

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 February 2005 (03.02.2005)

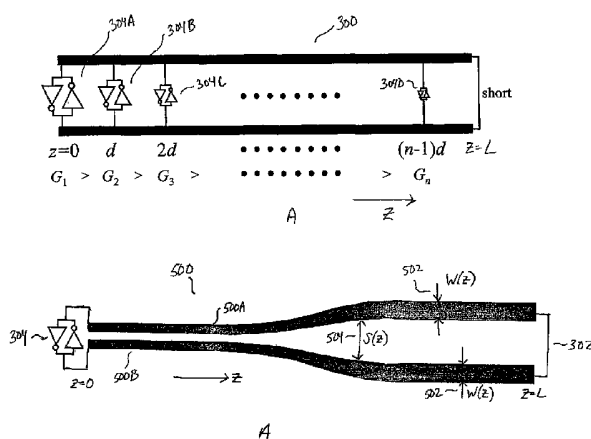
PCT

(10) International Publication Number
WO 2005/011101 A3

- (51) International Patent Classification⁷: **H03B 5/18**, H01P 7/08
- (21) International Application Number: PCT/US2004/023311
- (22) International Filing Date: 19 July 2004 (19.07.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/489,708 23 July 2003 (23.07.2003) US
60/533,904 2 January 2004 (02.01.2004) US
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— with international search report

[Continued on next page]

(54) Title: METHODS AND APPARATUS BASED ON COPLANAR STRIPLINES



(57) Abstract: Methods and apparatus for implementing various coplanar stripline (CPS) configurations, including standing wave oscillators (SWOs) using coplanar striplines (CPS). One example is given by a quarter-wavelength ($\lambda/4$) coplanar stripline standing wave oscillator (SWO), while another implementation utilizes a closed-loop coplanar stripline configuration. In various aspects, SWOs are configured to optimize sinusoidal performance at high frequencies with low power dissipation by incorporating various features that dramatically increase the quality factor Q of the oscillator. In particular, in one aspect, an amplitude-dependent tailored distributed amplification scheme is employed as a mode control technique using multiple amplifiers having different gains along the length of the coplanar stripline. In another aspect, a coplanar stripline configured such that its resistance per unit length R and conductance per unit length G are discrete or continuous functions of position along the coplanar stripline is employed to reduce SWO losses. In another aspect, an enhancement of the quality factor Q is achieved while at the same time reducing the phase velocity of waves propagating in the SWO, thereby also facilitating the fabrication of relatively smaller devices. In yet another aspect, SWOs are configured with frequency adjustability that is again optimized to reduce power dissipation while facilitating significant adjustments of oscillator frequency.

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(88) Date of publication of the international search report:
25 August 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(15) Information about Correction:

Previous Correction:

see PCT Gazette No. 22/2005 of 2 June 2005, Section II

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/023311

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03B5/18 H01P7/08

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 7 H03B H01P G02F

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, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 342 820 B1 (LEYTEN LUKAS ET AL) 29 January 2002 (2002-01-29) figure 2	1,2
A	----- O'MAHONY F ET AL: "10GHz clock distribution using coupled standing-wave oscillators" SOLID-STATE CIRCUITS CONFERENCE, 2003. DIGEST OF TECHNICAL PAPERS. ISSCC. 2003 IEEE INTERNATIONAL SAN FRANCISCO, CA, USA 9-13 FEB. 2003, PISCATAWAY, NJ, USA, IEEE, US, 9 February 2003 (2003-02-09), pages 1-10, XP010661533 ISBN: 0-7803-7707-9 figure 24.4.3 ----- -/--	1,2

☒ 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

12 May 2005

Date of mailing of the international search report

25. 05. 2005

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/023311

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 2002/149431 A1 (HAJIMIRI SEYED-ALI ET AL) 17 October 2002 (2002-10-17) abstract; figure 7 -----	1,2
A	US 2 735 941 A (RICHARD C. PECK) 21 February 1956 (1956-02-21) column 2, lines 10-21; figure 1 -----	1,2
A	US 3 699 475 A (ROBERT G. ROGERS) 17 October 1972 (1972-10-17) column 7, line 61 - column 8, line 10; figure 7a -----	1,2
X	EP 0 501 478 A (SONY CORPORATION; SONY CORP) 2 September 1992 (1992-09-02) column 14, lines 27-33 column 23, line 48 - column 24, line 1 column 24, lines 17-22 column 25, lines 20-24 column 26, lines 2-23 figures 16,17a,17b,29,33,34,37,38 -----	1,14-18, 36-40
X	GOVERDHANAM K ET AL: "COPLANAR STRIPLINE COMPONENTS FOR HIGH-FREQUENCY APPLICATIONS" IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, IEEE INC. NEW YORK, US, vol. 45, no. 10, PART 1, October 1997 (1997-10), pages 1725-1729, XP000704741 ISSN: 0018-9480 figure 2 -----	36
X	US 6 215 451 B1 (HADZOGLOU JAMES) 10 April 2001 (2001-04-10) figures 30b,30e -----	36

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2004/023311

Box II Observations where certain claims were found unsearchable (Continuation of item 2 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 III Observations where unity of invention is lacking (Continuation of item 3 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.:
1, 2, 14-23, 36-40
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/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-2

A standing wave oscillator including a one quarter wavelength coplanar stripline short-circuited at one end with at least one gain element between the conductors.

2. claims: 29-35

A standing wave oscillator with closed loop coplanar stripline short circuited at some position and with at least one gain element between the conductors.

3. claims: 36-40, 14-23

A coplanar stripline with parameters which vary along the length of the line.

4. claims: 41-49 and 3-13

A method of generating standing waves with gain distributed along the length of a coplanar stripline.

5. claims: 50-52 and 26-28

Frequency tuning in a coplanar stripline standing wave oscillator.

6. claims: 53-89 and 24-25

A coplanar stripline with arrays of floating conductors.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/023311

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