(12) **United States Patent**

Lindholm et al.

(10) Patent No.: **US 8,385,966 B2**

(45) Date of Patent: **Feb. 26, 2013**

(54) **METHOD, APPARATUS AND COMPUTER PROGRAM FOR POWER CONTROL RELATED TO RANDOM ACCESS PROCEDURES**

(75) Inventors: **Jari Lindholm**, Palojoki (FI); **Juha S. Korhonen**, Espoo (FI)

(73) Assignee: **Nokia Siemens Networks Oy**, Espoo (FI)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 587 days.

(21) Appl. No.: **12/387,661**

(22) Filed: **May 5, 2009**

(65) **Prior Publication Data**

US 2009/0286566 A1 Nov. 19, 2009

Related U.S. Application Data

(60) Provisional application No. 61/126,617, filed on May 5, 2008.

(51) **Int. Cl.**
H04B 7/00 (2006.01)

(52) **U.S. Cl.** **455/522**; 455/521

(58) **Field of Classification Search** .... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,722,051	A *	2/1998	Agrawal et al.	455/69
2003/0076812	A1 *	4/2003	Benedittis	370/350
2003/0119452	A1 *	6/2003	Kim et al.	455/69
2004/0001429	A1 *	1/2004	Ma et al.	370/210
2007/0149206	A1 *	6/2007	Wang et al.	455/450
2007/0201397	A1 *	8/2007	Zhang	370/329

OTHER PUBLICATIONS

Editor (motorola), 3GPP Draft; 3rd generation partnership project, mobile competence centre; vol. RAN WG1, Feb. 15, 2008, whole document.*

Interdigital Communications Corporation; "E-Ultra Uplink Power Control Proposal and Evaluation"; vol. RAN WG!, Jun. 22, 2007, whole document.*

Editor (Motorola): 3GPP Draft; R1-081056—36213-81 0-CR, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre ; 650, Route Des Lucioles ; F-06921 Sophia-Antipolis Cedex ; France, vol. RAN WG1, No. Sorrento, Italy; 20080215, Feb. 15, 2008, XP050109512.*

NTT Docomo et al: "Transmission Power Control in E-UTRA Uplink" 3GPP Draft; R1-070870 Transmission Power Control in E-UTRA Uplink, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre ;650, Route Des Lucioles ; F- 06921 Sophia-Antipolis Cedex ; France, vol. RANIWG1, No. St. Louis, USA; 20070206, Feb. 6, 2007, XP05010.*

(Continued)

Primary Examiner — Crystal L Hammond

(74) *Attorney, Agent, or Firm* — Harrington & Smith

(57) **ABSTRACT**

A first power control adjustment state g(i) and a second power control adjustment state f(i) are initialized for i=0 to each reflect an open loop power control error. An initial transmit power for a shared uplink channel is computed using full pathloss compensation. The computed initial transmit power depends on a preamble power of a first message sent on an access channel, and the initial transmit power is initialized with the second power control adjustment state f(0). A third message is sent from a transmitter on an uplink shared channel at the initial transmit power. In various implementations, the power for i=0 on the uplink control channel is also initialized similar to the initial transmit power for the third message and using full pathloss compensation, and after the third message (and retransmissions of it), subsequent messages sent on the uplink shared channel are sent at a power that is computed using fractional pathloss compensation.

17 Claims, 5 Drawing Sheets
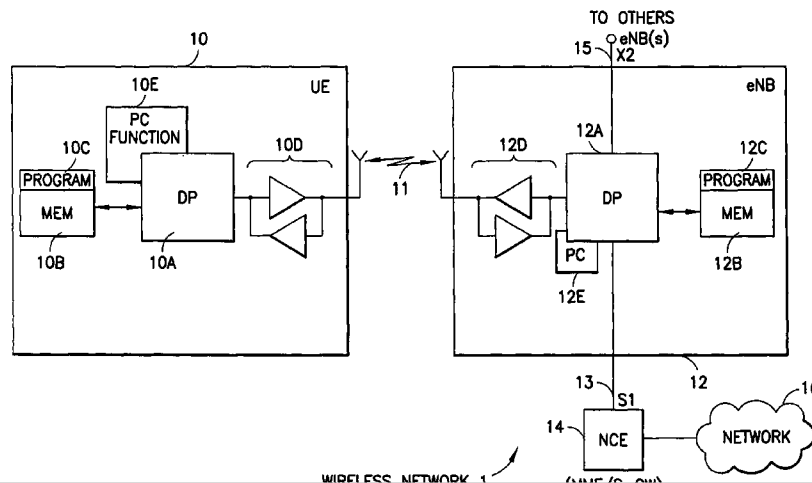
OTHER PUBLICATIONS

IPWIRELESS: "Initial Access Procedure and Uplink Synchronisa-tion" 3GPP Draft; R1-060637, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre ; 650, Route Des Lucioles ; F-06921 Sophia-Antipolis Cedex ; France, vol. RAN WG1, No. Denver, USA; 20060209, Feb. 9, 2006, XP050101560.*

"3rd Generation Partnershp Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8)". 3GPP TS 36.300 V8.4.0 (Mar. 2008), 5 pgs.

"3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8)", 3GPP TS 36.213 V8.2.0 (Mar. 2008), 30 pgs.

Motorola: 3GPP Draft; R1-081056—36213-810-CR, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre; vol. RAN WG1, No. Sorrento, Italy; Feb. 15, 2008, XP050109512.

NTT DoCoMo et al: "Transmission Power Control in E-UTRA Uplink" 3GPP Draft, R1-070870; vol. RAN WG1, No. St. Louis, USA; Feb. 6, 2007, XP050104882.

Qualcomm Europe: "RACH sequences and planning" 3GPP Draft; R1-062690; vol. RAN WG1, No. Seoul, Korea; Oct. 4, 2006, XP050103179.

IPWireless: "Initial Access Procedure and Uplink Synchronisation" 3GPP Draft; R1-060637; vol. RAN WG1, No. Denver, USA , Feb. 9, 2006, XP050101560.

NTT DoCoMo et al: "Transmission Power Control in E-UTRA Uplink" 3GPP Draft; R1-063316; vol. RAN WG1, No. Riga, Latvia; Nov. 2, 2006, XP050103761.

Interdigital Communications Corporation: "E-UTRA Uplink Power Control Proposal and Evaluation" 3GPP Draft; R1-072781; vol. RAN WG1, No. Orlando, USA; Jun. 22, 2007, XP050106465.

Nokia et al: "Clarifications on the Out-of sync handling for UTRA TDD" 3GPP Draft; R1-00/1097; vol. RAN WG1, No. Berlin, Ger-many; Aug. 27, 2000, XP050093021.

3GPP TS 36.321 V8.0.0 (Dec. 2007) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) Medium Access Control (MAC) protocol specification (Release 8).
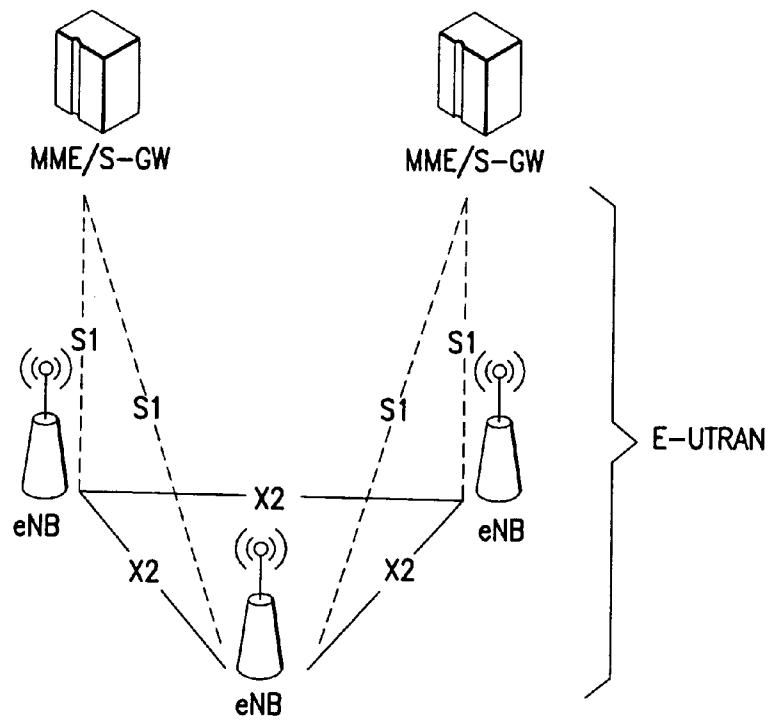
* cited by examiner

FIG. 1A
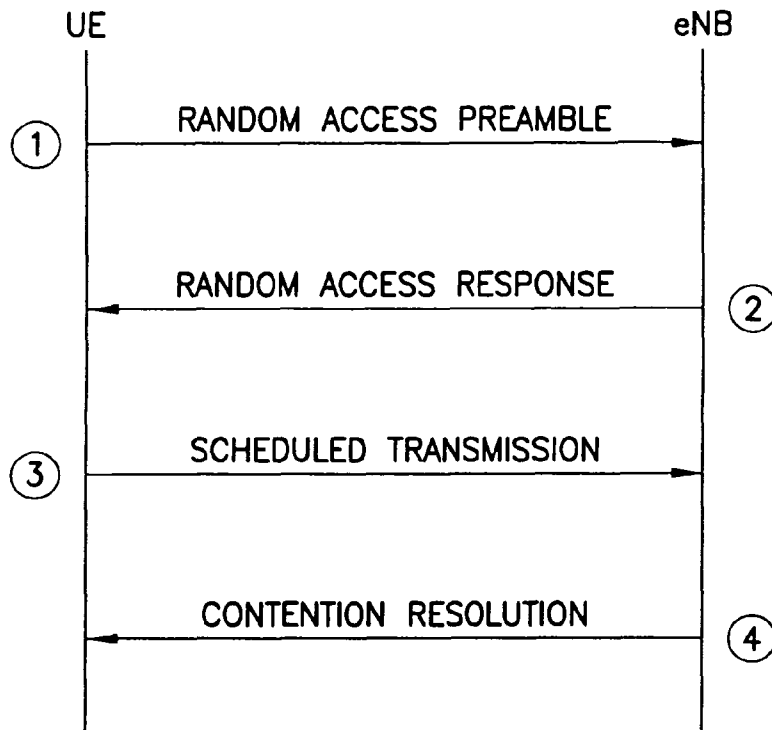PRIOR ART

CONTENTION BASED RANDOM ACCESS PROCEDURE

UE   eNB

(1)   RANDOM ACCESS PREAMBLE →

← RANDOM ACCESS RESPONSE   (2)

(3)   SCHEDULED TRANSMISSION →

← CONTENTION RESOLUTION   (4)

FIG.1B
PRIOR ART

NON-CONTENTION BASED RANDOM ACCESS PROCEDURE

UE   eNB

(0)   ← RA PREAMBLE ASSIGNMENT

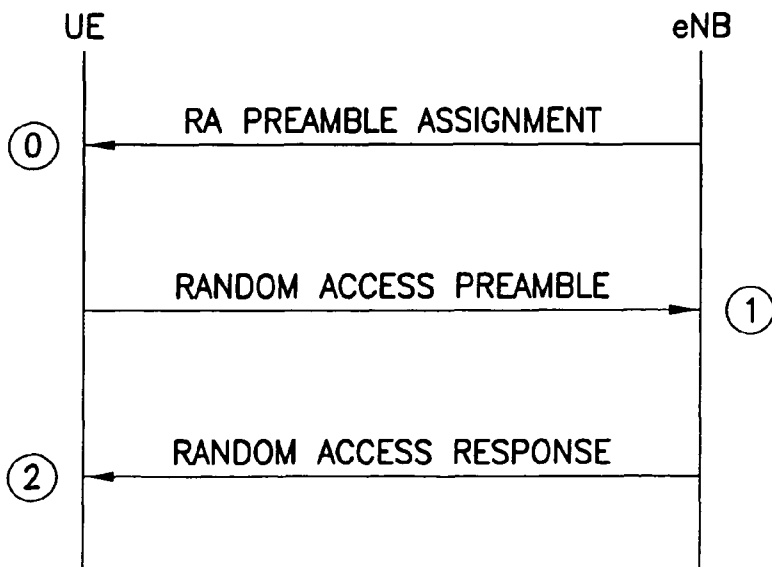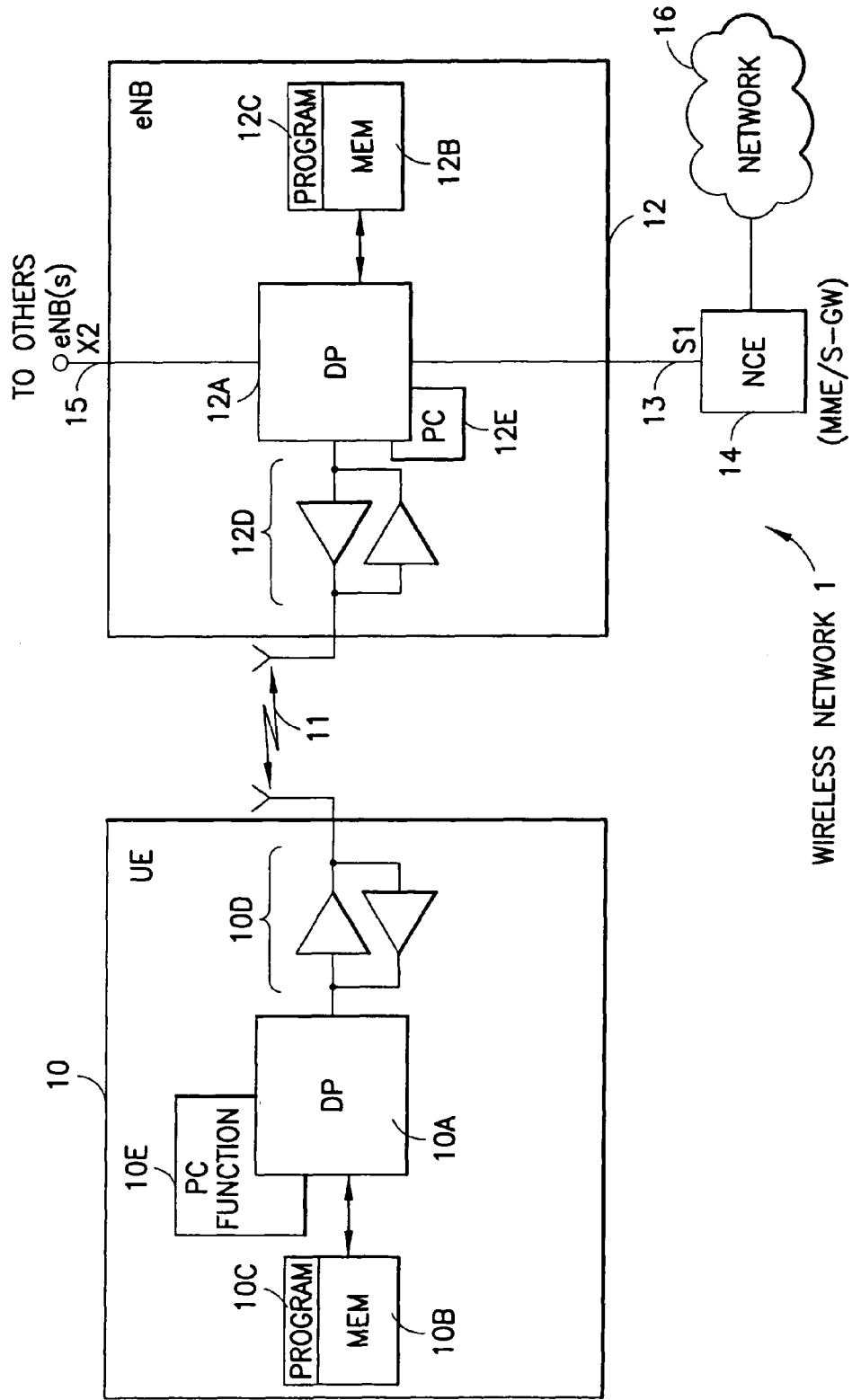RANDOM ACCESS PREAMBLE →   (1)

(2)   ← RANDOM ACCESS RESPONSE

FIG.1C
PRIOR ART

FIG.2

DOCKET ALARM

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.

fastcase®
Smarter legal research.