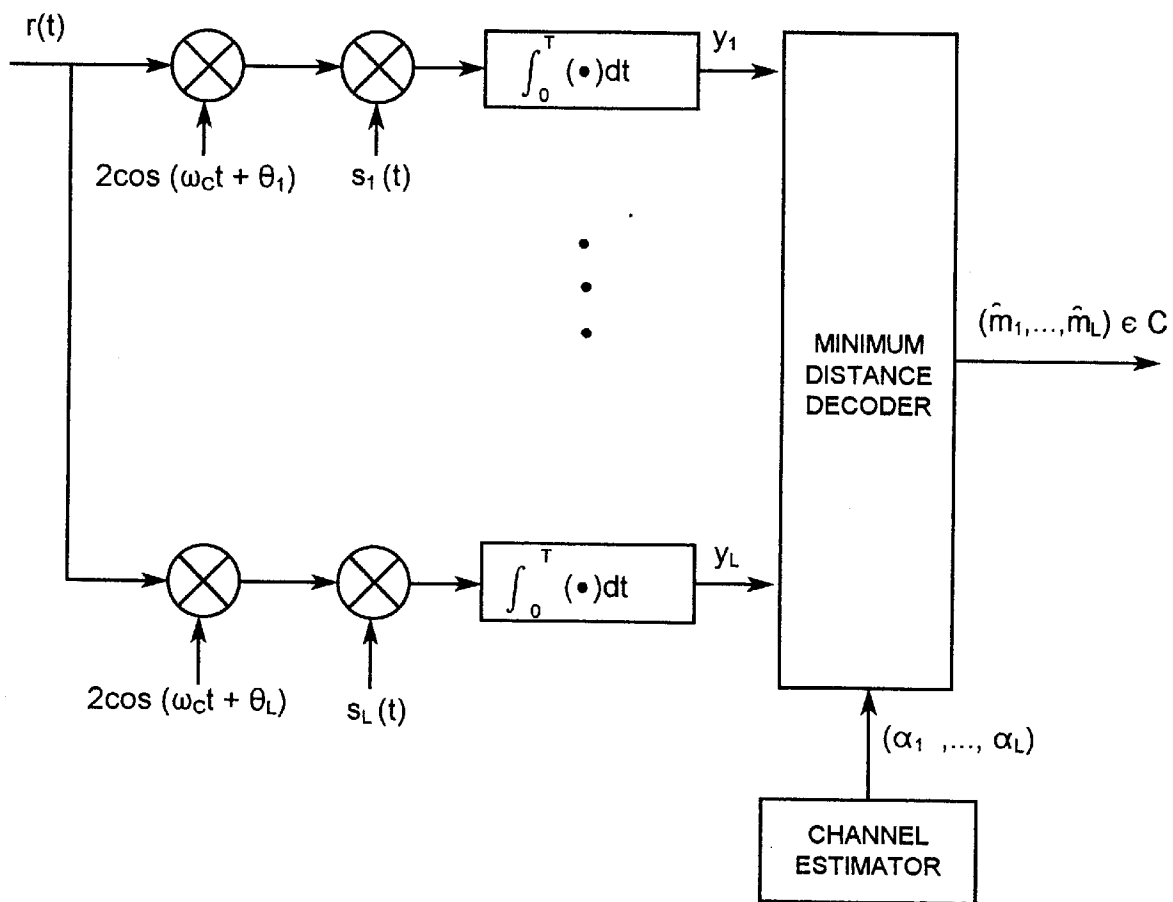
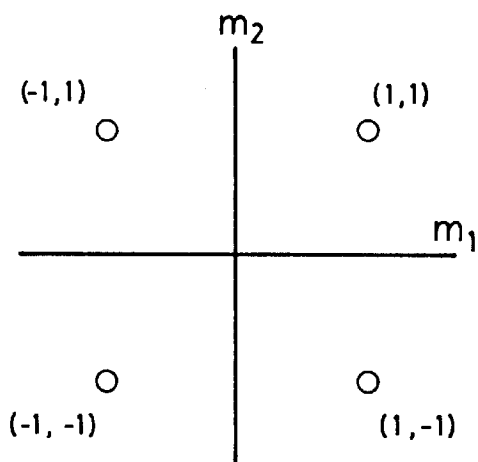
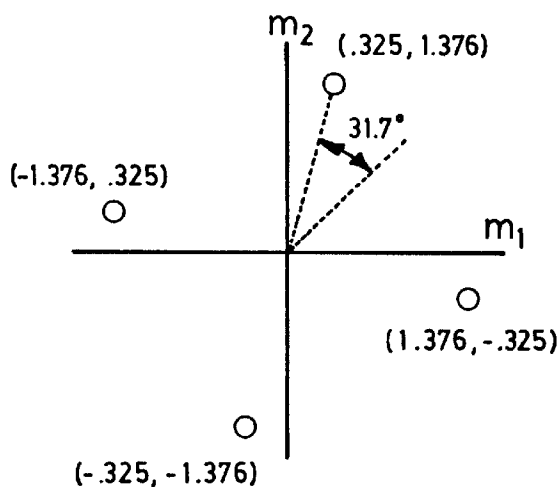


FIG. 2



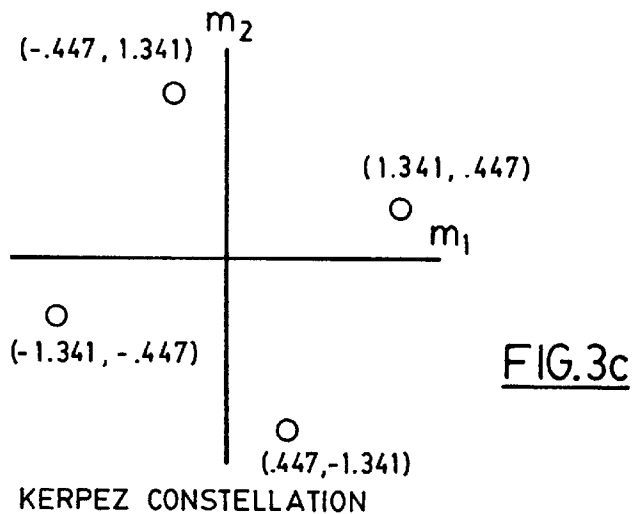
BASELINE CONSTELLATION

FIG. 3a
(PRIOR ART)



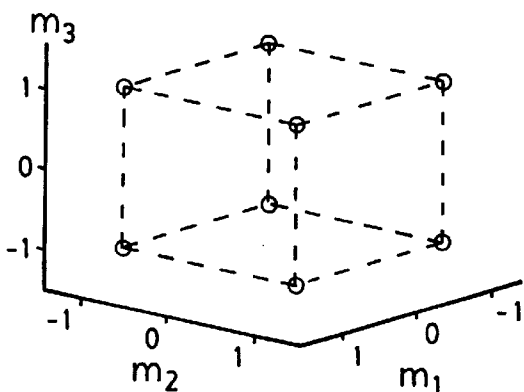
ROTATED CONSTELLATION

FIG. 3b



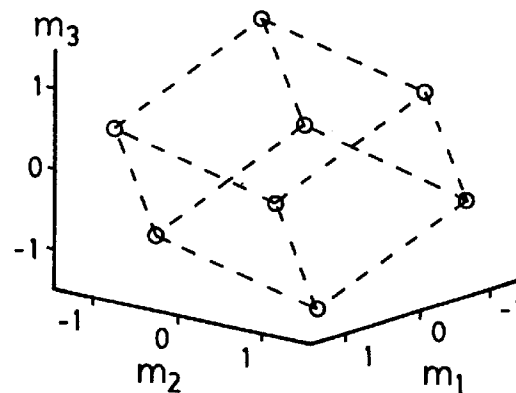
KERPEZ CONSTELLATION

FIG. 3c



BASELINE CONSTELLATION

FIG. 4a
(PRIOR ART)



ROTATED CONSTELLATION

FIG. 4b

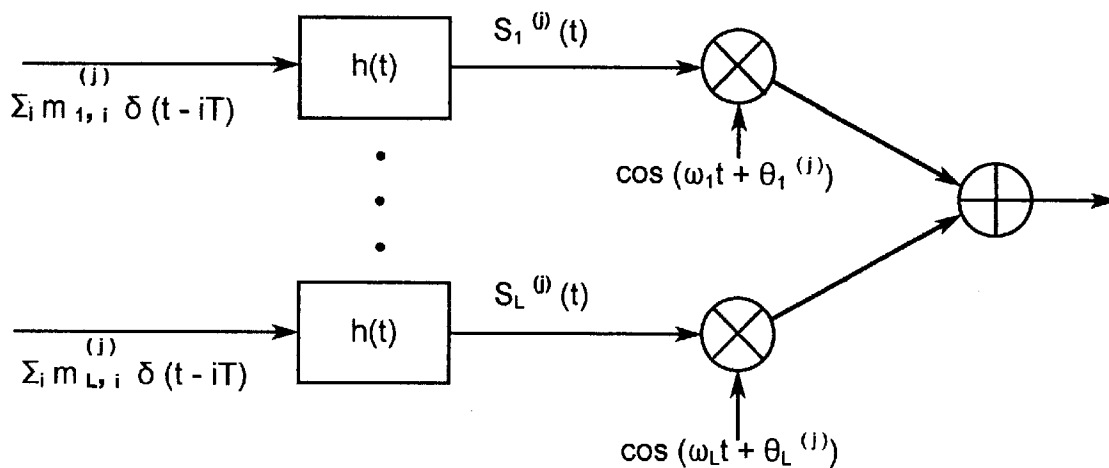


FIG. 5

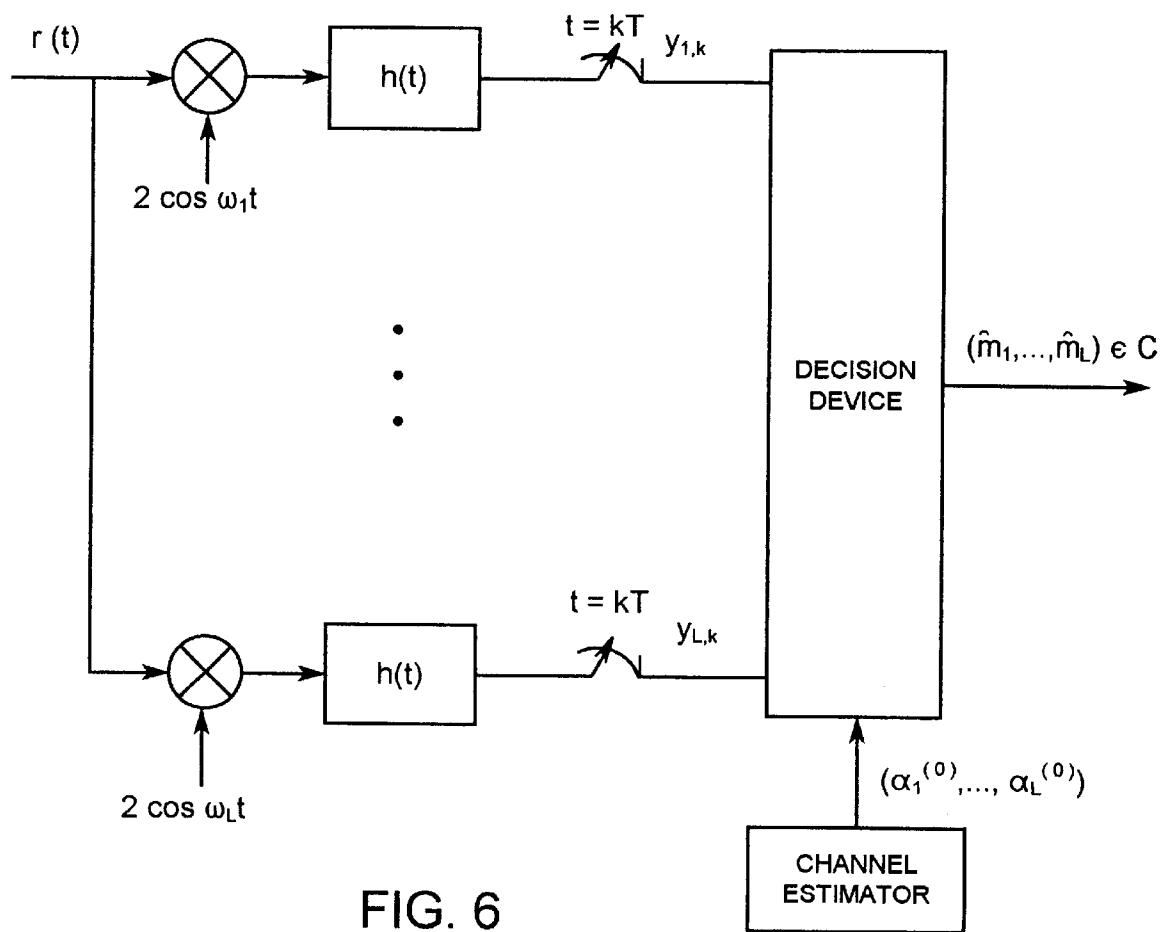


FIG. 6

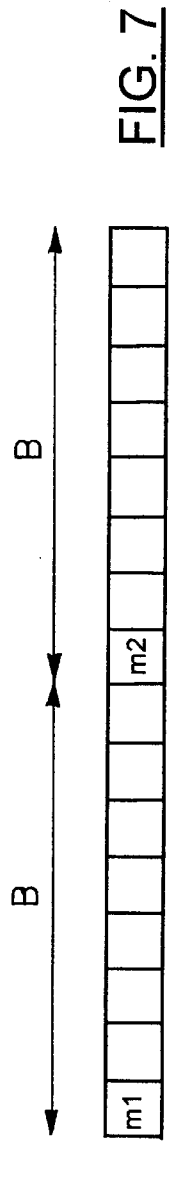


FIG. 7

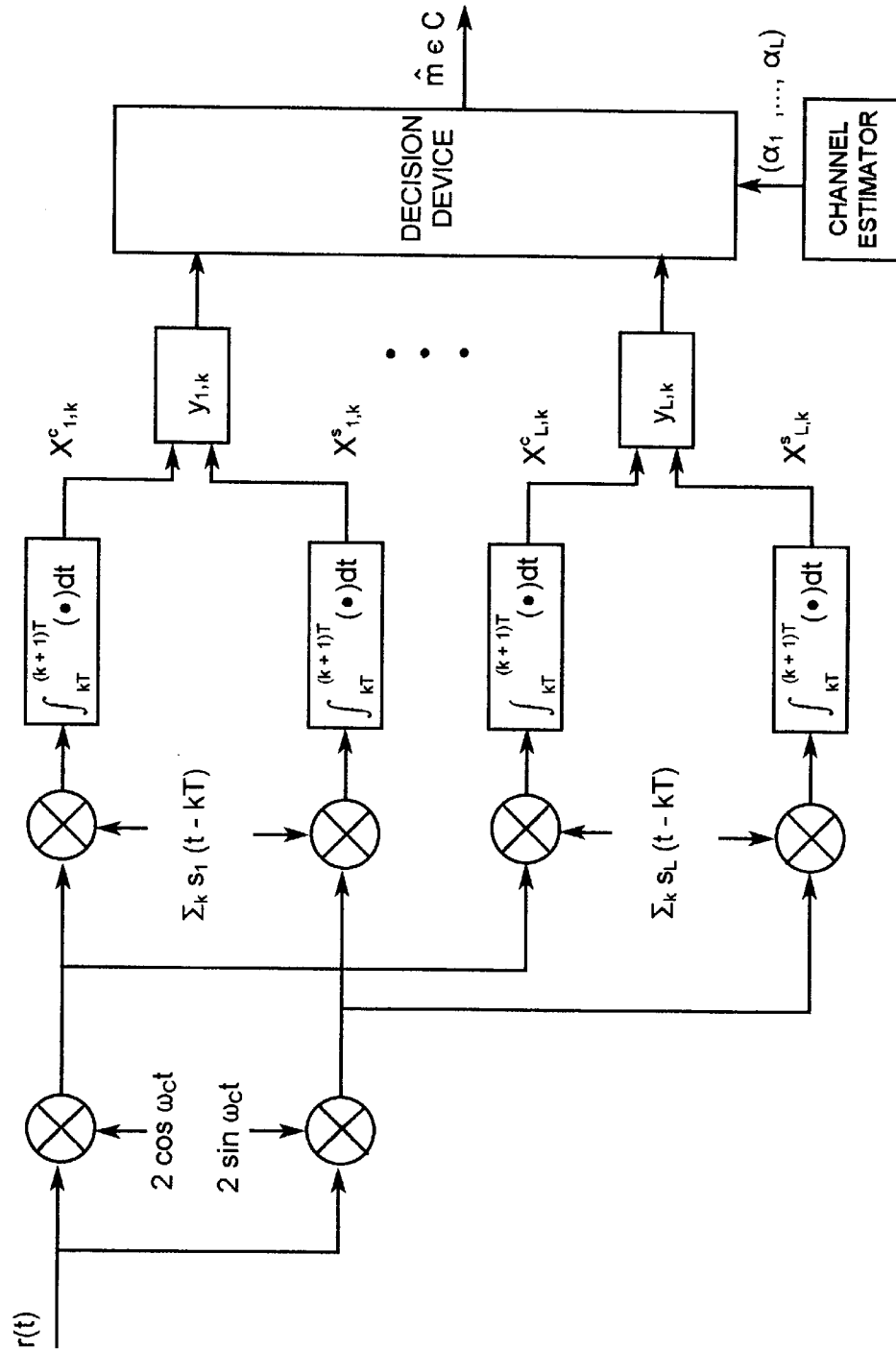


FIG. 8

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.