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# United States Patent [19]

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Larsen et al.

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## [54] MULTI-HOP PACKET RADIO NETWORKS

5,649,108	7/1997	Spiegel et al. ....	370/400
5,687,167	11/1997	Bertin et al. ....	370/254
5,734,825	3/1998	Lauck et al. ....	395/200.13

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### FOREIGN PATENT DOCUMENTS

0201308	11/1986	European Pat. Off. ....	H04L 11/20
0532485	3/1993	European Pat. Off. ....	H04B 7/26
9410774	5/1994	WIPO .....	H04K 1/00
9503652	2/1995	WIPO .....	H04B 7/26

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### OTHER PUBLICATIONS

[21] Appl. No.: 08/849,875

"Adjustable Transmission Power for Mobile Communications with Omnidirectional and Directional Antennas in an One-and Multi-Hop Environment" Perz et al, Gateway to the Future—Technology in motion, May 19–22, 1991.

[22] PCT Filed: Dec. 19, 1995

"Adaptive forwarding and routing in frequency-hop spread spectrum packet radio network with partial-band jamming", Pursley et al, Bridging the Gap Interoperatively, Survivability, Security Conference, Oct. 15–18, 1989.

[86] PCT No.: PCT/GB95/02972

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PCT Pub. Date: Jun. 27, 1996

"Knowledge-based configuration of multi-hop packet-switched radio networks", Andews et al, Fifth International Conference on Systems Engineering, Sep. 9–11, 1987.

### [30] Foreign Application Priority Data

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[52] U.S. Cl. .... 370/254; 370/400

[58] Field of Search ..... 370/312, 337, 370/347, 317, 346, 349, 318, 348, 229, 230, 231–235, 395, 397, 406, 413, 466, 351, 254, 255, 400

### [57] ABSTRACT

### [56] References Cited

#### U.S. PATENT DOCUMENTS

5,029,164	7/1991	Goldstein et al. ....	370/235
5,042,027	8/1991	Takase et al. ....	370/252
5,146,454	9/1992	Courtois et al. ....	370/230
5,278,830	1/1994	Kudo .....	370/230
5,319,638	6/1994	Lin .....	370/235
5,357,507	10/1994	Hughes et al. ....	370/230
5,404,353	4/1995	Ben-Michael et al. ....	370/232
5,446,734	8/1995	Goldstein .....	370/232
5,509,050	4/1996	Berland .....	359/58

An adaptive communication system utilizes opportunistic peak-mode transmissions to transmit data between originating and destination stations, via one or more intermediate stations. Each station monitors the activity of other stations in the network, storing connectivity information for use in subsequent transmissions. Each station also sends out probe signals from time to time, to establish which other stations are in range. Messages are then sent across the network from station to station, with confirmation data being transmitted back to the originating station, until the destination station is reached. Old messages, which would otherwise clog the network, are timed out and deleted. A communication network and transceiver apparatus for use in the network are also disclosed.

16 Claims, 13 Drawing Sheets

