**BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS**

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**Datasheet for the decision
of 29 April 2025**

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| **Case Number:** | T 1383/23 - 3.5.04 |
| **Application Number:** | 18889527.0 |
| **Publication Number:** | 3716625 |
| **IPC:** | H04N19/40, H04N19/70, H04N19/176, H04N19/18, H04N19/186, H04N19/119, H04N19/12 |
| **Language of the proceedings:** | EN |

**Title of invention:**
IMAGE CODING METHOD ON BASIS OF NON-SEPARABLE SECONDARY TRANSFORM AND DEVICE THEREFOR

**Applicant:**
LG Electronics Inc.

**Headword:**

**Relevant legal provisions:**
EPC Art. 54, 56, 84, 123(2)
RPBA 2020 Art. 12(4), 12(6), 13(2)

**Keyword:**

Main request - claims - clarity and support in the description (no)

Auxiliary requests 1 to 3 - complexity of amendment (no) - admitted (yes)

Auxiliary requests 1 to 3 - claims - clarity and support in the description (no)

Auxiliary requests 4 to 8 - late-filed requests - should have been submitted in first-instance proceedings (yes)

Auxiliary requests 9 and 10 - amendment after notification of communication under Article 15(1) RPBA - exceptional circumstances (yes)

Auxiliary request 9 - claims - support in the description (no)

Auxiliary request 10 - clarity and support in the description (yes) - novelty and inventive step (yes)

**Decisions cited:**

**Catchword:**

**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

Boards of Appeal of the
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**Case Number: T 1383/23 - 3.5.04**

**D E C I S I O N**
**of Technical Board of Appeal 3.5.04**
**of 29 April 2025**

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|---|---|
| **Appellant:** | LG Electronics Inc. |
| (Applicant) | 128, Yeoui-daero, |
| | Yeongdeungpo-gu |
| | Seoul 07336 (KR) |

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|---|---|
| **Representative:** | Mooser, Sebastian Thomas |
| | Wuesthoff & Wuesthoff |
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| **Decision under appeal:** | **Decision of the Examining Division of the European Patent Office posted on 1 December 2022 refusing European patent application No. 18889527.0 under Article 97(2) EPC.** |

**Composition of the Board:**

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| **Chair** | F. Sanahuja |
| **Members:** | A. Seeger |
| | W. Ungler |

## Summary of Facts and Submissions

I.      The appeal is against the examining division's decision to refuse European patent application No. 18 889 527.0.

II.     The prior-art documents cited in the decision under appeal were the following:

D1:    J. Chen et al., "Algorithm Description of Joint Exploration Test Model 3", Joint Video Exploration Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, 3rd meeting, Geneva, CH, No. JVET-C1001_v3

D2:    US 2017/0094313 A1

D3:    J. Chen et al., "Algorithm Description of Joint Exploration Test Model 7", Joint Video Exploration Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, 7th meeting, Turin, IT, No. JVET-G1001_v1, 19 August 2017

D4:    X. Zhao et al., "NSST: Non-Separable Secondary Transforms for Next Generation Video Coding", 2016 Picture Coding Symposium (PCS), Nuremberg, Germany, 7 December 2016, pages 1-5, DOI: 10.1109/PCS.2016.7906344

D5:    M. Koo et al., "Description of SDR video coding technology proposal by LG Electronics", Joint Video Experts Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, 10th meeting, San Diego, CA, No. JVET-J0017-v1, 3 April 2018

III.    The decision under appeal was based on the following
        grounds:

        (a) Claims 1, 10 and 11 of the main request and of
            auxiliary requests 1 and 2 then on file were not
            clear (Article 84 EPC), and their subject-matter
            did not involve an inventive step within the
            meaning of Article 56 EPC.

        (b) The subject-matter of claims 1, 10 and 11 of
            auxiliary request 3 then on file did not involve an
            inventive step within the meaning of
            Article 56 EPC.

IV.     The applicant (appellant) filed notice of appeal. With
        the statement of grounds of appeal, the appellant filed
        claims of a main request and of auxiliary requests 1
        to 8. According to the appellant, the claims of the
        main request were identical to the claims of the main
        request on which the decision under appeal was based.
        The appellant indicated a basis in the application as
        filed for the amendments to the claims of the auxiliary
        requests and provided arguments to support its opinion
        that the claims met the requirements of Articles 56
        and 84 EPC.

V.      The appellant was summoned to oral proceedings. In a
        communication under Article 15(1) RPBA, the board gave,
        *inter alia*, the following preliminary opinion:

        (a) Claims 1, 10 and 11 of the main request were not
            clear and lacked support in the description
            (Article 84 EPC).

        (b) The subject-matter of the independent claims of the
            main request did not enjoy the priority claim.

Document D5 was prior art under Article 54(2) EPC
for any subject-matter for which the priority claim
was found to be invalid.

(c) The board was minded to admit auxiliary requests 1
to 3 into the appeal proceedings in exercise of its
discretion under Article 12(4) RPBA.

(d) The independent claims of auxiliary requests 1 to 3
were not clear and lacked support in the
description (Article 84 EPC).

(e) The board intended not to admit auxiliary
requests 4 to 8 into the appeal proceedings under
Article 12(6) RPBA.

VI.     With its reply dated 27 March 2025, the appellant filed
amended claims according to auxiliary requests 9
and 10. The appellant argued in favour of the
admittance of these requests into the appeal
proceedings, indicated a basis for the amendments, and
submitted reasons why the claims of these requests were
clear and their subject-matter was new and inventive.

VII.    With a letter dated 23 April 2025, the appellant filed
a translation of the priority document.

VIII.   The board held oral proceedings on 29 April 2025.

During the oral proceedings, the appellant filed a new
auxiliary request 10 and withdrew the former auxiliary
request 10.

The appellant's final requests were that the decision
under appeal be set aside and that a patent be granted
on the basis of the claims of the main request or,

alternatively, on the basis of the claims according to
one of auxiliary requests 1 to 8 filed with the
statement of grounds of appeal, or of auxiliary
request 9 filed with its letter dated 27 March 2025, or
of auxiliary request 10 filed during the oral
proceedings of 29 April 2025.

At the end of the oral proceedings, the Chair announced
the board's decision.

IX.     Claim 1 of the main request reads as follows:

"A video decoding method performed by a decoding
apparatus, comprising:
deriving (S1500) transform coefficients of a target
block by obtaining information on the transform
coefficients from a bitstream;
deriving (S1510) a non-separable transform index for
the target block from information on the non-separable
transform index included in the bitstream, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform;
deriving (S1520) residual samples of the target block
by performing an inverse transform for the transform
coefficients of the target block, wherein the inverse
transform is performed by using the non-separable
transform index; and
generating (S1530) a reconstructed picture based on the
residual samples, wherein reconstructed samples in the
reconstructed picture is derived by using the residual
samples,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the inverse

transform based on the non-separable transform is
performed using an inverse transform matrix indicated
by the non-separable transform index,
wherein the size of the inverse transform matrix is
NxR,
wherein the R is equal to a number of input transform
coefficients to which the inverse transform based on
the non-separable transform is applied, the N is equal
to a number of output transform coefficients of the
inverse transform based on the non-separable transform,
and the N output transform coefficients are located in
a top-left target area of the target block, and
wherein the R is smaller than the N."

X.      Claim 10 of the main request reads as follows:

"A video encoding method performed by an encoding
apparatus, comprising:
deriving residual samples of a target block;
deriving transform coefficients of the target block by
performing a transform for the residual samples of the
target block;
deriving a non-separable transform index, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform; and
encoding image information including at least one of
information on the transform coefficients and
information on the non-separable transform index,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block

by using a transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input transform
coefficients to which the transform based on the
non-separable transform is applied, the N input
transform coefficients are the coefficients included in
the top-left target area of the target block, and the R
is equal to a number of output transform coefficients
of the transform based on the non-separable transform,
and
wherein the R is smaller than the N."

XI.     Claim 10 of auxiliary request 1 reads as follows
        (features added compared with claim 10 of the main
        request are <u>underlined</u> and deleted features are ~~struck
        through~~):

        "A video encoding method performed by an encoding
        apparatus, comprising:
        deriving residual samples of a target block;
        deriving transform coefficients of the target block by
        performing a transform for the residual samples of the
        target block;
        deriving a non-separable transform index <u>representing a
        transform matrix applied to a non-separable transform</u>,
        wherein a value of the non-separable transform index
        being 0 represents ~~a~~<u>the</u> non-separable transform not
        being used for the target block, and the value of the
        non-separable transform index not being 0 represents
        one of transform matrices used for the non-separable
        transform; and
        encoding image information including at least one of
        information on the transform coefficients and
        information on the non-separable transform index,

wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using ~~a~~the transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input transform
coefficients to which the transform based on the
non-separable transform is applied, the N input
transform coefficients are the coefficients included in
the top-left target area of the target block, and the R
is equal to a number of output transform coefficients
of the transform based on the non-separable transform,
and
wherein the R is smaller than the N."

Corresponding amendments were made to claim 1 of
auxiliary request 1.

XII.    Claim 10 of auxiliary request 2 reads as follows
(features added compared with claim 10 of the main
request are <u>underlined</u> and deleted features are ~~struck
through~~):

"A video encoding method performed by an encoding
apparatus, comprising:
deriving residual samples of a target block;
deriving transform coefficients of the target block by
performing a transform for the residual samples of the
target block;
deriving a non-separable transform index<u> representing a
transform matrix applied to a non-separable transform,</u>
wherein a value of the non-separable transform index
being 0 represents ~~a~~<u>the</u> non-separable transform not

being used for the target block, and the value of the
non-separable transform index not being 0 represents
one of transform matrices used for the non-separable
transform; and
encoding image information including at least one of
information on the transform coefficients and
information on the non-separable transform index,
<u>wherein the information on the transform coefficients</u>
<u>represents values of the transform coefficients of the</u>
<u>target block,</u>
wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using ~~a~~<u>the</u> transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input transform
coefficients to which the transform based on the
non-separable transform is applied, the N input
transform coefficients are the coefficients included in
the top-left target area of the target block, and the R
is equal to a number of output transform coefficients
of the transform based on the non-separable transform,
and
wherein the R is smaller than the N."

Corresponding amendments were made to claim 1 of
auxiliary request 2.

XIII.   Claim 10 of auxiliary request 3 reads as follows
        (features added compared with claim 10 of the main
        request are <u>underlined</u> and deleted features are ~~struck~~
        ~~through~~):

"A video encoding method performed by an encoding
apparatus, comprising:
deriving residual samples of a target block;
deriving transform coefficients of the target block by
performing a transform for the residual samples of the
target block;
deriving a non-separable transform index <u>representing a</u>
<u>transform matrix applied to a non-separable transform</u>,
wherein a value of the non-separable transform index
being 0 represents a<u>the</u> non-separable transform not
being used for the target block, and the value of the
non-separable transform index not being 0 represents
one of transform matrices used for the non-separable
transform; and
encoding image information including at least one of
information on the transform coefficients and
information on the non-separable transform index,
<u>wherein the information on the transform coefficients</u>
<u>represents values of the transform coefficients of the</u>
<u>target block,</u>
wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using a<u>the</u> transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input transform
coefficients to which the transform based on the
non-separable transform is applied, the N input
transform coefficients are the coefficients included in
the top-left target area of the target block, and the R
is equal to a number of output transform coefficients
of the transform based on the non-separable transform,
<u>the input transform coefficients being represented as a</u>

vector with N entries and the output transform
coefficients being represented as a vector with R
entries, and
wherein the R is smaller than the N."

Corresponding amendments were made to claim 1 of
auxiliary request 3.

XIV.    Claim 1 of auxiliary requests 4 and 5 reads as follows:

"A video decoding method performed by a decoding
apparatus, comprising:
deriving (S1500) transform coefficients of a target
block by obtaining information on the transform
coefficients from a bitstream;
deriving (S1510) a non-separable transform index for
the target block from information on the non-separable
transform index included in the bitstream, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform;
deriving (S1520) residual samples of the target block
by performing an inverse transform for the transform
coefficients of the target block, wherein the inverse
transform is performed by using the non-separable
transform index; and
generating (S1530) a reconstructed picture based on the
residual samples, wherein reconstructed samples in the
reconstructed picture is derived by using the residual
samples,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the inverse
transform based on the non-separable transform is

performed using an inverse transform matrix indicated
by the non-separable transform index,
wherein the size of the inverse transform matrix is
NxR,
wherein the R is equal to a number of input transform
coefficients to which the inverse transform based on
the non-separable transform is applied, the N is equal
to a number of output transform coefficients of the
inverse transform based on the non-separable transform,
and the N output transform coefficients are located in
a top-left target area of the target block,
wherein the R is smaller than the N, and
wherein the step of deriving the non-separable
transform index for the target block, includes:
scanning (R+1)th to Nth transform coefficients among
the transform coefficients of the target block; and
in a case of that a non-zero transform coefficient is
included in the (R+1)th to Nth transform coefficients,
deriving the value of the non-separable transform index
as 0."

XV.    Claim 1 of auxiliary request 6 reads as follows
       (features added compared with claim 1 of auxiliary
       request 4 are underlined):

       "A video decoding method performed by a decoding
       apparatus, comprising:
       deriving (S1500) transform coefficients of a target
       block by obtaining information on the transform
       coefficients from a bitstream, wherein the information
       on the transform coefficients represents values of the
       transform coefficients of the target block;
       deriving (S1510) a non-separable transform index for
       the target block from information on the non-separable
       transform index included in the bitstream, wherein a
       value of the non-separable transform index being 0

represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform;
deriving (S1520) residual samples of the target block
by performing an inverse transform for the transform
coefficients of the target block, wherein the inverse
transform is performed by using the non-separable
transform index; and
generating (S1530) a reconstructed picture based on the
residual samples, wherein reconstructed samples in the
reconstructed picture is derived by using the residual
samples,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the inverse
transform based on the non-separable transform is
performed using an inverse transform matrix indicated
by the non-separable transform index,
wherein the size of the inverse transform matrix is
NxR,
wherein the R is equal to a number of input transform
coefficients to which the inverse transform based on
the non-separable transform is applied, the N is equal
to a number of output transform coefficients of the
inverse transform based on the non-separable transform,
and the N output transform coefficients are located in
a top-left target area of the target block,
wherein the R is smaller than the N, and
wherein the step of deriving the non-separable
transform index for the target block, includes:
scanning (R+1)th to Nth transform coefficients among
the transform coefficients of the target block; and
in a case of that a non-zero transform coefficient is
included in the (R+1)th to Nth transform coefficients,
deriving the value of the non-separable transform index
as 0."

XVI.    Claim 1 of auxiliary requests 7 and 8 reads as follows
        (features added compared with claim 1 of auxiliary
        request 4 are <u>underlined</u>):

        "A video decoding method performed by a decoding
        apparatus, comprising:
        deriving (S1500) transform coefficients of a target
        block by obtaining information on the transform
        coefficients from a bitstream<u>, wherein the information
        on the transform coefficients represents values of the
        transform coefficients of the target block</u>;
        deriving (S1510) a non-separable transform index for
        the target block from information on the non-separable
        transform index included in the bitstream, wherein a
        value of the non-separable transform index being 0
        represents a non-separable transform not being used for
        the target block, and the value of the non-separable
        transform index not being 0 represents one of transform
        matrices used for the non-separable transform;
        deriving (S1520) residual samples of the target block
        by performing an inverse transform for the transform
        coefficients of the target block, wherein the inverse
        transform is performed by using the non-separable
        transform index; and
        generating (S1530) a reconstructed picture based on the
        residual samples, wherein reconstructed samples in the
        reconstructed picture is derived by using the residual
        samples,
        wherein in a case of the value of the non-separable
        transform index being not equal to 0, the inverse
        transform based on the non-separable transform is
        performed using an inverse transform matrix indicated
        by the non-separable transform index,
        wherein the size of the inverse transform matrix is
        NxR,

wherein the R is equal to a number of input transform coefficients to which the inverse transform based on the non-separable transform is applied, the N is equal to a number of output transform coefficients of the inverse transform based on the non-separable transform, <u>the input transform coefficients being represented as a vector with R entries and the output transform coefficients being represented as a vector with N entries,</u> and the N output transform coefficients are located in a top-left target area of the target block, wherein the R is smaller than the N, and wherein the step of deriving the non-separable transform index for the target block, includes: scanning (R+1)th to Nth transform coefficients among the transform coefficients of the target block; and in a case of that a non-zero transform coefficient is included in the (R+1)th to Nth transform coefficients, deriving the value of the non-separable transform index as 0."

XVII.   Claim 10 of auxiliary request 9 reads as follows (features added compared with claim 10 of the main request are <u>underlined</u> and deleted features are ~~struck through~~):

"A video encoding method performed by an encoding apparatus, comprising:
deriving residual samples of a target block;
deriving transform coefficients of the target block by performing a transform for the residual samples of the target block<u>, wherein the transform includes (i) a primary transform performed on the residual samples and (ii) a transform based on the non-separable transform performed on coefficients derived by performing the primary transform on the residual samples</u>;

deriving a non-separable transform index, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform; and
encoding image information including ~~at least one of~~
information on the transform coefficients <u>configured to</u>
<u>derive values of the transform coefficients of the</u>
<u>target block</u> and information on the non-separable
transform index <u>representing the value of the</u>
<u>non-separable transform index</u>,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using a transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input <u>of the</u>
<u>transform</u> ~~transform coefficients to which the transform~~
based on the non-separable transform ~~is applied~~, the ~~N~~
input <u>of the transform based on the non-separable</u>
<u>transform</u> ~~transform coefficients~~ are the coefficients
included in the top-left target area of the target
block, and the R is equal to a number of output <u>of the</u>
transform ~~coefficients of the transform~~ based on the
non-separable transform, ~~and~~
wherein the R is smaller than the N<u>,</u>
<u>wherein the top-left target area is an 8x8 top-left</u>
<u>area of the target block,</u>
<u>wherein the transform coefficients for the top-left</u>
<u>target area in a range of 1st to Rth transform</u>
<u>coefficients are derived based on the output of the</u>
<u>transform based on the non-separable transform, and</u>

wherein the transform coefficients for the top-left
target area in a range of (R+1)th to Nth transform
coefficients are equal to 0."

XVIII.  Claim 1 of auxiliary request 10 reads as follows:

"A video decoding method performed by a decoding
apparatus, comprising:
deriving (S1500) transform coefficients of a target
block by obtaining information on the transform
coefficients from a bitstream, wherein the information
on the transform coefficients is to derive values of
the transform coefficients of the target block;
deriving (S1510) a non-separable transform index for
the target block from information on the non-separable
transform index included in the bitstream, wherein the
information on the non-separable transform index
represents a value of the non-separable transform
index, wherein the value of the non-separable transform
index being 0 represents a non-separable transform not
being used for the target block, and the value of the
non-separable transform index not being 0 represents
one of transform matrices used for the non-separable
transform;
deriving (S1520) residual samples of the target block
by performing an inverse transform for the transform
coefficients of the target block, wherein the inverse
transform includes (i) an inverse transform based on
the non-separable transform performed on the transform
coefficients and (ii) a primary inverse transform
performed on coefficients derived by performing the
inverse transform based on the non-separable transform
on the transform coefficients, wherein the inverse
transform based on the non-separable transform is
performed by using the non-separable transform index;
and

generating (S1530) a reconstructed picture based on the
residual samples, wherein reconstructed samples in the
reconstructed picture is derived by using the residual
samples,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the inverse
transform based on the non-separable transform is
performed using an inverse transform matrix indicated
by the non-separable transform index,
wherein the size of the inverse transform matrix is
NxR,
wherein the R is equal to a number of input of the
inverse transform based on the non-separable transform,
the N is equal to a number of output of the inverse
transform based on the non-separable transform, the
input of the inverse transform based on the
non-separable transform is represented as a vector with
R entries and the output of the inverse transform based
on the non-separable transform is represented as a
vector with N entries, and the output of the inverse
transform based on the non-separable transform is
located in a top-left target area of the target block,
wherein the R is smaller than the N, and
wherein the top-left target area is the 8x8 top-left
area of the target block."

XIX.    Claim 10 of auxiliary request 10 reads as follows:

"A video encoding method performed by an encoding
apparatus, comprising:
deriving residual samples of a target block;
deriving transform coefficients of the target block by
performing a transform for the residual samples of the
target block, wherein the transform includes (i) a
primary transform performed on the residual samples and
(ii) a transform based on the non-separable transform

performed on coefficients derived by performing the
primary transform on the residual samples;
deriving a non-separable transform index, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform; and
encoding image information including information on the
transform coefficients configured to derive values of
the transform coefficients of the target block and
information on the non-separable transform index
representing the value of the non-separable transform
index,
wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using a transform matrix indicated by the
non-separable transform index,
wherein the size of the transform matrix is RxN,
wherein the N is equal to a number of input of the
transform based on the non-separable transform, the
input of the transform based on the non-separable
transform are the coefficients included in the top-left
target area of the target block, and the R is equal to
a number of output of the transform based on the
non-separable transform, the input of the transform
based on the non-separable transform is represented as
a vector with N entries and the output of the transform
based on the non-separable transform is represented as
a vector with R entries,
wherein the R is smaller than the N,
wherein the top-left target area is the 8x8 top-left
area of the target block,

wherein the transform coefficients for the top-left
target area in a range of 1st to Rth transform
coefficients are derived based on the output of the
transform based on the non-separable transform, and
wherein the transform coefficients for the top-left
target area in a range of (R+1)th to Nth transform
coefficients are equal to 0."

## Reasons for the Decision

1.      The appeal is admissible.

2.      Main request - clarity and support in the description
        (Article 84 EPC)

2.1     A claim lacks clarity if, *inter alia*, the exact
        distinctions which delimit the scope of protection
        cannot be learnt from it. The claims *per se* must be
        free of contradiction (see Case Law of the Boards of
        Appeal of the European Patent Office, 10th edition,
        2022, "Case Law", II.A.3.1).

        Article 84 EPC stipulates that the claims must be
        supported by the description. This requirement means
        that the subject-matter of the claim must be taken from
        the description and it is not permissible to claim
        something which is not described (see Case Law,
        II.A.5.1).

2.2     Claim 10 specifies a transform based on the
        non-separable transform that has N transform
        coefficients as input ("*N is equal to a number of input
        transform coefficients to which the transform based on
        the non-separable transform is applied*").

Furthermore, claim 10 contains the following statements: "*deriving transform coefficients of the target block by performing a transform for the residual samples of the target block*" and "*in a case of the value of the non-separable transform index being not equal to 0, the transform coefficients are derived by performing the transform based on the non-separable transform*". Hence this part of claim 10 specifies a transform having residual samples as input, wherein this transform can be the transform based on the non-separable transform.

This contradiction about the input of the transform (transform coefficients versus residual samples) renders claim 10 unclear.

Moreover, deriving transform coefficients using a single transform identified by a non-separable transform index is not supported by the description. According to the description, the residual samples of a target block are always transformed by a first transform into first transform coefficients, possibly followed by a second, non-separable, transform to convert the first transform coefficients into second transform coefficients (see e.g. paragraphs [121] to [123] of the description and Figure 5).

Corresponding objections apply to claim 1, where the output of the inverse transform based on the non-separable transform is defined both as the residual samples of the target block and as transform coefficients.

2.3    The appellant argued that the person skilled in the art, reading the claim with a mind willing to understand, would have understood the subject-matter of

claims 1 and 10 as specifying two subsequent transforms.

The board is not convinced by this argument, because claim 10 just specifies "*a transform*" and states that the output transform coefficients "*are derived by performing the transform based on the non-separable transform*". The person skilled in the art would thus have understood that claim 10 encompasses a case in which the output transform coefficients are derived by performing only the non-separable transform.

Likewise, claim 1 just specifies "*an inverse transform*" which "*is performed by using the non-separable transform index*". Hence the person skilled in the art would have understood that claim 1 encompasses a case in which the inverse transform comprises just an inverse transform based on the non-separable transform.

2.4     In view of the above, the board finds that claims 1 and 10 do not meet the requirements of Article 84 EPC.

3.      Auxiliary requests 1 to 3 - admittance
        (Article 12(4) RPBA)

3.1     The additional features in auxiliary requests 1 to 3 were already present in the independent claims of auxiliary requests 1 to 3 in the first-instance proceedings.

3.2     The board is thus of the opinion that the subject-matter of these requests is closely related to that dealt with in the first-instance proceedings. Further, the amendments are not complex.

3.3     Therefore the board admits auxiliary requests 1 to 3
        into the appeal proceedings in exercise of its
        discretion under Article 12(4) RPBA.

4.      Auxiliary requests 1 to 3 - clarity and support in the
        description (Article 84 EPC)

4.1     Claims 1 and 10 of auxiliary requests 1 to 3 contain
        the same features specifying the input and output of
        the transform or the inverse transform as mentioned
        under point 2. above for claims 1 and 10 of the main
        request.

4.2     The appellant did not submit arguments in this regard
        beyond those provided already for claims 1 and 10 of
        the main request.

4.3     Therefore claims 1 and 10 of auxiliary requests 1 to 3
        do not meet the requirements of Article 84 EPC for the
        same reasons as those set out under point 2. above for
        claims 1 and 10 of the main request.

5.      Auxiliary requests 4 to 8 - admittance
        (Article 12(6) RPBA)

5.1     Under Article 12(6), second sentence, RPBA, the board
        shall not admit requests which should have been
        submitted in the proceedings leading to the decision
        under appeal, unless the circumstances of the appeal
        case justify their admittance.

5.2     Claim 1 of each of auxiliary requests 4 to 8 contains
        the following additional features:

        "*wherein the step of deriving the non-separable
        transform index for the target block, includes:*

*scanning (R+1)th to Nth transform coefficients among the transform coefficients of the target block; and*

*in a case of that a non-zero transform coefficient is included in the (R+1)th to Nth transform coefficients, deriving the value of the non-separable transform index as 0."*

5.3     The technical effect of these features is to avoid explicit signalling of the non-separable transform index.

5.4     This technical effect is clearly different from the technical effect of applying the non-separable transform only to N coefficients located in the top-left target area of the target block, wherein the R is smaller than the N, which the appellant identified as the distinguishing features of the independent claims of the main request with respect to the closest prior-art document in first-instance proceedings (see statement of grounds of appeal, section D.I.2, penultimate paragraph).

The technical effect of these distinguishing features is a reduction in the memory usage and the number of multiplication operations required for the transform, and the encoding of fewer transform coefficients.

5.5     The board is therefore of the opinion that if the appellant wanted to establish inventive step based on such a different technical effect, this should have been done already in the first-instance proceedings.

5.6     The appellant argued that the distinguishing features of the independent claims of the main request and the

additional features of the independent claims of
auxiliary requests 4 to 8 had the common technical
effect of improving the coding efficiency.

The board finds that this technical effect is too broad
and merely represents the generic aim in the field of
video coding. In the present case, the technical
effects of the distinguishing features of the
independent claims of the main request and the
additional features of the independent claims of
auxiliary requests 4 to 8 may be formulated in more
concrete terms, as set out in points 5.3 and 5.4 above.

5.7     Furthermore, the board does not see any circumstances
        of the appeal case which might justify the admittance
        of auxiliary requests 4 to 8.

5.8     Therefore the board does not admit auxiliary requests 4
        to 8 into the appeal proceedings under Article 12(6)
        RPBA.

6.      Auxiliary requests 9 and 10 - taken into account
        (Article 13(2) RPBA)

6.1     Under Article 13(2) RPBA, any amendment to a party's
        appeal case made after notification of a communication
        under Article 15(1) RPBA shall, in principle, not be
        taken into account unless there are exceptional
        circumstances, which have been justified with cogent
        reasons by the party concerned.

6.2     Auxiliary requests 9 and 10 were filed after
        notification of the board's communication under
        Article 15(1) RPBA. These auxiliary requests therefore
        constitute amendments within the meaning of
        Article 13(2) RPBA 2020.

6.3     The board raised new objections in its communication under Article 15(1) RPBA. The appellant filed auxiliary requests 9 and 10 with the aim of overcoming these new objections. The board considers this to represent an exceptional circumstance within the meaning of Article 13(2) RPBA.

6.4     Therefore the board takes auxiliary requests 9 and 10 into account in exercise of its discretion under Article 13(2) RPBA.

7.      Auxiliary request 9 - support in the description (Article 84 EPC)

7.1     Claim 10 specifies that:
        (a) the size of the transform matrix used for the non-separable transform is RxN, wherein the R is smaller than the N
        (b) N is equal to a number of input coefficients of the non-separable transform
        (c) R is equal to a number of output coefficients of the non-separable transform

        Claim 10 leaves the format of input and output coefficients of the non-separable transform open, i.e. whether they are organised as a vector, a matrix, a set or in any other form.

7.2     However, the description only provides support for a format of the N input and R output coefficients of the non-separable transform in the form of vectors (see description paragraph [168]).

7.3    Therefore claim 10 lacks support in the description as
       it leaves the format of N input and R output
       coefficients of the non-separable transform open.

7.4    The appellant argued that, although claim 10 did not
       specify a format of the N input coefficients and the R
       output coefficients to the non-separable transform, it
       was clear from the use of an RxN transform matrix that
       the input and output coefficients had to be in the form
       of a vector.

7.5    The board is not convinced by this argument. The
       wording of claim 10 does not exclude further operations
       being applied to the input coefficients before "*using a
       transform matrix*". Likewise, the wording of claim 10
       does not exclude further operations being applied after
       "*using a transform matrix*" to generate the output
       coefficients. Therefore it is possible to organise the
       input and output coefficients of the non-separable
       transform in other forms.

7.6    Therefore the board finds that claim 10 lacks support
       in the description, contrary to the requirements of
       Article 84 EPC.

8.     Auxiliary request 10 - amendments (Article 123(2) EPC)

8.1    Claim 1 combines the features of claims 1 and 2 as
       originally filed.

       Claim 1 was amended to specify deriving transform
       coefficients of a target block "*by obtaining
       information on the transform coefficients from a
       bitstream, wherein the information on the transform
       coefficients is to derive values of the transform
       coefficients of the target block*". The amendment finds

a basis in paragraph [224] of the description as filed
and step S1500 of Figure 15.

Claim 1 was further amended to specify deriving a
non-separable transform index for the target block
"*from information on the non-separable transform index
included in the bitstream, wherein the information on
the non-separable transform index represents a value of
the non-separable transform index, wherein the value of
the non-separable transform index being 0 represents a
non-separable transform not being used for the target
block, and the value of the non-separable transform
index not being 0 represents one of transform matrices
used for the non-separable transform*". The amendment
finds a basis in paragraphs [120] and [226] to [228] of
the description as filed.

Claim 1 was further amended to specify "*wherein the
inverse transform includes (i) an inverse transform
based on the non-separable transform performed on the
transform coefficients and (ii) a primary inverse
transform performed on coefficients derived by
performing the inverse transform based on the non-
separable transform on the transform coefficients*". The
amendment finds a basis in paragraph [123] of the
description as filed and steps S550 and S560 of
Figure 5.

Claim 1 was further amended to specify "*wherein in a
case of the value of the non-separable transform index
being not equal to 0, the inverse transform based on
the non-separable transform is performed using an
inverse transform matrix indicated by the non-separable
transform index*". The amendment finds a basis in
paragraph [245] of the description as filed.

Claim 1 was further amended to specify "*wherein the size of the inverse transform matrix is NxR, wherein the R is equal to a number of input of the inverse transform based on the non-separable transform, the N is equal to a number of output of the inverse transform based on the non-separable transform, the input of the inverse transform based on the non-separable transform is represented as a vector with R entries and the output of the inverse transform based on the non-separable transform is represented as a vector with N entries*". The amendment finds a basis in paragraphs [168] and [169] in combination with paragraph [123] of the description as filed.

Claim 1 was further amended to specify "*the output of the inverse transform based on the non-separable transform is located in a top-left target area of the target block ... and wherein the top-left target area is the 8x8 top-left area of the target block*". The amendment finds a basis in paragraphs [105] and [173] in combination with paragraph [123] of the description as filed.

8.2    Independent claim 10 defines a video encoding method performed by an encoding apparatus. Its category is thus the same as that of the original claim 12. Claim 10 contains features of a video encoding method which are mirror images of the features of the video decoding method defined in claim 1 and find a corresponding basis.

Moreover, claim 10 specifies "*wherein the transform coefficients for the top-left target area in a range of 1st to Rth transform coefficients are derived based on the output of the transform based on the non-separable transform, and wherein the transform coefficients for*

*the top-left target area in a range of (R+1)th to Nth transform coefficients are equal to 0*". The amendment finds a basis in paragraphs [173] and [176].

8.3        Dependent claims 2 to 9 correspond to dependent claims 2 and 4 to 10 as originally filed.

In these dependent claims the abbreviation "*NSST*" contained in the original dependent claims was written out as "*non-separable transform*". The amendment finds a basis in paragraph [9] of the description as filed.

In dependent claim 2 the term "*core transform*" was replaced by the term "*primary inverse transform*". The amendment finds a basis in paragraph [87] of the description as filed and the fact that claim 2 depends on claim 1 defining a video decoding method performing a primary <u>inverse</u> transform.

In dependent claim 2 the feature "*located in a top-left target area*" was deleted, since amended claim 1 contains a corresponding feature.

In dependent claims 5 to 7 the term "*range of the NSST index*" was replaced by "*maximum value of the non-separable transform index*". The amendment finds a basis in paragraph [146] of the description as filed.

In dependent claim 9 the abbreviation "*CTU*" was written out as "*coding tree unit*". The amendment finds a basis in paragraph [196] of the description as filed.

8.4        The claims of auxiliary request 10 thus meet the requirements of Article 123(2) EPC.

9.      Auxiliary request 10 - clarity and support in the
        description (Article 84 EPC)

9.1     The feature of claim 10 "*deriving transform
        coefficients of the target block by performing a
        transform for the residual samples of the target block,
        wherein the transform includes (i) a primary transform
        performed on the residual samples and (ii) a transform
        based on the non-separable transform performed on
        coefficients derived by performing the primary
        transform on the residual samples*" clarifies that the
        residual samples of a target block are <u>always</u>
        transformed by a first transform into first transform
        coefficients, possibly followed by a second,
        non-separable, transform to convert the first transform
        coefficients into second transform coefficients (see
        paragraphs [121] to [123] of the description and
        Figure 5).

        A corresponding feature is included in claim 1.

9.2     The feature of claim 10 "*encoding image information
        including information on the transform coefficients
        configured to derive values of the transform
        coefficients of the target block and information on the
        non-separable transform index representing the value of
        the non-separable transform index*" makes it clear that
        both information to derive <u>values</u> of the transform
        coefficients of the target block <u>and</u> information on a
        <u>value</u> of the non-separable transform index are encoded.
        Thus the relevant information elements to enable the
        operation of a corresponding decoder become available
        (see description paragraphs [224] and [120]).

        The corresponding feature of claim 1 reads: "*deriving
        (S1500) transform coefficients of a target block by*

*obtaining information on the transform coefficients
from a bitstream, wherein the information on the
transform coefficients is to derive values of the
transform coefficients of the target block; deriving
(S1510) a non-separable transform index for the target
block from information on the non-separable transform
index included in the bitstream, wherein the
information on the non-separable transform index
represents a value of the non-separable transform
index*".

9.3     The feature of claim 10 "*wherein the transform
        coefficients for the top-left target area in a range of
        1st to Rth transform coefficients are derived based on
        the output of the transform based on the non-separable
        transform, and wherein the transform coefficients for
        the top-left target area in a range of (R+1)th to Nth
        transform coefficients are equal to 0*" specifies how
        <u>all</u> the output transform coefficients replacing the N
        input transform coefficients are set (see description
        paragraphs [173] and [176]).

9.4     These amended features resolve the objections under
        Article 84 raised in the board's communication under
        Article 15(1) RPBA (see point V.(a) above). The claims
        of auxiliary request 10 thus meet the requirements of
        Article 84 EPC.

10.     Auxiliary request 10 - novelty and inventive step
        (Articles 54 and 56 EPC)

10.1    Validity of the claimed priority

10.1.1  The present application claims the priority of
        US 62/599,021, which was accorded 15 December 2017 as
        filing date.

10.1.2   The board is convinced that this priority is valid,
         *inter alia*, because the independent claims specify
         that:
         (a) the input and output coefficients of the
             non-separable transform are organised as vectors,
         (b) the values of the transform coefficients R+1 to N
             are specified as equal to 0 in claim 10, and
         (c) the N (input/output) transform coefficients are
             included in the 8x8 top-left area of the target
             block.

         Hence the issues concerning the priority claim set out
         in the board's communication under Article 15(1) RPBA
         (see point V.(b) above) were resolved.

10.1.3   As a consequence, document D5, published on
         3 April 2018, is not prior art under Article 54 EPC.

10.2     The examining division identified document D4 as a
         starting point for assessing inventive step of the
         subject-matter of claim 10 (see decision under appeal,
         point 10.1). This was not contested by the appellant
         (see statement of grounds of appeal, section D.I.2),
         and the board agrees with this assessment.

10.3     Document D4 discloses a video encoding method performed
         by an encoding apparatus, comprising:

         deriving residual samples of a target block (see
         section III.A, first paragraph: "*the NxN residual
         block X*")

         deriving transform coefficients of the target block by
         performing a transform for the residual samples of the
         target block, wherein the transform includes (i) a

primary transform performed on the residual samples
(see section III.A, first paragraph: "*a full-size
separable transform is first applied on the NxN
residual block X as the primary transform and the
transform coefficient block Y is derived*") and (ii) a
transform based on the non-separable transform
performed on coefficients derived by performing the
primary transform on the residual samples (see
section III.A, first line before equation (6): "*a
non-separable transform is applied*" and equation (6))

deriving a non-separable transform index, wherein a
value of the non-separable transform index being 0
represents a non-separable transform not being used for
the target block, and the value of the non-separable
transform index not being 0 represents one of transform
matrices used for the non-separable transform; and
encoding image information including information on the
transform coefficients configured to derive values of
the transform coefficients of the target block and
information on the non-separable transform index
representing the value of the non-separable transform
index (see section III.B, third paragraph: "*An index,
namely NSST index, is signalled for each coding unit
(CU) to indicate which secondary transform among the
three candidates is applied. If the index value is
signalled as 0, secondary transform is not applied.
Otherwise, one of the three non-separable secondary
transform candidates ... is selected and the index is
signalled as well*", and section III, first paragraph:
"*A secondary transform is an additional transform
process between the primary transform and quantization
process*", from which it is implicit that information on
the transform coefficients to derive their values for
the target block is encoded)

wherein in a case of the value of the non-separable
transform index being not equal to 0, the transform
coefficients are derived by performing the transform
based on the non-separable transform for coefficients
included in a top-left target area of the target block
by using a transform matrix indicated by the
non-separable transform index (see section III.A, last
paragraph: "*Basically, the secondary transform is
applied only on the low-frequency components, e.g.,
top-left 4x4 or 8x8, which means T is a sparse matrix*")

wherein the size of the transform matrix is RxN (see
section III.A after equation (6) stating that the
secondary transform is expressed as a transform
matrix T and "*T is an $N^2 x N^2$ transform matrix*", meaning
that R = $N^2$ and N(claim 10) = $N^2$(D4))

wherein the N is equal to a number of input of the
transform based on the non-separable transform, and the
R is equal to a number of output of the transform based
on the non-separable transform, the input of the
transform based on the non-separable transform is
represented as a vector with N entries and the output
of the transform based on the non-separable transform
is represented as a vector with R entries (see
section III.A, paragraph containing equations (5)
and (6) describing that the coefficient block Y is
stretched into a coefficient vector of length $N^2$, which
is transformed by the transform matrix T of size $N^2 x N^2$
into a transform coefficient vector of length $N^2$ which
is subsequently re-organised as an NxN block)

wherein the top-left target area is the 8x8 top-left
area of the target block (see section III.B, first
paragraph: "*For 8x8 and larger transform coefficient*

*block, an 8x8 non-separable transform is applied on the low-frequency 8x8 transform coefficients*")

10.4    The subject-matter of claim 10 therefore differs from the disclosure of document D4 in that the former further specifies that:
(a) "*the input of the transform based on the non-separable transform are the coefficients included in the top-left target area of the target block*"
(b) "*the R is smaller than the N*"
(c) "*the transform coefficients for the top-left target area in a range of 1st to Rth transform coefficients are derived based on the output of the transform based on the non-separable transform, and wherein the transform coefficients for the top-left target area in a range of (R+1)th to Nth transform coefficients are equal to 0*"

10.5    According to the appellant, the distinguishing features achieve the technical effects of reducing memory usage and the number of multiplication operations and improving coding efficiency (see statement of grounds of appeal, section D.I.2). The board considers that the increase in coding efficiency is achieved by the more specific means of reducing the number of encoded transform coefficients.

10.6    Document D4 describes in the last paragraph of section III.A that "*Basically, the secondary transform is applied only on the low-frequency components, e.g., top-left 4x4 or 8x8, which means T is a sparse matrix*".

Therefore the objective technical problem may be formulated as how to reduce memory usage, the number of multiplication operations and the number of

coefficients to encode when applying the secondary
transform of document D4.

10.7   The person skilled in the art would have understood
       that, if the secondary transform were to be applied
       only to a top-left area (of a size WxH) of the NxN
       coefficient block in D4, this would have two
       consequences.

       Firstly, the input vector Y (see D4, section III.A,
       equation (5)) would have the following structure:
       (a) the first W values would be non-zero
       (b) the following W+1 to N values would be zero
       (c) the same structure repeats H times
       (d) the remaining elements are zero.

       Secondly, the output vector F (see D4, section III.A,
       equation (6)) would have the same structure as the
       input vector.

       It would have been obvious to the person skilled in the
       art that, when applying the transform matrix to the
       input vector Y, the columns of the transform matrix
       whose elements are multiplied with elements of the
       input vector Y with a zero value could be omitted. This
       is because multiplying these columns by the respective
       zeros in the input vector Y will always result in a
       zero contribution.

       Likewise, it would have been obvious to the person
       skilled in the art that the rows of the transform
       matrix which produce elements with zero values in the
       output vector F could be omitted. This is because
       multiplying these rows by the input vector Y always has
       to result in a zero output or an output that is not
       used.

As a result of both effects, the transform matrix can be reduced to a size of HWxHW. This transform matrix of reduced size will only be applied to the top-left part of the input coefficient block, i.e. the low-frequency components.

10.8    Therefore it would have been obvious to arrive at distinguishing feature (a) quoted under point 10.4 above.

However, this approach would not have reduced the number of coefficients to encode. None of the readily available tools for reducing the number of coefficients (e.g. coarser quantisation of transform coefficients, non-separable transform matrices to better compact the energy distribution of transform coefficients) hints at using a transform matrix having fewer rows than columns. Therefore the board considers that it would not have been obvious to arrive at distinguishing feature (b) quoted under point 10.4 above.

10.9    In view of the above, the board finds that the subject-matter of claim 10 is not obvious in view of the disclosure of document D4 combined with the common general knowledge of the person skilled in the art.

10.10   The board takes the view that the same applies if instead of document D4 either document D2, section 2.4.2 of document D1 or section 2.4.3 of document D3 (the parts about mode-dependent non-separable secondary transforms within the algorithm description of the Joint Exploration Test Models) were taken as the starting point for assessing inventive step.

Furthermore, the board is of the opinion that a combination of the disclosures of documents D4, D2, D1 and D3 would not lead to the subject-matter of claim 10 in an obvious manner either.

The same applies *mutatis mutandis* to the subject-matter of claim 1, defining a corresponding video decoding method wherein instead of an RxN transform matrix an NxR inverse transform matrix is defined.

10.11    In view of the above, the board finds that the subject-matter of the independent claims is novel (Article 54 EPC) and involves an inventive step within the meaning of Article 56 EPC.

**Order**

**For these reasons it is decided that:**

1.      The decision under appeal is set aside.

2.      The case is remitted to the examining division with the
        order to grant a patent with claims 1 to 10 of
        auxiliary request 10 filed during the oral proceedings
        of 29 April 2025 and a description to be adapted
        thereto.


The Registrar:                        The Chair:


U. Bultmann                           F. Sanahuja


Decision electronically authenticated