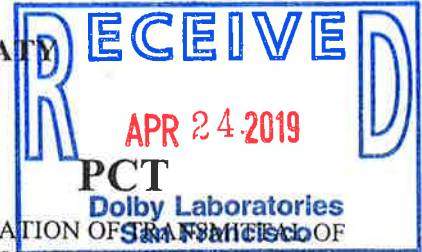


PATENT COOPERATION TREATY

From the INTERNATIONAL PRELIMINARY EXAMINING
AUTHORITY



To:

**DOLBY LABORATORIES, INC.
INTELLECTUAL PROPERTY GROUP
1275 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103,
UNITED STATES OF AMERICA**

NOTIFICATION OF TRANSMISSION OF
INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY (CHAPTER II OF
THE PATENT COOPERATION TREATY)

(PCT Rule 71.1)

Date of mailing
(day/month/year)

19 APR 2019

Applicant's or agent's file reference

D17023WO01

IMPORTANT NOTIFICATION

International application No.

PCT/US2018/023183

International filing date

(day/month/year) **19 March 2018
(19.03.2018)**

Priority date

(day/month/year) **23 March 2017
(23.03.2017)**

Applicant

DOLBY INTERNATIONAL AB

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/US

**Commissioner for Patents
Mail Stop PCT, Attn: IPEA/US
P.O. Box 1450
Alexandria, VA 22313-1450, United States of America**

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference D17023WO01	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/US2018/023183	International filing date (day/month/year) 19 March 2018 (19.03.2018)	Priority date (day/month/year) 23 March 2017 (23.03.2017)	
International Patent Classification (IPC) or both national classification and IPC IPC: G06F 17/00; G10L 19/02, 19/22, 19/24, 19/26 CPC: G06F 17/10; G10L 19/02, 19/22, 19/24, 19/26, 19/265			
Applicant DOLBY INTERNATIONAL AB			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:

☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).

☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).

☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____ containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 04 October 2018 (04.10.2018)	Date of completion of this report 15 April 2019 (15.04.2019)
Name and mailing address of the IPEA/US Commissioner for Patents Mail Stop PCT, Attn: IPEA/US P.O. Box 1450 Alexandria, VA 22313-1450, United States of America Facsimile No. (571)273-8300	Authorized officer RICHEMOND DORVIL Telephone No. 571-272-7602

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US2018/023183

Box No. 1 Basis of the report

1. With regard to the **language**, this report is based on:
- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):
- ☐ the international application as originally filed/furnished, or
- ☒ the description:
- pages 1-37 as originally filed/furnished.
- pages* NONE received by this Authority on (..)
- pages* NONE received by this Authority on (..)
- ☒ the claims:
- Nos. _____ as originally filed/furnished.
- Nos.* _____ as amended (together with any statement) under Article 19
- Nos.* 1-17 received by this Authority on 04 October 2018 (04.10.2018)
- ☒ the drawings:
- pages 1/2-2/2 as originally filed/furnished.
- pages* NONE received by this Authority on (..)
- pages* NONE received by this Authority on (..)
- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
- ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.4bis and 70.2(e)).
6. With regard to top-up searches (Rules 66.1ter and 70.2(f)):
- ☐ A top-up search was carried out by this Authority on _____
- ☐ Additional relevant documents have been discovered during the top-up search.
- ☒ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) _____ has/ have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US2018/023183

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 8 and 17

because:

☐ the said international application, or the said claims Nos. _____
relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 8 and 17 are so unclear that no meaningful opinion could be formed (*specify*):

They are so unclear that no meaningful opinion can be formed.

☐ the claims, or said claims Nos. _____ are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

☐ no international search report has been established for said claims Nos. _____

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

☐ furnish a sequence listing in the form of an Annex C/ST.25 text file, and such listing was not available to the International Preliminary Examining Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

☐ furnish a sequence listing on paper or in the form of an image file complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rules 13ter.1(a) or (b) and 13ter.2.

☐ See Supplemental Box for further details.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US2018/023183

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Claims	1-4, 5/1-5/4, 6/1-6/4, 7/1-7/4, 9-13, 14/10-14/13, 15/10-15/13, 16/10-16/13	YES
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Claims	NONE	NO
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Inventive step (IS)

Claims	1-4, 5/1-5/4, 6/1-6/4, 7/1-7/4, 9-13, 14/10-14/13, 15/10-15/13, 16/10-16/13	YES
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Claims	NONE	NO
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Industrial applicability (IA)

Claims	1-4, 5/1-5/4, 6/1-6/4, 7/1-7/4, 9-13, 14/10-14/13, 15/10-15/13, 16/10-16/13	YES
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Claims	NONE	NO
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2. Citations and explanations (Rule 70.7)

----- EXPLANATION -----

Claims 1 and 10 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest wherein the analysis filterbank includes analysis filters, $h_k(n)$, that are modulated versions of a prototype filter, $p_0(n)$, according to:

$$h_k(n) = p_0(n) \exp\{i \pi/M (k+1/2) (n-N/2)\}$$

In the closest prior art, Ekstrand (US 2011/0302230 A1) discloses wherein the analysis filterbank includes analysis filters, $h_k(n)$, that are modulated versions of a prototype filter, $p_0(n)$ (an analysis filterbank including analysis filters $h_k(n)$ that are modulated versions of a prototype filter; paragraph [0069], claims 9 & 11), according to:

$$h_k(n) = p_0(n) \exp\{i \pi/M (k+1/2) (n - D/2 - A)\}$$

(the analysis filters $h_k(n)$ are determined as

$$h_k(n) = p_0(n) \exp\{i \pi/M (k+1/2) (n - D/2 - A)\}$$

where A is an arbitrary constant and D is a system delay; paragraph [0069], claim 11) where $p_0(n)$ is a real-valued symmetric or asymmetric prototype filter (where $p_0(n)$ is an asymmetric prototype filter; claim 17), M is a number of channels in the analysis filterbank and N is the prototype filter order (M is a number of channels and N is a prototype filter length (order); paragraph [0069]).

Ekstrand and the references of record (US 2015/0317986 A1 (hereinafter Dolby986) and WO 2016/146492 (hereinafter Dolby 492)) fail to disclose wherein the analysis filterbank includes analysis filters, $h_k(n)$, that are modulated versions of a prototype filter, $p_0(n)$, according to:

$$h_k(n) = p_0(n) \exp\{i \pi/M (k+1/2) (n-N/2)\}$$

It would not have been obvious to one of ordinary skill in the art at the time the invention was made to have employed this system, because none of the references uncovered disclosed the nuances of the instant claim in a cumulative manner while still allowing for a plausible motivation to combine said references. Specifically, while Ekstrand discloses an equation that is almost identical to the claimed equation, it replaces the prototype filter order with a system delay and adds an arbitrary constant A and cannot be used to modify the method of Dolby986 to include the equation as disclosed, since the system delay different from the prototype filter order and accounting for the system delay is necessary to reduce phase dispersion (see Ekstrand; paragraph [0011]) in the method of Ekstrand. The references taken solely, or in combination, fail to provide the required limitations, and modification of any complementary combination of the references of record would be impermissible and not provide any advantages over the present application.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US2018/023183

Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
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Claims 2-4, 5/1-5/4, 6/1-6/4, 7/1-7/4 meet the criteria set out in PCT Article 33(2)-(3), because of their dependency on claim 1.

Claims 11-13, 14/10-14/13, 15/10-15/13, and 16/10-16/13 meet the criteria set out in PCT Article 33(2)-(3), because of their dependency on claim 10.

Claim 9 is directed to "A non-transitory computer readable medium containing instructions that when executed by a processor perform the method of claim 1." Thus, claim 9 meet the criteria set out in PCT Article 33(2)-(3) as the same reason as claim 1.

Claims 1-4, 5/1-5/4, 6/1-6/4, 7/1-7/4, 9-13, 14/10-14/13, 15/10-15/13, and 16/10-16/13 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

D17023WO01

CLAIMS

1. A method for decoding an encoded audio bitstream, the method comprising:
receiving the encoded audio bitstream, the encoded audio bitstream including audio data representing a lowband portion of an audio signal;
decoding the audio data to generate a decoded lowband audio signal;
extracting from the encoded audio bitstream high frequency reconstruction metadata, the high frequency reconstruction metadata including operating parameters for a high frequency reconstruction process that linearly translates a consecutive number of subbands from a lowband portion of the audio signal to a highband portion of the audio signal;
filtering the decoded lowband audio signal with an analysis filterbank to generate a filtered lowband audio signal;
extracting from the encoded audio bitstream a flag indicating whether either linear translation or harmonic transposition is to be performed on the audio data;
regenerating a highband portion of the audio signal using the filtered lowband audio signal and the high frequency reconstruction metadata in accordance with the flag; and
combining the filtered lowband audio signal and the regenerated highband portion to form a wideband audio signal,

wherein the analysis filterbank includes analysis filters, $h_k(n)$, that are modulated versions of a prototype filter, $p_0(n)$, according to:

$$h_k(n) = p_0(n) \exp \left\{ i \frac{\pi}{M} \left(k + \frac{1}{2} \right) \left(n - \frac{N}{2} \right) \right\}, \quad 0 \leq n \leq N; 0 \leq k < M$$

where $p_0(n)$ is a real-valued symmetric or asymmetric prototype filter, M is a number of channels in the analysis filterbank and N is the prototype filter order.

2. The method of claim 1 wherein the encoded audio bitstream further includes a fill element with an identifier indicating a start of the fill element and fill data after the identifier, wherein the fill data includes the flag.

3. The method of claim 2 wherein the identifier is a three bit unsigned integer transmitted most significant bit first and having a value of 0x6.

D17023WO01

4. The method of claim 2, wherein the fill data includes an extension payload, the extension payload includes spectral band replication extension data, and the extension payload is identified with a four bit unsigned integer transmitted most significant bit first and having a value of '1101' or '1110', and, optionally,

wherein the spectral band replication extension data includes:

an optional spectral band replication header,

spectral band replication data after the header,

an spectral band replication extension element after the spectral band replication data, and wherein the flag is included in the spectral band replication extension element.

5. The method of any one of claims 1-4 wherein the high frequency reconstruction metadata includes an operating parameter selected from the group consisting of envelope scalefactors, noise floor scale factors, sinusoid addition information, time/frequency grid information, crossover frequency, and inverse filtering mode.

6. The method of any one of claims 1-4 wherein the prototype filter, $p_0(n)$, is derived from coefficients of Table 4.

7. The method of any one of claims 1-4 wherein the prototype filter, $p_0(n)$, is derived from coefficients of Table 4 by one or more mathematical operations selected from the group consisting of rounding, subsampling, interpolation, or decimation.

8. The method of any one of claims 1-4 wherein a phase shift is added to the filtered lowband audio signal after the filtering and compensated for before the combining.

9. A non-transitory computer readable medium containing instructions that when executed by a processor perform the method of claim 1.

D17023WO01

10. A decoder for decoding an encoded audio bitstream, the decoder comprising:
 an input interface for receiving the encoded audio bitstream, the encoded audio bitstream including audio data representing a lowband portion of an audio signal;
 a core decoder for decoding the audio data to generate a decoded lowband audio signal;
 a deformatter for extracting from the encoded audio bitstream high frequency reconstruction metadata, the high frequency reconstruction metadata including operating parameters for a high frequency reconstruction process that linearly translates a consecutive number of subbands from a lowband portion of the audio signal to a highband portion of the audio signal;
 an analysis filterbank for filtering the decoded lowband audio signal to generate a filtered lowband audio signal;
 a deformatter for extracting from the encoded audio bitstream a flag indicating whether either linear translation or harmonic transposition is to be performed on the audio data;
 a high frequency regenerator for regenerating a highband portion of the audio signal using the filtered lowband audio signal and the high frequency reconstruction metadata in accordance with the flag; and
 a synthesis filterbank for combining the filtered lowband audio signal and the regenerated highband portion to form a wideband audio signal,
 wherein the analysis filterbank includes analysis filters, $h_k(n)$, that are modulated versions of a prototype filter, $p_0(n)$, according to:

$$h_k(n) = p_0(n) \exp \left\{ i \frac{\pi}{M} \left(k + \frac{1}{2} \right) \left(n - \frac{N}{2} \right) \right\}, \quad 0 \leq n \leq N; \quad 0 \leq k < M$$

 where $p_0(n)$ is a real-valued symmetric or asymmetric prototype filter, M is a number of channels in the analysis filterbank and N is the prototype filter order.

11. The decoder of claim 10 wherein the encoded audio bitstream further includes a fill element with an identifier indicating a start of the fill element and fill data after the identifier, wherein the fill data includes the flag.

12. The decoder of claim 11 wherein the identifier is a three bit unsigned integer transmitted most significant bit first and having a value of 0x6.

D17023WO01

13. The decoder of claim 11, wherein the fill data includes an extension payload, the extension payload includes spectral band replication extension data, and the extension payload is identified with a four bit unsigned integer transmitted most significant bit first and having a value of '1101' or '1110', and, optionally,

wherein the spectral band replication extension data includes:

an optional spectral band replication header,

spectral band replication data after the header,

an spectral band replication extension element after the spectral band replication data, and wherein the flag is included in the spectral band replication extension element.

14. The decoder of any one of claims 10-13 wherein wherein the high frequency reconstruction metadata includes an operating parameter selected from the group consisting of envelope scalefactors, noise floor scale factors, sinusoid addition information, time/frequency grid information, crossover frequency, and inverse filtering mode.

15. The decoder of any one of claims 10-13 wherein the prototype filter, $p_0(n)$, is derived from coefficients of Table 4.

16. The decoder of any one of claims 10-13 wherein the prototype filter, $p_0(n)$, is derived from coefficients of Table 4 by one or more mathematical operations selected from the group consisting of rounding, subsampling, interpolation, or decimation.

17. The decoder of any one of claims 10-13 wherein a phase shift is added to the filtered lowband audio signal after the filtering and compensated for before the combining.