

# *Exhibit 5*



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

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(54) **METHOD AND APPARATUS USING CELL-SPECIFIC AND COMMON PILOT SUBCARRIERS IN MULTI-CARRIER, MULTI CELL WIRELESS COMMUNICATION NETWORKS**

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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 0 days.

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(65) **Prior Publication Data**

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**Related U.S. Application Data**

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(51) **Int. Cl.**  
**H04W 4/00** (2018.01)  
**H04L 27/26** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... **H04L 27/2637** (2013.01); **H04B 1/707** (2013.01); **H04B 7/0413** (2013.01);  
(Continued)

(58) **Field of Classification Search**  
CPC .... H04L 5/0053; H04L 5/0007; H04L 5/0048  
See application file for complete search history.

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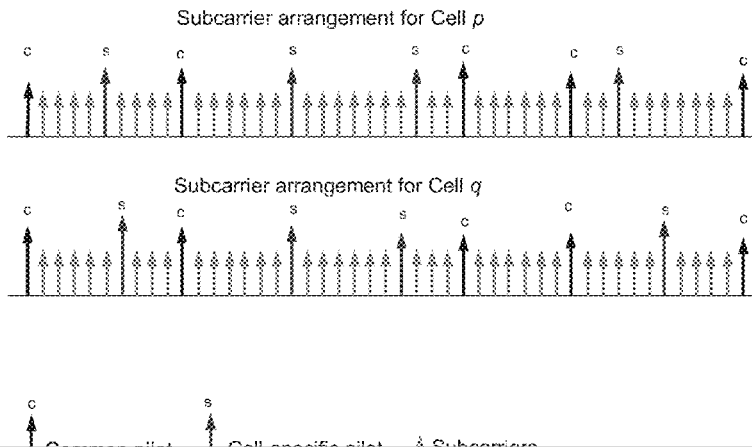
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(57) **ABSTRACT**

A multi-carrier cellular wireless network (400) employs base stations (404) that transmit two different groups of pilot subcarriers: (1) cell-specific pilot subcarriers, which are used by a receiver to extract information unique to each individual cell (402), and (2) common pilots subcarriers, which are designed to possess a set of characteristics common to all the base stations (404) of the system. The design criteria and transmission formats of the cell-specific and common pilot subcarriers are specified to enable a receiver to perform different system functions. The methods and processes can be extended to other systems, such as those with multiple antennas in an individual sector and those where some subcarriers bear common network/system information.

**30 Claims, 13 Drawing Sheets**



**Related U.S. Application Data**

No. 15/688,441, filed on Aug. 28, 2017, now Pat. No. 10,326,631, which is a continuation of application No. 14/746,676, filed on Jun. 22, 2015, now Pat. No. 9,749,168, which is a continuation of application No. 14/595,132, filed on Jan. 12, 2015, now Pat. No. 9,065,614, which is a continuation of application No. 13/874,278, filed on Apr. 30, 2013, now Pat. No. 8,934,473, which is a continuation of application No. 13/212,116, filed on Aug. 17, 2011, now Pat. No. 8,432,891, which is a continuation of application No. 10/583,530, filed as application No. PCT/US2005/001939 on Jan. 20, 2005, now Pat. No. 8,009,660.

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**H04W 72/04** (2009.01)  
**H04B 7/0413** (2017.01)  
**H04J 11/00** (2006.01)  
**H04L 25/02** (2006.01)

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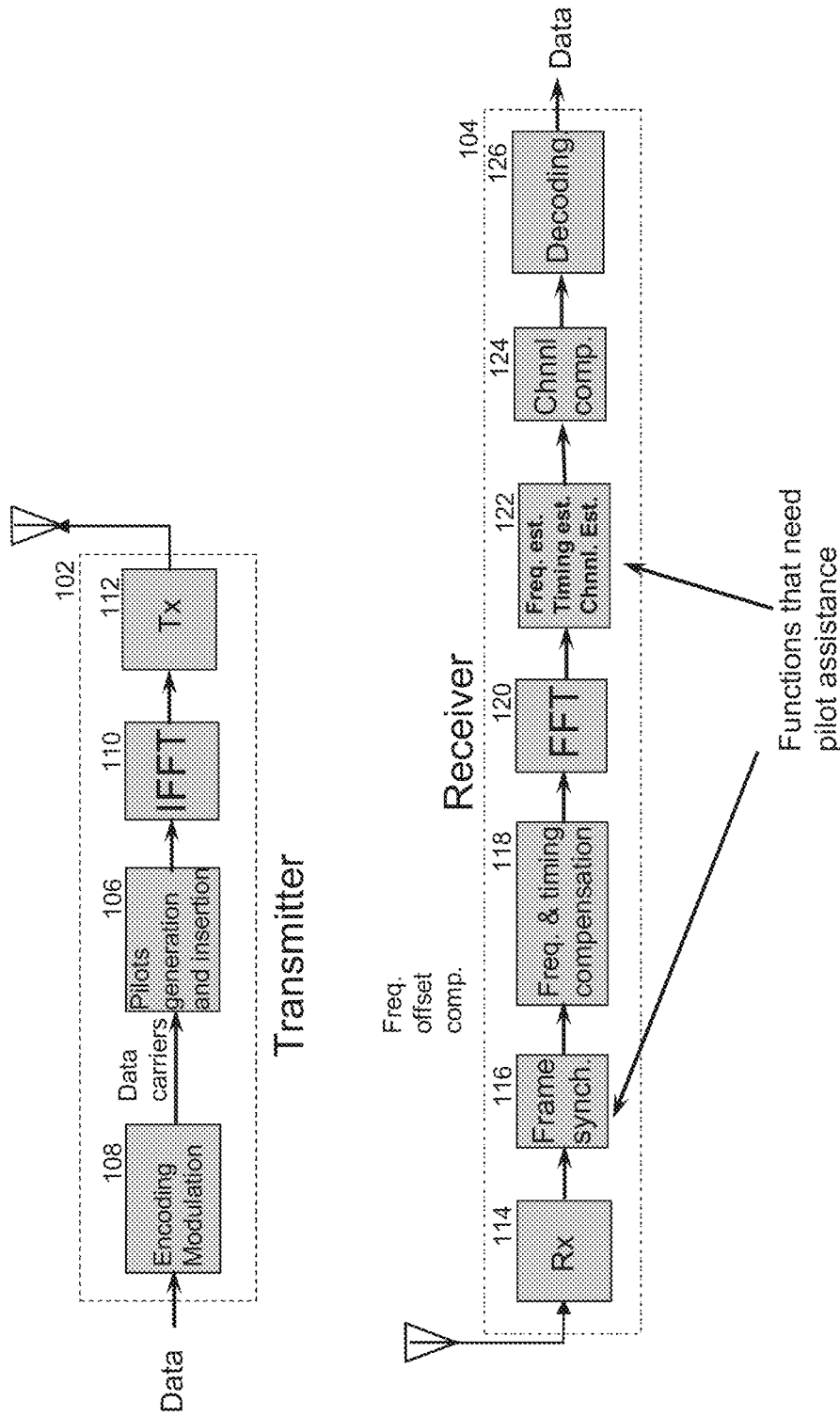


FIG. 1

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