

Exhibit 6



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

(10) **Patent No.:** **US 10,771,302 B2**
(45) **Date of Patent:** ***Sep. 8, 2020**

(54) **CHANNEL PROBING SIGNAL FOR A BROADBAND COMMUNICATION SYSTEM**

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(73) Assignee: **Neo Wireless LLC**, Wayne, PA (US)

(*) 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 disclaimer.

(21) Appl. No.: **15/953,950**

(22) Filed: **Apr. 16, 2018**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 14/321,615, filed on Jul. 1, 2014, now Pat. No. 9,948,488, which is a (Continued)

(51) **Int. Cl.**
H04L 12/26 (2006.01)
H04L 27/26 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **H04L 27/2626** (2013.01); **H04B 1/707** (2013.01); **H04B 1/711** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H04L 12/26
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,909,436 A 6/1999 Engstrom et al.
6,771,706 B2 8/2004 Ling et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CN 1407745 A 4/2003
CN 1445949 A 10/2003
(Continued)

OTHER PUBLICATIONS

Extended European Search Report received for counterpart European Patent Application No. 18196596.3, dated Feb. 20, 2019 (8 pages).

(Continued)

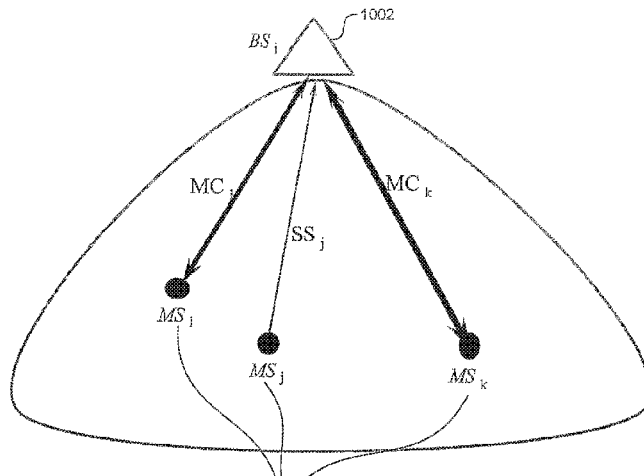
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(57) **ABSTRACT**

In a broadband wireless communication system, a spread spectrum signal is intentionally overlapped with an OFDM signal, in a time domain, a frequency domain, or both. The OFDM signal, which inherently has a high spectral efficiency, is used for carrying broadband data or control information. The spread spectrum signal, which is designed to have a high spread gain for overcoming severe interference, is used for facilitating system functions such as initial random access, channel probing, or short messaging. Methods and techniques are devised to ensure that the mutual interference between the overlapped signals is minimized to have insignificant impact on either signal and that both signals are detectable with expected performance by a receiver.

36 Claims, 18 Drawing Sheets



Related U.S. Application Data

continuation of application No. 13/861,942, filed on Apr. 12, 2013, now Pat. No. 8,767,522, which is a continuation of application No. 13/347,644, filed on Jan. 10, 2012, now Pat. No. 8,428,009, which is a continuation of application No. 12/975,226, filed on Dec. 21, 2010, now Pat. No. 8,094,611, which is a continuation of application No. 10/583,229, filed as application No. PCT/US2005/003518 on Jan. 27, 2005, now Pat. No. 7,864,725.

(60) Provisional application No. 60/540,586, filed on Jan. 30, 2004, provisional application No. 60/540,032, filed on Jan. 29, 2004.

(51) **Int. Cl.**

H04L 5/00 (2006.01)
H04L 25/03 (2006.01)
H04L 27/00 (2006.01)
H04B 1/707 (2011.01)
H04B 1/711 (2011.01)
H04L 25/02 (2006.01)

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

CPC **H04L 5/0007** (2013.01); **H04L 5/0028** (2013.01); **H04L 25/03834** (2013.01); **H04L 27/0008** (2013.01); **H04L 27/0012** (2013.01); **H04L 27/2602** (2013.01); **H04L 27/2647** (2013.01); **H04L 5/0016** (2013.01); **H04L 25/0228** (2013.01); **H04L 27/2607** (2013.01); **H04L 27/2655** (2013.01)

(58) **Field of Classification Search**

USPC 370/241, 252, 310, 328, 330, 464, 532
 See application file for complete search history.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,274,652	B1	9/2007	Webster et al.	
7,873,009	B2*	1/2011	Larsson	H04W 28/18 370/330
8,102,832	B2*	1/2012	Agrawal	H04B 1/713 370/342
8,363,691	B2*	1/2013	Hasegawa	H04B 1/707 370/335
2001/0021182	A1	9/2001	Wakutsu	
2002/0159422	A1	10/2002	Li et al.	
2003/0072255	A1	4/2003	Ma et al.	
2003/0179776	A1	9/2003	Sumasu et al.	
2004/0085946	A1	5/2004	Morita et al.	
2004/0171357	A1	9/2004	Lobinger et al.	
2004/0264600	A1	12/2004	Kao et al.	
2006/0114815	A1	6/2006	Hasegawa et al.	
2006/0245409	A1	11/2006	Korpela et al.	
2008/0304551	A1	12/2008	Li et al.	
2011/0211617	A1	9/2011	Li et al.	
2011/0299474	A1	12/2011	Li et al.	
2012/0106513	A1	5/2012	Li et al.	

FOREIGN PATENT DOCUMENTS

CN	1452326	10/2003
WO	2003058881 A2	7/2003

OTHER PUBLICATIONS

European Telecommunications Standards Institute, Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television, ETSI EN 300 744 V1.5.1 (Jun. 2004).

IEEE Standard for Local and metropolitan area networks; Part 16: Air Interface for Fixed Broadband Wireless Access Systems—Amendment 2: Medium Access Control Modifications and Additional Physical Layer Specifications for 2-11 GHz, IEEE Std. 802.16a-2003 (Apr. 1, 2003).

* cited by examiner

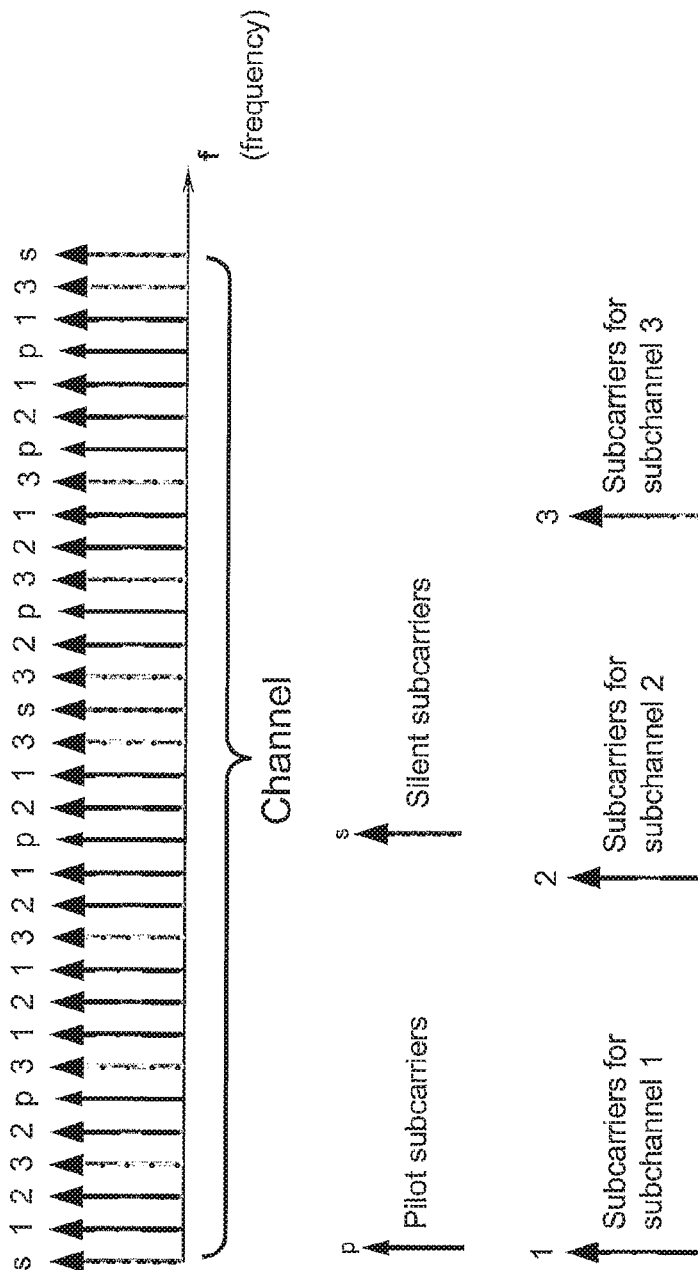


FIG. 1

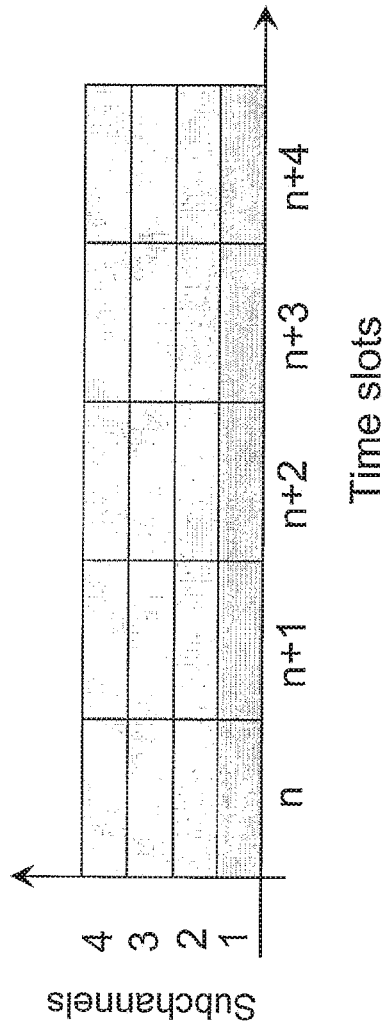


FIG. 2

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