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Datasheet for the decision of 11 June 2026

Case Number: T 0740/23 - 3.4.03

Application Number: 16704807.3

Publication Number: 3408847

IPC: G09G3/20

Language of the proceedings: EN

Title of invention:
DIGITAL IMAGE PROCESSING CHAIN AND PROCESSING BLOCKS AND A DISPLAY INCLUDING THE SAME

Applicant:
Barco NV

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

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Boards of Appeal

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Case Number: T 0740/23 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 11 June 2026

Appellant: (Applicant)	Barco NV President Kennedypark 35 8500 Kortrijk (BE)
Representative:	Kirkpatrick Avenue Wolfers, 32 1310 La Hulpe (BE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 8 December 2022 refusing European patent application No. 16704807.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	T. Häusser
Members:	A. Böhm-Pélissier
	E. Mille

Summary of Facts and Submissions

I. The appeal is directed against the decision of the examining division to refuse European patent application No. 16 704 807 for lack of inventive step (Article 56 EPC), unallowable amendments (Article 123(2) EPC) and lack of clarity (Article 84 EPC). Furthermore, some of the auxiliary requests were not admitted into the proceedings (Rule 137(3) EPC).

II. It is referred to the following **documents**

D1 = Pianykh, Oleg S.: "Digital Image Quality in Medicine", 2014, Springer, Cham Heidelberg New York Dordrecht London, XP002757553, ISBN: 978-3-319-01759-4

D2 = US 2014/363093 A1

D3 = US 2007/055143 A1

D4 = US 2007/035706 A1

D5 = US 2007/222724 A1

III. The invention

(a) The invention addresses the challenge of achieving accurate and efficient image processing for high-quality displays, particularly for medical imaging systems. Traditional systems require complex, non-linear processing steps to manage Electro-Optical Transfer Functions (EOTFs), which are used for transforming digital (colour) video signals into corresponding luminosity levels. These processes can lead to high resource consumption, increased

system complexity, and potential inaccuracies in grey-level and colour reproduction.

(b) This problem is solved by a perceptual quantizer with *floating point address encoding and piecewise linear data interpolation* that performs linear perceptual quantization within a digital image processing chain and *is implemented in a single DSP* (Digital Signal Processing) *block inside a processing engine*. By using floating-point representations, the invention reduces the memory and computational demands compared to fixed-point or linear integer-based Look-Up Tables (LUT). The perceptual quantizer ensures linear perceptual variations in luminosity, matching human vision sensitivity without requiring complex, high-precision transfer functions. The solution allows for adding (colour) *video signal* processing blocks without the need to reconfigure or redesign existing components, making it adaptable for various display technologies and applications.

IV. The appellant (applicant) **requests** that the decision of the examining division be set aside and that a patent be granted on the basis of the sole request filed with the letter of 10 October 2025 (based on auxiliary request 1 filed on 7 April 2023) comprising the following application documents:

Description:
Pages 1 to 78 filed with the letter of 10 October 2025

Claims:
No.1 to 13 filed with the letter of 10 October 2025

Drawings:

Sheets 1/30 to 30/30 as originally filed.

V. **Claim 1** according to the **sole request** (feature labelling "(1A)", "(1B)", ... added by the board as suggested by the appellant, highlighted features are added with respect to the claim wording underlying the impugned decision) reads as follows:

(1A) A perceptual quantizer for providing a linear perceptual quantizing process of an Electro-Optical Transfer Function, ~~(EOTF)~~,
(1B) for converting received digital code words of a video signal into visible light having a luminosity emitted by a display, the perceptual quantizer comprising:
(1C) a target contrast dependent exponential video coder comprising means for providing quantized video levels,
(1D) with which there is a fixed relative increment of luminosity per quantized video level,
(1E) so that every quantized video level visibly has the same proportional luminosity variation,
(1F) means for using floating point address encoding for grey tracking
(1FG1) and for grey tracking of video data representing linear luminosities,~~;~~
(1FG2) further comprising means for piecewise linear data interpolation,
*(1G) wherein said perceptual quantizer is configured to process as $L = (c^{v}$ - 1) * K based on c^{v} and is implemented in a single Digital Signal Processing, DSP, block inside a processing engine, whereby ~~v (or~~ v~~)~~ is normalized video (0 = black, 1 = white), wherein c is a perceptual contrast which is a measure for a target dynamic range, and $L = (c^{v}$ - 1) * K represents the linear luminosity*

derived with linear operators from $c^{\nu\forall}$, and the constant K = 1 / (c - 1).

Claim 11 according to the **sole request** (features "(11A)", "(11B)", ... correspond to features "(1A)", "(1B)", ... respectively) reads as follows:

(11A) A method of perceptual quantization for providing a linear perceptual quantizing process of an Electro-Optical Transfer Function, ~~(EOTF)~~,
(11B) for converting received digital code words of a video signal into visible light having a luminosity emitted by a display, the method comprising:
(11C) generating a target contrast dependent exponential video coding providing quantized video levels,
(11D) with which there is a fixed relative increment of luminosity per quantized video level,
(11E) so that every quantized video level visibly has the same proportional luminosity variation,
(11F) and using floating point address encoding for grey tracking
(11FG1) and for grey tracking of video data representing linear luminosities,
(11FG2) further comprising piecewise linear data interpolation; and
(11G) processing as $L = (c^{\nu\forall} - 1) * K$ based on $c^{\nu\forall}$ is implemented in a single Digital Signal Processing, DSP, block inside a processing engine, whereby ~~v (or v)~~ is normalized video (0 = black, 1 = white), wherein c is a perceptual contrast which is a measure for a target dynamic range, and $L = (c^{\nu\forall} - 1) * K$ represents the linear luminosity derived with linear operators from $c^{\nu\forall}$, and the constant K = 1 /(c - 1).

VI. The **reasoning** of the appellant, as far as it is relevant for this decision, can be summarised as follows:

(a) By adding the features "*means for using floating-point address encoding for grey tracking of video data representing linear luminosities*" and "*means for piecewise linear data interpolation*" to the independent claims all the essential features required to solve the objective technical problem are introduced, and inventive step is thereby established over the prior art, which neither discloses nor suggests these features in combination.

(b) the new independent claim also meet the requirements of Articles 84 and 123(2) EPC.

Reasons for the Decision

1. Main request - inventive step

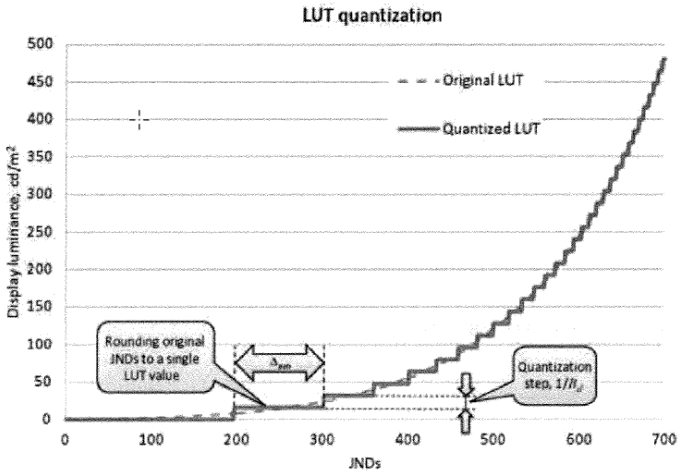
1.1 Closest state of the art

It is uncontested that D1 is the closest prior art. D2 discloses features not disclosed in D1 and is used for the inventive step discussion. D3 to D5 are more remote.

1.2 Disclosure of D1

1.2.1 D1 discloses an EOTF for converting received digital code words of a (greyscale) signal into visible light. The board agrees with the appellant that D1 fails to

disclose *video signals*, and in particular conversion of (colour) *video signals*.



D1, Figure 8.4

D1 discloses an exponential transfer function ($L_E(j)=a \cdot e^{j \cdot h}+c$), from which the function defined in feature (1G) may be derived. The board preliminarily agrees with the appellant that feature (1G) is not explicitly disclosed in D1. Derivation of feature (1G) relates to the discussion of inventive step. In particular, as can be seen in Figure 8.4 of document D1, the values on the x-axis are "JNDs" ("j"), i.e. discrete Just Noticeable Difference values, and not continuous x-values. A video signal is an electronic representation of moving visual images (cf. wikipedia). The JND format may also be used for moving video signals, but D1 discloses only static JND signals. Therefore, the board is of the opinion that D1 does not disclose a video signal.

1.2.2 It is undisputed that D1 does not disclose *means for using floating point address encoding for grey tracking* and that the *perceptual quantizer is implemented in a single DSP* (digital signal processing) *block inside a processing engine*.

1.3 Difference

1.3.1 D1 therefore discloses (references to D1, wording of claim 1):

(1A) a perceptual quantizer (cf. Figure 8.4) for providing a linear perceptual quantizing process of an Electro-Optical Transfer Function, EOTF,
(1B) for converting received digital code words of a ~~video~~ signal into visible light having a luminosity emitted by a display, the perceptual quantizer comprising:
(1C) a target contrast dependent exponential ($L_E(j)=a\cdot e^{j\cdot h}+c$) ~~video~~ coder comprising means for providing quantized (cf. Figure 8.4) ~~video~~ levels,
(1D) with which there is a fixed relative increment of luminosity per quantized ~~video~~ level,
(1E) so that every quantized ~~video~~ level visibly has the same proportional luminosity variation,
(1F) ~~means for using floating point address encoding for grey tracking~~
~~(1FG1) and for grey tracking of video data representing linear luminosities,~~
~~(1FG2) further comprising means for piece wise linear data interpolation,~~
(1G) wherein said perceptual quantizer is configured to process ~~as $L = (c^{\nu} - 1) * K$ based on c^{ν} and is implemented in a single DSP block inside a processing engine, whereby ν is normalized video (0 = black, 1 = white), wherein c is a perceptual contrast which is a measure for a target dynamic range, and $L = (c^{\nu} - 1) * K$ represents the linear luminosity derived with linear operators from c^{ν}, and the constant $K = 1 / (c - 1)$.~~

1.3.2 Consequently, in D1 none of the features (1B) to (1G) is disclosed in its entirety.

1.4 Technical effect and objective technical problem

1.4.1 The board agrees with the appellant that the invention solves the problem of achieving accurate grey tracking. Specifically, it ensures that dark grey details near the black level are preserved while also enhancing the smoothness of the transfer function near the white level. This also enables efficient processing, implementation of the processing into a single DSP block (for instance, within a field programmable gate array (FPGA)), streamlining the processing engine and improving overall performance.

1.4.2 Therefore, the objective technical problem to be solved is to achieve these effects.

1.5 Solution

1.5.1 The following is stated in the present application as the solution to this problem, i.e. as the inventive idea (passages also cited by the appellant in the statement setting out the grounds of appeal):

1.5.2 The problem of the invention is thus solved by a c*ombination of floating point address encoding and piece wise linear data interpolation* (see page 9, lines 14-16 of the description of the application).

1.6 Non-obviousness

1.6.1 The invention combines *floating point address encoding for grey tracking* with the efficient implementation of the computation of the transfer function in a single

DSP block, thereby ensuring that grey tracking is both highly accurate and efficiently processed.

1.6.2 D1 does not disclose the transfer function defined in the claims (feature (1G)), nor does D1 disclose this transfer function in the context of (moving) video signals. Other essential features of the invention (features (1F), (1G) [single DSP block] and (1FG2)) are not disclosed in D1, either.

1.6.3 D1 does not directly refer to feature (1G) nor does it directly suggest that (moving) video signals might be processed. D1 does not give any indication or hint to combine the teaching of D1 with the teaching of D2, either.

1.6.4 D2 discloses a device configured to implement a grey scale display function, where the processing is realized using an FPGA configured as a single computing device (see paragraph [0112]). D2 teaches that a functional model for predicting luminance values can be implemented in an FPGA using fixed-point values or integer-based formulas. D2 teaches a "*floating point input image*". However, there is no explicit or implicit disclosure or teaching in D2 of *floating point address encoding for grey tracking* by means of *piece wise linear data interpolation.* Paragraphs [0101], [0109] and [0124] of D2 also disclose only "*floating point representations*", "*floating point values*" or "*floating point representations image data*", but not "*floating point address encoding for grey tracking by means* of *piece wise linear data interpolation*".

1.6.5 The examining division held that the person skilled in the art would learn from document D2 how to reduce the bit depth of the input image in the device of D1 (cf.

page 116 of D1 describing the cost impact of many bits). Furthermore, a device receiving a floating point image as an input image inevitably meant that such a device was capable of using the floating point address encoding of that floating point image to establish, i.e. track, the grey level of that image.

1.6.6 However, the board is of the opinion that the method described in D1 provides a favourable solution to the cost problem precisely because the method is tailored to an inexpensive 8-bit monitor (page 116, last two paragraphs). Therefore, the skilled person would not look for an alternative solution. Even if D2 suggested *floating point address encoding for grey tracking*, D2 would not directly lead the skilled person to do this by *piece wise linear data interpolation,* because other interpolation methods are possible in the present context.

1.6.7 Therefore, even if a skilled person were to combine D1 and D2, they would only arrive at a device that incorporates a floating point input image and efficient hardware implementations based on fixed-point/integer processing. The specific inventive feature *floating point address encoding for grey tracking and piece wise linear data interpolation*, which enables the processing efficiency via a *single DSP block,* is neither disclosed in D1 nor in D2, nor would it emerge from their combination. This distinct feature combination and its synergistic effect with the efficient processing method form the basis for the invention's inventive step.

1.6.8 This allows embodiments of the invention to provide an efficient processing of the transfer function in a single DSP block inside a processing engine such as an FPGA.

1.6.9 None of the prior art documents D3, D4, or D5 disclose the features (1B) to (1G) of the present invention. D3 is related to a test system for testing a display. The goal of D3 is to optimise the calibration process rather than the video format. D3 also uses Just Noticeable Differences (JNDs). D4 relates to a display comprising a display modulator. D4 describes an image quality improvement method using light source modulation as a supplemental layer. This approach varies quantised levels based on light intensity and requires global image analysis. Unlike the present invention, D4 does not optimise processing bit usage and relies on light source modulation rather than digital processing optimisations. D5 relates to a crosstalk elimination circuit that corrects display input. D5 addresses crosstalk compensation in LCD panels via electrical adjustments using lookup tables. It focuses on electrical improvements rather than processing efficiency.

1.6.10 The same arguments apply to the corresponding independent method claim 11, the computer program product claim 12, and the non-transitory disk or other computer-readable medium claim 13.

1.6.11 Consequently, the subject-matter of claims 1, 11, 12 and 13 of the sole request meets the requirement of inventive step (Articles 52(1) and 56 EPC).

2. Articles 84 and 123(2) EPC

2.1 The independent claims comprise all features essential for achieving the envisaged technical effect and therefore meet the requirements of Article 84 EPC in conjunction with Rule 43(3) EPC.

2.2 Claim 1 is based upon claims 1 and 8 to 10 as originally filed. Claims 11 to 13 are additionally based on original claims 18 to 20. Therefore, the requirements of Article 123(2) EPC are also satisfied.

3. Conclusions

3.1 The board notes that the description was adapted to the new claims and that the relevant prior art is discussed therein.

3.2 Since all documents meet the requirements of the EPC the decision under appeal is set aside and the case is remitted to the examining division with order to grant a patent (Articles 111 (1) and 97(1) 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 in the following version:

Description:
Pages 1 to 78 filed with the letter of 10 October 2025

Claims:
No. 1 to 13 filed with the letter of 10 October 2025

Drawings:
Sheets 1/30 to 30/30 as originally filed.

The Registrar: The Chairman:

T. Buschek T. Häusser

Decision electronically authenticated