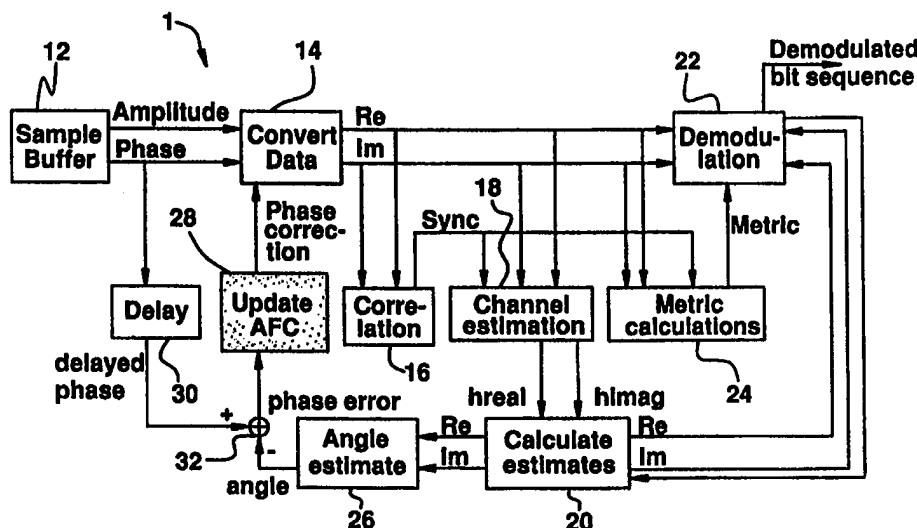




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/22, G01S 11/10	A3	(11) International Publication Number: WO 98/24251 (43) International Publication Date: 4 June 1998 (04.06.98)
(21) International Application Number: PCT/SE97/01993 (22) International Filing Date: 27 November 1997 (27.11.97) (30) Priority Data: 08/757,517 27 November 1996 (27.11.96) US (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventors: ERICSSON, Linus; Alliansvägen 32, S-187 63 Täby (SE). BJÖRK, Peter; Rosersbergsvägen 30, S-195 71 Rosersberg (SE). (74) Agent: TELEFONAKTIEBOLAGET LM ERICSSON; Patent och Trademark Dept., S-126 25 Stockholm (SE).		(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, 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, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims</i> <i>and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 13 August 1998 (13.08.98)

(54) Title: METHOD FOR ESTIMATING SPEED OF A MOBILE STATION IN A CELLULAR COMMUNICATIONS SYSTEM

**(57) Abstract**

A method is provided for accurately estimating the speed of mobile stations in a cellular communications system. Taking into account the Doppler shift of the information in a received burst, a frequency offset value is calculated for each received burst. For each burst, a signal quality value is calculated, which is compared with a predetermined signal quality threshold level. The absolute value of each of the frequency offset values whose signal quality value meets or exceeds the predetermined signal quality threshold is obtained. The frequency offset values whose signal quality values do not meet the threshold level are disregarded. The total mean of all of the absolute frequency offset values is then calculated. The total mean value is used to accurately estimate the speed of the mobile station. Consequently, the speed of faster and slower mobile stations can be readily distinguished, and a hierarchical cell structure can be effectively used to increase capacity and reduce handovers in a cellular communications system.

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			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon	KR	Republic of Korea	PL	Poland		
CN	China	KZ	Kazakstan	PT	Portugal		
CU	Cuba	LC	Saint Lucia	RO	Romania		
CZ	Czech Republic	LI	Liechtenstein	RU	Russian Federation		
DE	Germany	LK	Sri Lanka	SD	Sudan		
DK	Denmark	LR	Liberia	SE	Sweden		
EE	Estonia			SG	Singapore		

INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 97/01993

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/22 G01S11/10

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 G01S H04B H04Q

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.
Y	US 5 432 822 A (KAEWELL JR JOHN D) 11 July 1995 see column 2, line 18 - line 34 see column 4, line 26 - line 46 see column 5, line 18 - line 20; figure 2 ---	1,11-16
Y	EP 0 731 587 A (AT & T CORP) 11 September 1996 see column 4, line 18 - line 23 see column 4, line 38 - line 43 see column 12, line 29 - line 44; figures 1,7 --- -/--	1,11-16

☒ 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

19 June 1998

Date of mailing of the international search report

25/06/1998

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

Schut, G

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/SE 97/01993

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94 16512 A (PACIFIC COMMUNICATION SCIENCES) 21 July 1994 see page 12, line 35 - page 13, line 17 see page 23, line 27 - page 25, line 23 see page 28, line 7 - page 29, line 5; figures 7,19,22A ---	2,3,6,7, 10
A	EP 0 660 627 A (NOKIA MOBILE PHONES LTD) 28 June 1995 see column 3, line 32 - line 40 see column 3, line 47 - line 53 see column 5, line 15 - line 29 ---	1,11
A	US 5 136 616 A (DENT PAUL W) 4 August 1992 cited in the application see column 4, line 20 - column 5, line 9; figures 1,5 -----	8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/SE 97/01993

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5432822	A	11-07-1995	NONE		
EP 0731587	A	11-09-1996	US	5729558 A	17-03-1998
			JP	8321854 A	03-12-1996
WO 9416512	A	21-07-1994	US	5376894 A	27-12-1994
			AU	5963194 A	15-08-1994
			CA	2152781 A	21-07-1994
			EP	0746931 A	11-12-1996
			JP	8505499 T	11-06-1996
			US	5610949 A	11-03-1997
			US	5524127 A	04-06-1996
			US	5625652 A	29-04-1997
			US	5594758 A	14-01-1997
EP 0660627	A	28-06-1995	GB	2285198 A	28-06-1995
			AU	687907 B	05-03-1998
			AU	7916994 A	29-06-1995
			CN	1113643 A	20-12-1995
			JP	7212817 A	11-08-1995
US 5136616	A	04-08-1992	SE	462942 B	17-09-1990
			AU	621183 B	05-03-1992
			AU	4849990 A	24-08-1990
			CA	2007325 A,C	26-07-1990
			CN	1044560 A,B	08-08-1990
			DE	69007505 D	28-04-1994
			DE	69007505 T	30-06-1994
			DK	381636 T	25-07-1994
			EP	0381636 A	08-08-1990
			ES	2050418 T	16-05-1994
			HK	75494 A	05-08-1994
			IE	64210 B	26-07-1995
			JP	7010073 B	01-02-1995
			JP	3503828 T	22-08-1991
			KR	9600607 B	09-01-1996
			NO	301918 B	22-12-1997
			PT	92980 A,B	31-07-1990
			SE	8900281 A	26-01-1989
			WQ	9009069 A	09-08-1990

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/SE 97/01993

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5136616 A		SG 83994 G	25-11-1994