



- (51) International Patent Classification:  
H04B 3/21 (2006.01)
- (21) International Application Number:  
PCT/US2012/030739
- (22) International Filing Date:  
27 March 2012 (27.03.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
61/516,088 28 March 2011 (28.03.2011) US
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(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.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

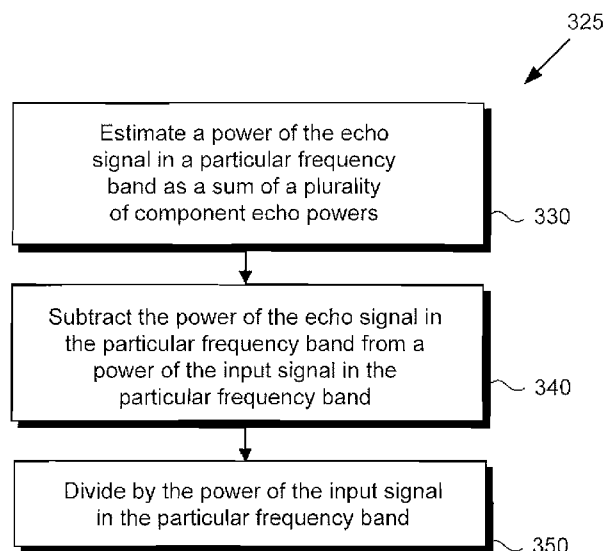
**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

[Continued on next page]

(54) Title: NONLINEAR ECHO SUPPRESSION

**Fig. 3B**



(57) Abstract: Presented is a method and associated system for suppression of linear and nonlinear echo. The method includes dividing an input signal into several frequency bands in each of a several of time frames. The input signal may include an echo signal. The method further includes multiplying the input signal in each of the several frequency bands by a corresponding echo suppression signal. Calculating the corresponding echo suppression signal may include estimating a power of the echo signal in a particular frequency band as a sum of several component echo powers, each of the several component echo powers due to an excitation from a far-end signal in a corresponding one of the several frequency bands. Calculating the corresponding echo suppression signal may further include subtracting the power of the echo signal in the particular frequency band from a power of the input signal in the particular frequency band.

WO 2012/135217 A3

**(88)** Date of publication of the international search report:  
20 December 2012

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2012/030739

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H04B3/21  
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)  
H04B  
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, 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	DIEGO A BENDERSKY ET AL: "Nonlinear residual acoustic echo suppression for high levels of harmonic distortion", ACOUSTICS, SPEECH AND SIGNAL PROCESSING, 2008. ICASSP 2008. IEEE INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, 31 March 2008 (2008-03-31), pages 261-264, XP031250538, ISBN: 978-1-4244-1483-3 the whole document	1-4, 10-14,20
A	----- WO 03/010950 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]) 6 February 2003 (2003-02-06) abstract; figures 1-3	1-4, 10-14,20
A	----- EP 1 978 649 A2 (ZARLINK SEMICONDUCTOR INC [CA]) 8 October 2008 (2008-10-08) abstract; figure 1 -----	1-4, 10-14,20

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  21 June 2012	Date of mailing of the international search report  17/10/2012
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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  Bauer, Frédéric
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2012/030739

## 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.:

1-4, 10-14, 20

### 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: 1-4, 10-14, 20

Claims 1 and 11 relate to method and corresponding system for echo suppression, said method comprising: dividing an input signal into a plurality of frequency bands in each of a plurality of time frames, said input signal comprising an echo signal; multiplying said input signal in each of said plurality of frequency bands by a corresponding echo suppression signal, -wherein calculating said corresponding echo suppression signal comprises: estimating a power of said echo signal in a particular frequency band as a sum of a plurality of component echo powers, each of said plurality of component echo powers due to an excitation from a far-end signal in a corresponding one of said plurality of frequency bands; subtracting said power of said echo signal in said particular frequency band from a power of said input signal in said particular frequency band.

Claims 2-4, 10, 12-14 and 20 further relate to calculating the echo suppression signal by dividing by said power of said input signal in said particular frequency band.

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2. claims: 5-9, 15-19

Claims 5-9 and 15-19 further relate to estimating the component echo powers by applying delays.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/030739

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
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