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Datasheet for the decision of 12 June 2026

Case Number: T 1243/24 - 3.4.01

Application Number: 20760651.8

Publication Number: 4008001

IPC: G10L21/0208, H04B3/20

Language of the proceedings: EN

Title of invention:
SYSTEMS AND METHODS FOR COVARIANCE SMOOTHING

Applicant:
Dolby Laboratories Licensing Corporation

Headword:
Covariance smoothing / Dolby Laboratories Licensing Corporation

Relevant legal provisions:
EPC Art. 84, 83

Keyword:
Claims - clarity (no)
Sufficiency of disclosure - (no)

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Case Number: T 1243/24 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 12 June 2026

Appellant: (Applicant)	Dolby Laboratories Licensing Corporation 1275 Market Street San Francisco, CA 94103 (US)
Representative:	AWA Sweden AB Box 5117 200 71 Malmö (SE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted/electronically transmitted on 14 March 2024 refusing European patent application No. 20760651.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	P. Scriven
Members:	P. Fontenay
	B. Müller

Summary of Facts and Submissions

I. The application was refused because claim 1 of the main request and first and second auxiliary requests filed before the Examining Division was not clear, contrary to Article 84 EPC, and because the inventions were not disclosed in a manner sufficiently clear and complete for them to be carried out by a person skilled in the art, contrary to Article 83 EPC.

II. The applicant appealed the decision, requesting that it be set aside and that a patent be granted on the basis of the main request or, in the alternative, on the basis of one of first and second auxiliary requests underlying the impugned decision.

III. The applicant objected that the Examining Division's decision to refuse the application focused on details that were of minor relevance for the claimed inventions and part of the skilled person's common general knowledge. To further support their arguments, the appellant referred to various documents intended to illustrate the common general knowledge in the technical field of audio processing.

IV. Oral proceedings were initially requested.

V. In a communication under Article 15(1) RPBA 2020, annexed to a summons to attend oral proceedings, the

appellant was informed of the Board's preliminary opinion.

VI. Although the Board shared the appellant's view that certain concepts mentioned in the claims appeared to be clear in the context of the application, it nevertheless considered that none of the versions of claim 1 according to the appellant's requests appeared to be clear in the meaning of Article 84 EPC. A similar provisional finding applied regarding the issue of sufficiency of disclosure under Article 83 EPC. While the description as a whole allowed some concepts to be clarified, the application failed to provide any clear indication regarding the determination of the *banded covariance matrix* and associated *smoothed banded covariance matrix*.

VII. The passages of the Board's communication that are relevant to this decision read:

> *Clarity - Article 84 EPC*
>
> *1. The Examining Division justified its decision, by observing that the concepts of "banded covariance matrix", "smoothed banded covariance matrix", "forgetting factor" and "bins", used in claim 1 of all requests, were unclear. These terms had no recognised meaning in the art and were not well-defined in the claims. Consequently, the related terms of "effective number of bins (Nb) in the frequency band", and "minimum number of bins for the frequency band (Nmin)" also*

lacked a well-defined meaning, in the context of the claimed invention. The step according to which "the effective number of bins is calculated as a sum of filter bank response values for the frequency band" was unclear, because the response values in question were not defined.

2. The Board acknowledges that the banded covariance matrix is defined as a matrix of covariances of the N channels in the frequency band, i.e., a matrix that reflects the dependencies between the channels for a given frequency band.

3. In contrast, the concept of a smoothed banded covariance matrix does appear to be ambiguous.

4. Claim 1 defines this concept using a process that includes the smoothed banded covariance matrix of a previous frame and a weighting of the difference between the corresponding matrices for a previous and current frames within the frame sequence. This corresponds, approximately, to equation 2 in the description. While the description suggests that the term "smoothed banded covariance matrix of a previous frame" refers to the matrix previously determined in an iterative calculation process, the claim language contains no explicit reference to such an iterative process. This raises doubts about the precise meaning of the smoothed banded covariance matrix of a previous frame referred to in the claim. Moreover, the

reference to the previous frame could be construed as referring to the frame data (in the time or frequency domain), as such, on which the smoothed covariance matrix is based and not on an earlier matrix.

5. An ambiguity arises from the use of the indefinite article "a" in defining the first member of the addition for the calculation, which corresponds to a smoothed banded covariance matrix for a previous frame and the second term of the addition, which also contains a reference to a smoothed banded covariance matrix for a previous frame of the sequence of frames. This does not reflect the content of equation 2 in the description, which refers to the immediately preceding previous smoothed banded covariance matrices for the determination of the two terms in the calculation. This language further generates ambiguities as to the covariances that are determined.

6. Moreover, the calculations to be performed require the determination of several parameters which are not clearly defined in the claim. This applies to both the "window" over which said matrix is calculated (claim 1 of the main and first auxiliary requests), and the forgetting factor, which serves as a weighting factor for the calculated difference between current and previous matrices.

7. The term "window", which appears in the step of calculating the smoothed banded

covariance matrix, lacks an antecedent in claim 1 of the main and first auxiliary requests. Even assuming, for the sake of argument, that a time window is meant, the claim language does not specify how the window is selected, and, more fundamentally, how the elements of the matrix can be obtained from it. This is particularly problematic since the elements of the banded covariance matrix are obtained from a frequency domain representation of each frame signal, i.e., in a process step in which no time-domain representation of the signals exists. Paragraphs [0036] and [0037] of the description add to the confusion, as they suggest that the window is determined before the matrices are calculated.

8. A similar issue exists regarding the parameter of the forgetting factor. Although the claim language clearly establishes that this parameter is calculated as the minimum of two values, the references to the parameters regarding the effective number of bins in the frequency band and the minimum number of bins for this frequency band does lead to ambiguities. Although the concept of bins is known in the field of signal processing, its use in the context of the claim is confusing, because the number of effective bins is defined as the sum of filter bank response values for the considered frequency band. This contradicts the general meaning of this concept and the corresponding indication in the claim that

the frequency band comprises a plurality of frequency bins.

9. Moreover, the reference in claim 1 to the minimum number of bins for the frequency band, which corresponds to the minimum number of bins that enable a good statistical estimate, is in itself unclear. As noted by the appellant, the notion of good statistical estimate is essentially subjective and does not allow for a precise determination of this parameter.

10. In summary, while claim 1 of all requests contain definitions of the terms "smoothed banded covariance matrix" and "forgetting factor", against which the Examining Division raised objections, these terms are defined in relation to other parameters that are ambiguous in the context of the invention. This concerns the effective and minimum number of bins as well as the term "bin" itself which is apparently used with different meanings.

11. It is unclear whether the last step in claim 1 of all requests regarding the output of the processed audio signal refers to the output of a signal after performing the various calculations recited in the claim, or to the last step of the entire chain of encoding and decoding an audio signal. In the latter case, this would contradict the implementation of the process by a receiver as defined in claim 12 of the main request

and claim 11 of the first and second auxiliary requests.

12. In the opinion of the Board, the contents of dependent claims 2 and 3 of the main request and of claim 2 of the first and second auxiliary requests are redundant with the content of the respective claim 1, which, in effect, describes such a first-order filter and specifies the parameters used for the filtering step.

13. A further ambiguity arises from the wording of independent claim 13 of the main request and corresponding independent claims 12 of the auxiliary requests which refer to a decoder comprising the system of claim 10, respectively, claim 9. While the steps of the method regarding the calculation of the banded covariance matrix and the smoothed banded covariance matrix according to claim 1 may be performed in an encoder or decoder, the steps of receiving an input signal and dividing it into a time-domain sequence of frames is performed only in the encoder.

14. The explicit reference, in claim 1 of the first and second auxiliary requests, to the combination of adjacent frequency bins of a per-bin covariance matrix into a frequency band, is inherently unclear. The description, in paragraph [0028], contains a similar formulation and does not help. A literal interpretation of the added feature in claim 1 of the auxiliary requests suggests that the matrices comprise bins which raises further

questions regarding the meaning of the term bin in the context of the invention.

15. It follows that the claims of the main request and first and second auxiliary requests are not clear (Article 84 EPC).

Insufficiency of disclosure - Article 83 EPC

16. The Examining Division based its conclusion on the finding that the meanings of "banded covariance matrix", "smoothed banded covariance matrix", and "forgetting factor" were not clear, and that the description failed to provide an unambiguous definition of these concepts.

17. The Board agrees that the various terms contributing to the definition of an invention must be devoid of ambiguity, in accordance with Article 84 EPC, and that this requirement is not met under the present circumstances for the reasons set out above. However, it notes that this aspect alone is not conclusive for the question of sufficiency of disclosure. A specific disclosure of an ambiguous term may be sufficient under Article 83 EPC, if it enables the skilled person to carry out the claimed invention over the whole scope.

18. The shortcomings regarding the unclear meaning of the term "window" and its impact on the determination of the smoothed banded covariance matrix (main request and first

auxiliary request), the confusing statements about the bins within a frequency band, and the unclear definition of the parameters for determining the forgetting factor (all requests), do not alter the finding that the application provides an example of how these terms can be construed and how they contribute to the processing of audio signals.

19. Concretely, the person skilled in the art would recognise that the window can correspond to a weighted function applied to a frame signal and that a bin simply reflects a frequency interval within a frequency band (paragraph [0036]). The description clarifies that the sum of the filter bank response values can be used to estimate the effective number of bins in a band instead of the actual number of bins in the band (paragraph [0032]). It further contains a concrete example of calculation of the forgetting factor.

20. However, and although the meaning of banded covariance matrix is clear in the context of the invention, its method of determination is not. While the Board agrees that the calculations for determining the covariance matrix associated with a bin (giving the term bin its usual understanding in the art of a narrow band within a broader frequency band) results from common general knowledge, this is not the case for the banded covariance matrix resulting from their combination.

21. The per-band matrices are determined, in paragraph [0038], for two analysis bands. A bin differs from a band by the frequency bandwidth, i.e. by a parameter that does not appear in the calculations to be performed. The example of paragraph [0038] therefore also applies to a bin. However, how the per-bin covariance matrices are combined to obtain the banded covariance matrix is not disclosed. It is also not trivial.

22. In the absence of clear guidelines, in the application, on how the per-bin matrices can be combined to obtain the banded covariance matrix and the resulting smoothed banded covariance matrix, the application appears insufficient for it to be carried out by a skilled person (Article 83 EPC). The documents E1 and E3, cited by the applicant regarding the existence of common general knowledge, confirm that the use of covariance matrices was well known when dealing with multi-channel architectures, but do not help when it comes to the combination of per-bin covariance matrices to obtain banded covariance matrices. (Document E3, which, in any case, does also not disclose the missing information, is a copy of a dissertation work and is not likely to provide good evidence of common knowledge.)

23. The objection concerns claim 1 of the first and second auxiliary requests, which contain an explicit reference to the combination of adjacent frequency bins of a per-bin covariance matrix into a frequency

band, as well as claim 1 of the main request which does not include this limitation but refers to frequency bands comprising a plurality of frequency bins. The absence of an explicit reference to the combination of bins of a per-bin covariance matrix into a frequency band, in claim 1 of the main request, does not alter the finding that the determination of banded covariance matrices based on the obtained bin signals for each band is not disclosed.

VIII. In response to the summons to attend oral proceedings, the applicant informed the Board that they intended neither to be present nor to be represented at the oral proceedings.

IX. In consequence, oral proceedings were cancelled.

X. Claim 1 of the main request reads:

An audio signal processing method, comprising:

receiving (201) an input signal (S) comprising N channels, wherein N>1;

dividing the input signal into a time-domain sequence of frames;

transforming each frame of the time-domain sequence of frames into a frequency domain representation comprising a plurality of frequency bands, wherein each frequency band comprises a plurality of frequency bins,

and lower-frequency bands have a lower number of bins per band than higher-frequency bands;

calculating, from the frequency domain representation of each frame of the time domain sequence of frames, a banded covariance matrix (A), wherein the banded covariance matrix (A) is a matrix of covariances of the N channels in the frequency band;

calculating a smoothed banded covariance matrix (Ã) over a window for a current frame of the sequence of frames, by adding a smoothed banded covariance matrix (Ã) for a previous frame of the sequence of frames and a difference between the banded covariance matrix for the current frame (A) and smoothed banded covariance matrix (Ã) for a previous frame of the sequence of frames, the difference weighted by a forgetting factor (λ_b), wherein the forgetting factor for a frequency band is calculated as a minimum of a maximum permitted forgetting factor (λ_{max}) and a ratio of an effective number of bins (N_b) in the frequency band and a minimum number of bins for the frequency band (N_{min}), wherein the effective number of bins (N_b) is calculated as a sum of filterbank response values for the frequency band, and wherein the minimum number of bins for the frequency band (N_{min}) corresponds to the minimum number of bins that are determined to give a good statistical estimate for the window;

processing the frequency domain representation of each frame of the time-domain sequence of frames based on the

smoothed banded covariance matrix to determine a processed audio signal; and

outputting the processed audio signal.

XI. Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that the (first) step of calculating has been further specified, and reads:

...
calculating, from the frequency domain representation of each frame of the time domain sequence of frames, a banded covariance matrix (A), wherein the banded covariance matrix (A) is a matrix of covariances of the N channels in the frequency band, where a plurality of adjacent frequency bins of a per-bin covariance matrix are combined into a frequency band;
...

XII. Claim 1 of auxiliary request 2 differs from claim 1 of the main request in that the first step of calculating has been further specified, and reads:

...
calculating, from the frequency domain representation of each frame of the time domain sequence of frames, a banded covariance matrix (A), wherein the banded covariance matrix (A) is an estimated matrix of covariances of the N channels in the frequency band, where a plurality of adjacent frequency bins of a per-bin

covariance matrix are combined into a frequency band;
...

and in that the reference to a window in the second step of calculating has been deleted and the wording of said step amended to recite:

..., wherein the effective number of bins (N_b) is calculated as a sum of the magnitude of filterbank response values for the frequency band, and wherein the minimum number of bins for the frequency band (N_{min}) corresponds to the minimum number of bins that are determined to give a good statistical estimate of the banded covariance matrix for the current frame;
...

Reasons for the Decision

1. The Board indicated, under points 1 to 23 of its communication under Article 15(1) RPBA 2020, why, in its opinion, the claims of the main request and of auxiliary requests 1 and 2 were unclear and the inventions that these claims defined not disclosed in a manner sufficiently clear and complete for them to be carried out by a person skilled in the art.

2. The Board's preliminary assessment was not challenged by the appellant. The Board sees no reason to deviate from it.

3. The main request and auxiliary requests 1 and 2 are, therefore, not allowable (Articles 84 and 83 EPC). In the absence of an allowable request, the decision of the Examining Division to reject the application has to be upheld.

4. The appellant indicated that they did not intend to be represented at the oral proceedings. Those proceedings were, therefore, cancelled. This decision is consequently handed down in written procedure (Article 12(8) RPBA).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Meyfarth P. Scriven

Decision electronically authenticated