

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
10 July 2008 (10.07.2008)

PCT

(10) International Publication Number
WO 2008/083086 A3

(51) International Patent Classification:
H04M 9/08 (2006.01)

(74) Agents: FRANZ, Warren L. et al.; TEXAS INSTRUMENTS INCORPORATED, Deputy General Patent Counsel, P.O. Box 655474, MS 3999, Dallas, TX 75265-5474 (US).

(21) International Application Number:
PCT/US2007/088592

(22) International Filing Date:
21 December 2007 (21.12.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/877,594 28 December 2006 (28.12.2006) US
11/693,850 30 March 2007 (30.03.2007) US

(71) Applicant (for all designated States except US): TEXAS INSTRUMENTS INCORPORATED [US/US]; P.O. Box 655474, Mail Station 3999, Dallas, TX 75265-5474 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): HARLEY, Thomas, Randall [US/US]; 10185 Goodin Circle, Columbia, MD 21046 (US). KOSANOVIC, Bogdan [US/US]; 5411 Glenwood Road, Bethesda, MD 20817 (US). GUPTA, Puneet [IN/IN]; 17/4 (front Side), First Floor, Shakti Nagar, New Delhi 110007 (IN).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, 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, IS, IT, LT, LU, LV, MC, MT, 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).

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR ACOUSTIC ECHO REMOVAL (AER)

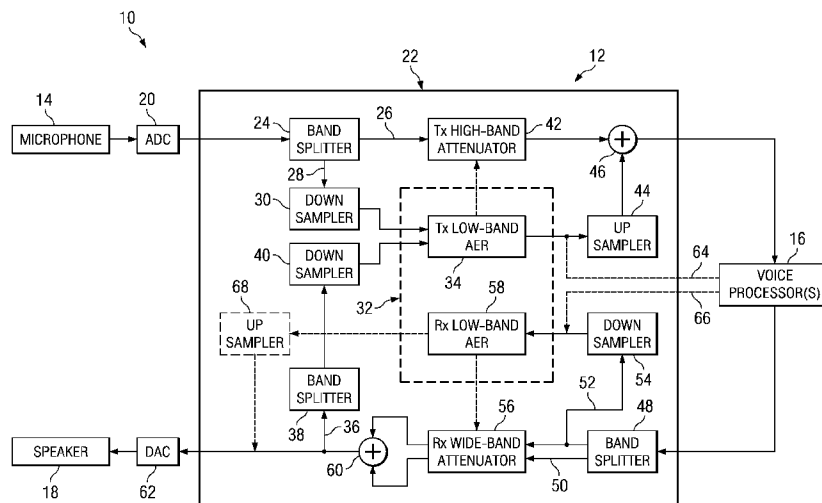


FIG. 1

(57) Abstract: One embodiment of the invention includes an acoustic echo removal system (12). A transmit signal and a receive signal, each having high and low frequency portions, are propagated between a microphone (14) and at least one voice processor (16). A first acoustic echo removal portion determines and provides a first variable attenuation gain to the low-frequency portion (28) of the transmit signal at a first sample frequency and provides a second variable attenuation gain to the low-frequency portion of the receive signal at the first sample frequency. A second acoustic echo removal portion provides the first variable attenuation gain to the high-frequency portion of the transmit signal at a second sample frequency and provides the second variable attenuation gain to both the high-frequency portion of the receive signal (36) and a copy of the low-frequency portion of the receive signal at the second sample frequency.

WO 2008/083086 A3



Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report*

(88) Date of publication of the international search report:
25 September 2008

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/88592

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04M 9/08 (2008.04)

USPC - 379/406.01

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)

USPC: 379/406.01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 370/286, 289 (see also text search below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Electronic Databases Searched: PubWEST(USPT,PGPB,EPAB,JPAB); USPTO, Google, Answers.com, Google Patents, WIPO, DialogWeb; Search Terms Used: echo, microphone, voice, processor, low, high, pass, filter, bandsplit, receive, transmit, signal, attenuation, variable, gain, frequency, halt, stop, adder, subtract, remove

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,038,251 A (CHEN, W.) 14 March 2000 (14.03.2000) col 1, ln 15-25, col 2, ln 28-35, 48-50, col 4, ln 2-8, col 8, ln 5-10, 60-67, col 9, ln 1-7, 25-61, col 11, ln 5-20, col 16, ln 27-30, 40-50, col 26, ln 32-35, col 45, ln 66-col 46, ln 15, 53-62, col 47, ln 37-49, col 48, ln 30-43, 60-col 49, ln 4; See Figs. 5B and 12	1-11 and 14-21
Y	US 2003/0147526 A1 (OSWAL et al.) 07 August 2003 (07.08.2003) para [0013], [0022]-[0030]; See Figs. 2A and 2B	1-11 and 16-21
Y	US 6,760,451 B1 (CRAVEN et al.) 06 July 2004 (06.07.2004) col 5, ln 45-55, col 6, ln 12-27, col 12, ln 1-56, col 16, ln 27-56, col 17, ln 61-col 18, ln 10	12-13
Y	US 2003/0118177 A1 (KARAKAS et al.) 26 June 2003 (26.06.2003) para [0015], [0017], [0069], [0166]-[0168], [0172] and [0179]	4-8, 12-21
Y	US 2004/0136447 A1 (LEBLANC, W.) 15 July 2004 (15.07.2004) para [0006], [0011], [0036], [0039], [0120] and [0125]-[0126]	2 and 20
Y	US 2004/0203403 A1 (CUTCHER et al.) 14 October 2004 (14.10.2004) para [0004]-[0004], [0007], [0010], [0012]-[0014] and [0017]-[0018]	10 and 18
Y	US 2003/0156711 A1 (TAKAHASHI et al.) 21 August 2003 (21.08.2003) para [0010] and [0026]	19

 Further documents are listed in the continuation of Box C.

* 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

13 April 2008 (13.04.2008)

Date of mailing of the international search report

01 MAY 2008

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Daf