

(12) **United States Patent**  
**Kazmi et al.**

(10) **Patent No.:** **US 10,044,613 B2**  
 (45) **Date of Patent:** **Aug. 7, 2018**

(54) **MULTIPLE RADIO LINK CONTROL (RLC) GROUPS**

(71) Applicant: **INTEL IP CORPORATION**, Santa Clara, CA (US)

(72) Inventors: **Zaigham Kazmi**, San Marcos, CA (US); **Ana Lucia Pinheiro**, Portland, OR (US)

(73) Assignee: **Intel IP Corporation**, Santa Clara, CA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **14/785,116**

(22) PCT Filed: **Dec. 13, 2013**

(86) PCT No.: **PCT/US2013/074861**

§ 371 (c)(1),

(2) Date: **Oct. 16, 2015**

(87) PCT Pub. No.: **WO2014/185953**

PCT Pub. Date: **Nov. 20, 2014**

(65) **Prior Publication Data**

US 2016/0094446 A1 Mar. 31, 2016

**Related U.S. Application Data**

(60) Provisional application No. 61/824,338, filed on May 16, 2013.

(51) **Int. Cl.**

**H04L 12/741** (2013.01)

**H04W 72/04** (2009.01)

(Continued)

(52) **U.S. Cl.**

CPC ..... **H04L 45/74** (2013.01); **G01C 21/005** (2013.01); **G01S 19/12** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC ..... H04L 45/74; H04L 12/6418; H04W 28/0252; H04W 72/0433; H04W 4/02; (Continued)

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2005/0073974 A1\* 4/2005 Kim ..... H04L 12/189 370/329

2012/0281666 A1 11/2012 Diachina et al. (Continued)

**FOREIGN PATENT DOCUMENTS**

CN 102655682 A 9/2012  
 EP 2916572 A1\* 9/2015 ..... H04W 72/0406

**OTHER PUBLICATIONS**

3GPP TSG-RAN WG2 #81—R2-130420: Protocol architecture alternatives for dual connectivity; Agenda Item 7.2; Jan. 28 to Feb. 1, 2013; Malta.

(Continued)

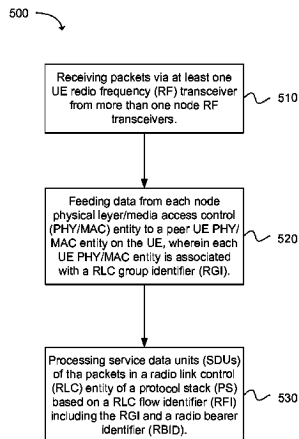
*Primary Examiner* — Jackie Zuniga Abad

(74) *Attorney, Agent, or Firm* — Thorpe North & Western

(57) **ABSTRACT**

Technology to process radio link control (RLC) groups is disclosed. In an example, a carrier aggregation (CA) capable user equipment (UE) operable process radio link control (RLC) groups can include a UE radio frequency (RF) transceiver and a processor. The UE RF transceiver can be configured to receive packets from more than one cell via a sending node RF transceiver. The processor can be configured to process service data units (SDU) of the packets in a radio link control (RLC) entity of a protocol stack (PS). Each SDU can be associated with an RLC flow identifier (RFI). The RFI can comprise an RLC group identifier (RGI) indicating the sending node RF transceiver, and a radio bearer identifier (RBID).

**28 Claims, 15 Drawing Sheets**



- (51) **Int. Cl.**  
*H04W 4/02* (2018.01)  
*H04L 12/64* (2006.01)  
*G01C 21/00* (2006.01)  
*G01S 19/12* (2010.01)  
*H04W 28/02* (2009.01)  
*H04W 84/12* (2009.01)  
*H04W 88/06* (2009.01)  
*H04W 16/18* (2009.01)

2013/0301547 A1\* 11/2013 Gupta ..... H04W 76/048  
 370/329  
 2014/0010192 A1 1/2014 Chang et al.

OTHER PUBLICATIONS

- (52) **U.S. Cl.**  
 CPC ..... *H04L 12/6418* (2013.01); *H04W 4/02*  
 (2013.01); *H04W 28/0252* (2013.01); *H04W*  
*72/0433* (2013.01); *H04W 72/0453* (2013.01);  
*H04W 16/18* (2013.01); *H04W 84/12*  
 (2013.01); *H04W 88/06* (2013.01)

3GPP TSG RAN WG2 Meeting #81bis—R2-131529: Impacts of Splitting a Single EPS Bearer between Two (or more) eNBs; Agenda Item 7.2; Apr. 15 to Apr. 19, 2013; Chicago, USA.

3GPP TSG RAN 2G2 Meeting #81bis—R2-131350: Discussion on protocol architecture comparison for dual connectivity; Agenda Item 7.2; Apr. 15 to Apr. 19, 2013; Chicago USA.

3GPP TSG-RAN WG2 Meeting #81bis—R2-131174: Protocol architecture for dual connectivity; Agenda Item 7.2; Apr. 15 to Apr. 19, 2013; Chicago, USA.

- (58) **Field of Classification Search**  
 CPC ... H04W 72/0453; G01C 21/005; G01S 19/12  
 See application file for complete search history.

3GPP TWG-RAN WG2 Meeting #81bis—R2-131164: Study of Solutions and Radio Protocol Architecture for Dual-Connectivity; Agenda Item 7.2; Apr. 15 to Apr. 19, 2013; Chicago USA.

Office Action dated Sep. 18, 2017, in European Patent Application No. 13884528.4, filed Dec. 13, 2013; 10 pages.

- (56) **References Cited**

U.S. PATENT DOCUMENTS

2013/0083783 A1 4/2013 Gupta et al.

\* cited by examiner

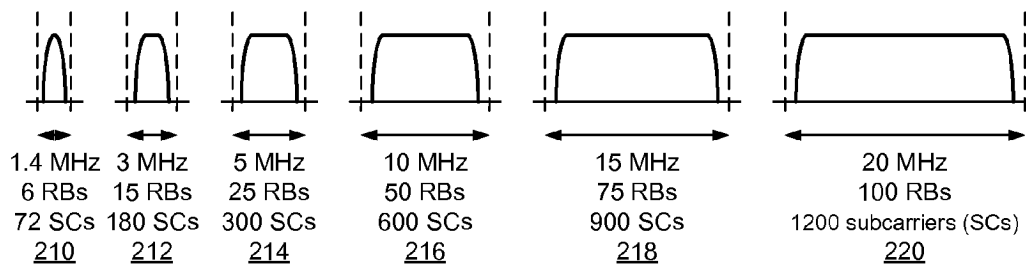


FIG. 1

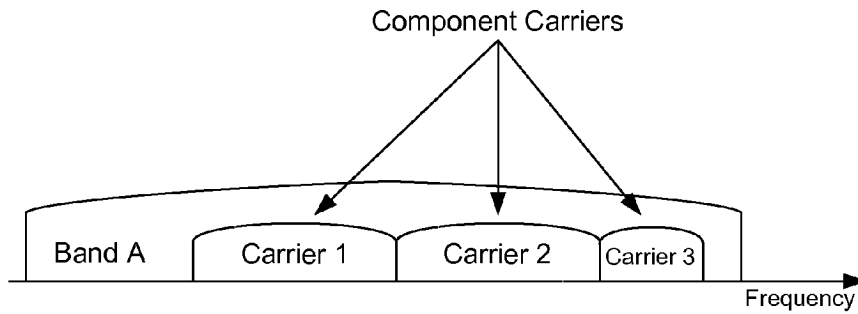


FIG. 2A

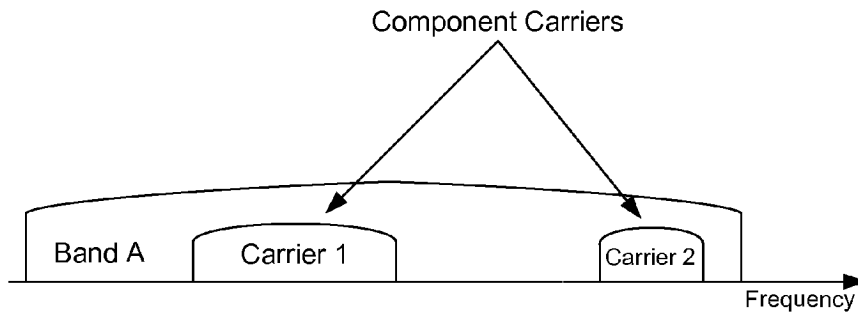


FIG. 2B

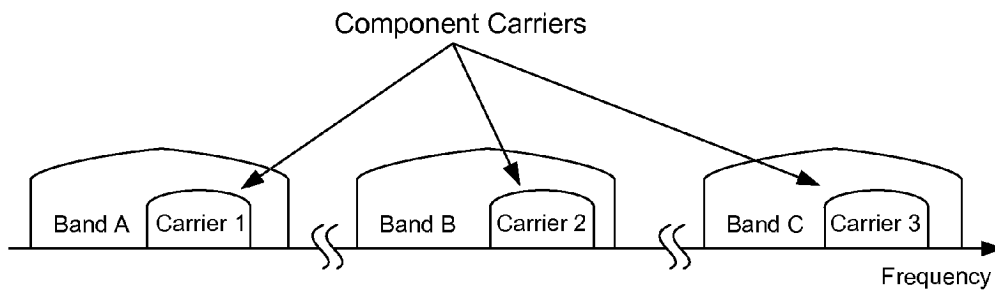


FIG. 2C

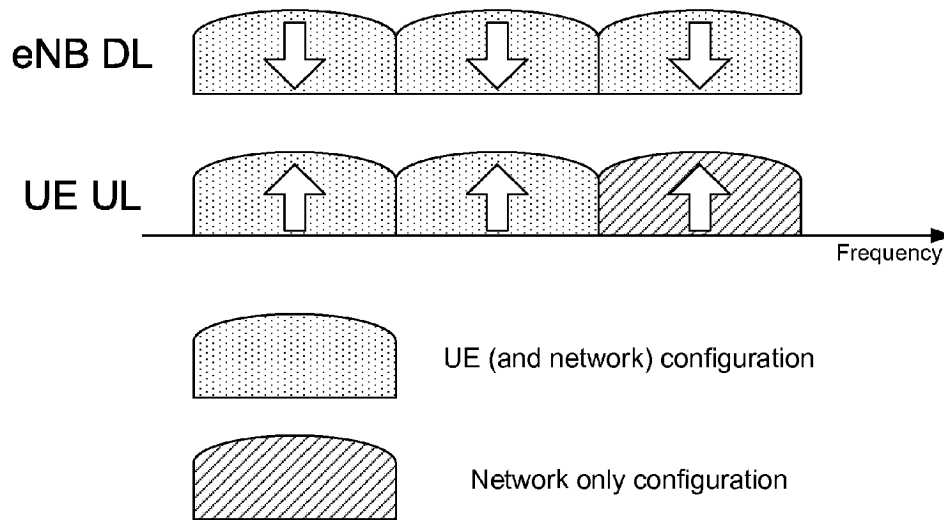


FIG. 3A

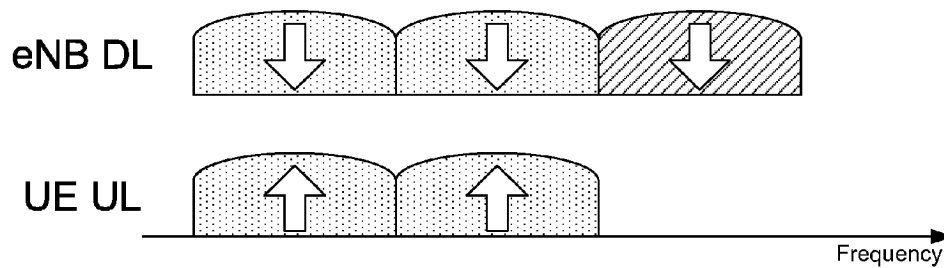


FIG. 3B

# 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.