(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 February 2008 (21.02.2008)

PCT

(10) International Publication Number
WO 2008/022235 A1

(51) **International Patent Classification:**
***H04L** 27/26* (2006 01)

(21) **International Application Number:**
PCT/US2007/076065

(22) International Filing Date: 16 August 2007 (16 08 2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/464,857 16 August 2006 (16 08 2006) US

(71) **Applicant** *(for all designated States except US):* **HARRIS CORPORATION** [US/US], 1025 W NASA Blvd , MS A-I ll, Melbourne, Floπda 32919 (US)

(72) Inventor: MOFFATT, Christopher D., 1621 Alpha St NE, Palm Bay, Florida 32907 (US)

(74) Agents: YATSKO, Michael S. et al , Harris Corporation, 1025 W NASA Blvd , MS A-I II, Melbourne, Florida 32919 (US)

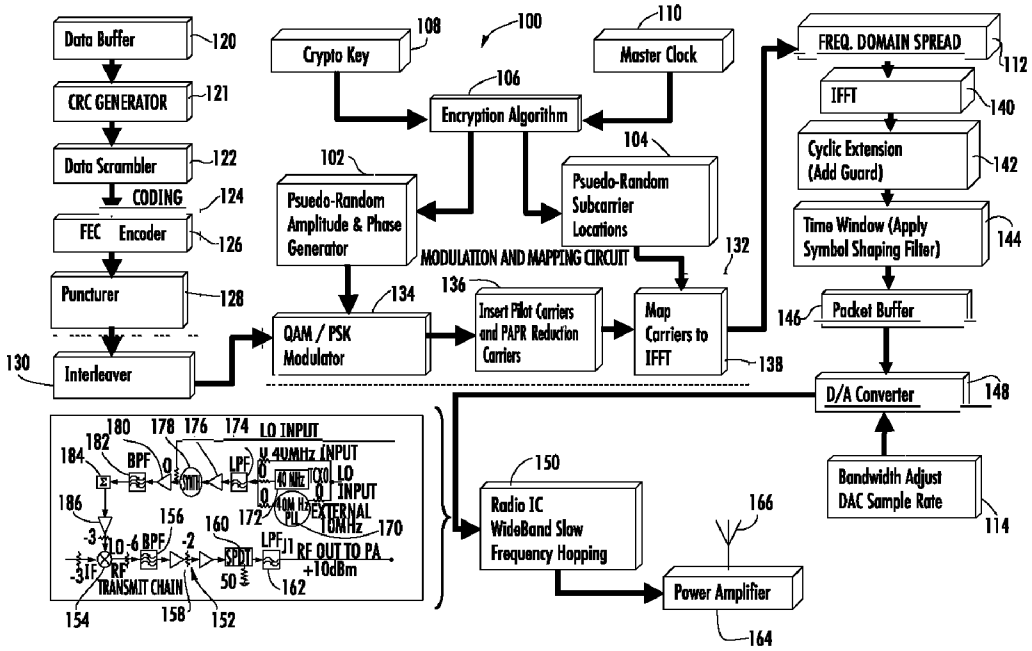
(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, **ID,** IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* **ARIPO** (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, **BJ,** CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:
— *with international search report*
— *with amended claims*

Date of publication of the amended claims: 3 Apπl 2008

(54) Title: SYSTEM AND METHOD FOR APPLYING FREQUENCY DOMAIN SPREADING TO MULTI-CARRIER COMMUNICATIONS SIGNALS



(57) **Abstract:** A system and device communicates data A modulation and mapping circuit modulates and maps data symbols into a plurality of multiple subcarπers that are orthogonal to each other based on a fixed or variable symbol rate A frequency domain spreader circuit is operatively connected to the modulation and mapping circuit and spreads the multiple subcarπers over the frequency domain

WO 2008/022235 A1

received by the International Bureau on 08 February 2008 (08.02.08)

CLAIMS

1. A device for communicating data, comprising:

a modulation and mapping circuit that modulates and maps data symbols into a plurality of multiple subcarriers that are orthogonal to each other based on a fixed or variable symbol rate and comprising a modulator circuit, a circuit for inserting pilot and Peak-to-Average Power Ratio (PAPR) carriers, and a subcarrier mapper circuit for mapping carriers to an Inverse Fast Fourier Transform (IFFT) in a matrix operation to form an Orthogonal Frequency Division Multiplexed (OFDM) communications signal based on a fixed or variable OFDM symbol rate; and

a frequency domain spreader circuit operatively connected to said modulation and mapping circuit for spreading the multiple subcarriers over the frequency domain.

2. The device according to Claim 1, wherein said frequency domain spreader circuit comprises a Walsh Transform circuit that is operative for applying a Walsh Transform for spreading said multiple subcarriers over the frequency domain.

3. The device according to Claim 2, wherein said Walsh Transform circuit is operative for multiplying an input vector of a symbol by the Walsh Transform.

4. The device according to Claim 1, and further comprising an Inverse Fast Courier Transform (IFFT) circuit positioned to receive signals from said frequency domain spreader circuit and applying the Inverse fast Fourier Transform (IFFT) for modulating multiple subcarriers orthogonal to each other.

5. The device according to Claim 1, wherein said modulator circuit is operative for mapping communications data into modulated symbols based on a specific mapping algorithm.

6. A method for communicating data, which comprises:

distributing communications data over multiple subcarriers that are orthogonal to each other based on a fixed or variable symbol rate by modulating communications data, inserting pilot and Peak-to-Average Power Ratio (PAPR) carriers, and mapping carriers to an Inverse Fast Fourier Transform (IFFT) in a matrix operation while forming an Orthogonal Frequency Division Multiplexed (OFDM) communications signal;

applying a frequency domain spreading function to spread the subcarriers over the frequency domain; and

transmitting the communications data over a communications signal that includes the subcarriers.

7. The method according fo Claim 6, which further comprises modulating a main carrier signal on which the multiple subcarrier frequencies are transmitted.

8. The method according to Claim 6, which further comprises generating pseudo random noise codes to said subcarriers for spreading said subcarriers over the frequency domain as a Walsh transform.

9. The method according to Claim 8, which further comprises multiplying an input vector of a symbol by the Walsh transform.