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Greszczuk et al.

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(54) **MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY**

(71) Applicant: **TQ DELTA, LLC**, Austin, TX (US)

(72) Inventors: **John A. Greszczuk**, Stow, MA (US); **Richard W. Gross**, Acton, MA (US); **Halil Padir**, Lexington, MA (US); **Michael A. Tzannes**, Lexington, MA (US)

(73) Assignee: **TQ DELTA, LLC**, Austin, TX (US)

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(63) Continuation of application No. 14/092,248, filed on Nov. 27, 2013, now Pat. No. 8,750,352, which is a continuation of application No. 13/887,889, filed on May 6, 2013, now Pat. No. 8,611,404, which is a

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(52) **U.S. Cl.**
CPC ***H04L 27/2601*** (2013.01); ***H04L 12/40006*** (2013.01); ***H04M 11/06*** (2013.01); ***H04W 52/0235*** (2013.01); ***H04W 52/0241*** (2013.01); *H04L 12/40169* (2013.01); *Y02B 60/50* (2013.01)

(58) **Field of Classification Search**
CPC H04B 1/402; H04B 3/23; H04L 27/2601
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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,206,886 A 4/1993 Bingham
5,224,152 A 6/1993 Harte
(Continued)

FOREIGN PATENT DOCUMENTS

EP 0473465 3/1992
EP 0840474 5/1998
(Continued)

OTHER PUBLICATIONS

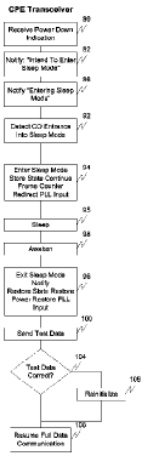
Official Action for Canadian Patent Application No. 2,800,005, dated Jun. 11, 2014.
(Continued)

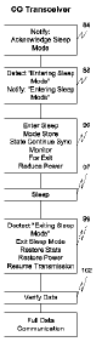
Primary Examiner — Khai Tran
(74) *Attorney, Agent, or Firm* — Jason H. Vick; Sheridan Ross, PC

(57) **ABSTRACT**

A multicarrier transceiver is provided with a sleep mode in which it idles with reduced power consumption when it is not needed to transmit or receive data. The full transmission and reception capabilities of the transceiver are quickly restored when needed, without requiring the full (and time-consuming) initialization commonly needed to restore such transceivers to operation after inactivity.

28 Claims, 4 Drawing Sheets





Related U.S. Application Data

continuation of application No. 13/152,558, filed on Jun. 3, 2011, now Pat. No. 8,437,382, which is a continuation of application No. 12/615,946, filed on Nov. 10, 2009, now Pat. No. 7,978,753, which is a continuation of application No. 11/425,507, filed on Jun. 21, 2006, now Pat. No. 7,697,598, which is a continuation of application No. 11/289,516, filed on Nov. 30, 2005, now abandoned, which is a continuation of application No. 11/090,183, filed on Mar. 28, 2005, now abandoned, which is a continuation of application No. 10/778,083, filed on Feb. 17, 2004, now abandoned, which is a continuation of application No. 10/175,815, filed on Jun. 21, 2002, now abandoned, which is a continuation of application No. 09/581,400, filed as application No. PCT/US99/01539 on Jan. 26, 1999, now Pat. No. 6,445,730.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,428,790	A		6/1995	Harper et al.
5,452,288	A		9/1995	Rahuel et al.
5,487,069	A		1/1996	O'Sullivan et al.
5,519,757	A		5/1996	Torin
5,566,366	A		10/1996	Russo et al.
5,581,556	A		12/1996	Ohie
5,590,396	A		12/1996	Henry
5,842,028	A	*	11/1998	Vajapey 713/310
5,852,630	A		12/1998	Langberg et al.
5,870,673	A		2/1999	Haartsen
5,960,344	A		9/1999	Mahany
6,047,378	A		4/2000	Garrett et al.
6,052,411	A		4/2000	Mueller et al.
6,154,642	A		11/2000	Dumont et al.
6,157,816	A		12/2000	Anderson et al.
6,246,725	B1		6/2001	Vanzieleghem et al.
6,278,864	B1		8/2001	Cummins et al.
6,332,086	B2		12/2001	Avis
6,347,236	B1		2/2002	Gibbons et al.
6,359,938	B1		3/2002	Keevill et al.
6,389,062	B1		5/2002	Wu
6,445,730	B1		9/2002	Greszczuk et al.
6,567,473	B1		5/2003	Tzannes
6,654,410	B2		11/2003	Tzannes
7,292,627	B2		11/2007	Tzannes
7,463,872	B2		12/2008	Jin et al.
7,697,598	B2		4/2010	Greszczuk et al.
7,978,753	B2		7/2011	Greszczuk et al.
8,412,964	B2	*	4/2013	Lee et al. 713/300
8,437,382	B2		5/2013	Greszczuk et al.
8,611,404	B2		12/2013	Greszczuk et al.
8,750,352	B2		6/2014	Greszczuk et al.
2002/0150152	A1		10/2002	Greszczuk et al.
2004/0160906	A1		8/2004	Greszczuk et al.
2005/0185726	A1		8/2005	Greszczuk et al.
2006/0078060	A1		4/2006	Greszczuk et al.
2012/0108169	A1		5/2012	Degauque et al.

FOREIGN PATENT DOCUMENTS

JP	H04-227348	A	8/1992
JP	H05-095315		4/1993
JP	H06-114196		4/1994
JP	H06-169278		6/1994
JP	H06-296176	A	10/1994
JP	H06-311080		11/1994
JP	H07-079265		3/1995
JP	H07-086995		3/1995
JP	H09-275587		10/1997
JP	H10-327309		12/1998
KR	1998-26703		8/1998
WO	WO 98/09461		3/1998
WO	WO 98/35473		8/1998
WO	WO 99/20027		4/1999
WO	WO 00/45559		3/2000

OTHER PUBLICATIONS

Bingham, "Multicarrier Modulation for Data Transmission: An Idea Whose Time Has Come," IEEE Communications Magazine, May 1990, vol. 28(5), pp. 5-8, 11.

Series G: Transmission Systems and Media, Digital Systems and Networks, "Spitterless Asymmetric Digital Subscriber Line (ADSL) transceivers," ITU-T G.992.2, International Telecommunication Union, Jun. 1999, 179 pages.

Macq et al., "A CMOS activity detector for ADSL link," ESSCIRC 1995, 21st European Soild-State Circuits Conference, Sep. 19-21, 1995, pp. 430-433.

International Search Report for International (PCT) App. No. PCT/US99/01539, mailed Oct. 29, 1999.

International Preliminary Examination Report for International (PCT) App. No. PCT/US99/01539, mailed Dec. 6, 2000.

Examiner's First Report for Australian Patent Application No. 23409/99, dated Feb. 7, 2003.

Notice of Acceptance for Australian Patent Application No. 23409/99, dated Jul. 25, 2003.

Official Action for Canadian Patent Application No. 2357551, dated Nov. 23, 2005.

Notice of Allowance for Canadian Patent Application No. 2357551, dated Dec. 14, 2007.

Official Action for Canadian Patent Application No. 2,633,064, dated Oct. 31, 2008.

Official Action for Canadian Patent Application No. 2,633,064, dated Aug. 17, 2009.

Notice of Allowance for Canadian Patent Application No. 2,633,064, dated Mar. 5, 2010.

Official Action for Canadian Patent Application No. 2,633,064, dated Oct. 15, 2010.

Communication under Rule 51(4) EPC, dated Apr. 22, 2004, granting European Patent Application No. 99 909 970.7-2411.

European Search Report for European Patent Application No. EP 04022871, dated Jul. 6, 2005.

Communication under Rule 51(4) EPC, dated May 7, 2007, granting European Patent Application No. 04022871.0.

Extended European Search Report and Opinion for European Patent Application No. 07021150, dated Feb. 15, 2008.

European Examination Report for European Patent Application No. 07021150, dated Oct. 9, 2008.

Official Action for European Patent Application No. 07021150, dated May 6, 2010.

Communication under Rule 71(3) EPC for European Patent Application No. 07021150.3, dated May 30, 2011.

Extended European Search Report for European Patent Application No. 10011996.5, dated Dec. 21, 2011.

Official Action for European Patent Application No. 10011996.5, dated May 29, 2013.

European Search Report for European Patent Application No. EP 10012013.8, mailed Dec. 27, 2011.

Communication under Rule 71(3) EPC, dated Jul. 5, 2013 granting European Patent Application No. 10012013.8.

Communication under Rule 71(3) EPC, dated Mar. 12, 2014 granting European Patent Application No. 10012013.8.

Decision to Grant a European Patent Pursuant to Article 97(1) EPC, dated Apr. 3, 2014 for European Patent Application No. 10012013.8.

Notice of Reasons for Rejection (including translation) for Japanese Patent Application No. 2000-596705, mailed Aug. 19, 2008.

(56) **References Cited**

OTHER PUBLICATIONS

Notice of Allowance for Japanese Patent Application No. 2000-596705, mailed Mar. 16, 2009.
Notification of Reasons for Rejection (including translation) for Japanese Patent Application No. 2008-323651, mailed Feb. 8, 2010.
Notification of Reasons for Refusal (including translation) for Japanese Patent Application No. 2008-323651, mailed Mar. 7, 2011.
Decision of Final Rejection for Japanese Patent Application No. 2008-323651, mailed Nov. 28, 2011.
English Translation of Preliminary Rejection re: Korean Application No. 2000-7009402, issued Nov. 15, 2005.
Official Action for U.S. Appl. No. 09/581,400 mailed Mar. 13, 2002.
Notice of Allowance for U.S. Appl. No. 09/581,400 mailed Jun. 17, 2002.
Official Action for U.S. Appl. No. 10/175,815 mailed Nov. 17, 2003.
Official Action for U.S. Appl. No. 10/778,083 mailed Nov. 30, 2004.
Official Action for U.S. Appl. No. 11/090,183 mailed Sep. 12, 2005.
Official Action for U.S. Appl. No. 11/289,516 mailed Mar. 27, 2006.
Official Action for U.S. Appl. No. 11/425,507, mailed Nov. 28, 2007.
Official Action for U.S. Appl. No. 11/425,507, mailed Aug. 22, 2008.
Official Action for U.S. Appl. No. 11/425,507, mailed Apr. 27, 2009.
Notice of Allowance for U.S. Appl. No. 11/425,507, mailed Sep. 22, 2009.
Official Action for U.S. Appl. No. 12/615,946, mailed Aug. 6, 2010.
Notice of Allowance for U.S. Appl. No. 12/615,946, mailed Apr. 25, 2011.
Official Action for U.S. Appl. No. 13/152,558, mailed Jun. 1, 2012.
Notice of Allowance for U.S. Appl. No. 13/152,558, mailed Feb. 4, 2013.
Official Action for U.S. Appl. No. 13/887,889 mailed Sep. 6, 2013.
Notice of Allowance for U.S. Appl. No. 13/887,889 mailed Oct. 23, 2013.
Official Action for U.S. Appl. No. 14/092,248 mailed Jan. 13, 2014.
Notice of Allowance for U.S. Appl. No. 14/092,248 mailed Mar. 18, 2014.
Official Action for Canadian Patent Application No. 2,800,005, dated Apr. 13, 2015.
Communication Under Rule 71(3) EPC—Intention to Grant for European Patent Application No. 10011996.5, dated Mar. 25, 2015.

* cited by examiner

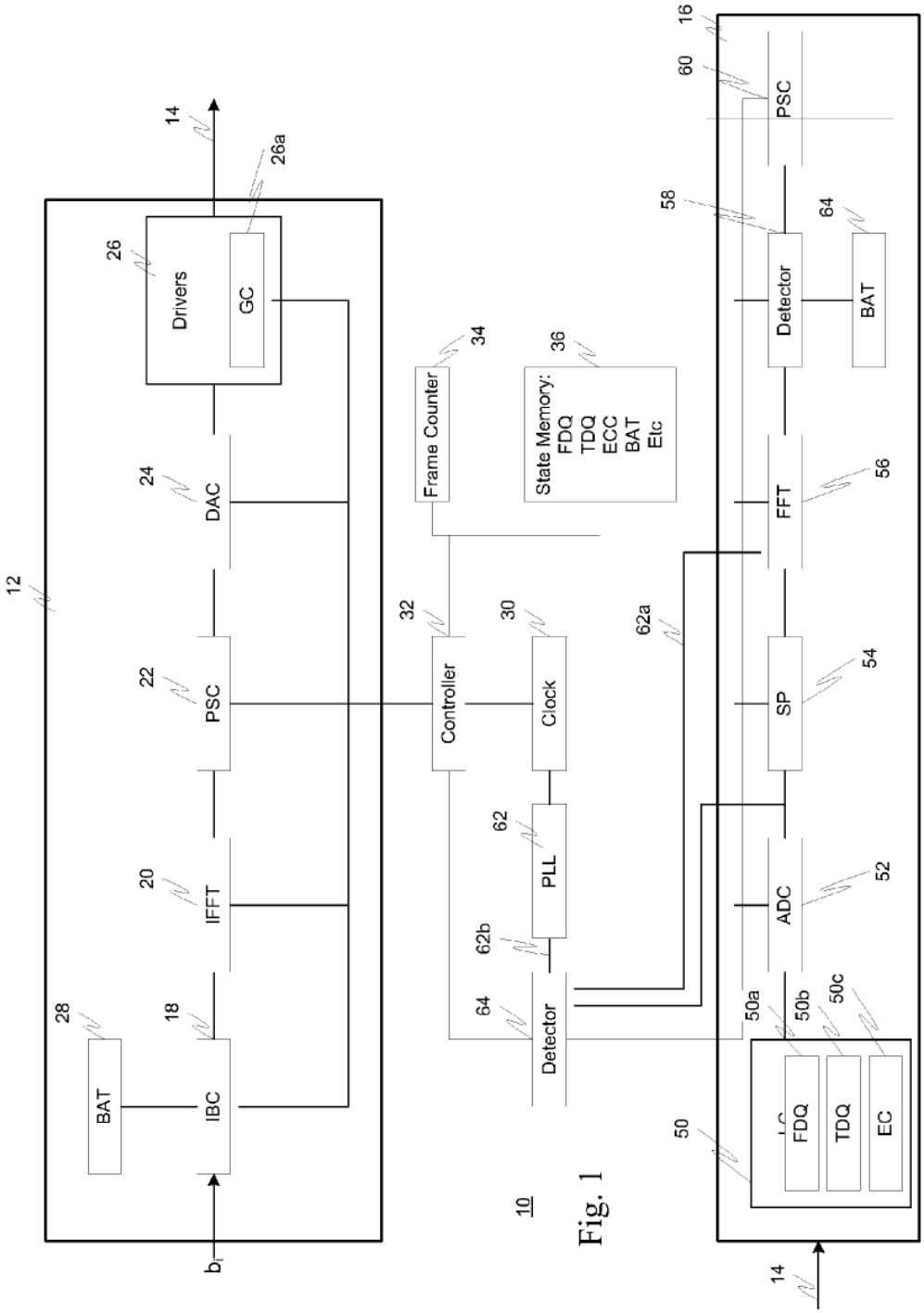

Fig. 1

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51	6
52	7
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Fig. 1A

Fig. 1B

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