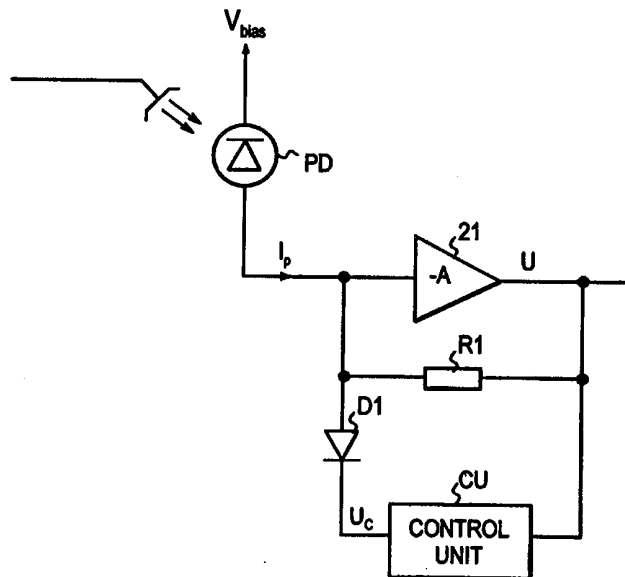




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : H04B 10/158, H03F 3/08</p>	<p>A3</p>	<p>(11) International Publication Number: WO 99/28768 (43) International Publication Date: 10 June 1999 (10.06.99)</p>
<p>(21) International Application Number: PCT/FI98/00891 (22) International Filing Date: 13 November 1998 (13.11.98) (30) Priority Data: 974224 13 November 1997 (13.11.97) FI (71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): RANTAKARI, Erkki [FI/FI]; Tunturikatu 18 C 27, FIN-00100 Helsinki (FI). (74) Agent: PATENT AGENCY COMPATENT LTD.; P.O. Box 156, FIN-00511 Helsinki (FI).</p>		<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, GD, 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 <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Finnish).</i></p> <p>(88) Date of publication of the international search report: 22 July 1999 (22.07.99)</p>

(54) Title: OPTICAL RECEIVER



(57) Abstract

The invention relates to an optical receiver comprising a transimpedance amplifier having an input and an output, a photo detector (PD) for converting the optical power arriving at the receiver, an adjustable impedance element (D1) operationally connected to the input of the transimpedance amplifier, and control means (CU) for controlling the current passing through the impedance element by adjusting the impedance of the impedance means. In order for the receiver to have a high dynamic range, the adjustable impedance element is a PIN diode and the control means comprise (a) separating means (LPU) for separating the direct voltage component from the output voltage of the transimpedance amplifier, and (b) means (VCU) for adjusting the voltage over the PIN diode directly on the basis of the separated direct voltage component.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00891

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: H04B 10/158, H03F 3/08 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)		
IPC6: H04B, H03F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI, JAPIO, NPL, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4415803 A (TRAN V. MUOI), 15 November 1983 (15.11.83), column 2, line 8 - line 31; column 3, line 34 - column 5, line 2, figures 2,3 --	1,3-6
A	US 4805236 A (REINO URALA), 14 February 1989 (14.02.89), column 5, line 1 - line 68, figure 5 --	1,3-6
A	GB 2247798 A (STC PLC), 11 March 1992 (11.03.92), figure 1, see the whole document --	1,3-6
A	EP 0433646 A2 (STANDARD ELEKTRIK LORENZ AKTIENGESELLSCHAFT), 26 June 1991 (26.06.91), page 3, line 18 - line 36, figure 1 --	1,3-6
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family 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 "I" 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		Date of mailing of the international search report
31 May 1999		02 June 1999 (02.06.99)
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Irenne Turcu/cs Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00891

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 5012202 A (STEWART S. TAYLOR), 30 April 1991 (30.04.91), column 1, line 67 - column 2, line 26; column 3, line 31 - column 4, line 39, figure 2 --	1,3-6
A	DE 4212934 A1 (ALCATEL SEL AKTIENGESELLSCHAFT), 21 October 1993 (21.10.93), see the whole document -- -----	1,3-6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI98/00891

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.: 2
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 next page.

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. 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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI98/00891

Claim 2 is a dependent claim, i.e. reference to claim 1, and refers to an optical receiver. Meanwhile, claim 1 refers to a method for controlling an optical receiver. Claim 2 is therefore unclear due to the reference to a claim of another category. According to Article 6 of the PCT Regulation, "the claims shall be clear and concise".

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

03/05/99

PCT/FI 98/00891

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4415803 A	15/11/83	NONE	
US 4805236 A	14/02/89	FI 91928 B,C FI 892890 A GB 2229597 A,B JP 2501612 T JP 2690129 B SE 462312 C SE 8902143 A WO 8804867 A	13/05/94 13/06/89 26/09/90 31/05/90 10/12/97 20/09/90 14/06/89 30/06/88
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EP 0433646 A2	26/06/91	DE 3938097 A DE 59009656 D	23/05/91 00/00/00
US 5012202 A	30/04/91	NONE	
DE 4212934 A1	21/10/93	NONE	