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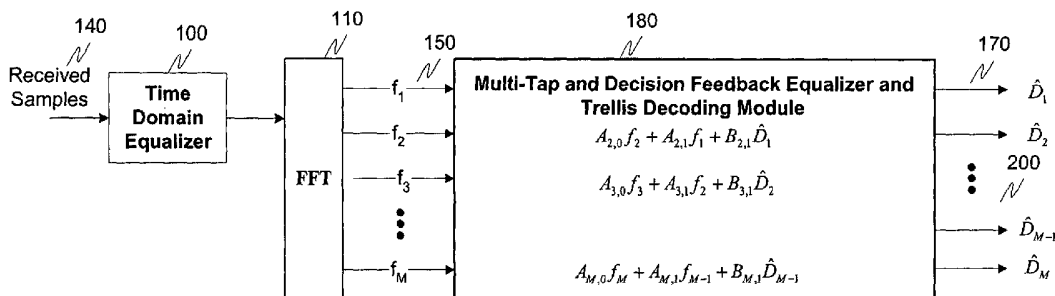
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(88) Date of publication of the international search report:
8 April 2004

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.

(54) Title: MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING



(57) Abstract: An input estimator is based on a combined MFDQ-DF and trellis for use in, for example, an ADSL environment. In particular, for an ADSL implementation, the system will have one feedback tap for the decision feedback. However, it should be appreciated that the idea and basic concept of using the structure of a trellis to aid in determining the feedback point can be extended to any system using a feedback equalizer to estimate input to a trellis decoder.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/23965

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L25/03 H04L27/26

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

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, WPI Data, IBM-TDB, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No. ...
X	US 6 356 586 B1 (KRISHNAMOORTHY RAJEEV ET AL) 12 March 2002 (2002-03-12)	1-9,16
Y	column 2, line 47 - line 54 column 4, line 23 - line 56	10-14
Y	KOPPELAAR A G C: "MATRIX EQUALIZATION FOR OFDM SYSTEMS" SYMPOSIUM ON INFORMATION THEORY IN THE BENELUX, XX, XX, 17 May 1993 (1993-05-17), pages 236-243, XP000199843 page 236, paragraph 1 page 239, paragraph 1 - paragraph [0002] page 241, section 5 ----- -/--	10-14

☒ 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

18 November 2003

Date of mailing of the international search report

06.02.04

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/23965

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	LEE S S ET AL: "TRELLIS-CODED OFDM SIGNAL DETECTION WITH MAXIMAL RATIO COMBINING AND COMBINED EQUALIZATION AND TRELLIS DECODING" IEICE TRANSACTIONS ON COMMUNICATIONS, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, JP, vol. E80-B, no. 4, 1 April 1997 (1997-04-01), pages 632-638, XP000721839 ISSN: 0916-8516 page 633, right-hand column, last paragraph - page 634, left-hand column, paragraph 1 page 635, right-hand column, last paragraph - page 636, right-hand column, paragraph 1 -----	1-14,16
A	EP 0 889 612 A (LUCENT TECHNOLOGIES INC) 7 January 1999 (1999-01-07) page 2, line 6 - line 22 page 2, line 35 - line 45 -----	1-14,16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/23965

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.: 15
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:
see FURTHER INFORMATION sheet PCT/ISA/210

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.:

1-16

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

Continuation of Box I.2

Claims Nos.: 15

The scope of protection of claim 15 cannot be determined because its subject-matter is not clear (Article 6 PCT). In particular, it is not known from the wording of the claim which kind of information is stored in the claimed information storage media, since it is purely defined by establishing that it is used by a feedback equalizer "to estimate input to a trellis decoder based at least on a structure of the trellis". This information could thus be the data needed by the equalizer, such as the received signal or alternatively information about the structure of the trellis; it could also refer to the code for performing the equalizing steps... It is therefore not possible to determine which is the information content of the information storage media. Consequently, and taking into account that the only feature provided about the claimed information storage media is precisely the information it contains, no meaningful search is possible.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-16

Frequency domain equalization to estimate input to a trellis decoder based at least on a structure of the trellis;

2. claim: 17

Branch metric definition to be used in a trellis decoder;

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/23965

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6356586	B1	12-03-2002	NONE

EP 0889612	A	07-01-1999	US 5872817 A 16-02-1999
			EP 0889612 A2 07-01-1999
			JP 3280622 B2 13-05-2002
			JP 11150481 A 02-06-1999
