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Walton et al.

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(54) **TRANSMISSION MODE SELECTION FOR DATA TRANSMISSION IN A MULTI-CHANNEL COMMUNICATION SYSTEM**

6,821,535 B2 11/2004 Nurmi et al.
6,927,728 B2* 8/2005 Vook et al. 342/377

(Continued)

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FOREIGN PATENT DOCUMENTS

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1451 days.

(Continued)

OTHER PUBLICATIONS

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(Continued)

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(51) **Int. Cl.**
H04W 4/00 (2009.01)
H04B 17/00 (2006.01)
H04B 7/185 (2006.01)
H04M 1/00 (2006.01)
H04K 1/10 (2006.01)

(57) **ABSTRACT**

(52) **U.S. Cl.** **370/329**; 370/341; 455/226.3; 455/13.3; 455/562.1; 375/260

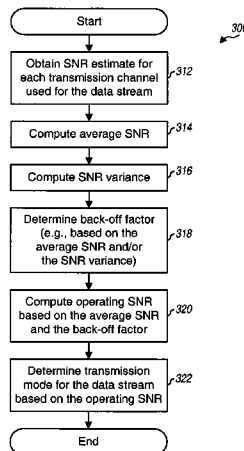
Techniques to select a suitable transmission mode for a data transmission in a multi-channel communication system with multiple transmission channels having varying SNRs. In one method, an SNR estimate is initially obtained for each of multiple transmission channels used to transmit a data stream. An average SNR and an unbiased variance are then computed for the SNR estimates for the multiple transmission channels. A back-off factor is determined, for example, based on the SNR variance and a scaling factor. An operating SNR for the transmission channels is next computed based on the average SNR and the back-off factor. The transmission mode is then selected for the data stream based on the operating SNR. The selected transmission mode is associated with a highest required SNR that is less than or equal to the operating SNR. The method may be used for any system with multiple transmission channels having varying SNRs.

(58) **Field of Classification Search** 370/332, 370/329, 334, 437, 341; 455/226.3, 13.3, 455/277.2, 693, 63.1, 562.1; 375/260
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS

6,144,711 A * 11/2000 Raleigh et al. 375/347
6,426,971 B1 7/2002 Wu et al.
6,463,290 B1 * 10/2002 Stilp et al. 455/456.1
6,478,422 B1 11/2002 Hansen
6,785,341 B2 8/2004 Walton et al.

20 Claims, 11 Drawing Sheets



U.S. PATENT DOCUMENTS

7,006,848	B2	2/2006	Ling et al.	
7,039,125	B2*	5/2006	Friedman	375/297
7,058,367	B1*	6/2006	Luo et al.	455/101
7,095,709	B2	8/2006	Walton et al.	
7,116,652	B2*	10/2006	Lozano	370/334
7,151,809	B2	12/2006	Ketchum et al.	
7,184,713	B2	2/2007	Kadous et al.	
7,191,381	B2*	3/2007	Gesbert et al.	714/759
7,324,429	B2*	1/2008	Walton et al.	370/203
7,636,573	B2*	12/2009	Walton et al.	455/454
2002/0027951	A1*	3/2002	Gormley et al.	375/224
2002/0075830	A1*	6/2002	Hartman, Jr.	370/333
2002/0127978	A1*	9/2002	Khatri	455/103
2002/0154705	A1	10/2002	Walton et al.	
2002/0163974	A1*	11/2002	Friedman	375/295
2003/0125040	A1*	7/2003	Walton et al.	455/454
2003/0236080	A1*	12/2003	Kadous et al.	455/226.1
2004/0082356	A1	4/2004	Walton et al.	
2004/0120411	A1*	6/2004	Walton et al.	375/260

2004/0136349	A1*	7/2004	Walton et al.	370/338
2004/0252632	A1*	12/2004	Bourdoux et al.	370/210
2008/0069015	A1*	3/2008	Walton et al.	370/280
2008/0267098	A1*	10/2008	Walton et al.	370/280
2008/0267138	A1*	10/2008	Walton et al.	370/336
2010/0067401	A1*	3/2010	Medvedev et al.	370/253
2010/0119001	A1*	5/2010	Walton et al.	375/260

FOREIGN PATENT DOCUMENTS

WO	01082521	11/2001
WO	WO 02/093784 A1	11/2002

OTHER PUBLICATIONS

Written Opinion-PCT/US04/008665, International Search Authority-European Patent Office-Oct. 6, 2004.
 Office Action dated Aug. 13, 2008 for Australian Application Serial No. 2004223374, 2 pages.
 Office Action dated Jun. 27, 2008 for Chinese Application Serial No. 200480011307.6, 3 pages.

* cited by examiner

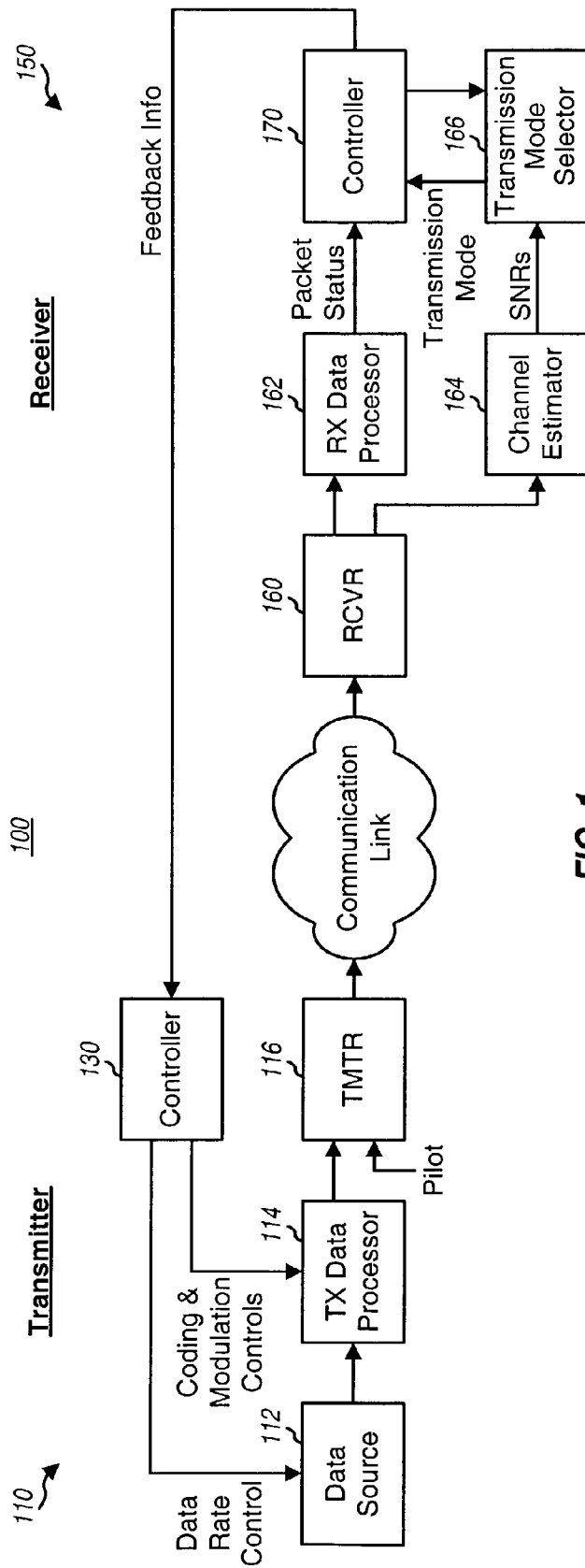


FIG. 1

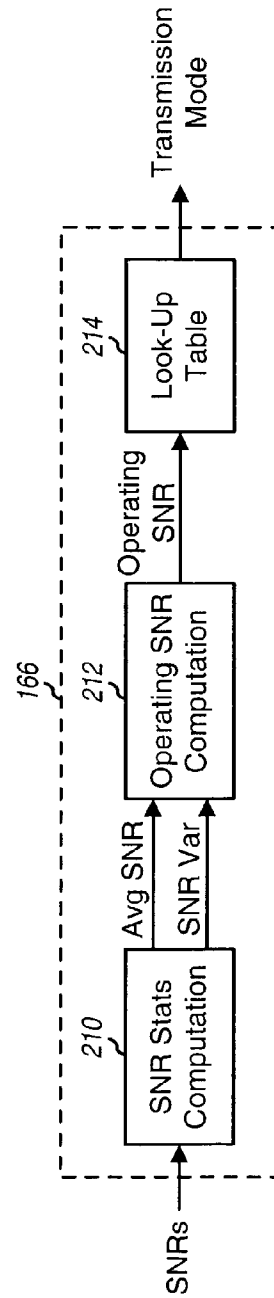


FIG. 2

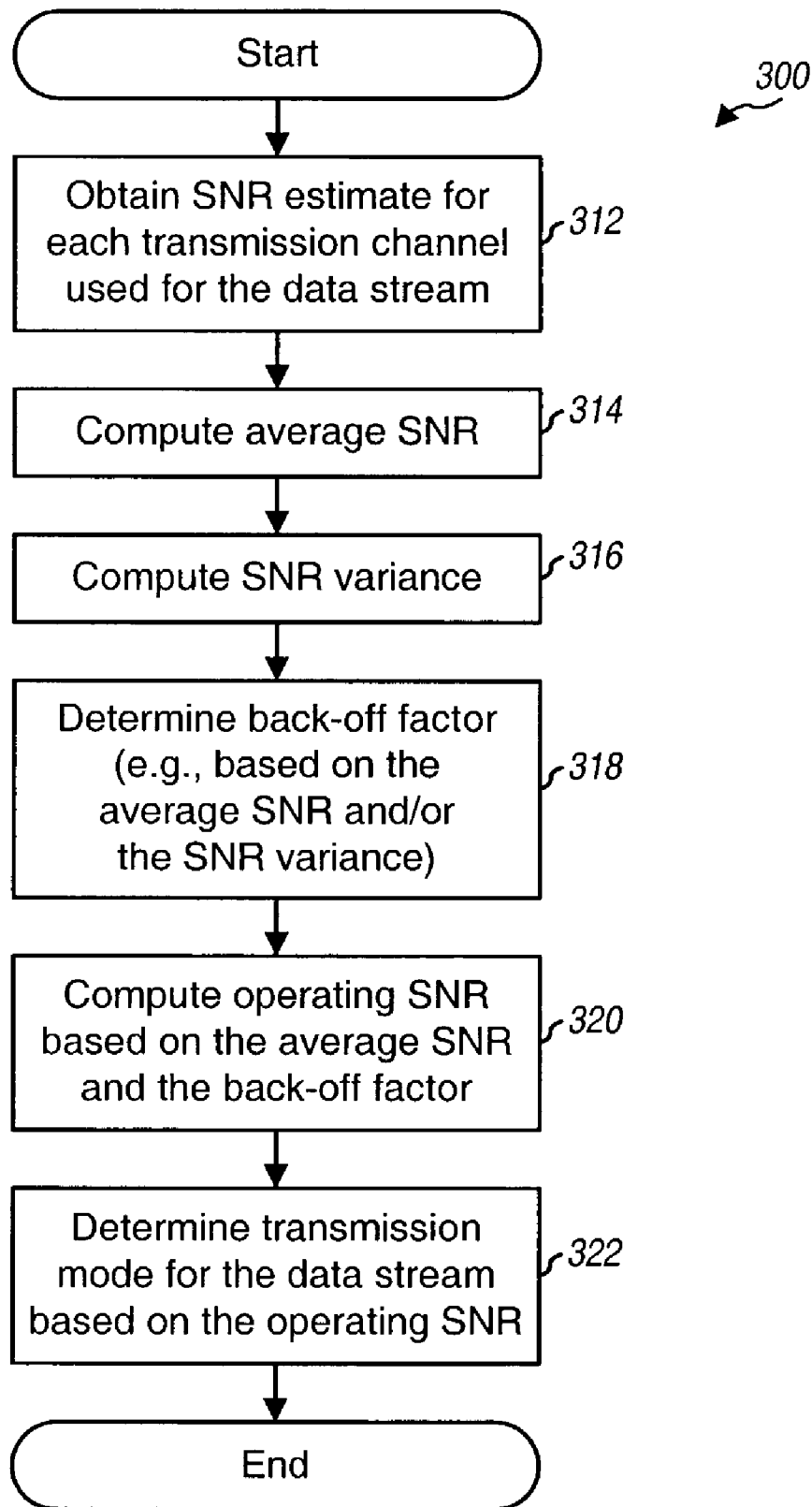


FIG. 3

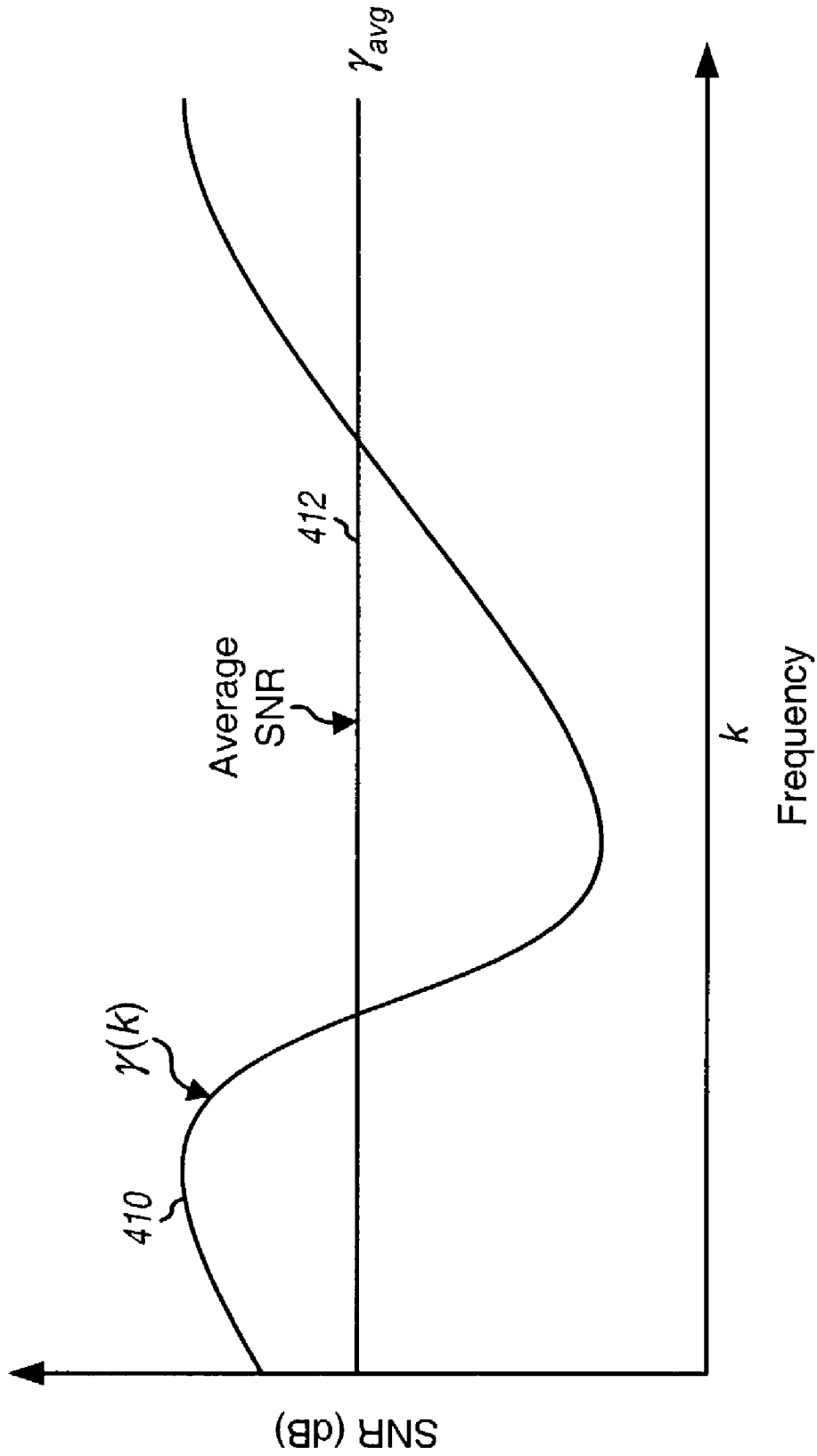


FIG. 4

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