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Datasheet for the decision of 8 September 2014

Case Number: T 1337/11 - 3.5.03

Application Number: 04811188.4

Publication Number: 1685697

IPC: H04M9/08

Language of the proceedings: EN

Title of invention:
Method and apparatus for adaptive echo and noise control

Applicant:
Motorola Mobility LLC

Headword:
Adaptive echo and noise control/MOTOROLA MOBILITY

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 1337/11 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 8 September 2014

Appellant: (Applicant)	Motorola Mobility LLC 600 North US Highway 45 Libertyville, IL 60048 (US)
Representative:	Kuhnen & Wacker Patent- und Rechtsanwaltsbüro Prinz-Ludwig-Straße 40A 85354 Freising (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 2 December 2010 refusing European patent application No. 04811188.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Cramer
Members:	T. Snell
	A. Madenach

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division refusing European patent application No. 04811188.4, published as International application no. WO 2005/053227 A, on the ground that the subject-matter of the claims of the main request did not involve an inventive step having regard to the disclosure of the following document:

D1: Le Bouquin Jeannès et al, "Combined Noise and Echo Reduction in Hands-Free Systems: A Survey", IEEE Transactions on Speech and Audio Processing, Vol. 9, No. 8, November 2001, pages 808 to 820.

A further set of claims submitted as an auxiliary request during the oral proceedings was not admitted.

II. In the notice of appeal the appellant requested that the decision be set aside in its entirety. In the subsequently filed statement of grounds, the appellant requested as a main request that a patent be granted on the basis of the claims submitted with the letter dated 20 March 2008 (ie the claims rejected by the examining division), or alternatively on the basis of the claims of a new auxiliary request filed with the statement of grounds.

III. Claim 1 of the appellant's main request reads as follows:

"A method for echo and noise control in a communication device, comprising:
receiving a signal at an input to the communication device;
determining background noise in the signal; and

adaptively determining an order of noise suppression and echo cancellation based on the background noise in the signal, by comparing the background noise to at least one threshold;
performing echo cancellation prior to noise suppression on the signal if the background noise is below the at least one threshold; and
performing noise suppression prior to echo cancellation on the signal if the background noise is above the at least one threshold."

Claim 6 of the request reads as follows:

"An electronic device, comprising:
an audio input configured to receive a received signal;
an audio output configured to output an output signal;
a transceiver configured to transmit a transmitted signal; and
an adaptive echo and noise control system coupled to the audio input, the audio output, and the transceiver, the adaptive echo and noise control system including
an echo canceller; and
a noise suppressor,
wherein the adaptive echo and noise control system is configured to adaptively determine an order of echo cancellation and noise suppression based on an amount of noise in the received signal, by comparing the background noise to at least one threshold;
performing echo cancellation prior to noise suppression on the signal if the background noise is below the at least one threshold; and
performing noise suppression prior to echo cancellation on the signal if the background noise is above the at least one threshold, to generate a desired signal, and
wherein the adaptive echo and noise control system is

further configured to send the desired signal to the transceiver."

In view of the board's decision, there is no need to recite the claims of the auxiliary request.

Reasons for the Decision

1. Background

The present invention is directed to a method and an apparatus for adaptive echo cancellation combined with noise control in a communications device. As stated in the description on page 1, communication devices are used in a variety of environments that have different noise levels. Thus noise suppression may be used with communication devices to enhance communication. This creates an additional problem in determining the proper amount of noise suppression for optimal communication quality. Another problem is that communication devices may have loudspeakers which cause acoustic echoes. To overcome this problem, it is known to use adaptive echo cancellation. However, the combined presence of noise suppression and adaptive echo cancellation can cause additional problems. These problems are caused because the signal resulting from noise suppression can result in less efficient echo cancellation. Furthermore, echo cancellation in a noisy environment may be inefficient when performed prior to noise suppression. The general aim of the invention is therefore to provide an improved method and apparatus for adaptive echo and noise control.

2. Articles 123(2) and 84 EPC - claims 1 and 6, main request

The examining division raised no objection on the grounds of either Article 123(2) or 84 EPC. The board sees no reason to raise any objection either.

3. *Closest prior art*

Document D1 was considered by the examining division to represent the closest prior art. This document provides a survey of known solutions for combining echo cancellation and noise suppression. One structure shown in Fig. 4 shows a cascaded structure of an echo canceller followed by a noise suppression filter. An alternative structure, called a ""Dual" Structure of optimal Filtering" (cf. Fig. 5), discloses a noise suppression filter preceding the echo canceller. In a later section entitled "Evaluation and Complexity", it is stated that the first structure becomes less attractive than the "dual" structure in noisy conditions.

4. *Solution*

In essence, the claimed solution comprises adaptively determining the order of noise suppression and echo cancellation by comparing the background noise to at least one threshold, performing echo cancellation prior to noise suppression on the signal if the background noise is below the at least one threshold, and performing noise suppression prior to echo cancellation on the signal if the background noise is above the at least one threshold.

5. *Inventive step*

5.1 It is not in dispute that the features of the solution are not disclosed in document D1. The examining division nevertheless considered that the solution was obvious in the light of the disclosure of D1. However, the board takes a different view for the reasons set out in the following paragraphs.

5.2 The examining division's decision is based on the following reasoning, using the problem-solution approach:

"6.1 Document D1 is regarded as the closest prior art to the subject-matter of claim 1, since it compares the performance of two echo and noise control schemes, namely a first scheme (p. 812, left column, section IV-A2 & Fig. 4, "cascaded structure derived from optimal filtering") performing echo cancellation prior to noise suppression on a received signal ("y(k)") and a second scheme (p. 812, left column, section IV-A3 & Fig. 5, "dual structure of optimal filtering") performing noise suppression prior to echo cancellation on a received signal ("y(k)"). Further, Dl discloses that (p. 815, right column) in low noise conditions the first scheme (Fig. 4) performs well but, when the noise level rises, the first scheme (Fig. 4) becomes less attractive in comparison with the second scheme (Fig. 5)(*"in low noise conditions, the structure derived from optimal filtering, Section IV-A2 is equivalent to the structure chosen as reference, i.e. the open loop filter. When noise level increases, the first structure becomes less attractive than [sic] dual structure of optimal filtering"* together with "the open-loop post filter, section IV-C2 is chosen as the

reference structure since informal listening tests indicate good performance"). Finally, Dl discloses that (p.808) the echo and noise control schemes disclosed in Dl are implemented within communication devices, in particular devices for telephone applications.

6.2 The claimed method differs from the one *[board's underlining]* disclosed in D1 in that one of the two aforementioned schemes is adaptively performed according to a determined background noise (level) in the received signal, in such a way that the first scheme is performed if the determined noise (level) is below a threshold and the second scheme is performed if the determined noise (level) is above said threshold.

6.3 The problem to be solved by this difference is how to provide an echo and noise control scheme which performs well in both high-noise and low-noise conditions.

6.4 In order to solve the aforementioned problem, the skilled person in view of the teaching of D1 (Figs. 4-5 and [page] 815 right column) will choose the first scheme when the noise conditions are low and will choose the second scheme when the noise conditions are high. The most straightforward way to check whether there is a low or a high noise condition the skilled person could think of would be to determine the noise level of the microphone signal (see p. 810, last 2 lines of section II, "*we assume that noise is present in the microphone observation(s)*") and compare it to a threshold, arriving thus at the subject-matter of claim 1."

5.3 In the board's view, the analysis of the examining division is flawed since it is based on an ex-post facto analysis, for the following reasons:

(i) The examining division states that the claimed method differs from "the one" disclosed in D1, although its analysis starts out not from one arrangement but from a passage of the document in section D comparing the performance of two alternative arrangements, ie those described in section IV-A, paragraphs 2 and 3. This section however also mentions other arrangements, ie those disclosed in section IV-A, paragraphs 1 and 4, as well as sections IV-B and IV-C. If the skilled person were to start out from the overall content of D1, or even just the section containing the passage referred to in the decision, by determining that the solution is to be based on the two arrangements of section IV-A, paragraphs 2 and 3, part of the solution has already been anticipated.

(ii) The examining division states that in view of the teaching of D1, the skilled person will choose the first scheme (Fig. 4) when the noise conditions are low. However, the quoted passage of D1 ("When the noise level increases, the first structure becomes less attractive than "dual" structure of optimal filtering, structure with preprocessing, and filtering applied to the microphone observation") does not state that the "dual" scheme performs worse than the first scheme at low noise, only that it and other schemes are better than the first scheme when the noise level increases. Hence, plausibly, the skilled person reading this passage would solve the stated problem by using either the dual scheme, the structure with preprocessing (IV-A, 5), or the filtering applied to the microphone

signal (IV-B) alone. Furthermore, D1 teaches apparently that the more complex scheme described in section IV-C2 is better than any of the other schemes (cf. p. 815, third paragraph, first sentence). Hence, the teaching of D1 would not obviously lead to the claimed solution.

(iii) The skilled person is given no hint from document D1 either to base any processing on the detection of a noise threshold, or to switch between any two of the schemes presented in the document. The examining division has not indicated another prior art document disclosing any similar feature. Hence, the categorising of this feature as obvious in the board's view is also based on hindsight.

Consequently, the board finds that the subject-matter of claim 1 involves an inventive step having regard to the disclosure of document D1 (cf. Articles 52(1) and 56 EPC).

5.4 Claim 6

These remarks apply, *mutatis mutandis*, to independent claim 6.

6. Conclusion

The decision accordingly has to be set aside. In order that full compliance of the application documents with the EPC can be determined, the case is remitted to the examining division for further prosecution.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The Registrar: The Chairman:

G. Rauh R. Cramer

Decision electronically authenticated