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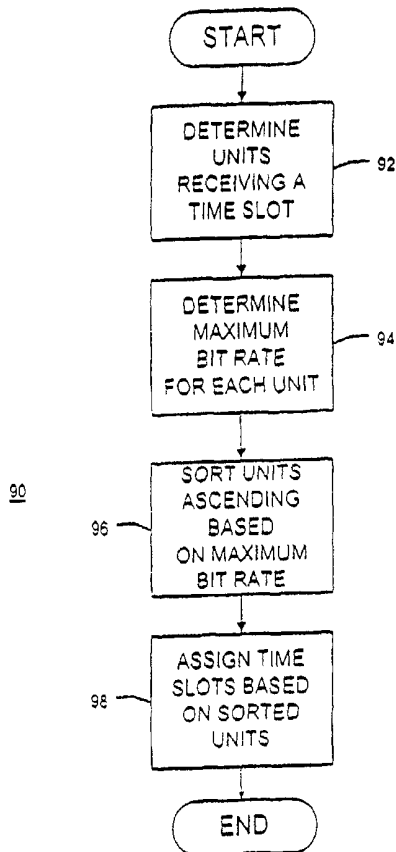
2403 Montgomery Avenue, Cardiff by the Sea, CA 92007 (US). POLLMAN, Steve; 8531 Tyler Street, Santee, CA 92071 (US). PRICE, Frederick, W.; 2528 El Gavilan Court, Carlsbad, CA 92009 (US). HADAR, Rami; 5361 Renaissance Avenue, San Diego, CA 92122 (US). ARVIV, Eli; Hemmek Aylon Street 25/4, Modi'in (IL). GAZELLE, David; Oranim Street 7.B., Givat Shmuel (IL). GILBERT, Sheldon; 12710 Monterrey Cypress, San Diego, CA 92130 (US).

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[Continued on next page]

(54) Title: IMPROVED FRAME STRUCTURE FOR AN ADAPTIVE MODULATION WIRELESS COMMUNICATION SYSTEM



(57) Abstract: A method of assigning downlink time slots to receive units where the units may generate data using different modulation schemes. The method preferably assigns the downlink time slots as a function of the complexity of modulation schemes employed by the units. Further, the method preferably assigns the time slots from the least complex modulation scheme to the most complex scheme. The method may further assign uplink time slots to transmit units where the transmit units may generate data using different modulation schemes. The method preferably assigns the uplink time slots as a function of the complexity of modulation schemes employed by the uplink units. Further, the method preferably assigns the uplink time slots from the least complex modulation scheme to the most complex scheme. In other embodiments, the downlink time slots are assigned as a function of the bit per symbol rate employed by the receive units, preferably from the lowest bit per symbol rate to the highest bit per symbol rate. Further, the uplink time slots are assigned as a function of the bit per symbol rate employed by the transmit units, preferably from the lowest bit per symbol rate to the highest bit per symbol rate. The present invention is also a method of simplifying the encoding of a predetermined number of bits of data into frames. The method adds error coding bits so that a ratio of the frame length times the baud rate of the frame times the bit packing ratio of the data divided the total bits of data is always an integer. The method may also convolutionally encode the bits of data so that the same equation is also always an integer. The present invention is also a method of updating the weights of a FIR filter where the filter processes symbols having variable modulation rates. When the modulation rate of the incoming symbols changes, the weights corresponding to the first symbol having the new modulation rate are changed based as the symbol propagates through the filter.



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model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

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# INTERNATIONAL SEARCH REPORT

Inte. onal Application No  
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 H04L1/00 H04L27/00				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
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, WPI Data				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X  Y	EP 0 891 060 A (MATSUSHITA ELECTRIC IND CO LTD) 13 January 1999 (1999-01-13) abstract  column 9, line 48 -column 10, line 51 --- -/--	1,2,10, 11,30-33 3-9, 12-18, 34-36		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.				
<input checked="" type="checkbox"/> Patent family members are listed in annex.				
° Special categories of cited documents :				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> <li>*A* document defining the general state of the art which is not considered to be of particular relevance</li> <li>*E* earlier document but published on or after the international filing date</li> <li>*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)</li> <li>*O* document referring to an oral disclosure, use, exhibition or other means</li> <li>*P* document published prior to the international filing date but later than the priority date claimed</li> </ul> </td> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> <li>*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</li> <li>*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</li> <li>*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.</li> <li>*Z* document member of the same patent family</li> </ul> </td> </tr> </table>			<ul style="list-style-type: none"> <li>*A* document defining the general state of the art which is not considered to be of particular relevance</li> <li>*E* earlier document but published on or after the international filing date</li> <li>*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)</li> <li>*O* document referring to an oral disclosure, use, exhibition or other means</li> <li>*P* document published prior to the international filing date but later than the priority date claimed</li> </ul>	<ul style="list-style-type: none"> <li>*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</li> <li>*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</li> <li>*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.</li> <li>*Z* document member of the same patent family</li> </ul>
<ul style="list-style-type: none"> <li>*A* document defining the general state of the art which is not considered to be of particular relevance</li> <li>*E* earlier document but published on or after the international filing date</li> <li>*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)</li> <li>*O* document referring to an oral disclosure, use, exhibition or other means</li> <li>*P* document published prior to the international filing date but later than the priority date claimed</li> </ul>	<ul style="list-style-type: none"> <li>*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</li> <li>*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</li> <li>*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.</li> <li>*Z* document member of the same patent family</li> </ul>			
Date of the actual completion of the international search  <h2 style="text-align: center;">5 January 2001</h2>	Date of mailing of the international search report  <h2 style="text-align: center;">05. 04. 2001</h2>			
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  <h2 style="text-align: center;">PIEPER, T</h2>			

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International Application No  
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>SAMPEI S ET AL: "ADAPTIVE MODULATION/TDMA SCHEME FOR PERSONAL MULTI-MEDIA COMMUNICATION SYSTEMS" PROCEEDINGS OF THE GLOBAL TELECOMMUNICATIONS CONFERENCE (GLOBECOM),US,NEW YORK, IEEE, 28 November 1994 (1994-11-28), pages 989-993, XP000488685 ISBN: 0-7803-1821-8 page 989, left-hand column, last paragraph -right-hand column, paragraph 1 page 990, left-hand column, paragraph 1 -right-hand column, paragraph 1; figures 1,2</p>	<p>3-9, 12-18, 34-36</p>
A	<p>TOYOKI UE ET AL: "SYMBOL RATE AND MODULATION LEVEL CONTROLLED ADAPTIVE MODULATION/TDMA/TDD FOR PERSONAL COMMUNICATION SYSTEMS" PROCEEDINGS OF THE VEHICULAR TECHNOLOGY CONFERENCE,US,NEW YORK, IEEE, vol. CONF. 45, 25 July 1995 (1995-07-25), pages 306-310, XP000550184 ISBN: 0-7803-2743-8 abstract page 306, paragraph 3 page 306, right-hand column, last paragraph -page 307, left-hand column, paragraph 4; figure 2</p>	<p>5,14,36</p>
A	<p>EP 0 845 916 A (ERICSSON TELEFON AB L M) 3 June 1998 (1998-06-03)  page 4, line 18 - line 20; table 1 page 5, line 39 - line 53</p>	<p>2-4,6-9, 11-13, 15-18, 30-35</p>
A	<p>EP 0 507 384 A (PHILIPS ELECTRONICS UK LTD ;KONINKL PHILIPS ELECTRONICS NV (NL)) 7 October 1992 (1992-10-07) abstract page 2, line 3 - line 10 page 2, line 24 - line 39 page 3, line 1 - line 7 page 3, line 44 -page 4, line 21</p>	<p>1,5,10, 14,30,36</p>
A	<p>WO 92 22162 A (BRITISH TELECOMM) 10 December 1992 (1992-12-10) abstract; figures 1-3,7 page 5, line 16 - line 22 page 11, line 10 - line 34</p>	<p>1,5,10, 14,30,36</p>

# INTERNATIONAL SEARCH REPORT

International application No.  
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## 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.:  
  
1-18, 30.36

### 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: 1-18, 30-36

Transmission method with variable modulation

2. Claims: 19-29

Encoding method

3. Claims: 37-40

Method for setting weights in a FIR filter

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/20577

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
EP 0891060	A	13-01-1999	JP 11032096 A	02-02-1999
			JP 11041310 A	12-02-1999
			CA 2242123 A	09-01-1999
EP 0845916	A	03-06-1998	US 5983101 A	09-11-1999
EP 0507384	A	07-10-1992	AU 659140 B	11-05-1995
			AU 1399892 A	08-10-1992
			CA 2064921 A	04-10-1992
			CS 9200969 A	14-10-1992
			DE 69226114 D	13-08-1998
			DE 69226114 T	18-02-1999
			ES 2120983 T	16-11-1998
			HK 1013378 A	07-04-2000
			HU 61860 A	01-03-1993
			JP 5091079 A	09-04-1993
			SG 48070 A	17-04-1998
			US 5369637 A	29-11-1994
WO 9222162	A	10-12-1992	AT 162035 T	15-01-1998
			AU 656972 B	23-02-1995
			AU 1772492 A	08-01-1993
			CA 2110578 A	10-12-1992
			DE 69223961 D	12-02-1998
			DE 69223961 T	30-07-1998
			EP 0587620 A	23-03-1994
			ES 2112318 T	01-04-1998
			HK 1008162 A	30-04-1999
			JP 6507763 T	01-09-1994
			SG 47627 A	17-04-1998
			US 5828695 A	27-10-1998