I. Facts and Submissions

1.1. The opposed European patent EP 1 449 238 is based upon European patent application number 00932308.0 filed on 11.05.2000. Priority is claimed with reference to US 09/311126 filed on 13.05.1999.

The patent proprietors are The Trustees of Princeton University and The University of Southern California.

Notices of opposition were filed by the following opponents:

Sumation Company Limited (Opponent I), on 08.03.2007;

Merck Patent GmbH (Opponent II), on 23.07.2007;

BASF Aktiengesellschaft (Opponent III), on 01.08.2007.

The documents cited by the parties are numbered as follows:

D1 Yuguang Ma, Houyu Zhang, Jiacong Shen & Chiming Che, Synthetic Metals 94 (1998), 245-248 (Sumation D1, Merck D4, BASF E1)

D2 M A Baldo, D F O'Brien, Y You, A Shoustikov, S Sibley, M E Thompson and S R Forrest, Nature, 1998, vol. 395, p. 151-154 (Sumation D2, Merck D7, BASF E2)

D3 Yanqin Li, Yue Wang, Ying Zhang, Ying Wu & Jiacong Shen, Synthetic Metals 99 (1999) 257-260, published 23 February 1999 (Sumation D3, BASF E3)

D4 "Inorganic Chemistry" (2nd edition) by Gary L. Miessler and Donald A.Tarr, Prentice-Hall (1998) (Sumation D4, BASF E14)

D5 "Chemistry of the Elements" N N Greenwood and A Earnshaw, Pergamon Press (1984) (Sumation D5)

D6 M A Baldo, S Lamansky, P E Burrows, M E Thompson and S R Forrest, Applied Physics Letters 75(1), 4-6, 1999, published 5 July 1999 (Sumation D6)

D7 E. Vander Donckt, B Camerman, F Hendrick, R Herne and R Vandeloise, Bull. Soc. Chim. Belg vol 103 (5-6), p. 207-211, 1994 (Sumation D7, BASF E7)

D8 S Hoshino and H Suzuki, Applied Physics Letters 69(2), 1996, 224 (Sumation D8)

D9 G DiMarco, M Lanza, M Pieruccini and S Campagna, Advanced Materials 1996, 8 (7), 576-580 (Sumation D9, Merck D3, BASF E8)

D9A Abstract of D9, printed from the data bank SciFinder (Merck D9)

D10 A J Lees, Chem. Rev. 1987, 87, 711-743 (Sumation D10)

D11 Book of Abstracts, 217th American Chemical Society National Meeting, March

21-25, 1999, Abstract 541: "Optical Properties of Pt(II) cyclometalated complexes in

polymer matrices, preparation and potential uses in OLEDs" S Lamansky & M E Thompson (Sumation D11, BASF E4)

D12 K A King, P J Spellane and R J Watts, J. Am. Chem. Soc. 1985, 107, 1431-1432 (Sumation D12, BASF E6)

D13 "Photochemistrv and Photohysics of Metal Complexes" D M Roundhill, Plenum Press, 1994 (Sumation D13)

D14 Abstracts of disclosures of triarylamine hosts (Sumation D14)

D15 C W Tang, S AVanSlyke and C H Chen, J. Appi. Phys. 1989 65(9), 3610-3616 (Sumation D15)

D16 WO 01/41512 A1, Priority: 01.12.1999, publication date: 07.06.2001 (Merck D1)

D17 EP 1013740 A2, Priority: 25.12.1998, publication date: 28.06.2000 (Merck D2)

D17P1 JP 10 37045298

D18 Römpp, Lexikon Chemie, 9. Auflage, 1990/91, Thieme-Verlag, keywords: ,,Fluoreszenz and "Phosphoreszenz" (Merck D5)

D19 D. F. O'Brien et al., Applied Physics Letters 1999, 74, 442-444, ,,Improved energy transfer in electrophosphorescent devices", publication date: 18.01.1999 (Merck D6, BASF E13)

D20 M. G. Colombo et at, Topics in Current Chemistry 1994, 111, 143-171, "Competition Between Ligand Centered and Charge Transfer Lowest Excited States in bis Cyclometalated Rh^{3+} and Ir^{3+} Complexes" (Merck D8)

D21 A. Vogler, H. Kunkley, ACS Symposium Series (1987), 333 (High Energy Processes Organomet. Chem.), 155-68 CODEN: ACSMC 8; ISSN: 0097-6156, Chapter 10, 156-168, 1987 ,,Electrochemiluminescence of Organometallics and Other Transition Metal Complexes" (BASF E5)

D22 M. Klessinger, J. Michels, Physikalische Organische Chemie, Band 3, 1989 ,,Lichtabsorption und Photochemie organischer Moleküle" Ed. M. Klessinger, pages 208, 209, 226, 227 (BASF E9)

D23 P. W. Atkins, Molecular Quantum Mechanics — 2nd ed., 1983, pages 214 to 218 (BASF E10)

D24 P. W. Atkins, Physikalische Chemie, second corrected edition of the first edition, 1990, pages 484, 485 (BASF E11)

D25 Baldo et al., Pure Appl. Chem., Vol. 71, No. 11, 2095-2106, 1999 (BASF E12)

D26 US 7 125 998 B2

D27 US 7 179 915 B2

D28 “High Quantum Efficiency in Organic Light-Emitting Devices with Iridium-Complex as a Triplet Emissive Center”, Tetsuo TSUTSUI, Moon-Zae YANG, Masayuki YAHIRO, Kenji NAKAMURA, Teruichi WATANABE, Taishi TSUJI, Yoshinori FUKUDA, Takeo WAKIMOTO, Satoshi MIYAGUCHI, Jpn. J. Appi. Phys. Vol. 38 (1999), pp. L 1502 - L 1504, Part 3, No. 12B, 15 December 1999

D29 “Organic Light Emitting Diodes”, M. E. Thompson et al., Comprehensive Organometallic Chemistry III, Volume 12, 101 (2007)

D30 “Coupling Reactions of Terminal Acetylenes with a Cyclometallated Aryl Ligand”, Guochen Jia, Hon Man Lee, Hai Ping Xia, Ian D. Williams, Organometallics 1996,15, 5453-5455

D31 “Vinylidene and Carbyne Complexes Derived from the Reactions of $OsCl(PPh_3)(PCP)$ (PCP = $2,6\text{-}(PPh_2CH_2)_2C_6H_3$) with Terminal Acetylenes”, Ting Bin Wen, Yuk King Cheung, Junzhi Yao, Wing-Tak Wong, Zhong Yuan Zhou, Guochen Jia, Organometallics 2000,19, 3803-3809

D32 Nicholas J. Turro, Modern Molecular Photochemistrv, University Science Books, California, 1991, pages 3-7

D33 “Angular Dependence of the Emission from a Conjugated Polymer Light-

Emitting Diode: Implications for Efficiency Calculations”; Neil C. Greenham, Richard H. Friend, Donald D. C. Bradley; Adv. Mater. 1994, 491

D34 The American Institute of Physics Bulletin of Physics News, Number 437 (Story #2), July 2, 1999 by Phillip F. Schewe and Ben Stein

D35 “Encapsulated Cores: Host-Free Organic Light-emitting Diodes Based on Solution-Processible Electrophosphorescent Dendrimers”, Shih-Chun Lo, Thomas D. Anthopoulos, Ebnizar B. Namdas, Paul L. Burn, Ifor D.W. Samuel, Adv. Mater. 2005, 1945-1948

D36 Ma et al., Appl. Ohys. Lett., Vol. 74, No. 10, 8 March 1999, pages 1361-1363

D37 Sajoto et al., Inorganic Chemistry, Vol. 44, No. 22, 2005, pages 7992-8003

D38 H. U. Güdel et al., Inorg. Chem. 1994, 33, 545-550

D39 Experiments performed at BASF in September 2011, submitted by Opponent II on 30.09.2011

D40 Experiments performed at BASF in September 2011, submitted by Opponent II on 30.09.2011

D41 Expert Opinion of Professor W. A. Herrmann submitted by the Proprietor on 29.09.2011

S1 Ghica et al., Journal of Optoelectronics and Advanced Materials, Vol 7, No. 6. December 2005, pages 2997-3003

S2 Schöbel et al., Organic Electroluminescence, pages 5-11 from Annual Report 1997/98 of Institut für Hochfrequenztechnik, TU Beaunschweig

S3 Curioni et el., Chemical Physics Letters 294 (1998), 263-271

S4 US5486406

S5 WO03/088271

S6 Lunak et al., Chemical Physics 170 (1993), 77-80

S7 JP07-263145A

S8 Translation of S7

S9 Kwong et el., Advanced Materials 2000, 12, No. 15, pages 1134-1138

1.2. All the three Opponents requested the revocation of the patent in its entirety in accordance with Article 101(2) EPC on the grounds of lack of novelty (Articles 100(a) and 54 EPC), inventive step (Articles 100(a) and 56 EPC) and insufficiency of disclosure (Articles 100(b) and 83 EPC).

Conversely, the Proprietor requested the rejection of the oppositions and the maintenance of the patent as granted in accordance with Article 101(2) EPC.

All parties requested oral proceedings pursuant to Article 116(1) EPC.

1.3. With letter of 08.07.2011 the Opposition Division summoned the parties to attend oral proceedings.

1.4. With the letter of 27.07.2011 Opponent III filed document D38 and further observations concerning novelty and inventive step of the claims of the contested patent.

1.5. With the letter dated 30.09.2011 Opponent II filed documents D39 and D40 and further observations on insufficiency of disclosure and inventive step.

1.6. With the letter dated 29.09.2011 the Proprietor filed First to Fourth Auxiliary Requests in case the patent cannot be maintained as granted (Main Request). The Proprietor also filed document D41, an Expert Opinion concerning the definition for a metal complex being organometallic or not.

1.7. With the letter dated 30.09.2011 Opponent I filed documents S1 to S9 and further observations concerning novelty.

1.8. With the letter dated 25.10.2011 Opponent I requested the transfer of opposition from Sumation Company Ltd. to Sumitomo Chemical Co., Ltd.

1.9. With the letter dated 31.10.2011 the Proprietor expressed the view that it is unclear whether Opponent I (Sumation Company Ltd.) still exists and whether the opponent status has been validly transferred to Sumitomo Chemical Co., Ltd. For this reason, the Proprietor requested that Opponent I be excluded from the oral proceedings.

1.10. Oral proceedings were held on 03.11.2011 with the result that the patent was maintained in amended form on the basis of the Second Auxiliary Request and the amended description, Article 101(3)(a) EPC.

1.11. During oral proceedings, Opponent I declared that Sumation Company Ltd. still exists and submitted a letter of authorization (Annex 1) from the company.

1.12. The Opposition Division admitted Opponent I into the proceedings and asked Opponent I to submit evidence for the existence of Sumation Company Ltd.

1.13. During oral proceedings, the Proprietor requested that documents D38 (cited by Opponent III), D39-D40 (cited by Opponent II) and S1-S9 (cited by Opponent I) not be admitted into the proceedings, while they are late filed and not prima facie relevant.

II. Reasons for the Decision

1. The oppositions were filed in due time and stated the grounds of opposition. The requirements of Rule 76 and Articles 99(1) and 100 EPC have been met. The oppositions are therefore admissible.

2. The First to Fourth Auxiliary Requests are considered admissible, since they comply with Articles 123(2), 123(3) and 84 EPC.

3. Concerning the legal status of Opponent I, the following has to be taken into account:

With letter of 25.10.2011, Opponent I requested to record the transfer of the opposition to Sumitomo Chemical Co., Ltd (hereinafter SCC). The representative submitted that Opponent I became a wholly and directly owned subsidiary of SCC on 31.07.2007. Furthermore, by virtue of a partial business transfer agreement of 26.03.2009, the business assets of the research and development and manufacturing operations of the macromolecular organic EL materials business of Opponent I were transferred to SCC as of 01.04.2009. A letter of agreement was filed as evidence.

With communication dated 04.11.2011 the EPO informed the parties that the name of O1 had been amended as requested. However, the request filed on 25.10.2011 did not relate to a change of name of Opponent I but to the transfer of the opposition to a different legal person. Therefore the communication of 04.11.2011 should be set aside.

Regarding the transfer of the opposition, in its decision G 2/04 (OJ EPO 2005, 549) the Enlarged Board of Appeal has decided that the status as an opponent cannot be freely transferred. The only exception is implicitly provided in Rule 84(2) EPC, which accepts a transfer of opponent status in cases of universal succession (e.g. incorporation and merging of legal persons).

In G 4/88 (OJ EPO 1989, 480) the Enlarged Board also allowed the transfer of opponent status to a third part in a case where a company filed an opposition in the interest of a part of the company without legal personality and subsequently transferred the assets of that part to the third party. In G 2/04 the Enlarged Board decided that the rationale of G 4/88 cannot be extended to "similar" situations.

According to the submissions and evidence currently on file, SCC is not the universal successor of Opponent I and the submitted facts do not correspond to the situation where a transfer of the opposition was allowed in G4/88. Therefore, Sumitomo Chemical Co., Ltd. cannot acquire the status as opponent in the present case. Hence, Opponent I remains Sumation Company Limited.

Moreover, it is noted that the letter of agreement, dated 01.10.2011 (point F) indicates that a liquidator has been appointed to act on behalf of Opponent I during the period prior to its final dissolution at a date yet to be determined.

4. Concerning the admissibility of documents D38 to D40 and S1 to S9, the Opposition Division was of the opinion that D38 and S1 to S9 are late filed and not prima facie relevant, whereas the Division found D39 and D40 relevant for the question of inventive step and therefore admitted these documents into the proceedings.

5. Main Request

5.1. Sufficiency of Disclosure, Articles 100(b) and 83 EPC

According to Opponent I, the patent in suit provides only one example of an organometallic iridium compound and only one example of an organometallic osmium compound, and it contains no information relating to other organometallic iridium or osmium compounds that may be used as a phosphorescent emitter in an OLED. The claims extend to all phosphorescent organometallic iridium and osmium compounds, and no limitation on chemical structure or properties is present in the independent claims. Accordingly, the claims extend to compounds which require undue burden in

their synthesis, to compounds which may emit light in any part of the spectrum and to compounds which have any level of stability or lifetime. Additionally, the layers can contain many components, and the skilled person should do a lot of undue experimentation to find out the suitable ones. The patent therefore fails to meet the requirement that it must contain sufficient information to allow the person skilled in the art, using his common general knowledge, to perform the invention over the whole area claimed without undue burden and without needing inventive skill.

Opponent II took the view that the feature "phosphorescent" in claims 1 and 16 is not limiting, since it is not defined what should be understood under this feature, and the patent contains no information concerning the differentiation of phosphorescent and non-phosphorescent materials. Opponent II referred to D18, a general textbook in chemistry, which contains no clear definition for phosphorescence, therefore, all organometallic iridium- and osmium complexes should be regarded as phosphorescent. If, however, the feature "phosphorescent" is to be regarded as limiting over the prior art and not all organometallic iridium- and osmium complexes are regarded as phosphorescent, then the invention is not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, since no teaching exists in the patent, which organometallic iridium- and osmium complexes show phosphorescence and which not. Furthermore, claims 1 and 16 are very broad, but the patent in suit provides only one example of an organometallic iridium compound and only one example of an organometallic osmium compound. The skilled person obtains therefore only very limited information, which iridium and osmium complexes can be chosen in order to obtain efficient OLEDs. However, the requirement of sufficient disclosure is that the skilled person must be able to reproduce all the possible examples that fall within the claimed scope. Opponent II referred to decision T 435/91, in which it was decided that when a component of a claim is defined through its function, the disclosure is not sufficient, if the patent discloses only single examples rather than a technical teaching suitable for generalization, which puts the skilled person in a position of being able to obtain the desired result without undue burden through the whole scope of the claim containing the functional definition. This corresponds to the present case: the claims of the patent in suit contain the functional definition that the organometallic iridium or osmium complexes are phosphorescent. On the one hand, as mentioned above, it is not disclosed which complexes should qualify as phosphorescent, but on the other hand, even if it was clear for the skilled person how to differentiate between phosphorescent and non-phosphorescent complexes, the invention is not sufficiently disclosed. Although the patent discloses two concrete examples, the whole subject-matter of the claims cannot be reproduced by the person skilled in the art, since the essential feature the complexes being phosphorescent is a functional definition. The requirement of sufficient disclosure is that the skilled person must be able to

reproduce the whole subject-matter of the claims rather than only a part of it without undue experimentation and without needing inventive skill. However, through the functional definition, the claims attempt to protect not only the solution of the technical problem, which is the production of OLEDs containing the specifically disclosed iridium- and osmium complexes, but they also extend to all other possible solutions of the problem, where no technical information was given, how one could successfully find further suitable iridium- and osmium complexes. Opponent II referred to decision T 694/92 as well, concerning broad claims, when, after reading the description, the skilled person is not in a position to be able to perform the invention over the whole area claimed without undue burden and without needing inventive skill. In this context, Opponent II cited document D16, which discloses organometallic iridium complexes for use in OLEDs. These complexes fall under the definition given in claim 1 and 16 of the contested patent and have a very similar structure to that of the complex of the patent. It is clear from D16 that even complexes having highly similar structures can behave very differently in OLEDs to a degree that not all of them are suitable for use in such devices. It is therefore also clear that not all possible organometallic iridium complexes can solve the technical problem of the opposed patent. Consequently, from the description and the claims of the patent the skilled person obtains no information, which of the very high number of possible iridium complexes can be used to solve the technical problem and how to differentiate between suitable and unsuitable complexes. Opponent II also referred to documents D39 and D40, where it was shown that a particular phosphorescent iridium complex falling under the definition given in claims 1 and 16 of the patent is not suitable for use in OLEDs, since the device fabricated does not emit light. These experiments clearly show that not any possible iridium complex is suitable for solving the problem.

Opponent III was of the opinion that the skilled person obtains no information from the patent how the iridium- and osmium complexes of the patent can be synthesized or whether they are commercially available. Furthermore, the patent in suit provides only one example of an organometallic iridium compound and only one example of an organometallic osmium compound, but the claims relate to all possible organometallic iridium or osmium complexes. It is, however, not credible that all the known iridium and osmium complexes are suitable for use in OLEDs. Evidence for it can be found in D16, where it was shown that ligands of the complexes can quench the emission. The complexes of D16 fall under the definition of claim 1, which clearly shows that not all possible iridium complexes are suitable for use in OLEDs, but the patent provides no information how to select the complexes suitable for use in an OLED. The devices of document D37 containing also iridium complexes show only small or no emission at all. Therefore, the invention cannot be worked through the whole claimed scope.

The Proprietor refuted the arguments of the Opponents. He pointed out that the term "phosphorescent" is well understood in the art and refers to triplet state emission. Claims 1 and 16 are not directed to any organometallic iridium and osmium compounds, but only to those that are phosphorescent, and only these can be chosen to be used in the layer and the device. There are numerous organometallic iridium and osmium complexes disclosed in the prior art, which provides sufficient information how to select the suitable complexes, and even without the prior art, it is a routine experiment to find out whether a complex is phosphorescent or not. Complexes having completely quenched luminescence (D16) produce no phosphorescence and therefore are not chosen for use in the layer or the device. Similarly, the iridium complex Ir-1 of documents D39 and D40 shows no phosphorescence above 200 K, therefore it does not meet the selection criteria and would not be chosen for a device operating under normal conditions. Consequently, D16 and D39-D40 do not impose any contradiction with respect to sufficient disclosure of the invention. As for the synthesis of the complexes, organometallic iridium and osmium complexes are known from the prior art and their synthesis is well documented. Concerning claims 1 and 16 being too broad, the objection of lack of sufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts, that the skilled person is able to readily perform the invention over the whole area claimed without undue burden and without needing inventive skill. According to the proprietor, in the present case there are no such verifiable facts that may support serious doubts in this respect. On the contrary, D39-D40 clearly show that Opponent II was able to reproduce the invention.

The Opposition Division found the arguments of the Proprietor convincing and therefore was of the opinion that the Main Request satisfies the criteria of Article 83 EPC.

5.2. Novelty, Articles 100(a) and 54 EPC

5.2.1. Question of the validity of the priority claim

Opponent I pointed out that claims 1-15 of the patent directed towards an electroluminescent layer are not directly an unambiguously derivable from the priority application US 09/311126 filed on 13.05.1999. The priority document discloses an OLED comprising a heterostructure containing several organic layers. However, the patent extends to an OLED comprising an electroluminescent layer that is present in any arrangement other than a heterostructure arrangement, and in particular an arrangement in which the electroluminescent layer is the only organic layer present. Furthermore, claims 1-15 of the patent relate to an electroluminescent layer on its own, not within a heterostructure, but no single layer is disclosed in the priority document. No individualization of an emitting layer independent of a light emitting

device is possible. Therefore, the patentability of the subject-matter of claims 1-15 should be considered with regard to the state of the art at the filing date of the patent (11.05.2000).

According to Opponent III, the priority application does not disclose an electroluminescent layer as it is presently claimed in claim 1 of the patent. On the contrary, the whole priority application is concerned with an organic light emitting device containing an emissive layer and an emissive layer within an organic light emitting device, rather than with an electroluminescent layer that is independent of an organic light emitting device. Therefore, prior art available to te public before 11.05.2000 is relevant for the patentability of the subject-matter of claims 1-15 of the patent.

The Proprietor took the view that the priority application discloses an emissive layer which is part of an OLED comprising a heterostructure, i.e. a sub-entity is claimed. The presence of an electroluminescent layer in OLEDs is an implicit part of an OLED for every skilled person. This feature is literally described on page 3, lines 5 to 8 of the priority document. In line with decision G 2/98, the question to be answered for assessing the validity of the priority claim is whether the electroluminescent layer of claim 1 is directly and unambiguously derivable from the priority document by a skilled person using his general knowledge. In the present case, the skilled person directly and unambiguously derives from the priority document that it is the same invention to use phosphorescent organometallic iridium complexes in an emissive layer (priority document) or in an electroluminescent layer comprising such an emissive layer (claims 1-15 of the patent). The heterostructure referred to in the priority document is not an essential feature for the definition of the invention and therefore can be omitted in accordance with decision T 515/2000. Therefore the priority is valid for the electroluminescent layer of claim 1 of the Main Request.

The Opposition Division shared the view of the Opponents that for claims 1-15 of the patent in suit the priority claim is not valid. It is also to be added that although an electroluminescent molecule is mentioned in the priority document, there is no mention of an independent electroluminescent layer. Therefore, the patentability of the subject-matter of claims 1-15 of the Main Request should be considered with regard to the state of the art at the filing date of the patent (11.05.2000).

5.2.2. Novelty

The Opponents cited documents D1, D6, D17 and D25 against novelty of claim 1 as well as document D1 against novelty of claim 16 of the Main Request.

D1: page 246, Figure 1, an electroluminescent layer comprising a phosphorescent organometallic osmium complex; an OLED comprising said electroluminescent layer

D6: page 5, an electroluminescent layer comprising a phosphorescent organometallic iridium complex; an OLED comprising said electroluminescent layer
D17: page 38, compounds F-20 and F-21, an electroluminescent layer comprising a phosphorescent organometallic iridium complex; an OLED comprising said electroluminescent layer

D25: page 2103, an electroluminescent layer comprising a phosphorescent organometallic iridium complex; an OLED comprising said electroluminescent layer

According to the Proprietor, none of D1, D6, D17 or D25 destroys the novelty of claims 1 and 16. On the one hand, the osmium complex of D1 cannot be considered to be organometallic in the meaning of the patent. The term "organometallic" is clearly defined in the description in paragraph 22, lines 23 to 25 with reference to document D4. In this document, organometallic compounds are defined as compounds containing direct metal-carbon bonds (page 1, first paragraph of D4). Furthermore, it is noted in D4 that cyanide is usually considered a classical, nonorganic ligand (page 424 of D4). For the question of novelty, this definition is the only relevant one, since the patent is its own dictionary (cf. T311/93 and T1321/04). This definition of the term "organometallic" is also supported by an expert opinion of Prof. Dr. W. A. Herrmann, which was submitted by the Proprietor as document D41. Therefore, the osmium complex of D1 is not organometallic and D1 does not prejudice the novelty of claims 1 and 16. On the other hand, concerning D6, D17 and D25, these documents disclose OLEDs rather than electroluminescent layers. An electroluminescent layer cannot be individualized and taken out of the device independently, and the OLED cannot be novelty destroying to its layer. Consequently, D6, D17 and D25 do not prejudice the novelty of claim 1.

The Opposition Division was of the opinion that documents D6, D17 and D25 disclose the electroluminescent layer of claim 1 and the organic light emitting device of claim 16 of the Main Request. Therefore, claims 1 and 16 of the Main Request are not novel under Article 54(1) and (2) EPC.

6. First Auxiliary Request

Claims 1 and 16 of the Main Request correspond to claims 1 and 13 of the First Auxiliary Request, respectively. The difference between the Main Request and the First Auxiliary Request is that the reference to the osmium complex is missing from claims 1 and 13 of the First Auxiliary Request. As a consequence, for the reasons outlined under item 4.2.2. above, the subject-matter of claims 1 and 13 of the First Auxiliary Request is not novel over the disclosure of D6, D17 and D25.

7. Second Auxiliary Request

7.1. Novelty, Articles 100(a) and 54 EPC

The Opponents raised no objection against novelty of the Second Auxiliary Request, but Opponent II maintained that the Second Auxiliary Request did not meet the criteria of Article 83 EPC.

The Opposition Division was of the opinion that the Second Auxiliary Request satisfied the criteria of Articles 83 and 54(1) and (2) EPC.

7.2. Inventive step, Articles 100(a) and 56 EPC

Opponent I considered D1 as the closest prior art and took the view that claim 1 of the Second Auxiliary Request lacked inventive step over D1 in view of D9. He pointed out that Figure 2 of the patent shows a wide range of quantum efficiencies (including low ones) of different OLEDs containing the same iridium complex. These values are comparable to the quantum efficiency of the OLED of D1, in which the device contained an osmium complex. Therefore, the technical problem to be solved by the patent is to find alternatives to the osmium complexes disclosed in D1. In the introduction of D1 reference is made to the use of triplet emitting metal complexes for increasing the efficiency of OLEDs, and Ru, Os and Ir are mentioned as possible metals. After experimentation with an OLED containing an osmium complex, D1 concludes that materials with high triplet state photoluminescent (PL) efficiency can be used as the emitting layer of OLEDs. D1 directly refers to document D9 (reference 5 in D1) as disclosing a suitable iridium complex. Thus the skilled person is clearly motivated by the teaching of D1 to produce OLEDs using a phosphorescent organometallic iridium compound. When looking for suitable iridium complexes having high PL efficiency, one can find such complexes in D10.

Opponent II stressed that no inventive step can be acknowledged to the whole scope of claim 1. The patent discloses (paragraph 6) that the use of phosphorescent organometallic iridium complexes in OLEDs leads to high external quantum efficiency of the devices. This is, however, not the case for all phosphorescent organometallic iridium complexes. D39 and D40 show a phosphorescent organometallic iridium complex which was used to produce an OLED. This complex, when incorporated into the device, does not emit light, and the quantum efficiency of this device is more than 20 times lower than that of a device without said iridium complex. Therefore, the use of this complex does not lead to the desired technical effect, i.e. to a high quantum efficiency. As a consequence, the technical problem is not solved through the whole scope claimed, which means that the subject-matter of claim 1 does not involve an inventive step. Opponent II considers D1 as the closest prior art. The difference between D1 and the patent is that the OLED of the patent contains iridium complexes instead of osmium complexes. Since no technical effect is associated to the presence of iridium complexes in the OLEDs of the patent, the technical problem to be solved must be defined as how to find alternative emitter materials for OLEDs. The introduction of D1 already states that iridium complexes can be used in OLEDs, and

D1 also contains a direct pointer towards D9, which discloses a phosphorescent iridium complex. D1 concludes that materials with high triplet state PL efficiency can be used as the emitting layer of OLEDs. Therefore, the skilled person would consider iridium complexes as clear alternatives to osmium complexes for use in OLEDs.

According to Opponent III, D1 discloses every feature of claim 1 with the difference that in the OLED of claim 1 an iridium complex is used rather than an osmium complex. The introduction of D1 states that organometallic complexes exhibiting strong triplet state emission provide a possibility to design high efficiency OLEDs. As concrete examples, D1 refers to Ru, Os and Ir complexes. D1 also suggests (page 248, first paragraph of the right column) that materials with high triplet state PL efficiency can be used as the emitting layer of OLEDs. Therefore, it would be obvious for the skilled person to replace the osmium complex in the OLED of D1 with an organometallic iridium complex. Furthermore, D1 also contains a direct reference (reference 5) to D9, which discloses an organometallic iridium complex having a high triplet state PL efficiency. Another possible combination of D1 would be with D7 or D12, which disclose (D7: page 207, left column, second paragraph; D12: page 1431, right column, first paragraph) organometallic iridium complexes with high PL efficiency and high luminescent quantum yield. D1 could also be combined with D10, which also discloses (page 731, point 5) iridium complexes having a high PL quantum yield. For the reasons given above, claim 1 does not involve an inventive step.

The Proprietor drew the attention of the parties to the fact that both economics and science acknowledged the importance of the invention and experts called the invention a major breakthrough in OLED technology. The Proprietor agreed that document D1 can be considered as the closest prior art, coming from the same technical field. The difference is that in the patent an organometallic iridium complex is used as the emitter. Example 3, paragraph 28 of the patent shows that the fabricated device has a very high quantum efficiency of 8%. The iridium complexes have strong spin-orbit coupling and efficient intersystem crossing, which leads to the phenomenon that the whole emission originates from phosphorescence without fluorescence. It means a highly efficient emission and a very high efficiency of the obtained device. The problem to be solved, therefore, is to find electroluminescent emitters with high efficiency. Concerning the OLED of D1, containing an osmium complex, this device has a very low efficiency (below 0.1%, see page 247, right column). Therefore, when reading D1, the skilled person would come to the conclusion that emissive materials with high triplet state PL efficiency will not improve the luminescent efficiency of an OLED. Instead, D1 foresees that the efficiency can be improved through the optimization of the device structure and does not mention that more efficient emitters could also be used to improve the device efficiency. The speculation of the authors of D1 that materials with high triplet state PL efficiency can be used as the emitting layer of OLEDs is in clear contradiction with their own experimental data. Although D1

makes reference to several documents (references 4-7 in D1), these publications describe ruthenium, rhenium and iridium compounds without any indicated preference for the iridium complexes. According to the Proprietor, the combination of D1 with D7, D9, D10 or D12 by the Opponents is clearly an ex-post-facto analysis having the present invention in mind. None of D7, D9, D10 or D12 is concerned with OLEDs, electroluminescence or emitters for OLEDs. Even if D1 contains a reference to D9, the latter document is from a different technical field (oxygen sensors) and discloses not only iridium but also ruthenium complexes. The luminescent quantum yield of the ruthenium complex is higher than that of the iridium complex, therefore, if a choice should be made by the skilled person, he would choose the ruthenium complex. Thus, there is no objective reason to combine the teaching of D1 with that of any of D7, D9, D10 or D12. Concerning the objection that the technical problem is not solved through the whole scope claimed, the Proprietor took the view that the intrinsic properties of phosphorescent organometallic iridium complexes make them suitable for use as emitters in OLEDs. As for Figure 2 of the patent, which shows a wide range of quantum efficiencies of different OLEDs containing the same iridium complex, it must be observed that high device efficiency can be attained if the layers of the OLED are properly chosen. The Opponents did not prove that the desired technical effect cannot be obtained within the entire range of phosphorescent organometallic iridium complexes. As far as D39 and D40 are concerned, the experiments clearly demonstrate that the iridium complex Ir-1 shows no phosphorescence above 200 K, therefore it does not meet the selection criteria and would not be chosen for a device operating under normal conditions. Consequently, for the assessment of inventive step, D39 and D40 are irrelevant.

The Opposition Division found the arguments of the Proprietor convincing. Starting from D1, the skilled person would not be directed to use a phosphorescent organometallic iridium complex in place of the osmium compound of D1. There is also no clear direction in D1 that would steer the skilled artisan's attention to the complexes disclosed in D7, D9, D10 or D12, since these documents are from different technical fields and are concerned with photoluminescence rather than electroluminescence. Furthermore, documents D39 and D40 do not prove that the technical problem of finding further electroluminescent emitters for OLEDs is not solved through the whole scope claimed, since the iridium complex Ir-1 of D39 and D40 is not phosphorescent above 200 K and the OLED fabricated therewith necessarily shows no phosphorescent emission either under normal conditions.

7.3. The patent was therefore maintained in amended form on the basis of the Second Auxiliary Request and the amended description (Annex 2) filed at the end of the oral proceedings, Article 101(3)(a) EPC.