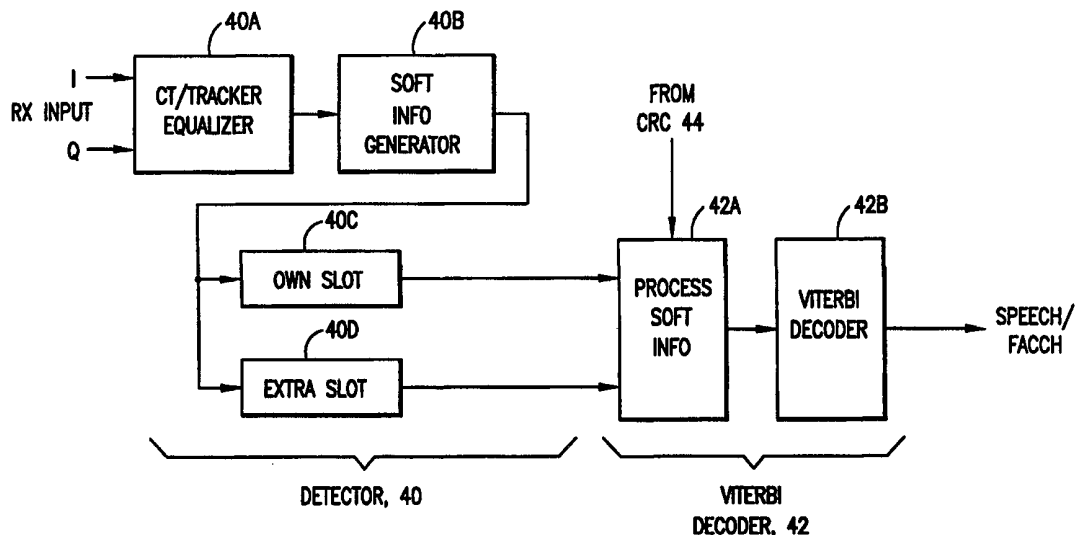




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : H04L 1/08</p>	<p>A3</p>	<p>(11) International Publication Number: WO 99/14885</p> <p>(43) International Publication Date: 25 March 1999 (25.03.99)</p>									
<p>(21) International Application Number: PCT/EP98/05908</p> <p>(22) International Filing Date: 16 September 1998 (16.09.98)</p> <p>(30) Priority Data:</p> <table border="0"> <tr> <td>60/060,707</td> <td>18 September 1997 (18.09.97)</td> <td>US</td> </tr> <tr> <td>60/088,950</td> <td>11 June 1998 (11.06.98)</td> <td>US</td> </tr> <tr> <td>09/108,446</td> <td>1 July 1998 (01.07.98)</td> <td>US</td> </tr> </table> <p>(71) Applicant (for all designated States except US): NOKIA MOBILE PHONES LIMITED [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).</p> <p>(72) Inventors; and</p> <p>(75) Inventors/Applicants (for US only): PAATELMA, Risto [FI/FI]; Kalevalantie 21 B 20, FIN-90570 Oulu (FI). BERG, Heikki [FI/FI]; Tellervontie 2 A 4, FIN-90570 Oulu (FI). KAASILA, Pekka [FI/FI]; Pihlajanmarjatie 26, FIN-90800 Oulu (FI). TUUTIJARVI, Mika [FI/FI]; Radiomastontie 7 B 16, FIN-90230 Oulu (FI). ALANARA, Seppo [FI/FI]; Rantakatu 5 A 23, FIN-90100 Oulu (FI).</p> <p>(74) Agents: FRAIN, Timothy, John et al.; Nokia IPR Department, Nokia House, Summit Avenue, Farnborough, Hampshire GU14 0NZ (GB).</p>		60/060,707	18 September 1997 (18.09.97)	US	60/088,950	11 June 1998 (11.06.98)	US	09/108,446	1 July 1998 (01.07.98)	US	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published</p> <p><i>With international search report.</i></p> <p>(88) Date of publication of the international search report: 3 June 1999 (03.06.99)</p>
60/060,707	18 September 1997 (18.09.97)	US									
60/088,950	11 June 1998 (11.06.98)	US									
09/108,446	1 July 1998 (01.07.98)	US									

(54) Title: TIME DIVERSITY IN A TDMA SYSTEM



(57) Abstract

A TDMA radiotelephone system is described wherein a base station transmits a slot and a repeat of the slot to a mobile station. The mobile station selectively receives the slots, detects soft information from each of the slots, and provides a combination of the soft information to a channel decoder, such as a Viterbi decoder, for enhancing the operation of the channel decoder. In a further aspect of this invention a method is described for operating a wireless communication system includes the steps of: (a) transmitting a time slot and a repeat of the time slot to a channel; (b) receiving the time slot and the repeat of the time slot with a diversity receiver; (c) processing the received time slot and the repeat of the time slot with a first channel estimator and with a second channel estimator, respectively; and (d) performing a joint detection in accordance with a technique that minimizes a metric.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/05908

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L1/08

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 6 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KONDO Y ET AL: "ADAPTIVE TIME DIVERSITY FOR TDMA/TDD PERSONAL COMMUNICATION SYSTEMS" 1995 FOURTH IEEE INTERNATIONAL CONFERENCE ON UNIVERSAL PERSONAL COMMUNICATIONS RECORD, GATEWAY TO THE 21ST. CENTURY TOKYO, NOV. 6 - 10, 1995, no. CONF. 4, 6 November 1995, pages 973-976, XP000690097 IEEE, New York, US see abstract	1-4, 6, 7, 10-14, 26-30, 32, 34
Y	see page 973, paragraph II see table 1 see figures 1-3 --- -/--	8, 9

☒ 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

15 March 1999

Date of mailing of the international search report

29/03/1999

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

Toumpoulidis, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/05908

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AN S H: "A NEW SOFT METRIC FOR FH/DPSK SYSTEMS WITH CODING AND DIVERSITY IN THE PRESENCE OF PARTIAL-BAND NOISE JAMMING" MILITARY COMMUNICATIONS IN A CHANGING WORLD, MCLEAN, VA., NOV. 4 - 7, 1991, vol. 2, 1 January 1991, pages 586-590, XP000273785 IEEE, New York, US see abstract	1,12-14, 26,31,32
A	see paragraph I see paragraph II see figure 1	5
X	US 5 481 572 A (SKOELD JOHAN ET AL) 2 January 1996 see abstract see column 2, line 49 - column 3, line 17	15, 17-20, 22-25,33
A	see figure 7 see claim 1	16,21
Y	EP 0 381 949 A (SIEMENS AG) 16 August 1990 see abstract	8,9
Y	US 5 614 914 A (BOLGIANO D RIDGELY ET AL) 25 March 1997 see abstract see column 6, line 18 - line 27	9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 98/05908

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5481572	A	02-01-1996	NONE		
EP 0381949	A	16-08-1990	US	5155744 A	13-10-1992
US 5614914	A	25-03-1997	AU	4462096 A	29-03-1996
			EP	0779991 A	25-06-1997
			FI	970955 A	14-04-1997
			JP	10509287 T	08-09-1998
			WO	9608908 A	21-03-1996
			US	5663990 A	02-09-1997
			US	5859879 A	12-01-1999