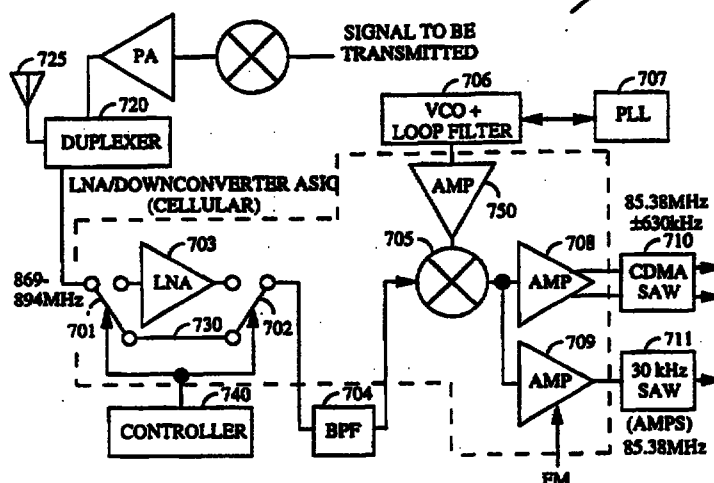




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04B 7/005		A3	(11) International Publication Number: WO 96/19048
			(43) International Publication Date: 20 June 1996 (20.06.96)
(21) International Application Number: PCT/US95/16002		(81) Designated States: AL, AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, 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), ARIPO patent (KE, LS, MW, SD, SZ, UG).	
(22) International Filing Date: 11 December 1995 (11.12.95)			
(30) Priority Data: 357,951 / 16 December 1994 (16.12.94) / US 522,467 / 31 August 1995 (31.08.95) / US			
(71) Applicant: QUALCOMM INCORPORATED [US/US]; 6455 Lusk Boulevard, San Diego, CA 92121 (US).		Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(72) Inventors: WHEATLEY, Charles, E., III; 2208 Caminito Del Barco, Del Mar, CA 92014 (US). PETERZELL, Paul, E.; 6146 Calle Mariselda #203, San Diego, CA 92124 (US). KORNFIELD, Richard, K.; 12384 Brickella Street, San Diego, CA 92129 (US). WEILAND, Ana, L.; 2042 Sheridan Road, Encinitas, CA 92024 (US).		(88) Date of publication of the international search report: 6 September 1996 (06.09.96)	
(74) Agent: MILLER, Russell, B.; Qualcomm Incorporated, 6455 Lusk Boulevard, San Diego, CA 92121 (US).			

(54) Title: METHOD AND APPARATUS FOR INCREASING RECEIVER IMMUNITY TO INTERFERENCE



(57) Abstract

The method and apparatus of the present invention improve the immunity to interference of a radio receiver. The power level of a received signal is detected. If the power level meets or exceeds a predetermined power threshold, the low noise amplifier (703) is by-passed (730), thus increasing the intercept point of the receiver components. Alternative embodiments include the use of an RF power detector (105) to control the front-end gain (110) as a function of jammer power. In lieu of a switchable RF gain block (730), several methods of continuous gain control are proposed. Continuous gain control allows the interference suppression and sensitivity of the receiver to be adjusted at lower signal levels than the switchable gain block. A method of the present invention adjusts the input gain by a predetermined amount (1601). The receiver processing measures the gain change in the IF signal power (1605). If the change is less than the predetermined amount (1610), the CDMA signal and jammers are below the noise floor and, therefore, the gain is increased (1615). If the IF signal power change is greater than the predetermined amount, the interference is evident and the gain is reduced to reduce the intermodulation products (1620). This process is used until the receiver is operating at the best compromise between interference and noise figure.

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.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LJ	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 95/16002

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04B7/005

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 H04B H03G

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 Y	EP,A,0 342 671 (ATE CORP) 23 November 1989 see column 1, line 19 - column 2, line 16 see column 2, line 50 - column 3, line 57; figures 1,2 ---	8,11,15 1,3-5,7, 9,16,17, 22
Y	EP,A,0 622 907 (NOKIA MOBILE PHONES LTD) 2 November 1994 see column 2, line 31 - line 50 see column 3, line 30 - column 4, line 51; figure 2 ---	1,3-5,7, 9,12
X Y	WO,A,91 07037 (QUALCOMM INC) 16 May 1991 see page 21, line 23 - page 23, line 25; figures 4,5 ---	12,13 16,17

	-/--	



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

A document member of the same patent family

Date of the actual completion of the international search

16 July 1996

Date of mailing of the international search report

24. 07. 96

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

Bossen, M

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 95/16002

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,A,5 093 840 (SCHILLING DONALD L) 3 March 1992 see column 4, line 41 - line 54; figures 1,2 see column 5, line 20 - line 27 -----	14

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 95/ 16002

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:

1. Claims 1-11, 15, 22-26 (See annex sheet)
 2. Claims 12-14, 16-21 (See annex 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/

1. Claims 1-11, 15, 22-26: Reducing the gain in the reception path if the power level of the received signal exceeds a predetermined threshold.
2. Claims 12-14, 16-21: Controlling the gain in the transmission path from a control signal of the receiving automatic gain control.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 95/16002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
EP-A-0342671	23-11-89	US-A-	4870372	26-09-89
		AU-B-	608198	21-03-91
		AU-B-	3491689	23-11-89
		CA-A-	1323659	26-10-93
		JP-A-	2022906	25-01-90

EP-A-0622907	02-11-94	FI-A-	931872	27-10-94

WO-A-9107037	16-05-91	US-A-	5056109	08-10-91
		AU-B-	646001	03-02-94
		AU-B-	6728390	31-05-91
		CA-A-	2072989	08-05-91
		CN-A,B	1053870	14-08-91
		CN-A-	1090107	27-07-94
		EP-A-	0500689	02-09-92
		IL-A-	96218	27-02-94
		JP-T-	4502841	21-05-92
		US-A-	5485486	16-01-96
		US-A-	5265119	23-11-93
		US-A-	5257283	26-10-93
		US-A-	5267262	30-11-93

US-A-5093840	03-03-92	CA-A-	2091783	17-05-92
		EP-A-	0515610	02-12-92
		W -A-	9209156	29-05-92
		US-A-	5299226	29-03-94
