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**Datasheet for the decision  
of 11 April 2019**

**Case Number:** T 1392/14 - 3.4.03

**Application Number:** 06845857.9

**Publication Number:** 1964104

**IPC:** G09G5/36

**Language of the proceedings:** EN

**Title of invention:**  
SIGN AND METHOD FOR LIGHTING

**Applicant:**  
Cree, Inc.

**Headword:**

**Relevant legal provisions:**  
EPC 1973 Art. 56

**Keyword:**  
Inventive step - all requests (no)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
**Chambres de recours**

Boards of Appeal of the  
European Patent Office  
Richard-Reitzner-Allee 8  
85540 Haar  
GERMANY  
Tel. +49 (0)89 2399-0  
Fax +49 (0)89 2399-4465

Case Number: T 1392/14 - 3.4.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.03**  
**of 11 April 2019**

**Appellant:** Cree, Inc.  
(Applicant) 4600 Silicon Drive  
Durham, NC 27703 (US)

**Representative:** Dummett Copp LLP  
25 The Square  
Martlesham Heath  
Ipswich IP5 3SL (GB)

**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 27 January 2014  
refusing European patent application No.  
06845857.9 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** G. Eliasson  
**Members:** M. Papastefanou  
W. Van der Eijk

## Summary of Facts and Submissions

- I. The appeal is against the decision of the examining division refusing the European patent application No. 06 845 857.9 (published as WO 2007/075730 A2) on the grounds that the Main request before it lacked clarity (Article 84 EPC) and did not involve an inventive step within the meaning of Article 56 EPC. Auxiliary requests 1 to 3 were also found to be lacking inventive step.
- II. The appellant (applicant) requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the Main request or one of the 1<sup>st</sup> to 4<sup>th</sup> Auxiliary requests, all filed with the statement setting out the grounds of appeal.
- III. After the board issued summons to oral proceedings and its preliminary opinion regarding the requests on file, the appellant informed that it would not be attending the oral proceedings, which were, thus, held in its absence. At the end of the oral proceedings, the chairman announced the decision of the board.
- IV. Reference is made to the following documents:  
  
D3: EP 1 526 057 A2;  
D4: US 2005/0127381 A1;  
D12: US 6,510,633 B1.
- V. Claim 1 of the **Main request** has the following wording:  
  
*A sign, comprising:  
a sign structure,  
a display comprising at least a portion of at least a first surface on said sign structure, said display*

comprising at least one display color hue, each said display color hue having  $x,y$  coordinates on a 1931 CIE Chromaticity Diagram; and  
a plurality of light emitters, said light emitters outside said display and oriented such that when illuminated, they emit light that illuminates at least a portion of said display, said light emitters each selected from among solid state light emitters and luminescent materials, each said light emitter, when illuminated, emitting light of an illumination color hue, each illumination color hue having  $x,y$  coordinates on said 1931 CIE Chromaticity Diagram, wherein line segments drawn on said 1931 CIE Chromaticity Diagram connecting respective  $x,y$  coordinates of at least some of said illumination color hues define a shape which encompasses  $x,y$  coordinates of every display color hue in said display.

VI. Claim 1 of the **1<sup>st</sup> Auxiliary request** has the following wording:

*A sign, comprising:*  
*a sign structure having a first surface on which a display is positioned, the display comprising two or more printed colors, each of said printed colors having a display color hue having  $x,y$  coordinates on a 1931 CIE Chromaticity Diagram; and*  
*a plurality of light emitters oriented such that the light emitters shine towards the display on the surface of the sign structure, the light emitters being mounted along the bottom, the top and/or one or both sides of the sign structure, and/or are mounted remote from the sign structure,*  
*wherein the light emitters comprise a white light source having a CRI of 75 or less and one or more additional light emitters being selected from among*

*solid state light emitters and luminescent materials, each light emitter, when illuminated, emitting light of an illumination color hue having x,y coordinates on said 1931 CIE Chromaticity Diagram, and wherein line segments drawn on said 1931 CIE Chromaticity Diagram connecting respective x,y coordinates of said illumination color hues define a shape which encompasses a shape defined by line segments connecting x,y coordinates of each of said display color hues.*

VII. Claim 1 of the **2<sup>nd</sup> Auxiliary request** has the same wording as claim 1 of the 1st Auxiliary request with the exception that the option that the light emitters "*are mounted remote from the sign structure*" has been deleted.

VIII. Claim 1 of the **3rd Auxiliary request** differs from claim 1 of the 2<sup>nd</sup> Auxiliary request in that the last feature is worded as follows:

*wherein line segments drawn on said 1931 CIE Chromaticity Diagram connecting respective x,y coordinates of said illumination color hues define a shape which encompasses a shape defined by line segments connecting x,y coordinates of each of said display color hues, such that the gamut of the illumination colors of the light emitted by the light emitters fully encompasses the gamut of the display colors.*

IX. Claim 1 of the **4<sup>th</sup> Auxiliary request** has the following wording:

*A method of illuminating a sign, the sign comprising a sign structure having a first surface on which a*

*display is positioned, the display comprising two or more printed colours and each of the printed colours having a display colour hue, and a plurality of light emitters comprising solid state light emitters, each of the light emitters, when illuminated, emitting light of an illumination colour hue, and the method comprising:*

- determining x, y coordinates of colour points on a 1931 CIE Chromaticity Diagram that when connected by line segments defines a gamut that encompasses all of the display colour hues;*
- selecting said light emitters such that the shape defined by line segments connecting x, y coordinates on a 1931 CIE Chromaticity Diagram of at least some of the illumination colour hues fully encompasses said gamut of display colour hues; and*
- mounting the selected light emitters such that the light emitters shine towards and illuminate the display.*

- X. The appellant essentially argued that none of the prior art documents disclosed or suggested to select light emitters such that the shape defined by line segments connecting x,y coordinates on a 1931 CIE Chromaticity Diagram of the illumination colour hues encompasses all the x,y coordinates of all the display colour hues. The skilled person starting from D12 would thus not be able to arrive at the claimed subject matter without exercising inventive skill.

### **Reasons for the Decision**

1. The duly summoned appellant did not attend the oral proceedings before the board, as it had already announced in advance. According to Rule 71(2) EPC 1973, the proceedings could continue without the appellant. In accordance with Article 15(3) of the Rules of

Procedure of the Boards of Appeal (RPBA), the board relied in its decision only on the appellant's written submissions. The board being in a position to decide the case at the conclusion of the oral proceedings (Articles 15(5) and (6) RPBA), the voluntary absence of the appellant was not a reason for delaying the decision (Article 15(3) RPBA).

2. Preliminary remarks - technical background

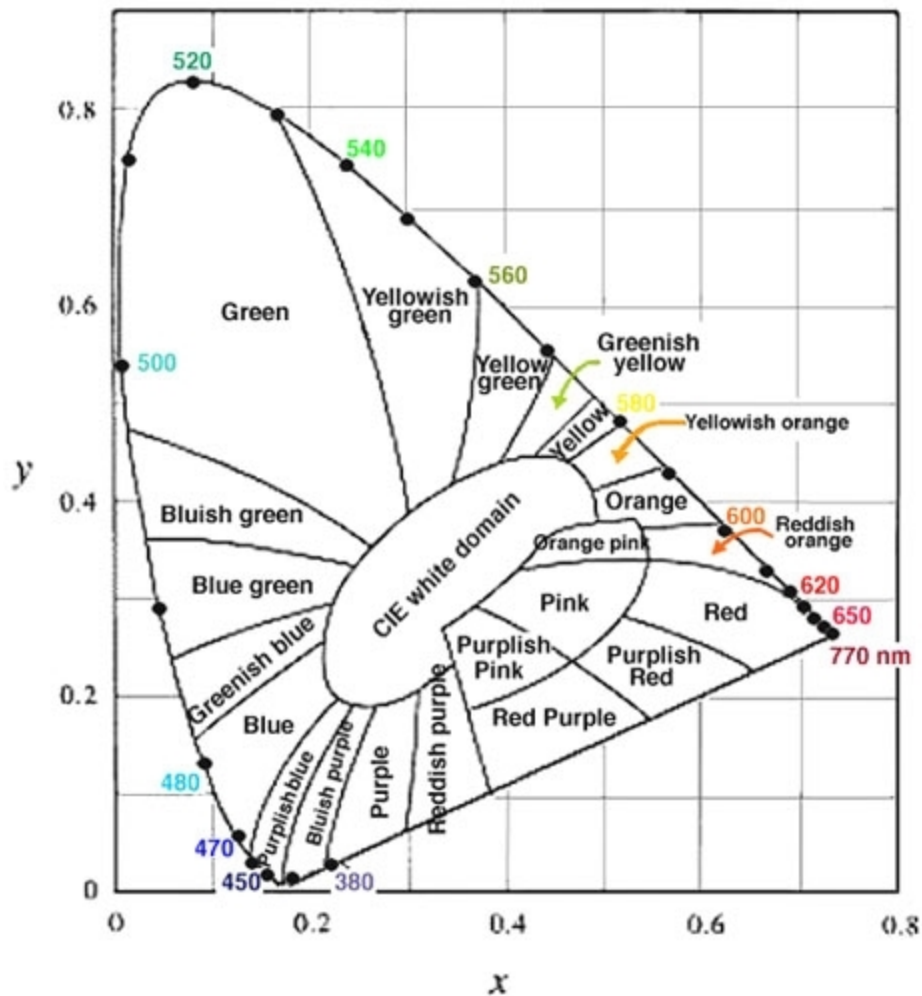
The following points explain briefly some general principles used in the present case and are considered to be common general knowledge.

- 2.1 The International Commission on Illumination (in French Commission internationale d'éclairage - CIE) is the international authority on light illumination, colour and colour spaces. In 1931 the CIE introduced a diagram representing the color space perceived by a human observer. The diagram is known as the 1931 CIE Chromaticity Diagram (see also Figure 1 of the application) and represents the whole range of colours the human eye can perceive.

Chromaticity is an objective specification of the quality of colour regardless of its luminance.

On the diagram, each colour (hue) is represented by coordinates on two axes, called usually  $x$  and  $y$ . Hence, each colour of the colour space can be specified by its  $x, y$  coordinates in the CIE 1931 Chromaticity Diagram.





2.2 It is well known that if two colours are represented with their  $x,y$  coordinates as two points on the 1931 CIE Chromaticity Diagram and these points are joined by a straight line (segment), all the colours corresponding to the  $x,y$  coordinates of the points of this segment can be reproduced by mixing the two colours defining the two end points of the segment.

Similarly, if more than two colours are represented as points (with their  $x,y$  coordinates) on the diagram and the points are joined by segments to form a shape, all the colours corresponding to the  $x,y$  coordinates of the points within this shape can be reproduced by mixing the initial colours corresponding to the points

defining the shape (vertices).

2.3 Regarding the perception of colour by the human eye, the perceived colour of objects that do not emit light themselves is the result of (partial) reflection of incident light. The spectrum of the reflected light defines the colour which the human eye perceives. For example, an object illuminated with white light (which contains the whole visible light spectrum) and which reflects only the red part of the incident light will be perceived as red. But if it is illuminated with a light that does not contain any red component, then its perceived colour will be different.

3. The claimed invention

3.1 The claimed invention relates to a sign, such as an advertising billboard or a road/traffic sign. The sign comprises two elements. First a display, which is to be understood as a panel or a surface on which a message/image/logo is printed. Second, light emitters (sources) which are arranged to illuminate the display so that its printed content can be visible.

3.2 The problem the invention is addressing is how to provide appropriate light emitters so that the printed content of the display is rendered correctly when illuminated. In particular, how to select the colours of the light emitters so that the colours of the display are correctly rendered when illuminated.

3.3 The proposed solution consists in using the 1931 CIE Chromaticity Diagram to select the light emitters in order to ensure that the colours of the display are rendered correctly. The colours of the display are represented by their corresponding  $x, y$  coordinates on

the diagram and the light emitters are selected such that the points of the diagram representing the colours of the emitted light define a shape that encompasses the x,y coordinates of all the colours of the display.

4. Main request - Inventive Step (Article 56 EPC 1973)

4.1 The Main request corresponds to the Main request underlying the decision under appeal with some minor wording amendments.

The board agrees with the appellant in that the last feature of claim 1 is to be understood such that the shape defined by the segments drawn on the 1931 CIE Chromaticity Diagram encompasses all the display colour hues (in contrast to the examining division, see point 6.3 of the impugned decision).

4.2 It is common ground that document D12 represents the closest prior art.

D12 discloses a sign comprising a sign structure (see for example Figures 2 and 5). The sign comprises a display (display panel 10). The display panel is conceived as a sign or a billboard (see column 1, line 7) comprising for example a printed message on its front surface (14) (see also Figure 5). The sign comprises thus at least one display colour hue.

The sign comprises further a plurality of light emitters outside said display and oriented such that when illuminated they emit light that illuminates at least a portion of said display (see light sources 26, Figure 2; column 3, line 52 to column 4, line 24). These light emitters can be of different types, including fluorescent and LEDs (which are solid state

emitters; see column 3, lines 40 to 51).

That the colours of the display and the light emitted by the light sources have respective  $x,y$  coordinates in the 1931 CIE Chromaticity Diagram is considered implicit, since all colours have corresponding  $x,y$  coordinates in the 1931 CIE Chromaticity Diagram.

4.3 Hence, the feature distinguishing the sign according to claim 1 from the sign in D12 is the last feature of the claim: *"wherein line segments drawn on said 1931 CIE Chromaticity Diagram connecting respective  $x,y$  coordinates of at least some of said illumination color hues define a shape which encompasses  $x,y$  coordinates of every display color hue in said display"*.

4.4 According to the properties of the 1931 Chromaticity Diagram explained above (see point 2.2), all the colours encompassed in the defined shape can be produced by mixing the colours defining the shape's vertices.

Therefore, the technical effect of this distinguishing feature is that it guarantees that the light emitters are able to render correctly all the colours printed on the display.

4.5 Correct rendering of displays in signs/billboards in the context of the present invention is regarded as an important issue, especially when the displays relate to road or traffic signs.

When LEDs are used as light sources for the sign of D12, the concerns regarding the limited spectrum of light LEDs emit (see also page 3, line 5 to page 4, line 5 of the present application) will also have to be

taken into consideration.

- 4.6 There are no explicit details about the problems regarding the selection of appropriate LEDs as light sources in D12. Hence, the skilled person would look into the other available documents of the state of the art for relevant information.
- 4.6.1 D4 describes a light emitting device comprising a combination of light emitting diodes (LEDs) of different colours (see paragraphs [0003], [0009] and [0013]). Using the 1931 CIE Chromaticity Diagram (Figure 2) and the representation of the colours of the light emitted by the LEDs on it, the invention of D4 seeks to provide a selection of colour LEDs that would produce (when combined) a light with a colour as close as possible to the colour of the light perceived as white by the human eye (paragraphs [0033] and [0034]). In particular, as it is stated in paragraph [0009], a light source comprising red, amber (yellow), green and blue (RAGB) LEDs can cover the entire visible spectrum and render accurately the colours of illuminated objects.
- 4.6.2 In document D3, which describes light sources for illuminating railway signs (paragraphs [0003], [0005]), LEDs are selected for a light source that is to emit white light in order to illuminate and render correctly all the colours foreseen for railway signs comprising reflective materials (paragraphs [0006] and [0007]). In particular (see paragraphs [0024] and [0025]), the colours of the LEDs are selected in such a way that they are able to render correctly the colours of the reflective materials on the signs ("displays" in the claim terms) and this selection is done based on the representation of the colours on the 1931 CIE

Chromaticity Diagram (see Figure 4).

The use of the Diagram in the selection of the colours of the LEDs is demonstrated in the last lines of paragraph [0025] (see column 5, lines 1-7) in combination with Figure 4. When, after a first selection of colours for the LEDs it is determined that a particular colour hue of the reflective materials ("weiß") is not rendered correctly ("nicht erreicht") an additional green LED is added so that it can be rendered correctly. Although it is not explicitly described, the board considers evident from the Diagram (Figure 4) that with the first selection of colours (Yellow - "Gelb", Blue - "Blau" and Red - "Rot") the colour "weiß" would lie outside a shape that is defined by the x,y coordinates of yellow, red and blue colours on the Diagram. When Green - "Grün" is added, a new shape defined by the x,y coordinates corresponding to the colours of the LEDs (including an additional vertex corresponding to the green colour) will encompass all the required colour hues, including "weiß".

- 4.7 The appellant argued that the skilled person would not find any relevant information in D3 or in D4 in order to arrive at the claimed subject matter in an obvious way (see appellant's letter of 7 March 2019, pages 2 and 3).

Regarding D4, the appellant pointed out that it merely disclosed mixing light colours so that light perceived by humans as white is produced.

D3 states only in paragraph [0025] that a LED of green colour was added in order to produce white light that did not depart "*from the white emission of the white*

*LEDs*". There was no mention or suggestion that the green light was added so that a shape defined by  $x, y$  coordinates of the colours of the LEDs would encompass all the required colour hues. Neither was there any disclosure that a colour hue of the reflective material was not rendered correctly because its  $x, y$  coordinates on the Chromaticity Diagram lay outside a shape defined by the colours of the LEDs.

- 4.8 The board acknowledged that neither in D3 nor in D4 there was any explicit disclosure of the claimed feature. However, the board is of the opinion that in both of these documents the use of the 1931 CIE Diagram in optimising the selection of the colour of the light emitters (LEDs) is demonstrated.

The skilled person starting from the sign of D12 and seeking information on how to better select the LEDs for the light sources such that the colour hues of the display are rendered correctly, would find in D3 or in D4 a suggestion to use the 1931 Chromaticity Diagram and the representation of the colours of the LEDs and the display on it. The requirement that a shape defined by the points corresponding to the colours of the LEDs should encompass all the required display colour hues in order to assure correct rendering is, according to the board's opinion, part of common general knowledge, as already explained (see point 2.2).

- 4.9 The board concludes, therefore, that the subject matter of claim 1 of the Main request does not involve an inventive step within the meaning of Article 56 EPC 1973.

5. Auxiliary requests

5.1 Compared to the Main request, claim 1 of the **1<sup>st</sup> Auxiliary request** additionally defines that the light emitters are mounted along the bottom, the top and/or one or both sides of the sign structure and/or are mounted remote from the sign structure and that they comprise a source having a CRI (Colour Rendering Index) of 75 or less.

5.1.1 The former feature (regarding the mounting of the light emitters) is disclosed in D12 (see Figures 2 and 5).

The latter (regarding the CRI) does not appear to be addressing any particular technical problem and appears to merely imply that the light emitter is neither an incandescent bulb (which is known to have a CRI around 95) nor a fluorescent lighting source (CRI 70-85) (see also page 1, line 25 to page 2, line 2 of the published application). Since the light emitters in D12 consist of LEDs, which are known to have lower CRIs than fluorescent light, the board considers this feature to be implicitly disclosed in D12.

5.1.2 The appellant pointed out that in none of the prior art documents there was any suggestion to use a light source with a CRI of 75 or less and argued that with the claimed invention a display on a sign could be significantly illuminated with high energy efficiency white light from a white light source with low CRI (75 or less) and the rendering of the colours of the display was improved by the inclusion of the one or more additional light emitters recited in the claims. Moreover, the board had not referred to any basis for the assertion that LEDs were known to have lower CRI than fluorescent lighting sources (see letter of appellant dated 7 March 2019, page 3 under "First



Auxiliary Request").

- 5.1.3 The board remains of the opinion that it is common general knowledge that LEDs have a CRI that is lower than fluorescent lighting sources and considers that this is also corroborated by the application itself. In the passage cited in point 5.1.1 above (page 1, line 25 to page 2, line 2), the CRI of several types of light (including fluorescent light) is given, suggesting that this information was generally known. In the following paragraphs (page 2, line 17 to page 3, line 26) there is the general description of LEDs which is also presented as generally known information and it is specifically stated that LEDs have a rather low CRI (see lines 15-16 on page 2 and lines 15-16 on page 3). Moreover, in lines 13-16 on page 2 it is specifically mentioned that "there are ongoing efforts" to provide LEDs with improved CRI so that LEDs can be used in place of incandescent or fluorescent lights (see also lines 10 to 12 on page 2).

The board is hence of the opinion that the application acknowledges as common general knowledge that LEDs have a low CRI, which is lower than the CRI of fluorescent light and does not find necessary to provide further references.

Therefore, since LEDs are used as light emitters in the sign of D12, a white light source with a CRI of 75 or less is implicitly disclosed in D12, as well.

- 5.2 Claim 1 of the **2<sup>nd</sup> Auxiliary request** differs from claim 1 of the 1<sup>st</sup> Auxiliary request only in that in the feature regarding the mounting of the light emitters the last option (the emitters being mounted remote from the sign structure) is omitted.

Hence, the subject-matter of claim 1 of the 2<sup>nd</sup> Auxiliary request does not involve an inventive step for the same reasons as the 1<sup>st</sup> Auxiliary request.

5.3 Claim 1 of the **3rd Auxiliary request** has the same wording as claim 1 of the 2<sup>nd</sup> Auxiliary request with the addition of the following feature at the end: "*such that the gamut of the illumination colors of the light emitted by the light emitters fully encompasses the gamut of the display colors*".

5.3.1 In this feature the term "gamut" (of colours) is introduced. "Colour gamut" is known to mean a range of colours. When, for example, the colour gamut of a device (like a monitor) is mentioned, this is understood as the entire range of colours available on this device.

In claim 1 of the Main request, the shape defined by the segments connecting the x,y coordinates of the illumination colours encompasses the x,y coordinates of all the display colour hues. In claim 1 of the 1<sup>st</sup>, 2<sup>nd</sup> and 3rd Auxiliary requests the shape defined by the segments connecting the x,y coordinates of the illumination colour hues encompasses *the shape* defined by the segments connecting the x,y coordinates of the display colour hues. The board does not see any difference in these two definitions, since any 3 or more points defined by x,y coordinates on the 1931 CIE Chromaticity Diagram define a shape, irrespective of whether these points are actually connected by segments or not.

The board considers also self-evident that any shape defined on the 1931 CIE Chromaticity Diagram will

encompass a range of colours, i.e. a colour gamut (see also point 2.2 above).

- 5.3.2 The added feature is regarded, hence, as a mere explanation of the feature preceding it and cannot be seen as any inventive contribution. The subject-matter of claim 1 of the 3rd Auxiliary request therefore does not involve an inventive step for the same reasons as the 1<sup>st</sup> and 2<sup>nd</sup> Auxiliary requests.
- 5.4 Claim 1 of the **4<sup>th</sup> Auxiliary request** defines a method with features corresponding essentially to the features of the sign of claim 1 of the Main request.
- 5.4.1 The appellant argued that the method of claim 1 defined two activities, which were not disclosed or suggested in the documents of the prior art. By performing these activities the light emitters were tailored to the gamut of colour hues on a display on a sign structure. In some cases a large number of light emitters would be necessary to fully encompass the gamut of display colour hues, whereas in some others the gamut of display colour hues can be encompassed with fewer light emitters, thereby possibly reducing component cost and/or energy demands (see appellant's letter of 7 March 2019, pages 3 and 4, under "Fourth Auxiliary Request").
- 5.4.2 The board notes that the said two activities consist of (see claim 1 of 4<sup>th</sup> Auxiliary request):  
(a) *determining x,y coordinates of colour points on a 1931 CIE Chromaticity Diagram that when connected by line segments defines [sic] a gamut that encompasses all of the display colour hues; and*

(b) *selecting said light emitters such that the shape defined by line segments connecting x,y coordinates on a 1931 Chromaticity Diagram of at least some of the illumination colour hues fully encompasses said gamut of display colour hues.*

5.4.3 As explained with respect to the 3rd Auxiliary request (see point 5.3.1) the board does not see any substantive difference between the use of the term "shape defined by the segments connecting x,y coordinates (on the 1931 CIE Chromaticity Diagram) of illumination/display colour hues" and the term "colour gamut of illumination/display colour hues". Hence, whether there is a first shape (defined by the illumination colour hues) encompassing the x,y coordinates of the display colour hues (as in the Main request) or a shape defined by the x,y colour hues (1<sup>st</sup>, 2<sup>nd</sup> and 3rd Auxiliary requests) or the gamut of the display colour hues (4<sup>th</sup> Auxiliary request) does not make any substantive difference to the claimed subject-matter. As already explained with respect to the previous requests, the board considers this feature to be obvious to the skilled person.

5.4.4 Moreover, the board cannot see how the definition of the two identified activities in claim 1 of the 4<sup>th</sup> Auxiliary request provides for light emitters tailored to the gamut of the display colour hues as the appellant argued. According to the claim, the only constraint is that the shape defined by the segments connecting the x,y coordinates of the illumination colour hues encompasses the gamut of the display colour hues. It is evident that, once the shape defined by the segments connecting the x,y coordinates of the display colour hues is formed/defined on the 1931 CIE Chromaticity Diagram, defining thus the gamut of the

display colour hues (see Figure 4, shape 10), there is no limitation as to the number (quantity) or the location of points (corresponding to the x,y coordinates of the illumination colour hues) to be used in order to define a shape (15 in Figure 4) such that it encompasses the first shape (10) (see also page 18, lines 18-31 of the application). The number and the colour of the light emitters to use is left for the user to decide, as long as the corresponding x,y coordinates define a shape that encompasses the shape defined by the x,y coordinates of the display colour hues. Although it would make sense to use the minimum number of light emitters necessary to define a shape that would encompass the shape defined by the display colour hues, such a decision is left to the user and may depend on other factors such as material and energy cost, but is not a result or a consequence of the claimed method. The board cannot, therefore, follow this argument of the appellant.

- 5.4.5 The board concludes, hence, that the subject-matter of claim 1 of the 4<sup>th</sup> Auxiliary request does not involve any inventive step, either.
6. Since none of the appellant's requests is allowable, the appeal must fail.

**Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:



S. Sánchez Chiquero

G. Eliasson

Decision electronically authenticated