

# *Exhibit 5*



US010447450B2

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

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(54) **METHOD AND SYSTEM FOR  
MULTI-CARRIER PACKET  
COMMUNICATION WITH REDUCED  
OVERHEAD**

**H04L 1/00** (2006.01)

**H04W 72/04** (2009.01)

**H04J 11/00** (2006.01)

**H04W 52/14** (2009.01)

(71) Applicant: **Neocific, Inc.**, Bellevue, WA (US)

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

CPC ..... **H04L 5/0053** (2013.01); **H04J 11/005**

(2013.01); **H04L 1/0003** (2013.01); **H04L**

**1/0009** (2013.01); **H04L 1/0029** (2013.01);

**H04L 5/006** (2013.01); **H04L 5/0007**

(2013.01); **H04L 5/0044** (2013.01); **H04L**

**27/2601** (2013.01); **H04W 52/146** (2013.01);

**H04W 72/04** (2013.01); **H04W 72/048**

(2013.01); **H04L 5/0094** (2013.01)

(72) Inventors: **Xiaodong Li**, Kirkland, WA (US);  
**Haiming Huang**, Bellevue, WA (US);  
**Titus Lo**, Bellevue, WA (US); **Ruifeng**  
**Wang**, Sammamish, WA (US)

(73) Assignee: **Neocific, Inc.**, Bellevue, WA (US)

(58) **Field of Classification Search**

CPC ..... **H04L 5/0053**; **H04L 1/0003**; **H04J 11/005**

See application file for complete search history.

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-  
claimer.

*Primary Examiner* — Chandradas B Patel

(74) *Attorney, Agent, or Firm* — Perkins Coie LLP

(21) Appl. No.: **15/676,421**

(57)

**ABSTRACT**

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A method and system for minimizing the control overhead in a multi-carrier wireless communication network that utilizes a time-frequency resource is disclosed. In some embodiments, one or more zones in the time-frequency resource are designated for particular applications, such as a zone dedicated for voice-over-IP (VoIP) applications. By grouping applications of a similar type together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a portion of the time-frequency resource can be achieved. In some embodiments, modular coding schemes associated with the packet streams may be selected that further reduce the amount of necessary control information. In some embodiments, packets may be classified for transmission in accordance with application type, QoS parameters, and other properties. In some embodiments, improved control messages may be constructed to facilitate the control process and minimize associated overhead.

(65) **Prior Publication Data**

US 2018/0183558 A1 Jun. 28, 2018

**Related U.S. Application Data**

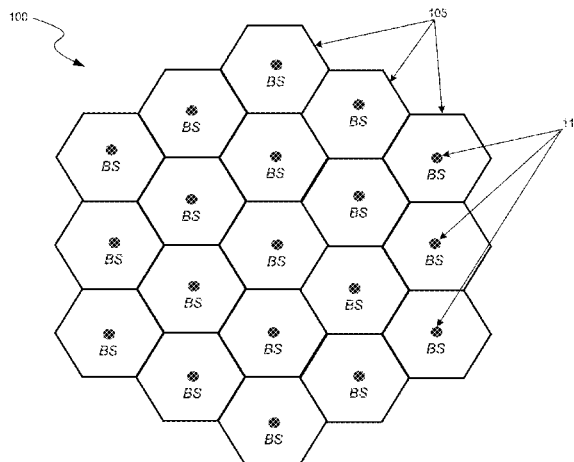
(63) Continuation of application No. 14/720,554, filed on  
May 22, 2015, now Pat. No. 9,735,944, which is a  
continuation of application No. 14/248,243, filed on  
Apr. 8, 2014, now Pat. No. 9,042,337, which is a  
continuation of application No. 13/115,055, filed on  
May 24, 2011, now Pat. No. 8,693,430, which is a  
continuation of application No. 11/908,257, filed as  
(Continued)

(51) **Int. Cl.**

**H04L 5/00** (2006.01)

**H04L 27/26** (2006.01)

**18 Claims, 12 Drawing Sheets**



**Related U.S. Application Data**

application No. PCT/US2006/038149 on Sep. 28, 2006, now Pat. No. 7,948,944.

- (60) Provisional application No. 60/721,451, filed on Sep. 28, 2005.

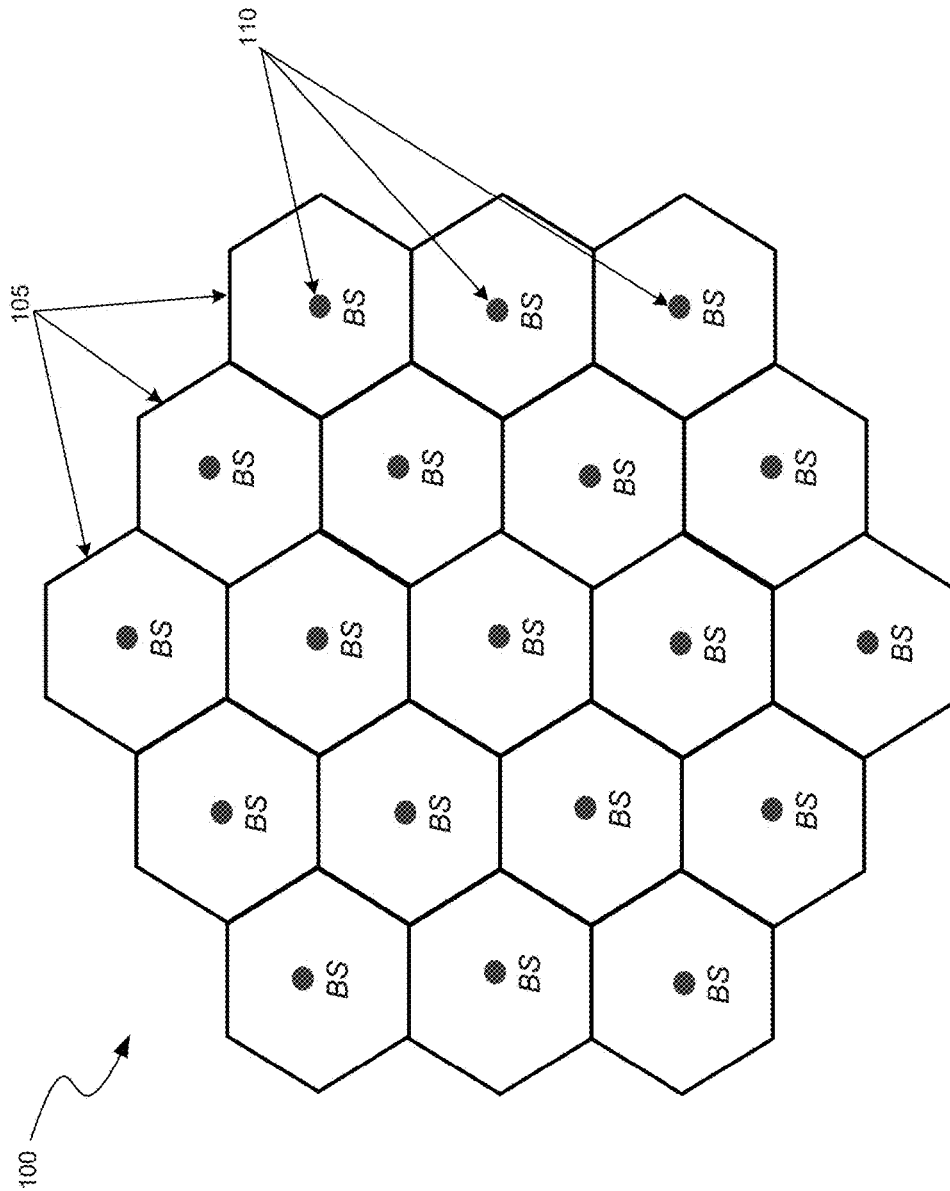


FIG. 1

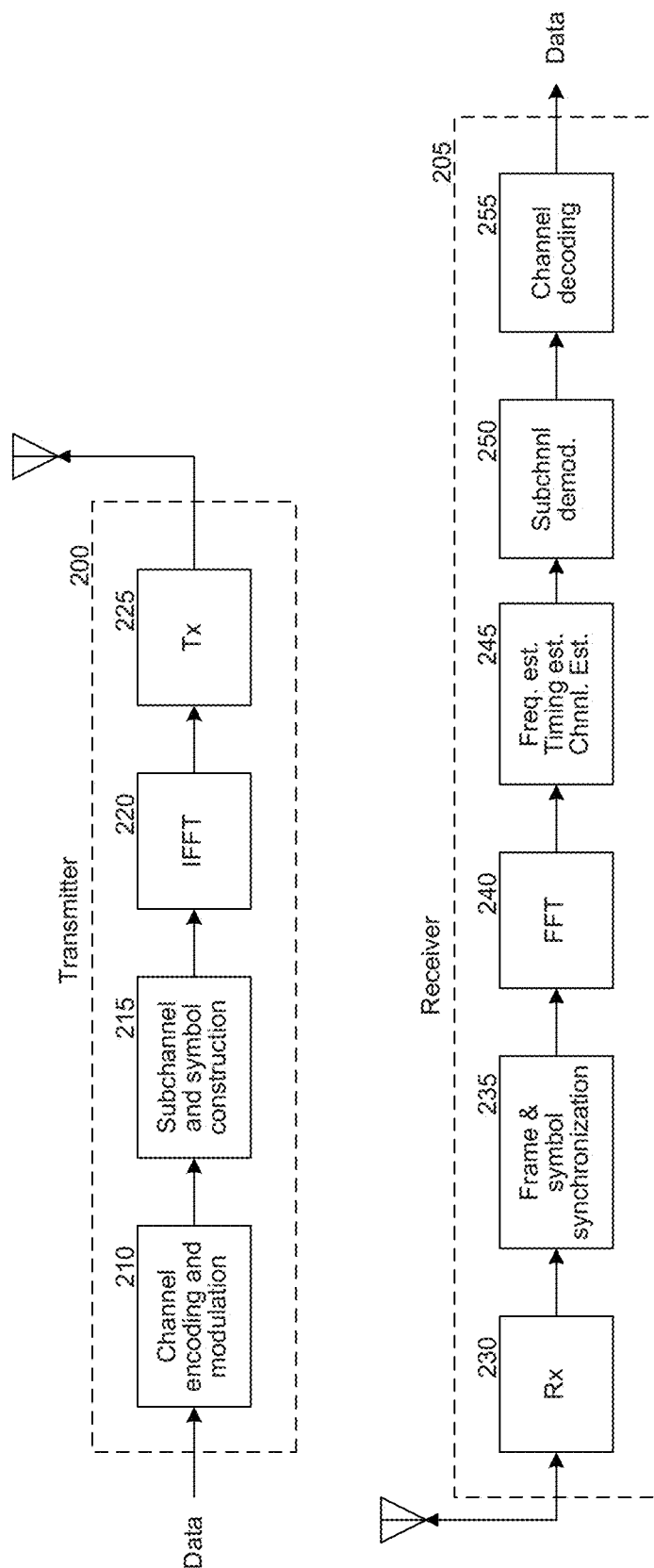


FIG. 2

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