

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
13 February 2003 (13.02.2003)

PCT

(10) International Publication Number  
**WO 2003/013088 A3**

(51) International Patent Classification<sup>7</sup>: **H04L 25/03**,  
H04B 1/707, H04L 7/02

Ivan Jesus Fernandez; 1134 Felspar Street, Apt. 2, San Diego, CA 92109 (US). **SMEE, John E.**; 5220 Fiore Terrace, Apt. M212, San Diego, CA 92122 (US).

(21) International Application Number:  
PCT/US2002/024417

(74) Agents: **WADSWORTH, Philip R.** et al.; QUALCOMM Incorporated, 5775 Morehouse Drive, San Diego, CA 92121 (US).

(22) International Filing Date: 31 July 2002 (31.07.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
09/921,513 1 August 2001 (01.08.2001) US

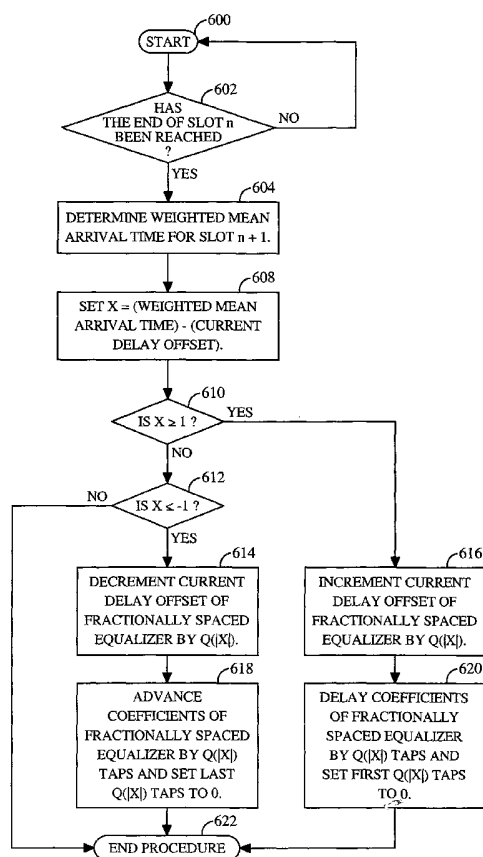
(71) Applicant: **QUALCOMM INCORPORATED** [US/US];  
5775 Morehouse Drive, San Diego, CA 92121 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: JOINT SYNCHRONIZATION AND MODIFICATION OF THE COEFFICIENTS OF AN ADAPTIVE EQUALIZER FOR A CDMA RECEIVER



(57) Abstract: A method is disclosed for joint synchronization and modification of the coefficients of an adaptive linear equalizer (350) operating at chip-rate or higher in a CDMA system. A tracking module (340) estimates from the timing position and received energies of the Rake fingers the barycenter of the channel impulse response. This value is used to determine a delay offset at which the data is read out from the input buffer (310). If the delay offset has increased one chip (less delay) compared to the previous time slot, the equalizer coefficients of the adaptive equalizer are shifted to the right (more delay) compared to the previous time slot, the equalizer coefficients of the adaptive equalizer are shifted to the left (less delay). In this way the old coefficients of the previous slot can still be used for LMS adaption and the adaption accuracy is increased.



ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK,  
TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,  
GW, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report:  
11 March 2004

**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

In **International Application No**  
**PCT/US 02/24417**

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L25/03 H04B1/707 H04L7/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 285 480 A (CHENNAKESHU SANDEEP ET AL) 8 February 1994 (1994-02-08)	1, 8, 9, 12-16, 22, 23, 25-27
Y	figure 3 column 1, line 65 column 2, line 32 column 5, line 51 - line 66 column 8, last paragraph	2-7, 10, 17-21
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\* & \* document member of the same patent family

Date of the actual completion of the international search

3 February 2003

Date of mailing of the international search report

06.03.03

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Stolte, N

## INTERNATIONAL SEARCH REPORT

Int. Patent Application No.

PCT/US 02/24417

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 177 740 A (CHENNAKESHU SANDEEP ET AL) 5 January 1993 (1993-01-05)  figure 2 column 2, paragraph 1 column 2, line 59 - line 62 column 5, line 55 - line 57 column 7, paragraph 1 column 7, line 39 - line 63 ----	1-10, 12-23, 25-27
Y	EP 1 033 823 A (HITACHI LTD) 6 September 2000 (2000-09-06) figures 4,5,8 abstract column 7, line 15 - line 24 column 9, line 13 - line 15 column 11, paragraph 39 ----	2-7,10, 17-21
Y	US 5 838 744 A (ZHENG BAOHUA) 17 November 1998 (1998-11-17) abstract column 2, line 62 -column 3, line 50 column 5, line 22 - line 60 column 6, line 64 -column 7, line 10 figures 1-3 ----	11,24
Y	US 6 175 588 B1 (FRANK COLIN D ET AL) 16 January 2001 (2001-01-16) figure 6 column 3, line 32 - line 53 column 9, line 26 - line 30 column 17, line 11,12 column 17, line 45 - line 47 column 18, line 32 - line 35 ----	11,24
A	WO 01 18985 A (NOKIA NETWORKS OY ;VIHRIAE LAE JAAKKO (FI)) 15 March 2001 (2001-03-15) figure 6 page 2, line 4 - line 7 page 3, paragraph 1 page 5, line 13 - line 14 page 13, line 2 - line 3 page 13, line 18 - line 27 page 14 -----	11,24

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 02/24417

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-10, 12-23, 25-27

The subject-matter of these claims is a method/system for synchronization and tracking. These claims are directed to the problem of avoiding jumps in the synchronisation timing. To this purpose, the time delays and signal energies of different correlator outputs, called Rake fingers, is used to determine the center of gravity of the impulse response. This value is used to determine the delay offset at which the data is read out from the input buffer.

2. Claims: 11, 24

The subject-matter of these claims is a method/system to modify of the coefficients of the equalizer if a change of the synchronization timing occurs. These claims in the field of adaptive equalization are directed to the problem that a change of the synchronization timing may render the previously adapted coefficients useless. Synchronization is carried out using the time delays of different correlators, called Rake fingers. These values are used to determine the delay offset at which the data is read out from the input buffer. A change of the delay offset is compensated by a shift of the equalizer coefficients.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

In International Application No

PCT/US 02/24417

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5285480	A	08-02-1994	CA 2076084 A1	04-03-1993
US 5177740	A	05-01-1993	CA 2076107 A1	04-03-1993
EP 1033823	A	06-09-2000	JP 2000252962 A	14-09-2000
			CN 1266343 A	13-09-2000
			EP 1033823 A1	06-09-2000
US 5838744	A	17-11-1998	NONE	
US 6175588	B1	16-01-2001	BR 9806431 A	21-12-1999
			CN 1230059 A	29-09-1999
			DE 19860094 A1	01-07-1999
			FR 2773290 A1	02-07-1999
			GB 2333422 A	21-07-1999
			JP 11266232 A	28-09-1999
			RU 2168277 C2	27-05-2001
WO 0118985	A	15-03-2001	FI 991871 A	02-03-2001
			AU 7002200 A	10-04-2001
			CN 1321367 T	07-11-2001
			EP 1127417 A1	29-08-2001
			WO 0118985 A1	15-03-2001
			NO 20012134 A	30-04-2001