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- (71) Applicant (for all designated States except US): **RF MICRO DEVICES, INC.** [US/US]; 7628 Thorndike Road, Greensboro, NC 27409 (US).
- (72) Inventors: **KHLAT, Nadim**; 24 Rue Pierre De Fermat, Midi-pyrenees, F-31270 Cugnaux (FR). **HORLANDER, Karl, F.**; 7124 Capulin Crest Drive, Apex, NC 27539 (US).
- (74) Agent: **HORLANDER, Karl, F.**; Withrow & Terranova, PLLC, 100 Regency Forest Drive, Suite 160, Cary, NC 27518 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

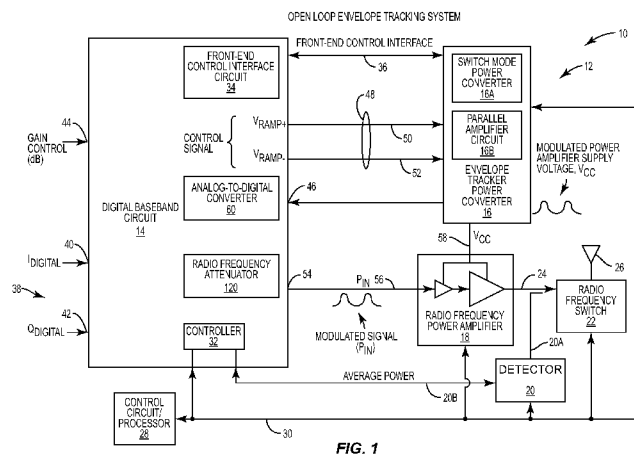
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Published:

- with international search report (Art. 21(3))
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18 October 2012

(54) Title: GROUP DELAY CALIBRATION METHOD FOR POWER AMPLIFIER ENVELOPE TRACKING



(57) Abstract: An open loop envelope tracking system calibration technique and circuitry are proposed. A radio frequency power amplifier receives a modulated signal. An envelope tracker power converter generates a modulated power amplifier supply voltage for the radio frequency power amplifier based on a control signal derived from the modulated signal. A first output power and a second output power of the radio frequency power amplifier are measured when the control signal is respectively delayed by a first delay period and a second delay period. A sensitivity of the output power of the radio frequency power amplifier is near a maximum near the first delay period and the second delay period. The first delay period and/or the second delay period are adjusted until the first output power substantially equals the second output power. The first delay period and the second delay period are used to obtain a calibrated fine tuning delay offset.

WO 2012/109227 A3

INTERNATIONAL SEARCH REPORT

International application No PCT/US2012/024124

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H03F1/02
 ADD.

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)
 H03F

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/097591 A1 (KIM BYUNG-WOOK [KR]) 16 April 2009 (2009-04-16) figures 1-4	1,20,42
A	-----	
A	US 2008/081572 A1 (ROFOUGARAN AHMADREZA [US]) 3 April 2008 (2008-04-03) figures 3, 5	1,20,42
A	-----	
A	US 2007/183532 A1 (MATERO JORMA [FI]) 9 August 2007 (2007-08-09) figures 5-8	1,20,42
A	-----	
A	US 2008/242246 A1 (MINNIS BRIAN [GB] ET AL) 2 October 2008 (2008-10-02) figures 3, 4	1,20,42

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Further documents are listed in the continuation of Box C.

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 application or patent 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

23 May 2012

Date of mailing of the international search report

24/08/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Agerbaek, Thomas

INTERNATIONAL SEARCH REPORT

International application No PCT/US2012/024124

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>ATSO HEKKALA ET AL: "Adaptive Time Misalignment Compensation in Envelope Tracking Amplifiers", SPREAD SPECTRUM TECHNIQUES AND APPLICATIONS, 2008. ISSSTA '08. IEEE 10TH INTERNATIONAL SYMPOSIUM ON, IEEE, PISCATAWAY, NJ, USA, 25 August 2008 (2008-08-25), pages 761-765, XP031319113, ISBN: 978-1-4244-2203-6 figures 1, 5-9</p> <p style="text-align: center;">-----</p>	1,20,42

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2012/024124

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2009097591	A1	16-04-2009	KR	20090036670 A		15-04-2009
			US	2009097591 A1		16-04-2009

US 2008081572	A1	03-04-2008	NONE			

US 2007183532	A1	09-08-2007	CN	101379695 A		04-03-2009
			EP	1985009 A2		29-10-2008
			KR	20080093060 A		17-10-2008
			US	2007183532 A1		09-08-2007
			WO	2007091134 A2		16-08-2007

US 2008242246	A1	02-10-2008	AT	502438 T		15-04-2011
			CN	101233681 A		30-07-2008
			EP	1911153 A1		16-04-2008
			JP	2009503983 A		29-01-2009
			KR	20080031463 A		08-04-2008
			US	2008242246 A1		02-10-2008
			WO	2007013034 A1		01-02-2007

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/024124

Box No. 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 No. 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 fees, this Authority did not invite payment of additional fees.
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.:

1-18, 20-35, 41, 42

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- 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: 1-18, 20-35, 41, 42

Delay tuning of envelope tracking power supply for RF power amplifier involving measuring RF PA output power at two different delay settings and determining optimum delay setting from the two delay settings.

2. claims: 19, 36-40

Independent claim 19: Delay tuning of envelope tracking power supply for RF power amplifier using two different delay settings and determining offset delay from the two delay settings.

Dependent claims 36-40: details concerning temperature.
