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Ma et al.

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(54) **DUAL-MODE SHARED OFDM METHODS/TRANSMITTERS, RECEIVERS AND SYSTEMS**

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H04B 7/216 (2006.01)

H04L 1/02 (2006.01)

(52) **U.S. Cl.** **370/208**; 370/335; 370/342; 375/267

(58) **Field of Classification Search** 370/208, 370/308, 240, 310-350; 455/277.1; 375/267, 375/299, 346-348

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,315,670 A *	5/1994	Shapiro	382/240
5,345,439 A *	9/1994	Marston	370/320
6,192,026 B1	2/2001	Pollack et al.	370/203
6,282,185 B1 *	8/2001	Hakkinen et al.	370/342
6,298,092 B1 *	10/2001	Heath et al.	375/267

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0760560 8/1996

(Continued)

OTHER PUBLICATIONS

Tarokh, Vahid et al., "Space-Time Block Coding for Wireless Communications: Performance Results", Mar. 1999, IEEE Journal on Selected Areas in Communications, vol. 17, No. 3, pp. 451-460.*

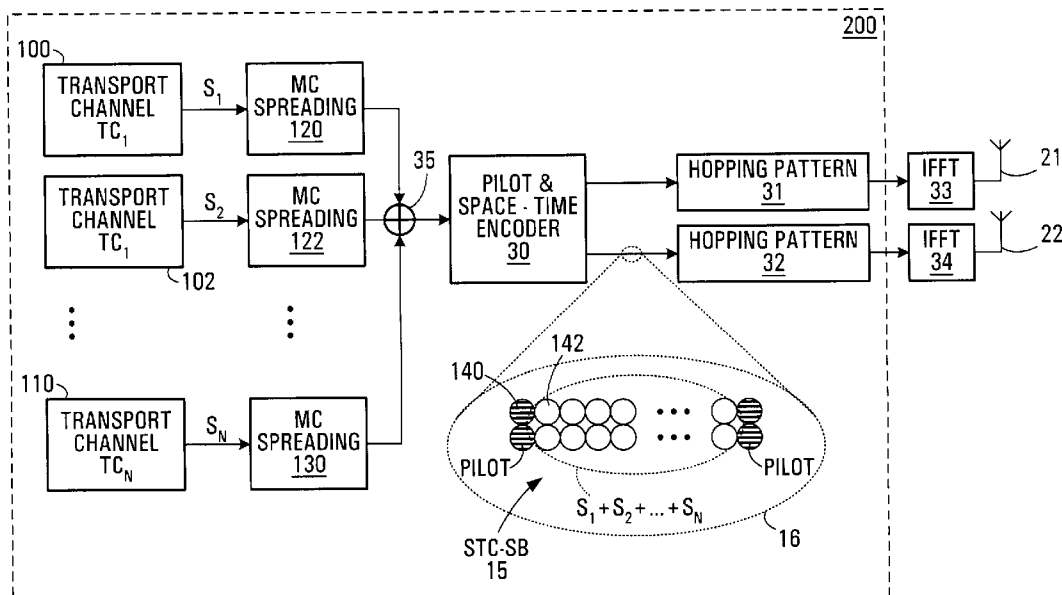
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Primary Examiner—Tri H Phan

(57) **ABSTRACT**

A wireless terminal and network terminal are provided for implementing a new uplink OFDM protocol. In the new protocol, the wireless terminal has a first transmit chain for generating and transmitting a low rate mode OFDM transmission in a first frequency band of the OFDM band; and a second transmit chain for generating and transmitting a burst-mode transmission in a second frequency band of the OFDM band, the first frequency band being distinct from the second frequency band. An access channel is provided which is overlaid over the low rate mode transmissions of other users.

76 Claims, 17 Drawing Sheets



U.S. PATENT DOCUMENTS

6,606,296	B1 *	8/2003	Kokkonen	370/203
6,967,936	B1 *	11/2005	Laroia et al.	370/329
7,095,708	B1 *	8/2006	Alamouti et al.	370/208
2002/0191569	A1 *	12/2002	Sung et al.	370/335
2004/0203395	A1 *	10/2004	Chizhik et al.	455/63.1
2004/0228267	A1 *	11/2004	Agrawal et al.	370/203
2006/0133522	A1 *	6/2006	Sutivong et al.	375/260
2007/0211790	A1 *	9/2007	Agrawal et al.	375/147

FOREIGN PATENT DOCUMENTS

EP	0786890	1/1997
EP	1005190	11/1999
EP	1124347	1/2001
WO	9637066	5/1996
WO	9802982	1/1998
WO	0079722	6/2000

WO 0135563 5/2001

OTHER PUBLICATIONS

Chen, Kwang-Cheng et al, "A Programmable Architecture for OFDM-CDMA", Nov. 1999, National Taiwan University, IEEE Communications Magazine, 0163-6804/99, pp. 76-82.*

T. Chee, Hybric OFDM-CDMA: A Comparison of MC/DS-CDMA, MC-CDMA and OFCDM, Sep. 2002, Dept. of Electrical & Electronic, Adelaide University, Australia, pp. 1-10.*

Hélard, J. -F; Baudais J. -Y; Citerne, J.; Linear MMSE Detection Technique for MC-CDMA; Electronics Letters, Mar. 30, 2000, vol. 36, No. 7.

Callonnec, Denis; Pace, Daniel; Castelain, Damien; Introduction to SFDMA Multiple Access Networks and Their Possible Implementation in Terrestrial DVB Return Channels; IEEE, 1997, pp. 281-285.

Naguib, Ayman, F.; Seshadri, Nambi; Calderbank, A.R.; Applications of Space-Time Block Codes Interference Supression for High Capacity and High Data Rate Wireless Systems; IEEE, 1998, pp. 1803-1810.

* cited by examiner

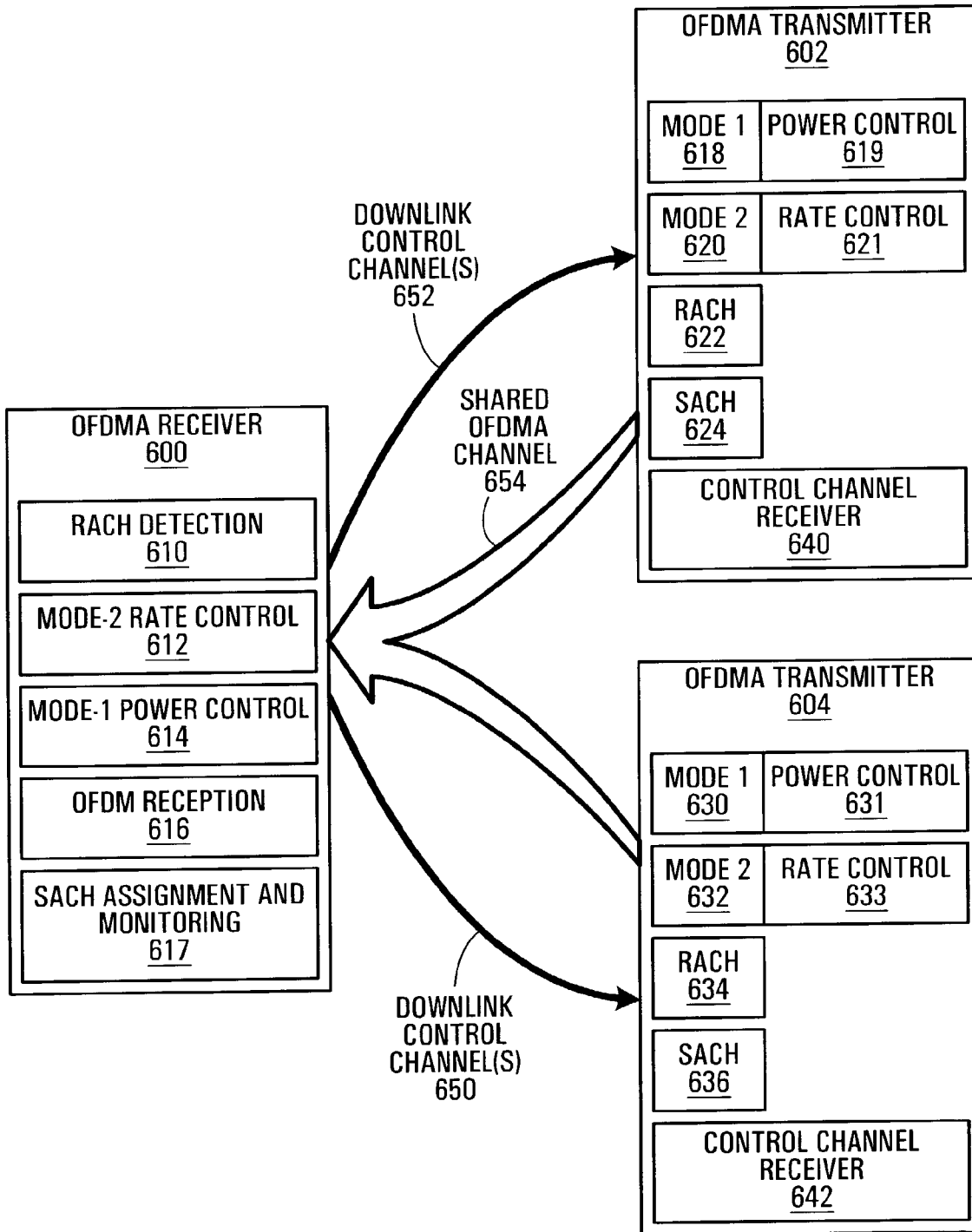


FIG. 1

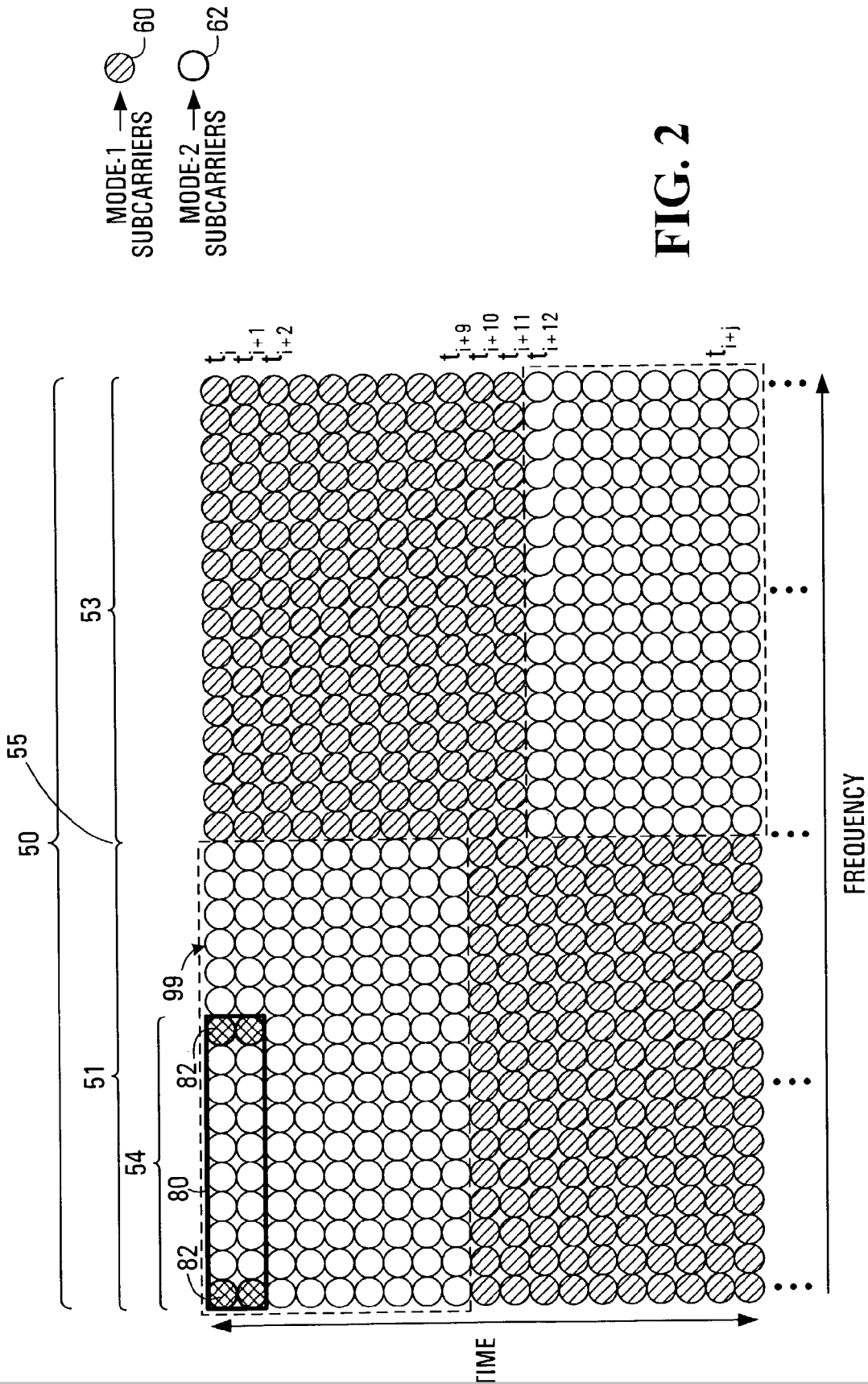


FIG. 2

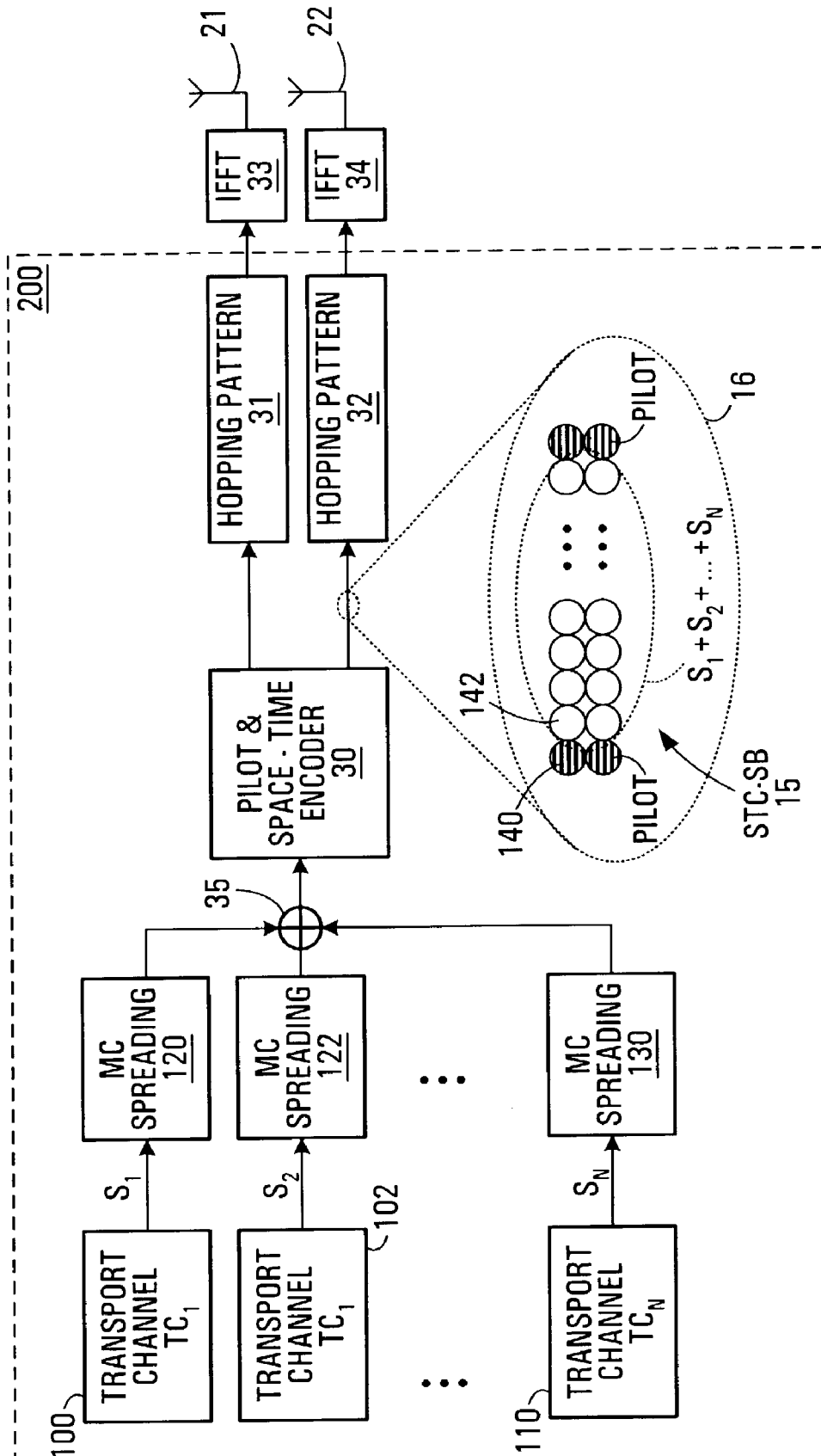


FIG. 3

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