UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

PICTIVA DISPLAYS INTERNATIONAL LTD., *Plaintiff*, v. SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC. *Defendants*.	Case No. 2:23-cv-00495-JRG **JURY TRIAL DEMANDED**

SAMSUNG ELECTRONICS CO. LTD. AND SAMSUNG ELECTRONICS AMERICA, INC.'S P.R. 3-3 AND 3-4
CORRECTED INVALIDITY CONTENTIONS

Defendants Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Defendants" or "Samsung") hereby provide the following Preliminary Invalidity Contentions ("Contentions") to Plaintiff Pictiva Displays International Ltd. ("Plaintiff" or "Pictiva") for U.S. Patent Nos. 6,949,389 (the "'389 patent"), 8,314,547 (the "'547 patent"), 8,558,223 (the "'223 patent"), 8,723,164 (the "'164 patent"), 9,257,492 (the "'492 patent"), and 11,828,425 (the "'425 patent").

I. PRELIMINARY STATEMENT AND RESERVATION OF RIGHTS

In its Infringement Contentions dated March 11, 2024, Pictiva asserted the following claims (the "Asserted Claims"):

- the '389 patent: 34, 35, 41, 43-46;
- the '547 patent: 1-5, 8-14;
- the '223 patent: 1-2, 10-14;

- the ’164 patent: 1-16;
- the ’492 patent: 1, 2, 6, 8-10, 16.[1]
- the ’425 patent: 1-4, 9-10, 12, 17-18[2]

Samsung does not provide any Contentions directed to claims that Pictiva has not asserted for purposes of infringement. To the extent Pictiva may be permitted to assert additional claims in the future, Samsung reserves all rights to disclose new or supplemental contentions regarding such claims.

Because the same claim scope must apply for both infringement and invalidity, these Contentions are based on Pictiva’s assertions in its Infringement Contentions. Samsung does not thereby implicitly or explicitly agree with Pictiva’s construction of the claims. Samsung reserves all rights to disclose new or supplemental invalidity contentions, including to address any construction of the claims rendered by the Court, changed theories of infringement, and any evidence obtained during the course of discovery.

Subject to the rights reserved in these Contentions, all Asserted Claims are invalid under at least one or more of 35 U.S.C. §§ 102, 103, and/or 112. The Asserted Claims are invalid because they are anticipated and/or rendered obvious under 35 U.S.C. §§ 102 and 103. If Pictiva contends or a fact-finder finds that one or more limitations of the Asserted Claims are not disclosed in the prior art identified as anticipatory, Samsung reserves the right to assert obviousness based on the identified references and/or to identify other references that would have rendered obvious the allegedly missing limitation. Furthermore, the obviousness combinations of references provided

[1] Pictiva did not identify claim 3 in its infringement contentions cover pleading, but does identify claim 3 in its infringement chart.

[2] While Pictiva’s infringement contentions cover pleading identifies claim 11, the infringement chart does not identify claim 11 as an asserted claim and does not chart this claim as infringed.

below and in the accompanying claim charts under 35 U.S.C. § 103 are exemplary only and are not intended to be exhaustive. If or when Pictiva challenges the disclosure of any of these references with respect to particular limitations of the Asserted Claims, Samsung reserves the right to supplement these Contentions to assert additional or different bases for obviousness. Samsung reserves the right to use any combination of the references set forth in these Contentions to demonstrate the obviousness of the Asserted Claims. Additionally, certain claims of the Asserted Patents are invalid for failure to comply with the written description, enablement, and definiteness requirements of 35 U.S.C. § 112.

Samsung expressly reserves the right to amend, correct, and/or supplement these Contentions in accordance with the Docket Control Order governing this case.

* * *

These Contentions reflect Samsung's knowledge, investigation, and discovery as of the date of service. Samsung reserves the right to supplement these Contentions as appropriate and for any permissible reason. For example, pursuant to the Docket Control Order, Samsung reserves the right to supplement these Contentions after subsequent case events, including any disclosure by Pictiva of amended or supplemental infringement contentions, any ruling by the Court on claim construction, or in response to arguments made and positions taken by Pictiva during fact and expert discovery. Samsung also reserves the right to supplement these Contentions if it becomes aware of additional prior art, becomes aware of additional features of the prior art references cited below, or becomes aware of any other relevant information through discovery, including non-party discovery, or otherwise. Samsung also reserves the right to modify or supplement its Contentions based on the Court's construction of the claims.

In addition to the charts attached hereto, Samsung expressly incorporates by reference, as if expressly set forth in these Contentions, all invalidity positions, prior art, and claim charts asserted against Pictiva in any Pictiva lawsuit or IPR proceeding by Samsung, prior defendants, petitioners, and potential or actual licensees to the Asserted Patents. Samsung also incorporates any future discovery responses and expert reports in such litigations or proceedings.

Samsung's citations to disclosures in any particular prior art reference are not (and are not intended to be) exhaustive but rather illustrative. Samsung reserves the right to rely on uncited portions of the prior art references and on other publications and expert testimony as aids in understanding and interpreting the cited portions, as providing context thereto, as additional evidence that the prior art discloses a claim limitation or the alleged invention as a whole, as evidence of the state of the art at a particular time, as evidence of the obviousness factor of contemporaneous development by others, and as evidence of motivation to combine. Samsung also reserves the right to rely on uncited portions of the prior art references, other publications, and testimony, including expert testimony, to establish bases for combination of prior art references that render the charted claims obvious. Due to the related nature of the Asserted Patents, Samsung also reserves the right to rely on any cited portions of a prior art reference for one Asserted Patent against all Asserted Patents. Samsung also reserves the right to rely upon any documentary or testimonial evidence of the existence of any systems that embodied or practiced the disclosures found in the accompanying invalidity charts, for example as discussed in the prior art references cited herein, as such systems may qualify as prior art under 35 U.S.C. § 102(g).[3]

Samsung intends to rely on admissions concerning the scope of the prior art relevant to the Asserted Patents found in, *inter alia*: the patent prosecution histories for the Asserted Patents and

[3] Citations herein refer to the pre-AIA version of Title 35 of the U.S. Code.

related patents and/or patent applications (including all prior art cited therein); any deposition testimony of the named inventors on the Asserted Patents and related patents and/or patent applications in this matter or any other matter; evidence and testimony relating to the level of skill in the art; and the papers filed and any evidence submitted by Pictiva in connection with this matter.

Samsung reserves the right to assert that the Asserted Claims are invalid under 35 U.S.C. § 102(f) in the event Samsung obtains additional evidence that the inventors named in any of the Asserted Patents did not invent the subject matter claimed therein. Should Samsung obtain such evidence, it will provide the name of the person(s) from whom and the circumstances under which the alleged invention or any part of it was derived.

These Contentions are not intended to include or otherwise reflect Samsung's claim interpretations. Because the Court has not yet construed any of the claims in this litigation, Samsung bases these Contentions at least on its present understanding of Pictiva's view and application of the claim scope, to the extent that view can be inferred from Pictiva's actual and/or apparent application of those claims. But Samsung does not adopt any constructions or interpretations impliedly or expressly in these Contentions. Moreover, Samsung's Contentions may reflect alternative positions as to claim construction and scope.

For the purposes of these Contentions, Samsung has made assumptions regarding possible meanings of indefinite claim terms. By making these assumptions, Samsung does not admit that any claim language satisfies 35 U.S.C. § 112. Similarly, the use of asserted claim terms herein should not be understood to mean that such terms, as used in the Asserted Patents or claims thereof, are definite or otherwise comply with the conditions of patentability under 35 U.S.C. § 112. Likewise, the use of asserted claim terms herein should not be understood to suggest or imply a common, usual, ordinary, customary, plain, or accepted meaning in the art for any such terms.

By providing these Contentions, Samsung is not waiving nor limiting its rights to make arguments in the future about the proper scope of the claims or to advance alternative constructions to those Pictiva advocates. Samsung expressly reserves the right to argue for such alternative claim constructions during this litigation and to supplement these Contentions after the Court has issued a claim construction ruling.

Samsung's factual investigations, including its investigation of prior art and grounds for invalidity, is ongoing. Further, Samsung's invalidity positions will be the subject of expert testimony. Samsung reserves the right to supplement these Contentions, including, without limitation, adding additional prior art and grounds of invalidity in accordance with the Federal Rules of Civil Procedure and Docket Control Order in this case, or otherwise.

II. PERSON HAVING ORDINARY SKILL IN THE ART

'389 patent: A person of ordinary skill in the art of the '389 patent at the time of the alleged invention would have had a bachelor's degree in Electrical Engineering, Materials Science, or a related field, and at least one year of experience in display technologies. An individual with additional education could have less research or industrial experience and vice versa.

'547 patent: A person of ordinary skill in the art at the time of the alleged inventions would have had a B.S. degree in electrical engineering, physics, or a comparable field of study, and would have had at least three years of research or industrial experience with semiconductor (organic or inorganic) optoelectronic devices and/or lighting or displays. An individual with additional education could have less research or industrial experience and vice versa.

'223 patent: A person of ordinary skill in the art at the time of the alleged invention of the '223 patent would have had a university degree in chemistry and additional expertise or a second university degree in the field of electrical engineering, particularly optoelectronics, or alternatively

a university degree in electrical engineering and additional expertise or a second university degree in the field of chemistry. The person of ordinary skill in the art has spent several years studying the structure and function of organic optoelectronic components, in particular OLEDs, and has detailed knowledge of the chemical structure of light-emitting organic layers and the transport of charge carriers to these layers. In this respect, the person of ordinary skill in the art works at the interface between electrical engineering/physics (charge carrier transport and light emission processes in optoelectronic components) and chemistry, in particular organic chemistry (materials and layer stack combinations suitable).

'164 patent: A person of ordinary skill in the art at the time of the alleged invention of the '164 patent would have had a Bachelor's degree in chemistry, physics, or a comparable field of study, and at least three years of research or industrial experience with organic optoelectronic light-emitting devices. An individual with additional education could have less research or industrial experience and vice versa.

'492 patent: A person of ordinary skill in the art at the time of the alleged inventions would have had a B.S. degree in electrical engineering, physics, or a comparable field of study, and would have had at least three years of research or industrial experience with semiconductor (organic or inorganic) optoelectronic devices and/or lighting or displays. An individual with additional education could have less research or industrial experience and vice versa.

'425 patent: A person of ordinary skill in the art at the time of the alleged invention of the '425 patent would have had a bachelor's degree in electrical engineering, physics, or a comparable field of study, and at least three years of research or industry experience with organic light-emitting devices. An individual with additional education could have less research or industry experience and vice versa.

III. IDENTIFICATION OF RELEVANT PRIOR ART

A. Priority Dates

Pictiva has alleged but not yet shown that the Asserted Claims in some of the Asserted Patent are entitled to a priority date earlier than the filing date of each Asserted Patent. To the extent that Pictiva attempts to assert an earlier priority date for any Asserted Claim, Samsung reserves the right to amend this disclosure to address any such claim.

B. Prior Art Patent Publications

Based on their investigation to date, Samsung has provided in the list below the prior art patent publications presently known to Samsung that it contends anticipate and/or render obvious the Asserted Claims. The prior art identified in these Contentions discloses (i.e., anticipates and/or renders obvious) the elements of the Asserted Claims either explicitly or inherently. Samsung reserves the right to rely on any prior art identified in these Contentions against any of the Asserted Patents. Similarly, the prior art patent publications listed on the face of the Asserted Patents discloses (i.e., anticipates and/or renders obvious) the elements of the Asserted Claims either explicitly or inherently, and Samsung reserves the right to rely on any such reference.

Prior-art patents or publications included in these Contentions may be related (such as a divisional, continuation, continuation-in-part, parent, or child) to earlier or later-filed patents or publications, may have counterparts filed in other jurisdictions, or may incorporate (or be incorporated by) other patents or publications by reference. The listed patents or publications are intended to be representative of these other patents or publications to the extent they exist. Samsung accordingly reserves the right to modify, amend, or supplement these Contentions with these related patents or publications, as well as other prior art references, upon further investigation. Additionally, any reference in these Contentions, including the appendices and

exhibits thereto, to a specific subsection or subsections of 35 U.S.C. § 102, is merely exemplary, and Samsung expressly reserves the right to rely on additional or other sections of 35 U.S.C. § 102, as appropriate. If Pictiva asserts that one or more of these references or systems fails to disclose one or more elements of a claim, Samsung reserves the right to also use those references to invalidate the claim under 35 U.S.C. § 103.

Discovery is ongoing, and Samsung's prior art investigation and third-party discovery is therefore not yet complete. Samsung reserves the right to present additional items of prior art under 35 U.S.C. §§ 102 and/or 103 that are located during the course of discovery or further investigation. For example, Samsung expects to receive documents from additional third parties either through informal requests or under subpoenas that are believed to have knowledge, documentation, and/or corroborating evidence concerning some of the prior art listed and discussed below. These third parties include without limitation the authors, inventors, or assignees of the references listed in these disclosures.

Name	**Country of Origin**	**Publication/Issue Date**
U.S. Pat. No. 6,592,933 (Himeshima)	United States	April 22, 1999
KR100276140	Korea	June 25, 1999
U.S. Pat. No. 7,282,240 (Jackman)	United States	October 16, 2007
U.S. Patent Application Publication No. 2007/0023734 ("Igarashi '734")	United States	February 1, 2007
Japanese Published Application No. H10-170918 ("Shiotani '918")	Japan	June 26, 1998
U.S. Patent Application Publication No.	United States	November 22, 2001

2001/0043043 (“Aoyama ’043”)		
U.S. Patent Application Publication No. 2004/0233664 (“Beeson ’664”)	United States	November 25, 2004
U.S. Patent No. 6,949,389 (“Pilcher ’389”)	United States	September 27, 2005
Japanese Patent Publication No. 2007-277631 (“Suzuki ’631”)	Japan	October 25, 2007
U.S. Patent Application Publication No. 2007/0001587 (“Hatwar ’587”)	United States	January 4, 2007
U.S. Patent Application Publication No. 2007/0020483 (“Kim ’483”)	United States	January 25, 2007
WIPO Publication No. 2008/040323 (“Diekmann ’323”)	International	April 10, 2008
U.S. Patent Application Publication No. 2005/0146267 (“Lee ’267”)	United States	July 7, 2005
U.S. Patent Application Publication No. 2007/0159095 (“Koichi ’095”)	United States	July 12, 2007
U.S. Patent Application Publication No. 2008/0211394 (“Koshihara ’394”)	United States	September 4, 2008
U.S. Patent Application Publication No. 2004/0080267 (“Cok ’267”)	United States	April 29, 2004
U.S. Patent Application Publication No. 2008/0055266 (“Harada ’266”)	United States	March 6, 2008
U.S. Patent Application Publication No. 2003/0153240 (“DeJule ’240”)	United States	August 14, 2003

U.S. Patent Application Publication No. 2003/0146696 (“Park ’696”)	United States	August 7, 2003
U.S. Patent Application Publication No. 2006/0152150 (“Boerner ’150”)	United States	July 13, 2006
U.S. Patent No. 6,624,828 (“Dresevic ’828”)	United States	September 23, 2003
U.S. Patent Application Publication No. 2008/0211395 (“Koshihara ’395”)	United States	June 15, 2010
U.S. Patent Application Publication No. 2008/0278070 (“Kim ’070”)	United States	November 13, 2008
U.S. Patent Application Publication No. 2003/0159910 (“Caldwell ’910”)	United States	August 28, 2003
U.S. Patent Application Publication No. 2008/0238305 (“Kondo ’305”)	United States	October 2, 2008
U.S. Patent Application Publication No. 2006/0214892 (“Harada ’892”)	United States	September 28, 2006
Korean Patent Application Publication No. 2006-0081648 (“Ko ’648”)	Korea	July 13, 2006
Japanese Patent Application Publication No. 2007-265841 (“Takagi ’841”)	Japan	October 11, 2007
Japanese Patent Application Publication No. 2004-145878 (“Iwase ’878”)	Japan	September 28, 2006
Japanese Patent Application Publication No. 2007-207469 (“Takashima ’469”)	Japan	August 16, 2007
U.S. Pat. No. 6,866,901 (Burrows ’901)	United States	April 3, 2003
U.S. Pat. No. 5,734,225 (“Biebuyck”)	United States	July 10, 1996

U.S. Pat. No. 6,087,196 (“Sturm”)	United States	July 11, 2000
U.S. Pat. No. 6,337,222 (“Shimoda”)	United States	January 8, 2002
U.S. Pat. App. No. 2003/0048074 (“Ni”)	United States	March 13, 2003
EP 1,093,166 (“Yamazaki ’166”)	European Union	April 18, 2001
U.S. Pat. No. 6,597,111 (“Silvernail”)	United States	May 29, 2003
U.S. Patent No. 8,808,457 (“Pagano”)	United States	January 29, 2004
U.S. Pat. No. 6,413645 (“Graff”)	United States	July 2, 2002
U.S. Pat. No. 6,198,217 (“Suzuki ’217”).	United States	March 6, 2001
U.S. Patent No. 5,686,360 (“Harvey ’360”)	United States	April 11, 1997
U.S. Pat. App. No. 2003/0011300 (“Palanisamy ’300”)	United States	January 13, 2001
U.S. Pat. No. 5,771,562 (“Harvey III”)	United States	June 30, 1998
WO2001008242A1 (“Duthaler ’242”)	WO	February 1, 2001
U.S. Pat. No. 6,633,121 (“Eida ’121”)	United States	December 13, 2001
U.S. Pat. No. 6,525,467 (“Eida ’467”)	United States	October 12, 2001
U.S. Patent No. JPH1041069A (“Fujimori ’069”)	United States	February 13, 1998
JPH09245964A (“Kijima ’964”)	Japan	September 19, 1997
U.S. Pat. No. 5,691,877 (“Hanamura”)	United States	November 25, 1997
JP 2007-234730A (“Watanabe”)	Japan	September 13, 2007
JPH0945582A (“Hanamura ’582”)	Japan	February 14, 1997
KR101000383B1 (“Lim ’383”)	Korea	January 7, 2010

WO2011073856A1 (“Schwab ’856”)	WO	June 23, 2011
JP2009156913A (“Tanba ’913”)	Japan	July 16, 2009
JP2000208363A (“Azuma ’363”)	Japan	July 28, 2000
WO2012096007A1 (“Yanagi ’007”)	WO	July 19, 2012
WO2007144163A2 (“Schindler ’163”)	WO	December 21, 2007
JP2003317610A (“Hasei ’610”)	Japan	November 7, 2003
U.S. Pat. No. 5,920,454 (“Nomura”)	United States	February 11, 1997
WO/2011036089 (“Ingle ’089”)	WO	March 31, 2011
U.S. Pat. No. 3,997,411 (“Muenz”)	United States	December 14, 1976
U.S. Pat. No. 7,994,418 (“Tandon”)	United States	March 18, 2010
U.S. Pat. No. 3,256,588 (“Sikina”)	United States	June 21, 1966
U.S. Pat. No. 8,816,335 (“Schwab”)	United States	June 14, 2012
U.S. Pat. No. 6,780,688 (“Kim”)	United States	August 24, 2004
U.S. Pat. No. 6,350,996 (“Kawai”)	United States	February 26, 2002
U.S. Patent. Publication No. 2005/0129978 (“Nakashima”)	United States	June 16, 2005
U.S. Patent Publication No. 2002/0086180 (“Seo180”)	United States	July 4, 2002
U.S. Patent Publication No. 2005/0084713 (“Kido713”)	United States	April 21, 2005
U.S. Patent No. 6,396,209 (“Kido209”)	United States	December 13, 1999
U.S. Patent Publication No. 2007/0181876 (“Itai”)	United States	August 9, 2007
U.S. Patent Publication No. 2005/0084712 (“Kido712”)	United States	April 21, 2005

U.S. Patent Publication No. 2007/0231599 (“Nakamura”)	United States	October 4, 2007
U.S. Patent Publication No. 2002/0024293 (“Igarashi”)	United States	February 28, 2002
U.S. Patent No. 6,391,482 (“Matsuo”)	United States	February 1, 2002
WO2006/035973 (“Kumaki”)	WO	April 6, 2006
U.S. Patent Publication No. 2002/0034654 (“Toguchi”)	United States	March 21, 2002
U.S. Patent Publication No. 2007/0262693 (“Seo693”)	United States	November 15, 2007
JP 2002-100479 (“Sato”)	Japan	April 5, 2002
JP 2008-106015 (“Kido015”)	Japan	May 8, 2008
U.S. Patent No. 8,258,501 (“Werner501”)	United States	June 30, 2006
U.S. Patent Publication No. 2004/0155238 (“Thompson”)	United States	August 12, 2004
U.S. Patent Publication No. 2007/0069636 (“Choulis”)	United States	March 29, 2007
U.S. Patent Publication No. 2006/0251921 (“Forrest”)	United States	November 9, 2006
WO 2005/027586	WO	March 24, 2005
U.S. Patent Publication No. 2006/0227079 (“Kashiwabara”)	United States	October 12, 2006
U.S. Patent Publication No/ 2006/0250076 (“Hoffmann”)	United States	November 9, 2006
U.S. Patent No. 7,560,729 (“Kitamura”)	United States	March 30, 2005
U.S. Patent No. 5,920,080 (“Jones”)	United States	May 8, 1998
U.S. Patent No. 8,026,512 (“Fong”)	United States	November 16, 2006
CN 001582073 (“Yong”)	China	February 16, 2005

JP 2005-108730 (“Ara”)	Japan	April 21, 2005
JP 2005-011735 (“Kijima”)	Japan	January 13, 2005
JP 2001-110568 (“Sugiura”)	Japan	April 20, 2001
WO 2005/086251 (“Werner251”)	WO	September 15, 2005
JP 2003-082341 (“Enomoto”)	Japan	March 19, 2003
U.S. Patent Publication No. 2005/0089717 (“Cosimbescu”)	United States	April 28, 2005
U.S. Pat. No. 6,027,630 (“Cohen”)	United States	Feb. 22, 2000
U.S. Patent Publication No. 2008/0020208 (“Lee”)	United States	Jan 24, 2008
EP 1423552 (“Shtein552”)	EU	February 6, 2004
WO 2003/020999 (“Shtein999)	WO	March 13, 2003
U.S. Patent Publication No. 2009/0017330 (“Iwakuma”)	United States	November 21, 2007
U.S. Patent Publication No. 2003/0146443 (“Yamazaki443”)	United States	August 7, 2003
U.S. Patent Publication No. 2009/0026929 (“Song”)	United States	March 13, 2008
U.S. Patent Publication No. 2005/0170205 (“Helber”)	United States	August 4, 2005
U.S. Patent No. 6,097,147 (“Baldo”)	United States	August 1, 2000
U.S. Patent Publication No. 2006/0225611 (“Kato”)	United States	October 12, 2006
U.S. Patent Publication No. 2002/0117962 (“Beierlein”)	United States	August 29, 2002
WO 2006/054137 (“Karg”)	WO	May 26, 2006
JP 2005-93418 (“Takei”)	Japan	April 7, 2005
KR 2007-0117200 (“Lee200”)	Korea	December 12, 2007

KR 2007-0080221 (“Lee221”)	Korea	August 9, 2007
U.S. Patent No. 7,438,980 (“Yeh”)	United States	July 8, 2005
U.S. Patent No. 8,017,254 (“Itai254”)	United States	March 2, 2007
U.S. Patent No. 8,110,293 (“Ahn”)	United States	November 20, 2007
U.S. Patent Publication No. 2005/0158582 (“Ise”)	United States	July 21, 2005
U.S. Patent Publication No. 2007/0014916 (“Daniels”)	United States	June 14, 2006
U.S. Patent Publication No. 2007/0057254 (“Mishima”)	United States	March 15, 2007
U.S. Patent Publication No. 2007/0262704 (“Tsai”)	United States	November 15, 2007
U.S. Patent Publication No. 2008/0074034 (“Jou”)	United States	September 22, 2006

C. Prior Art Non-Patent Publications[4,5]

Name	Publication Date
Organic Light-Emitting Diodes Based on New N-Doped Electron Transport Layer (“Ma”)	August 29, 2008
Precise, scalable shadow mask patterning of vacuum-deposited organic light emitting devices (“Tian”)	Sep/Oct. 1999
Micropatterning of small molecular weight organic semiconductor thin films using organic vapor phase deposition (“Shtein”)	April 1, 2003
Multiple Bonds Between Metal Atoms (Cotton et al.)	2005

[4] Any discussion of a non-patent publication in either Section III.C or in one of the claim charts included herewith that discloses a corresponding product or system shall also apply with equal force to the underlying product or system. In other words, both the non-patent publication and the underlying product or system themselves qualify as prior art in the context that they are used herein.

[5] Discovery is currently ongoing, and Samsung will supplement these Contentions with respect to the public availability, as necessary, of any non-patent publication if and when more information becomes available. Indeed, Samsung expects to receive documents from third parties either through informal requests or under subpoenas that are believed to have knowledge, documentation, and/or corroborating evidence concerning the public availability of the identified non-patent publications.

Advanced Inorganic Chemistry (Cotton and Wilkinson)	1972
Multiple Metal-Metal Bonds (Cotton)	September 1983
Studies of Tetrakis(trifluoroacetate) Dirhodium. 2. A Pi Complex of Hexamethylbenzene with Tetrakis(trifluoroacetate) Dirhodium(II,II) (“Cotton1999”)	1999
Studies of Tetrakis(trifluoroacetate) Dirhodium. Part 4. Solventless synthesis of Rh2(O2CCF3)2(CO)4 combined with Rh2(O2CCF3)4, a compound with infinite chains of rhodium atoms (Cotton et al.)	2000
Closed-Shell Molecules That Ionize More Readily Than Cesium (Cotton et al.)	December 6, 2002
Reactions of Hexa-ferf-butoxyditungsten(W-W) with Diphenylacetylene. Syntheses and Structures of W2(OCMe3)4(/x-C6H5C)2 and W2(OCMe3)4(CgH5CCCgH5)2 (Cotton et al.)	1983
Supramolecular Assemblies of Dimetal Complexes with Polydentate N-Donor Ligands: From a Discrete Myramic to 3D Channel Network (Cotton et al.)	November 11, 2002
Synthesis and reactivity of a very strong reducing agent containing a quadruple bond: structures of W2(hpp)4 and W2(hpp)4Cl2 4CH2Cl2 (Cotton et al.)	2002
Advanced Screen Printing Practical Approaches for Printable & Flexible Electronics (Numakura)	2008
Optical properties of silicon-based thin-film solar cells in substrate and superstrate configuration (Brammer et al.)	2002
Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers (Buehler)	1978
Gas Permeation and Lifetime tests On Polymer-Based Barrier Coatings (Burrows et al)	2001
Ultra barrier flexible substrates for flat panel displays (Burrows et. al)	2001
Light-Emitting Devices based on Doped Polymer thin Films (Chung-Chih)	November 1997
Full Color OLED on Silicon Microdisplay (Ghosh)	February 27, 2002.
Resistance Calculations for Thin Film Patterns (P.M. Hall)	1967
Topographical Patterning of Chemically Sensitive Biological Materials Using a Polymer-based Dry Lift Off (Ilic)	2000
Screen Printable Epoxy Embedded Capacitor Pastes with High Dielectric Constant for Organic Substrate Applications (Jang)	2008
Circuit Design and Parameters in Thin-Film technology (Jenny)	1963
Encapsulation of organic light-emitting diode using thermal chemical-vapour-deposition polymer film (Yamashita)	2001

Improved Lifetime and Efficiency of Organic Light Emitting Diodes for Applications in Displays (Kowalsky et al)	1999
A Novel Pixel Design for AM-OLED Displays using Nanocrystalline Silicon TFTs (Lin et al)	June 2011
The Chemistry, Physics and Engineering of Organic Light-Emitting Diodes (Scott and Malliaras)	2000
Benzocyclobutene polymer as an interlayer dielectric material (Mills)	1997
Photolithographic patterning of vacuum-deposited organic light emitting devices (Tian et al)	1997
Evaluation of Available Encapsulation Materials for Low-cost long-life silicon photovoltaic arrays (Battelle Columbus Labs) (Carmichael)	1978
Thick Encapsulated Amorphous Silicon Solar Cells (Crone et. al)	1996
Embedded components in printed circuit boards: a processing technology review (Jillek)	2005
Interface and Material Considerations of OLED (Sato)	1999
Planar Process for 16 Mb Bubble Memory Devices Using Therman Reflow-type Polyimide (Umezaki).	1989
Recent progress in flexible displays (Weaver et. al.)	2002
Flexible organic light emitting devices (Weaver et. al)	2001
Flexible organic LED Displays (Weaver et al.)	2001
A Novel Route to Molecular Self-Assembly: Self-Intermixed Monolayer Phases (de Wild et al.)	2002
A doping mechanism for organic semiconductors derived from SXPS measurements on co-evaporated films of CuPc and TCNQ and on a TCNQ/CuPc interface (Mayer et al.)	August 26, 2008
Highly power efficient organic light-emitting diodes based on p-doped and novel n-doped carrier transport layers (Khan et al.)	October 19, 2007
A new dirhodium tetraacetate cerbenoid: Synthesis, crystal structure and catalytic application (Na et al.)	September 12, 2007
High efficiency and low voltage p-i-n electrophosphorescent OLEDs with double-doping emissiong layers (He et al.)	September 2004
A Spectroelectrochemical Investigation of Arylamine Based Hole Transporting Materials (“Paterson”)	September 2003
H.Y. Kang et al., *Electroluminescence Properties of Organic Light-Emitting Diodes with a Red Dye Doped into Alq3: Rubrene Mixed Host*, 45(3) J. Korean Physical Soc’y 756–760 (Sept. 2004) (Kang)	September 2004

Zhou et al., *Stable and efficient electrophosphorescent organic light-emitting devices grown by organic vapor phase deposition*, 86 App. Phys. Lett. 021107 (2005)	2005
Kim et al., *Relationship between host energy levels and device performances of phosphorescent organic light-emitting diodes with triplet mixed host emitting structure*, 91 Appl. Phys. Lett. 083511 (2007)	2007
Holmes et al., *Efficient, deep-blue organic electrophosphorescence by guest charge trapping*, 83 Appl. Phys. Lett. 3818–3820 (2003)	2003
Yang and Neher, *Polymer electrophosphorescence devices with high power conversion efficiencies*, 84 Appl. Phys. Lett. 2476–2478 (2004)	2004
Choulis et al., *The effect of interfacial layer on the performance of organic light-emitting diodes*, 87 Appl. Phys. Lett. 113503 (2005)	2005
D'Andrade et al., *Relationship between the ionization and oxidation potentials of molecular organic semiconductors*, 6 Organic Electronics 11–20 (2005)	2005
Djurovich et al., *Measurement of the lowest unoccupied molecular orbital energies of molecular organic semiconductors*, 10 Organic Electronics 515–520 (2009)	2009
Butschke et al., *Thermal C-H Bond Activation of Benzene with Cationic [Pt(CX3)(L)]+ Complexes in the Gas Phase: A Combined Experimental/Theoretical Study (X=H, D; L=1,10-Phenanthroline, 2,20-Bipyrimidine, 2,20-Bipyridine, and (o,o0-Cl2C6H3)NdC(CH3)-C(CH3)dN(o,o0-Cl2C6H3))*	July 15, 2009
Gerdes et al., *Comparative Gas-Phase and Solution-Phase Investigations of the Mechanism of C-H Activation by [(N-N)Pt(CH3)(L)]* (2003)	2003
Gerdes et al., *Cationic Platinum(II) Carboxylato Complexes Are Competent in Catalytic Arene C-H Activation under Mild Conditions* (2004)	May 11, 2004
Moret et al., *Ligand Binding Energies in Cationic Platinum(II) Complexes: A Quantitative Study in the Gas Phase* (2007)	February 16, 2007
Tamada et al., *Change of molecular orientation with post-polymerization of a thin film of N-methylolacrylamide prepared with VDP*	1996
Tamada et al., *Real-time in situ observation of photo-induced vapor deposition polymerization of N-vinylcarbazole with Fourier transform IR reflection absorption spectroscopy*	1997
Jeffrey M. Njus & Daniel J. Sandman (2005) Thermally Annealed Solid State Polymerization of 2,3-Dicyano-5,7-Dimethyl-6H-1,4-Diazepine: An NMR Study, Molecular Crystals and Liquid Crystals, 440:1, 53-63, DOI: 10.1080/15421400590957701	August 31, 2006

Bobisch et al., *Ordered binary monolayer composed of two organic molecules: Copper-phthalocyanine and 3,4,9,10-perylenetetra-carboxylic-dianhydride on Cu(111)*	November 8, 2003
Rousseau et al., *Highly Conducting Charge-Transfer Compounds of Tetrathiafulvalene and Transition Metal-"dmit" Complexes*	1986
Demadis et al., *The Localized-to-Delocalized Transition in Mixed-Valence Chemistry*	September 12, 2001
Hipps et al., *A Self-Organized 2-Dimensional Bifunctional Structure Formed by Supramolecular Design*	February 16, 2002
Lin et al., *Template-directed supramolecular self-assembly of coordination dumbbells at surfaces*	September 20, 2007
Scudiero et al., *A Self-Organized Two-Dimensional Bimolecular Structure*	2003
Troshin et al., *Supramolecular Association of Pyrrolidinofullerenes Bearing Chelating Pyridyl Groups and Zinc Phthalocyanine for Organic Solar Cells*	October 9, 2007
Yoshimoto et al., *Two-Dimensional Supramolecular Organization of Copper Octaethylporphyrin and Cobalt Phthalocyanine on Au(111): Molecular Assembly Control at an Electrochemical Interface*	June 19, 2004

Moreover, the prior art non-patent publications listed on the faces of the Asserted Patents disclose (i.e., anticipate and/or renders obvious) the elements of the Asserted Claims either explicitly or inherently, and Samsung reserves the right to rely on any such reference. Samsung reserves the right to rely on any prior art reference listed on the face of any one of the Asserted Patents against any of the Asserted Patents.

D. <u>Prior Art Systems and/or Knowledge</u>

The Asserted Claims are invalid under 35 U.S.C. §§ 102 and/or 103 based on prior art items offered for sale or publicly used or known or prior inventions, such as prior art products, including systems embodying any alleged inventions or structures described in, and/or any knowledge disclosed by or referred to in, any of the prior art patents or prior art publications identified above in Sections III.B and III.C. Because Samsung has not yet completed discovery in this case, Samsung reserves the right to supplement theses Contentions with facts, documents, or

other information learned at a later point through third-party discovery or further investigation. For example, Samsung expects to receive documents from additional third parties either through informal requests or under subpoenas that are believed to have knowledge, documentation, and/or corroborating evidence concerning some of the prior art listed above and below and/or additional prior art. These third parties include without limitation the authors, inventors, or assignees of the references listed in these Contentions. In addition, Samsung reserves the right to assert invalidity under other sections of 35 U.S.C. § 102 to the extent that discovery or further investigation yield information forming the basis for such invalidity.

Moreover, all of the systems and products listed below qualify as prior art to each of the Asserted Patents under at least pre-AIA 35 U.S.C. §§ 102(a)/(b). Such systems and products were known, used, offered for sale, and/or sold in the United States prior to the appropriate priority date corresponding to each of the Asserted Patents.

Phones
Samsung Galaxy S
Samsung Galaxy S II
Samsung Galaxy Note
Motorola Timeport P8767

Other Products
iRiver Clix2
eMagin SVGA displays
Pioneer Car Radios

The Federal Circuit has held that "[t]he proper test for the public use prong of the [pre-AIA] § 102(b) statutory bar is whether the purported use: (1) was accessible to the public; or (2) was commercially exploited." *See Invitrogen Corp. v. Biocrest Mfg. L.P.*, 424 F.3d 1374, 1380 (Fed. Cir. 2005). Additionally, the on-sale bar of § 102(b) is triggered when the invention is both (1) the subject of a commercial offer for sale not primarily for experimental purposes and (2) ready

for patenting. *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 67 (1998). Each of the systems and products listed above meets these criteria.

The above discussion is not exclusive. Samsung reserves the right to rely on both the listed products as well as other products that may become known and/or relevant during the course of this matter.

Any citation to one or more of these prior art references, or other prior art references regarding any method or system, should be construed to constitute not only a citation to the prior art reference itself but also a reference to the system itself. Discovery is ongoing in this case, and Samsung will supplement these Contentions if and when more information becomes available. Accordingly, Defendants reserve the right to modify, amend, and/or supplement these contentions as information becomes available from non-parties.

E. Prior Art Under 35 U.S.C. §§ 102(f) and 102(g)

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before the earliest claimed priority date of the Asserted Patents to which it is applied for invalidity, and none was abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Samsung has not yet completed discovery in this case, including taking depositions of the named inventors of the Asserted Patents, reviewing Pictiva's productions, and seeking discovery of prior inventions by third parties, Samsung reserves the right to supplement

these Contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

IV. ANTICIPATION AND OBVIOUSNESS (35 U.S.C. §§ 102 AND 103)

The Asserted Claims are anticipated by and/or rendered obvious in view of one or more items of prior art identified in these Contentions, alone and/or in combination. Based on its investigation to date, Samsung has provided in the lists above the prior art presently known to Samsung that anticipates and/or renders obvious the Asserted Claims under at least Pictiva's actual and/or apparent application of those claims. The prior art identified in these Contentions discloses (i.e., anticipates and/or renders obvious) the elements of the Asserted Claims either explicitly or inherently.

Prior art patents or publications included in these Contentions may be related (such as a divisional, continuation, continuation-in-part, parent, or child) to earlier or later-filed patents or publications, may have counterparts filed in other jurisdictions, or may incorporate (or be incorporated by) other patents or publications by reference. The listed patents or publications are intended to be representative of these other patents or publications to the extent they exist. Samsung accordingly reserves the right to modify, amend, or supplement these Contentions with these related patents or publications, as well as other prior art references, upon further investigation. Additionally, any reference in these Contentions, including the appendices and/or exhibits thereto, to a specific subsection or subsections of 35 U.S.C. § 102, is merely exemplary, and Samsung expressly reserves the right to rely on additional or other sections of 35 U.S.C. § 102, as appropriate.

Although Samsung's investigation is ongoing, information available to date indicates that each prior art system disclosed above was at least (1) known or used in this country before the

alleged invention of the claimed subject matter of the Asserted Patents; (2) in public use, on sale, or offered for sale in this country more than one year before the effective filing date for the Asserted Patents; or (3) invented and not abandoned, suppressed, or concealed prior to the alleged invention of the Asserted Patents.

Much of the art identified in these Contentions reflects common knowledge and the state of the art prior to the filing or asserted priority dates of the Asserted Patents. As such, the obviousness combinations in these Contentions are intended to be exemplary. There are many possible combinations of the disclosed prior art, and the inclusion of certain exemplary combinations does not exclude other combinations. For example, where a particular contention calls for combining references, any of a number of references can be combined.

Depending on the construction of the claims of the Asserted Patents, and/or positions that Pictiva or its expert witnesses may take concerning claim interpretation, infringement, and/or invalidity issues, different ones of the charted prior art references in the Exhibits may be of greater or lesser relevance and different combinations of these references may be implicated. Given the uncertainty, the charts may reflect alternative applications of the prior art against the Asserted Claims.

Citations to particular excerpts from the prior art are likewise exemplary and not exhaustive of the evidentiary support for the invalidity of the Asserted Patents contained in and/or concerning a particular piece of prior art. Samsung may rely on uncited portions of the prior art references, other documents or operational systems, the "Background of the Invention" and other relevant portions of the Asserted Patents, the prosecution histories of the Asserted Patents (including all cited references) and their related patents and applications, and forthcoming fact and expert testimony to provide context to aid in understanding the prior art reference and/or the cited portions

of the references. Where Samsung cites to a particular figure in a reference, the citation encompasses the caption and description of the figure and any text relating to or discussing the figure. Likewise, where Samsung cites text referring to a figure, the citation includes the figure as well (and vice versa).

A. Prior Art Under 35 U.S.C. § 102

Samsung contends that at least the primary prior art references (Exs. A-01 through E-13) identified below, by themselves, anticipate one or more of the Asserted Claims:

Exhibits	Primary References and/or Systems
A-1	U.S. Pat. No. 6,866,901 (Burrows '901)
A-2	U.S. Patent No. 5,686,360 ("Harvey '360")
A-3	U.S. Pat. App. No. 2002/0140347 ("Weaver")
A-4	U.S. Pat. App. No. 2001/0052752 ("Ghosh")
A-5	U.S. Pat. App. No. 2003/0206332 ("Yamazaki '332")
A-6	U.S. Pat. No. 6,069,443 ("Jones '443")
A-7	U.S. Pat. No. 6,198,220 ("Jones '220")
A-8	U.S. Pat. No. 6,660,409 ("Komatsu")
A-9	U.S. Pat. App. No. 2003/0117068 ("Forrest")
A-10	U.S. Pat. No. 5,734,225 ("Biebuyck")
A-11	U.S. Pat. No. 6,087,196 ("Sturm")
A-12	U.S. Pat. No. 6,337,222 ("Shimoda")
A-13	U.S. Pat. App. No. 2003/0048074 ("Ni")
A-14	EP 1,093,166 ("Yamazaki '166")
A-15	U.S. Pat. No. 6,597,111 ("Silvernail")
A-16	U.S. Patent No. 8,808,457 ("Pagano")
A-17	Precise, scalable shadow mask patterning of vacuum-deposited organic light emitting devices ("Tian")
A-18	U.S. Pat. No. 6,413645 ("Graff")
A-19	U.S. Pat. No. 6,198,217 ("Suzuki '217").
A-20	U.S. Pat. App. No. 2003/0011300 ("Palanisamy '300")
A-21	U.S. Pat. No. 5,771,562 ("Harvey III")
A-22	WO2001008242A1 ("Duthaler '242")
A-23	U.S. Pat. No. 6,633,121 ("Eida '121")
A-24	U.S. Pat. No. 6,525,467 ("Eida '467")
A-25	eMagin SVGA+ and/or SVGA-3D Microdisplays ("the eMagin SVGA Displays")
A-26	JPH1041069A ("Fujimori '069")
A-27	JPH09245964A ("Kijima '964")
A-28	The Motorola Timeport P8767 ("the Motorola Timeport")
A-29	Pioneer OLED Car Radios ("the Pioneer OLED Radio")

A-30	U.S. Pat. No. 8,955,217 (“Burrows ’217”)
B-1	U.S. Patent Application Publication No. 2007/0023734 (“Igarashi ’734”)
B-2	Japanese Published Application No. H10-170918 (“Shiotani ’918”)
B-3	U.S. Patent Application Publication No. 2001/0043043 (“Aoyama ’043”)
B-4	U.S. Patent Application Publication No. 2004/0233664 (“Beeson ’664”)
B-5	U.S. Patent No. 6,949,389 (“Pilcher ’389”)
B-6	U.S. Patent Application Publication No. 2003/0146696 (“Park ’696”)
B-7	U.S. Patent Application Publication No. 2006/0152150 (“Boerner ’150”)
B-8	U.S. Patent No. 6,624,828 (“Dresevic ’828”)
B-9	Korean Patent Application Publication No. 2006-0081648 (“Ko ’648”)
B-10	iRiver Clix2
C-1	U.S. Patent. Publication No. 2005/0129978 (“Nakashima”)
C-2	J.W. Ma et al, Organic light-emitting diodes based on new n-doped electron transport layer (“Ma”)
C-3	U.S. Patent Publication No. 2002/0086180 (“Seo180”)
C-4	U.S. Patent Publication No. 2005/0084713 (“Kido713”)
C-5	U.S. Patent No. 6,396,209 (“Kido209”)
C-6	U.S. Patent Publication No. 2007/0181876 (“Itai”)
C-7	U.S. Patent Publication No. 2005/0084712 (“Kido712”)
C-8	U.S. Patent Publication No. 2007/0231599 (“Nakamura”)
C-9	U.S. Patent Publication No. 2002/0024293 (“Igarashi”)
C-10	U.S. Patent No. 6,391,482 (“Matsuo”)
C-11	WO2006/035973 (“Kumaki”)
C-12	U.S. Patent Publication No. 2002/0034654 (“Toguchi”)
C-13	U.S. Patent Publication No. 2007/0262693 (“Seo693”)
C-14	JP 2002-100479 (“Sato”)
C-15	JP 2008-106015 (“Kido015”)
C-16	Max Shtein et al, Micropatterning of small molecular weight organic semiconductor thin films using organic vapor phase deposition (“Shtein”)
C-17	U.S. 8,258,501 (“Werner501”)
C-18	WO 2005/086251 (“Werner251”)
C-19	iRiver Clix2
D-1	U.S. Patent Publication No. 2004/0155238 (“Thompson”)
D-2	U.S. Patent Publication No. 2007/0069636 (“Choulis”)
D-3	U.S. Patent Publication No. 2006/0251921 (“Forrest”)
D-4	U.S. Patent Publication No. 2006/0227079 (“Kashiwabara”)
D-5	U.S. Patent Publication No/ 2006/0250076 (“Hoffmann”)
D-6	U.S. Patent No. 7,560,729 (“Kitamura”)
D-7	U.S. Patent No. 8,026,512 (“Fong”)
D-8	CN 001582073 (“Yong”)
D-9	JP 2005-108730 (“Ara”)
D-10	JP 2005-011735 (“Kijima”)
D-11	JP 2001-110568 (“Sugiura”)
D-12	iRiver Clix2

E-1	U.S. Pat. No. 5,691,877 (“Hanamura”)
E-2	U.S. Pat. No. 5,920,454 (“Nomura”)
E-3	WO/2011036089 (“Ingle ’089”)
E-4	U.S. Pat. No. 3,997,411 (“Muenz”)
E-5	U.S. Pat. No. 7,994,418 (“Tandon”)
E-6	U.S. Pat. No. 3,256,588 (“Sikina”)
E-7	U.S. Pat. No. 8,816,335 (“Schwab”)
E-8	U.S. Pat. No. 6,780,688 (“Kim”)
E-9	U.S. Pat. No. 6,350,996 (“Kawai”)
E-10	JP 2007-234730A (“Watanabe”)
E-11	JPH0945582A (“Hanamura ’582”)
E-12	KR101000383B1 (“Lim ’383”)
E-13	WO2011073856A1 (“Schwab ’856”)
E-14	JP2009156913A (“Tanba ’913”)
E-15	JP2000208363A (“Azuma ’363”)
E-16	WO2012096007A1 (“Yanagi ’007”)
E-17	WO2007144163A2 (“Schindler ’163”)
E-18	JP2003317610A (“Hasei ’610”)
E-19	Samsung Galaxy
E-20	iRiver Clix2
F-1	Japanese Patent Publication No. 2007-277631 (“Suzuki ’631”)
F-2	U.S. Patent Application Publication No. 2007/0001587 (“Hatwar ’587”)
F-3	U.S. Patent Application Publication No. 2007/0020483 (“Kim ’483”)
F-4	WIPO Publication No. 2008/040323 (“Diekmann ’323”)
F-5	U.S. Patent Application Publication No. 2005/0146267 (“Lee ’267”)
F-6	U.S. Patent Application Publication No. 2007/0159095 (“Koichi ’095”)
F-7	U.S. Patent Application Publication No. 2008/0211394 (“Koshihara ’394”)
F-8	U.S. Patent Application Publication No. 2004/0080267 (“Cok ’267”)
F-9	U.S. Patent Application Publication No. 2008/0055266 (“Harada ’266”)
F-10	U.S. Patent Application Publication No. 2003/0153240 (“DeJule ’240”)
F-11	U.S. Patent Application Publication No. 2008/0211395 (“Koshihara ’395”)
F-12	U.S. Patent Application Publication No. 2008/0278070 (“Kim ’070”)
F-13	U.S. Patent Application Publication No. 2003/0159910 (“Caldwell ’910”)
F-14	U.S. Patent Application Publication No. 2008/0238305 (“Kondo ’305”)
F-15	U.S. Patent Application Publication No. 2006/0214892 (“Harada ’892”)
F-16	“Organic Light-Emitting Diodes Based on New N-Doped Electron Transport Layer” (“Ma”)
F-17	Japanese Patent Application Publication No. 2007-265841 (“Takagi ’841”)
F-18	Japanese Patent Application Publication No. 2004-145878 (“Iwase ’878”)
F-19	Japanese Patent Application Publication No. 2007-207469 (“Takashima ’469”)
F-20	iRiver Clix2

Specifically, Samsung contends that at least the references and/or systems in the table above independently anticipate the Asserted Claims under 35 U.S.C. §§ 102(a), (b), (e), (f), and/or (g), as set forth in the charts attached as:

- Exhibits A-01 through Exhibits A-30 for the asserted claims of the ’389 patent;
- Exhibits B-01 through Exhibits B-10 for the asserted claims of the ’547 patent;
- Exhibits C-01 through Exhibits C-19 for the asserted claims of the ’223 patent;
- Exhibits D-01 through Exhibits D-12 for the asserted claims of the ’164 patent;
- Exhibits E-01 through Exhibits E-20 for the asserted claims of the ’492 patent.
- Exhibits F-01 through Exhibits F-20 for the asserted claims of the ’425 patent.

Samsung’s claim charts provide exemplary citations to the prior art references that teach or suggest every element of each of the Asserted Claims of the Asserted Patent. To the extent that an element of an Asserted Claim is not shown in a chart, the Asserted Claims would have been obvious based on a combination of one or more other prior art references, as set forth below and in Exhibits A-F.

These charts, however, are exemplary. The claimed features are similarly described and suggested in other places (including in all of the documents cited during prosecution of each piece of prior art), and also were present when prior-art systems practicing the described prior art were used before the application that ultimately led to the Asserted Patents. Thus, where patents or other printed materials are disclosed, Samsung reserves the right to also rely on those materials as descriptions of systems, devices, or methods referenced therein, publicly used, and/or on sale or known in the United States. Further, Samsung reserves the right to rely on other evidence of the prior art beyond merely the exemplary references cited in the charts attached as Exhibits.

Where patents or other printed materials are disclosed, Samsung reserves the right to also rely on those materials as descriptions of systems, devices, or methods referenced therein, publicly used, and/or on sale or known in the United States. Samsung reserves the right to also use those references to invalidate the claim under 35 U.S.C. § 103.

B. Prior Art Under 35 U.S.C. § 103

To the extent that a primary reference is deemed, by itself, not to anticipate or render obvious a claim for failing to teach one or more limitations, the claim would nonetheless have been obvious to a POSITA at the time of the invention by the combination of the primary reference with one or more other primary references and/or the knowledge of someone skilled in the art.

Moreover, Exhibits A-Obviousness, B-Obviousness, C-Obviousness, D-Obviousness, E-Obviousness, and F-Obviousness list secondary prior art references and identify, on limitation-by-limitation bases, exemplary disclosures where each secondary reference teaches the limitations of the asserted claims. To the extent that a primary reference is deemed, by itself, not to anticipate or render obvious a claim for failing to teach one or more limitations, the claim would nonetheless have been obvious to a POSITA at the time of the invention by the additional combination of the primary reference with one or more of the references listed as disclosing those alleged missing limitations in Exhibits A-Obviousness, B-Obviousness, C-Obviousness, D-Obviousness, E-Obviousness or F-Obviousness. To the extent that an element of an Asserted Claim is not shown in a chart, the Asserted Claims would have been obvious based on a combination of one or more other prior art references, as set forth below and in Exhibits A-F.

As such, a POSITA would have been motivated to combine any reference set forth in at least the following charts:

- Exhibit A-01 through Exhibit A-30 and Exhibit A-Obviousness for the asserted claims of the ’389 patent;

- Exhibit B-01 through Exhibit B-10 and Exhibit B-Obviousness for the asserted claims of the ’547 patent;
- Exhibit C-01 through Exhibit C-19 and Exhibit C-Obviousness for the asserted claims of the ’223 patent; and
- Exhibit D-01 through Exhibit D-12 and Exhibit D-Obviousness for the asserted claims of the ’164 patent;
- Exhibit E-01 through Exhibit E-20 and Exhibit E-Obviousness for the asserted claims of the ’492 patent.
- Exhibit F-01 through Exhibit F-20 and Exhibit F-Obviousness for the asserted claims of the ’425 patent.

Such combinations would be achieved, for example, by merely combining the disclosures described in the respective claim charts for each reference.

These charts, however, are exemplary. The claimed features are similarly described and suggested in other places (including in all of the documents cited during prosecution of each piece of prior art), and also were present when prior-art systems practicing the described prior art were used before the application that ultimately led to the Asserted Patents. Where patents or other printed materials are disclosed, Samsung reserves the right to also rely on those materials as descriptions of systems, devices, or methods referenced therein, publicly used, and/or on sale or known in the United States. Further, Samsung reserves the right to rely on other evidence of the prior art beyond merely the exemplary references cited in the charts attached as Exhibits.

Samsung’s assertion that the combinations above render the asserted claims obvious under 35 U.S.C. § 103 is not, and is not intended to be, an admission or suggestion that each reference does not independently anticipate the Asserted Claims under 35 U.S.C. § 102. *See Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (“‘[A]nticipation is the epitome of obviousness.’”) (quoting *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982)). Further, the fact that certain secondary references are listed solely in Exhibits A-Obviousness, B-Obviousness, C-

Obviousness, D-Obviousness, E-Obviousness, or F-Obviousness is not intended to be an admission or suggestion that each individual reference cited therein does not also independently anticipate and/or render obvious the Asserted Claims under 35 U.S.C. §§ 102 and 103. Samsung expressly reserves the right to rely on any secondary reference cited in Exhibits A-Obviousness, B-Obviousness, C-Obviousness, D-Obviousness, E-Obviousness or F-Obviousness as if it were set forth as a primary reference in Section IV.A, *supra*. Finally, the inclusion of the exemplary combinations in the attached Exhibits does not exclude other combinations of prior art disclosed in this or previous sections.

C. <u>Exemplary Combinations</u>

Exemplary combinations of prior art references that render the Asserted Claims invalid as obvious under 35 U.S.C. § 103 are described in:

- Exhibit A-Obviousness for the asserted claims of the ’389 patent;
- Exhibit B-Obviousness for the asserted claims of the ’547 patent;
- Exhibit C-Obviousness for the asserted claims of the ’223 patent;
- Exhibit D-Obviousness for the asserted claims of the ’164 patent;
- Exhibit E-Obviousness for the asserted claims of the ’492 patent.
- Exhibit F-Obviousness for the asserted claims of the ’425 patent.

Moreover, each prior art reference or system may be combined with (1) information known to persons skilled in the art at the time of the alleged invention; (2) any other anticipatory prior art references or systems; and (3) any of the additional prior art identified above or in the prosecution of the Asserted Patents and related applications.

Below are examples of prior art references and/or systems that would have been combined by one of ordinary skill in the art at the time of the alleged invention. These combinations are merely examples.

1. ’389 Patent

The Asserted Claims of the ’389 patent are rendered obvious by:

- Burrows ’901 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Harvey ’360 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Weaver alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Ghosh alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Yamazaki 332 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Jones 443 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Jones 220 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Komatsu alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Forrest alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Biebuyck alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Sturm alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Shimoda alone or in combination with one or more of the references identified in Exhibits A1-A-30;

- Ni alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Yamazaki ’166 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Silvernail alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Pagano alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Tian alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Graff alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Suzuki alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Palanisamy alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Harvey 562 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Duthaler alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Eida ’121 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Eida ’467 alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- eMagin SVGA Display alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Fujimori alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- Kijima alone or in combination with one or more of the references identified in Exhibits A1-A-30;
- The Motorola Timeport alone or in combination with one or more of the references identified in Exhibits A1-A-30;

- The Pioneer OLED Car Radios alone or in combination with one or more of the references identified in Exhibits A1-A-30;

- Burrows ’217 alone or in combination with one or more of the references identified in Exhibits A1-A-30;

- Any combination of one or more of the references and/or systems identified in Exhibit A-Obviousness.

2. ’547 Patent

- Igarashi ’734 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Shiotani ’918 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Aoyama ’043 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Beeson ’664 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Pilcher ’389 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Park ’696 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Boerner ’150 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Dresevic ’828 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Ko ’648 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- iRiver Clix2 alone or in combination with one or more of the references identified in Exhibits B1-B10;

- Any combination of one or more of the references and/or systems identified in Exhibit B-Obviousness.

3. ’223 Patent

- Nakashima alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Ma or in combination with one or more of the references identified in Exhibits C1-C19;
- Seo180 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Kido713 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Kido209 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Itai alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Kido712 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Nakamura alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Igarashi alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Matsuo alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Kumaki alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Toguchi alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Seo693 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Sato alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Kido015 alone or in combination with one or more of the references identified in Exhibits C1-C19;
- Shtein alone or in combination with one or more of the references identified in Exhibits C1-C19;

- Werner501 alone or in combination with one or more of the references identified in Exhibits C1-C19;

- Werner251 alone or in combination with one or more of the references identified in Exhibits C1-C19;

- iRiver Clix2 alone or in combination with one or more of the references identified in Exhibits C1-C19;

- Any combination of one or more of the references and/or systems identified in Exhibit C-Obviousness.

4. ’164 Patent

- Thompson alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Choulis or in combination with one or more of the references identified in Exhibits D1-D12;

- Forrest alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Kashiwabara alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Hoffmann alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Kitamura alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Fong alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Yong alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Ara alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Kijima alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Sugiura alone or in combination with one or more of the references identified in Exhibits D1-D12;

- iRiver Clix2 alone or in combination with one or more of the references identified in Exhibits D1-D12;

- Any combination of one or more of the references and/or systems identified in Exhibit D-Obviousness.

5. ’492 Patent

- Hanamura alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Nomura alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Ingle '089 alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Muenz alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Tandon alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Sikina alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Schwab 335 alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Kim alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Kawai alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Watanabe alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Hanamura '582 alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Lim alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Schwab 856 alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Tanba alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Azuma alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Yanagi alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Schindler alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Hasei alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- the iRiver Clix 2 alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- the Galaxy Devices alone or in combination with one or more of the references identified in Exhibits E-1-E-20;

- Any combination of one or more of the references and/or systems identified in Exhibit E-Obviousness.

6. ’425 Patent

- Suzuki ’631 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Hatwar ’587 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Kim ’175 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Diekmann ’323 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Lee ’267 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Koichi ’095 alone or in combination with one or more of the references identified in Exhibits F1-F20;

- Koshihara ’394 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Cok ’267 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Harada ’266 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- DeJule ’240 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Koshihara ’395 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Kim ’070 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Caldwell ’910 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Kondo ’305 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Harada ’892 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Ma alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Takagi ’841 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Iwase ’878 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Takashima ’469 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- iRiver Clix2 alone or in combination with one or more of the references identified in Exhibits F1-F20;
- Any combination of one or more of the references and/or systems identified in Exhibit F-Obviousness.

D. <u>Motivations to Combine</u>

To the extent a finder of fact finds that any primary prior art reference does not disclose one or more limitations of an asserted claim, the asserted claim is nevertheless obvious because the allegedly missing limitations contain nothing beyond ordinary improvements. In other words, the asserted claim combines known elements to achieve predictable results or chooses between clear alternatives known to those of skill in the art, particularly in view of the state of the art as reflected in the relevant prior art.

Moreover, as explained above, it would have been obvious to a person of skill in the art at the time of the alleged invention of the asserted claims to combine any primary reference with any combination of other primary references or secondary references so as to practice the asserted claims. To the extent that Pictiva argues that any concept claimed in the asserted claims is not disclosed in a primary reference, it would, at a minimum, have been obvious to adapt the primary reference to include the concept or combine it with other primary references or secondary references that disclose the concept.

The Supreme Court has held that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). "When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one." *Id*. at 417. As the Supreme Court made clear, "[f]or the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id*.

To determine whether there is an apparent reason to combine the known elements in the fashion claimed by the patent at issue, a court can "look to interrelated teachings of multiple

patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art." *Id*. at 418. For example, obviousness can be demonstrated by showing "there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *Id*. at 420. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id*. Common sense also teaches that "familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*.

However, the Supreme Court in *KSR* held that a claimed invention can be obvious even if there is no explicit teaching, suggestion, or motivation for combining the prior art to produce that invention. In summary, *KSR* holds that patents that are based on new combinations of elements or components already known in a technical field may be found to be obvious. *See, generally*, *KSR*, 127 S.Ct. 1727. Specifically, the Court in *KSR* rejected a rigid application of the "teaching, suggestion, or motivation [to combine]" test. *Id*. at 1741. "In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim." *Id*. at 1741-1742. "Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id*. at 1742. A key inquiry is whether the "improvement is more than the predictable use of prior art elements according to their established functions." *Id*. at 1740.

The rationale to combine or modify prior art references is significantly stronger when, as here, the references seek to solve the same problem, come from the same field, and correspond

well to each other. *In re Inland Steel Co*., 265 F.3d 1354, 1362 (Fed. Cir. 2001). The Federal Circuit has held that two references may be combined as invalidating art under similar circumstances, namely "[the prior art] focus[es] on the same problem that the . . . patent addresses: enhancing the magnetic properties of . . . steel. Moreover, both [prior art references] come from the same field . . . . Finally, the solutions to the identified problems found in the two references correspond well." *Id*. at 1364 (concerning patents and prior art relating to improving the magnetic and electrical properties of steel).

In view of the Supreme Court's *KSR* decision, the PTO issued a set of Examination Guidelines. Examination Guidelines for Determining Obviousness Under 35 U.S.C. §103 in view of the Supreme Court Decision in *KSR International Co. v. Teleflex, Inc*., 72 Fed. Reg. 57526 (October 10, 2007). Those Guidelines summarized the *KSR* decision and identified various rationales for finding a claim obvious, including those based on other precedents. Those rationales include:

> (A) Combining prior art elements according to known methods to yield predictable results;
>
> (B) Simple substitution of one known element for another to obtain predictable results;
>
> (C) Use of known technique to improve similar devices (methods, or products) in the same way;
>
> (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
>
> (E) "Obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
>
> (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art;
>
> (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

Id. at 57529. The above rationales likewise apply in rendering obvious the asserted claims of the Asserted Patents.

The references disclosed herein, alone or in combination, contain an explicit and/or implicit teaching or motivation to combine them due to the following: (1) the knowledge generally available to a POSITA; (2) the prior art references as understood by a POSITA; (3) the nature of the problem to be solved; (4) the fact that each prior art reference addresses similar problems; and (5) the knowledge of a POSITA that the disclosed elements had been or could be used together.

One of skill in the art would also have been motivated to combine the different publications and patents that were authored by employees of a given company or assigned to the same assignee and/or related to the same subject matter. Additionally, one of skill in the art would have been motivated to combine different references that were authored, developed, or invented by the same individual(s) related to the same subject matter. The common inventor/author/architect of the references demonstrate that they relate to continued work in a common field of effort and continued related developments in that field. One of skill in the art would, therefore, combine the references related to each individual. Additionally, based on the teachings of the references and/or the knowledge of one of ordinary skill, one of skill in the art would have been motivated to combine different references from the same company. For example, a POSITA would have been motivated to combine prior art systems or products with any related or applicable patent or non-patent documentation or literature relating to that system or owned by the same entity, including for the reason that these materials are related.

Further, below are additional motivations to combine prior art for particular claim limitations. The following discussions of specific claim limitations are merely examples and are not limiting. For example, where a POSITA would have been motivated to combine references

which together render obvious limitations from the independent claims, a POSITA would have also been motivated to combine said references in such a way as to render obvious various asserted dependent claims. The motivations identified with respect to any one Asserted Patent apply with equal force to any of the other Asserted Patents by virtue of their relationship and similarities.

1. '389 patent

(a) Background and State of the Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the '389 patent for the general subject matter of the '389 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the '389 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that "the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious"). Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the '389 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung's obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the '389 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement

its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserves the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

The Need for OLED Encapsulation was Well Known in the Art: It was well known as of the priority date of the ’389 patent that OLED pixels were susceptible to the permeation of oxygen and moisture, which limits the life span of any OLED device. *See, e.g.*, Burrows ’901 at 1:11-28; Silvernail at 1:12-27; (“One factor limiting the practical application of OLEDs is their Susceptibility to environmental elements Such as moisture and oxygen. Oxygen and moisture can produce deleterious effects on certain OLED structural components, Such as reactive metal cathode components.”); Jones ’443 at 1:57-66 (“Organic light emitting devices need to be protected from the atmosphere. The light emitting organic material in the light-emitting layer can be highly reactive. The material is Susceptible to water, oxygen, etc. Moisture and oxygen may cause a reduction in the useful life of the light emitting device. The cathode and anode may also be affected by oxidation. One disadvantage of oxygen and moisture penetration into the interior of the organic light emitting device is the potential to form metal oxides at the metal-organic interface.”); Ni at [0003]: “Besides, a lighting layer formed by fluorescent organic Solid material and an electrons transport layer and emitting materials layer are also extremely Sensitive to humidity, oxygen, and Some environmental factors, and any of which may render the organic Substance crystallized to result in detachment of the organic material layer from the cathode to have the so-called “dark spot” phenomenon happened. Therefore, a conventional organic EL

component can light only in a short lifetime if lacking a perfect package."); Komatsu at 2:40-44 ("Such cathode corrosion or oxidation gives rise to consider able growth of non-emitting regions, So called dark Spots (D.S.) in the light-emitting layer, and is a cause for characteristic degradation with time of organic electroluminescence devices."); Weaver ("Moreover, moisture and oxygen are also known to increase "dark spot areas" in connection with OLEDs."); Harvey '360 ("the multi-layer overcoating and the dielectric material acts as a physical barrier to atmospheric elements which can corrode the organic device and are a detriment to the reliability of organic LEDs").

The Use of a "Bi-layer" or Multiple Layers was Well Known in the Art: It was well known as of the priority date of the '389 patent that a multi-layer structure, including a two-layer structure, provided superior protection to OLED devices. Burrows '901 at 1:11-28: Silvernail at 1:12-27; Silvernail at 1:12-27 ("Such a multilayer structure can be applied directly onto the substrate or active region of an OLED device by use of a polymer multilayer process or ("PML" process). The PML process is disclosed, for example, in U.S. Pat. Nos. 4,842,893, 4,954,371, 5,260,095 and 6,224,948, all of which are incorporated herein in their entireties.") It was also well-known in the art that a planarizing layer over a device would provide for better adhesion of a subsequent layer. *See, e.g.*, Burrows '901 at 1:11-28: Silvernail at 1:12-27 ("Such a multilayer structure can be applied directly onto the substrate or active region of an OLED device by use of a polymer multilayer process or ("PML" process). The PML process is disclosed, for example, in U.S. Pat. Nos. 4,842,893, 4,954,371, 5,260,095 and 6,224,948, all of which are incorporated herein in their entireties."); Ni at [0014], [0017]: ("The rugged surface between the cathode and the component is flatted and thereby to eliminate the "step effect" caused by change of temperature in a plated inorganic layer."). It was also well-known in the art to apply the layers selectively over

only a portion of the substrate, including for example to avoid applying layers over electrical contacts. Burrows ’901 at 1:47-67; Harvey ’360 at Abstract (describing multi-layer overcoating); Graff at Abstract (same); Komatsu at abstract (same); Biebuyck at Abstract (same); Forrest at Abstract (same);

The Use of Ink-Jet Printing to Form Layers During OLED Fabrication and Other Manufacturing Processes was Well-Known in the Art: Ink-jet printing in electronic device manufacturing was well-known in the art as of the alleged priority date of the ’389 patent. *See, e.g.* Shimoda at 5:45-55 (““In an ink jet method, thin film materials can be applied in fine droplets (0.5 microns or less) and thereby, patterned application can be performed along fine patterns. Therefore, processes such as mask fabrication and etching which are required in a vapor phase film formation method can be eliminated. Thus, the yield can be improved, manufacturing cost can be reduced and production time can be shortened. Moreover, application materials can be exchanged more easily in an ink jet method than in a vapor phase film formation method. Therefore, a simpler apparatus can be used to form a multiple-thin-layered structure such as a DBR mirror.”); Duthaler ’242 at 10 (“The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. ”). The use of ink-jet printing for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.* Shimoda at 5:45-55; Sturm at 5:17-37, 7:1-19; Duthaler at 10. Ink-jet printing to form a layer in a selected area was also well-known in the art. *Id.*

The Use of a Mask to Selectively Deposit Layers in OLED Fabrication and Other Manufacturing Processes was Well-Known in the Art: The use of a mask to selectively deposit layers during manufacturing of OLEDs and other devices was well-known in the art. *See, e.g*

Burrows ’901 at 7:49-8:22; Tian at 2975-2976; Duthaler ’242 at 10:10-13, 14:13:-23 and 15:5-9; Yamazaki at ¶¶ 82, 140; Sato at 198-99; Ghosh; Sturm at 4:53-5:3; Jones 220 at 5:18-22 (describing how “shadow masking may be employed to prevent deposition of material in areas where external electrical connections to the OLED may be required.”); Ni at [0047] (“As shown in FIGS. 4A and 4B, a plurality of Sprayed or Screen-printed mask patterns 411 is the same with the EL component domains 401 formed on a substrate 40 in amount at corresponding positions, ***wherein each unit of the mask pattern 411 is slightly larger than each domain 401 in area***; the alignment Symbols 412 in the mask or Screen 41 must be exactly aligned with the alignment symbols 402 in the Substrate 40 when Spraying or Screen-printing, and the domains 401 comprise organic EL component's pixels 403 at least in thousands or up.”); *Id.* at cl. 16 (“The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position.”); Fujimori at [0040]; Silvernail at 2:28-40.

The Use of Metal and Ceramic Masks was Well Known in the Art: The use of a metal mas was well-known in the art as of the priority date of the ’389 patent. *See, e.g.* Sato’s “Interface and Material Considerations of OLEDs” (disclosing the use of a “metal shadow mask which defines 2mm stripe cathode pattern.”); Fujimori at [0034]: (“ the mask desirably contains a total of at least 1% of at least one of the magnetic elements Fe, Co, and Ni (at least 1% if an element is used alone) and more desirably a total of least 20%.”). A POSITA would further understand that magnetic masks, which are generally metal, were common and known in the art. *See, e.g.* Fujimori at [0030] “the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask

adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing.”).

The Use of a Mask in Contact With the Substrate was Well Known in the art. One common type of mask in the art was a magnetic mask, which comes in contact with the substrate using magnets. *See, e.g.* Fujimori at [0030] (“the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing.”). Another common type of mask was a stamp mask, which would have been affixed directly to the substrate. *See also, e.g.*, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140 at Abstract; U.S. Pat. No. 7,282,240 (Jackman) (describing masks in contact with the substrate).

It was also well-known in the art to use a non-sticking material over the areas in between the active areas.: A POSITA would have known as of the priority date of the ’389 patent that a mask could be disposed over the non-active areas to result in a layer over the active areas. *See, e.g.*, Jones 443 at 7:4-9 (“The OLED layer 18 and the first and second passivation layers 191 and 192 are preferably evaporatively deposited through the use of a shadow mask onto the display. This avoids deposition of the OLED layer 18 on the substrate 2 in the areas where the end portion 111 of the electrode elements 11 are located.”); Jones 220 at 5:18-22 (describing how “shadow masking may be employed to prevent deposition of material in areas where external electrical connections to the OLED may be required.”); Ni at [0047] (“As shown in FIGS. 4A and 4B, a plurality of Sprayed or Screen-printed mask patterns 411 is the same with the EL component domains 401 formed on a substrate 40 in amount at corresponding positions, ***wherein each unit of the mask pattern 411 is slightly larger than each domain 401 in area***; the alignment Symbols

412 in the mask or Screen 41 must be exactly aligned with the alignment symbols 402 in the Substrate 40 when Spraying or Screen-printing, and the domains 401 comprise organic EL component's pixels 403 at least in thousands or up."); *Id.* at cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28-40 ("An additional barrier layer 20 is disposed over the active region 15, which can also be a multilayer Structure, if desired. Composite barrier layer 22 is disposed on a top surface 11 of Substrate 10, Such that composite barrier layer 22 is positioned between substrate 10 and active region 15."); Ghosh at Fig. 3. A POSITA would have been motivated to combine any use of a mask with a mask with holes only over the active areas. Jones 443 at 7:4; Jones 220 at 5:18-22; Ni at [0047] ; *Id.* at cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28; Ghosh at Fig 3.

(b) Motivation to Combine

A person of ordinary skill in the art would have been motivated to combine any of the references in its obviousness chart as they all discuss methods and systems for encapsulating electronic devices and applying layers in electronics manufacturing. A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

A POSITA would also have been motivated to combine the references discussed in Exhibits A-1-A-30 because many of them share inventors. For example, the individuals below are inventors on multiple of the references discussed in Exhibits A-1-A-30.

Inventor	**References**
Paul Burrows	Burrows ’901, Forrest, Pagano, Tian, Burrows ’217
Stephen Forrest	Forrest, Tian,
John Chris Pagano	Pagano, Burrows ’901, Burrows ’217
Eric Mast	Burrows ’901, Graff, Burrows ’217
Peter Martin	Pagano, Burrows ’901, Graff, Burrows ’217
Gordon Graff	Burrows ’901, Pagano, Graff, Burrows ’217
Mark Gross	Burrows ’901, Pagano, Graff, Burrows ’217
Michael Weaver	Weaver ’347, Weaver ’111, Silvernail
Jeffrey Silvernail	Weaver ’111, Silvernail
Thomas Harvey	Harvey ’360, Harvey ’562
Frank So	Harvey ’360, Harvey ’562
Amalkumar Ghosh	Ghosh, Jones ’443
Gary Jones	Ghosh, Jones ’220, Jones ’443
Webster Howard	Ghosh, Jones ’220
Shunpei Yamazaki	Yamazaki ’332, Yamazaki ’166

In addition, many of the references discussed in Exhibits A-1-A-30 cite either to each other or to references invented or authored by the inventors of the references in Exhibits A-1-A-30. For

example, the references cite to each other as described below. Samsung reserves all rights to supplement this list, as this list is merely exemplary:

Reference	References Cited to	References which share inventors with references cited to.
Burrows ’901	Harvey ’360, Harvey ’562, Jones ’220, Silvernail, Weaver ’347	Forrest, Weaver ’111, Ghosh Jones ’443, Tian, Burrows ’217
Harvey ’360		Forrest, Tian, Harvey ’562
Weaver ’347[6]	Harvey ’360, Harvey ’562	Forrest, Tian, Burrows ’901, Pagano, Burrows ’217
Jones ’220	Biebuyck, Harvey ’360, Harvey ’562	Forrest, Tian, Burrows ’901, Pagano, Burrows ’217
Komatsu	Jones ’220	Ghosh, Jones ’443
Forrest	Jones ’220, Silvernail	Weaver ’347, Weaver ’111, Harvey ’360, Harvey ’562, Jones ’443, Burrows ’901, Forrest, Pagano, Tian, Graff, Burrows ’217
Silvernail		Forrest, Pagano, Tian, Burrows ’901, Harvey ’360, Harvey ’562, Burrows ’217
Pagano	Harvey ’360, Harvey ’562, Bieybuyck, Graff, Silvernail, Forrest,	Burrows ’901, Tian, Jones ’220, Jones ’443, Weaver ’347, Weaver ’111, Burrows ’217
Graff	Harvey ’360, Harvey ’562	Forrest, Pagano, Tian, Burrows ’901, Burrows ’217
Suzuki	Harvey ’562	Harvey ’360

Further non-limiting examples as to motivation to combine are discussed below.

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation of an OLED or other electronic device with a reference disclosing an ink-jet printing method to apply a planarization or other layer. A POSITA would understand that the use of an ink-jet printing method to pattern layers reduced costs and increased efficiency because photolithography and etching are expensive processes. *See, e.g.* Shimoda at 5:45-55; Tian at 2975;

[6] References cited are taken from U.S. Pat. No. 6,664,137, the patent that resulted from Weaver ’347.

Duthaler ’242 at 10. Ink-jet deposition was also understood to be a relatively inexpensive and accurate process. *See, e.g.* Shimoda at 5:45-55; Duthaler ’242 at 10 (“The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. ”). The use of ink-jet printing for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.* Shimoda at 5:45-55; Sturm at 5:17-37, 7:1-19; Duthaler at 10; Palanisamy (describing “selective” application of a passivation layer to areas using an “ink jet printer”). A POSITA would have expected to succeed in using ink-jet printing and would not have been required to perform undue experimentation to make use of ink-jet printing for application of a planarization or barrier layer.

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing a mask method to apply a planarization or other layer. A POSITA would understand that the use of a mask to pattern a layer reduced costs and increased efficiency because photolithography and etching are expensive processes. *See, e.g.* Shimoda at 5:45-55; Tian at 2975. Masking is also a relatively inexpensive and accurate process. *See, e.g.* Tian at 2975-2976; Duthaler ’242 at 10:10-13, 14:13:-23 and 15:5-9. (“The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. ”); Eida ’121; Palanisamy; Ni. A POSITA would have a reasonable expectation of success in using a mask to apply a planarization or other barrier layer. The use of masks for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.*, *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Yamazaki at ¶¶ 82, 140; Sato at 198-99; Ghosh; Sturm at 4:53-5:3.

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing a mask in contact with the substrate in applying a planarization layer. A POSITA would further understand that the use of a mask in contact with a substrate was known in the art. *See, e.g.*, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140 at Abstract; U.S. Pat. No. 7,282,240 (Jackman). Using a mask in contact with the substrate creates a method for ensuring that the deposited material is deposited only in gaps in the substrate. *Id.*; Fujimori at [0030]. A POSITA would also have a reasonable expectation of success in using a mask in contact with the substrate. It was a standard method to use a mask attached to the substrate, including for example a magnetic mask. *See, e.g.* Fujimori at [0030] ("the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing."); Fujimori at "Means to solve the problem" (discussing need for adhesion between the substrate and the mask, including using magnetism.).

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing a mask of a metal, ceramic, or polymer. A POSITA would also understand that the use a mask of a metal, ceramic, or polymer. Such masks were well known in the art, and would have had a reasonable expectation of success in using a metal, ceramic, or polymer mask in fabrication of an OLED or other electronic device. *See, e.g.* Sato's "Interface and Material Considerations of OLEDs" (disclosing the use of a "metal shadow mask which defines 2mm stripe cathode pattern."); Fujimori at [0034]: (" the mask desirably contains a total of at least 1% of at least one of the magnetic elements Fe, Co, and Ni (at least 1% if an element is used alone) and more desirably a total of least 20%."). A POSITA would know that metal, ceramic, and

polymer were standard materials for masks and manufacturing and cover a wide range or materials. A POSITA would further understand that magnetic masks, which are generally metal, were common and known in the art. *See, e.g.* Fujimori at [0030] "the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing.").

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing the use of a mask with hole openings over the active areas. It was well-known in the art to provide an insulating layer only over the active areas and not over areas such as electrical contacts that would need to be exposed in order to complete fabrication of the device. *See, e.g.*, Jones 443 at 7:4-9 ("The OLED layer 18 and the first and second passivation layers 191 and 192 are preferably evaporatively deposited through the use of a shadow mask onto the display. This avoids deposition of the OLED layer 18 on the substrate 2 in the areas where the end portion 111 of the electrode elements 11 are located."); Jones 220 at 5:18-22 (describing how "shadow masking may be employed to prevent deposition of material in areas where external electrical connections to the OLED may be required."); Ni at [0047] ("As shown in FIGS. 4A and 4B, a plurality of Sprayed or Screen-printed mask patterns 411 is the same with the EL component domains 401 formed on a substrate 40 in amount at corresponding positions, ***wherein each unit of the mask pattern 411 is slightly larger than each domain 401 in area***; the alignment Symbols 412 in the mask or Screen 41 must be exactly aligned with the alignment symbols 402 in the Substrate 40 when Spraying or Screen-printing, and the domains 401 comprise organic EL component's pixels 403 at least in thousands or up."); *Id.* at cl. 16 ("The method for packaging

organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28-40 ("An additional barrier layer 20 is disposed over the active region 15, which can also be a multilayer Structure, if desired. Composite barrier layer 22 is disposed on a top surface 11 of Substrate 10, Such that composite barrier layer 22 is positioned between substrate 10 and active region 15."); Ghosh at Fig. 3. A POSITA would have been motivated to combine any use of a mask with a mask with holes only over the active areas. Jones 443 at 7:4; Jones 220 at 5:18-22; Ni at [0047] ; *Id.* at cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28; Ghosh at Fig 3. A POSITA would also have had a reasonable expectation of success in doing so, as the use of masks to pattern was well known in the art. *Id.* A POSITA would also have known to use a mask material which would not stick to the underlying material so as not to delaminate the underlying material. *Id.* A POSITA would have had a reasonable expectation of success in combining these methods, as masking was a known technique and changing the pattern of the mask would done with a very high likelihood of success.

A POSITA would also have been motivated to use an organic planarizing layer in combination with any of the techniques and methods disclosed in Exs. A1-A-30. Organics were known to be good planarizing layers. *See, e.g.*, Biebuyck 4:41-64 (describing use of siloxane organic barrier layers for OLED encapsulation, and citing nine earlier patents describing the same) Jones '220 at 5:305 ("The material for these layers may be selected from a number of acceptable organic or inorganic materials"); Jones '220 at 5:3-5 ("The material for these layers may be

selected from a number of acceptable organic or inorganic materials"); Ni at [0046] ("The passivation layer should comprise at least: a wet-adsorption or inorganic filler agent, and a Solvent or nonsolvent, thermo-curing or UV-curing, organic or inorganic polymer Sub-layer."); Burrows '901 at cl. 6 ("wherein at least one of the decoupling layers is selected from organic polymers"); Fujimori at [0028] ("Organic material or electrode material flying toward the substrate in vapor deposition or the like is deposited on the substrate through the mask opening placed in front of the substrate to achieve the patterning of the organic electroluminescent element corresponding to the mask opening shape."); Harvey '360 at 3:4-6 (describing use of a "parylene" which is organic); Weaver '347 at [0035] (same); Ghosh at [0044] (same); Forrest at [0046]; (same); Silvernail at 8:1-13 (same); Burrows '901 at 6:11-34 (same). A POSITA would also understand that when a layer is applied over a mask, the layer is applied over the whole mask in most if not all cases. *See also, e.g.*, Burrows '901 at 7:65-8:9; Jones '443 7:4-9, Burrows '217 at 8:8-30; 8:56-9:9 (describing deposition of planarizing layer over "substantially all" of a barrier layer); Weaver '347 at Figs. 8-9 (showing spraying of material over a wide area).

(i) Claim 34:

A POSITA would have been motivated to combine the following references to disclose claim 34.

- Burrows '901 (A-1) with one of Harvey 360 (A-2), Weaver (A-3), Ghosh (A-4), Yamazaki '332 (A-5), Jones '443 (A-6), Jones '220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26), or Burrows '217 (A-30).

- Harvey 360 (A-2) with one of Weaver (A-3), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Weaver (A-3) with one of Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30). ,
- Ghosh (A-4) with one of Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30). ,
- Yamazaki ’332 (A-5) with one of Ghosh (A-4), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Jones ’443 (A-6) with one of Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18),

Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).

- Jones ’220 (A-7) with one of Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), SSilvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Komatsu (A-8) with one of Forrest (A-9), Biebuyck (A-10), Ni (A-13),Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Forrest (A-9) with one of Biebuyck (A-10), Ni (A-13),Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Biebuyck (A-10) with one of Ni (A-13), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Ni (A-13) with one of Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Silvernail (A-15) with one of Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).

- Pagano (A-16) with one of Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Graff (A-18) with one of Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Suzuki (A-19) with one of Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Palanisamy (A-20) with one of Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Harvey 562 (A-21) with one of Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Duthaler (A-22) with one of Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Eida 121 (A-23) with one of Eida 467 (A-24), Fujimori (A-26) or Burrows ’217 (A-30).
- Eida 467 (A-24) with one of Fujimori (A-26) or Burrows ’217 (A-30).
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) with one of Burrows ’901 (A-1), Harvey 360 (A-2), Weaver (A-3), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-14), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26), Burrows ’217 (A-30).

- Fujimori (A-26) with Burrows ’217 (A-30).
- Kijima (A-27) with one of Burrows ’901 (A-1), Harvey 360 (A-2), Weaver (A-3), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-14), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26), Burrows ’217 (A-30).
- The Motorola Timeport P8767 (A-28) with one of Burrows ’901 (A-1), Harvey 360 (A-2), Weaver (A-3), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-14), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26), Burrows ’217 (A-30).
- Pioneer OLED Car Radios (A-29) with one of Burrows ’901 (A-1), Harvey 360 (A-2), Weaver (A-3), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Komatsu (A-8), Forrest (A-9), Biebuyck (A-10), Ni (A-13), Silvernail (A-14), Silvernail (A-15), Pagano (A-16), Graff (A-18), Suzuki (A-19), Palanisamy (A-20), Harvey 562 (A-21), Duthaler (A-22), Eida 121 (A-23), Eida 467 (A-24), Fujimori (A-26), Burrows ’217 (A-30).

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would have been motivated to combine the bi-layer of a planarizing layer and a barrier layer (or a many layered barrier layer with alternating barrier and planarization layers)

with a method of fabrication which "selectively" deposited those layers. The use of a bi-layer, including a planarizing layer, to encapsulate electronic devices and especially OLED devices was well-known in the art. *See, e.g.*, It was well known as of the priority date of the '389 patent that a multi-layer structure, including a two-layer structure, provided superior protection to OLED devices. Burrows '901 at 1:11-28: Silvernail at 1:12-27; Silvernail at 1:12-27 ("Such a multilayer structure can be applied directly onto the substrate or active region of an OLED device by use of a polymer multilayer process or ("PML" process). The PML process is disclosed, for example, in U.S. Pat. Nos. 4,842,893, 4,954,371, 5,260,095 and 6,224,948, all of which are incorporated herein in their entireties.") It was also well-known in the art that a planarizing layer over a device would provide for better adhesion of a subsequent layer. *See, e.g.*, Burrows '901 at 1:11-28: Silvernail at 1:12-27 ("Such a multilayer structure can be applied directly onto the substrate or active region of an OLED device by use of a polymer multilayer process or ("PML" process). The PML process is disclosed, for example, in U.S. Pat. Nos. 4,842,893, 4,954,371, 5,260,095 and 6,224,948, all of which are incorporated herein in their entireties."); Ni at [0014], [0017]: ("The rugged surface between the cathode and the component is flatted and thereby to eliminate the "step effect" caused by change of temperature in a plated inorganic layer."); Komatsu at abstract; Biebuyck at Abstract. It was also well-known in the art to apply the layers selectively over only a portion of the substrate, including for example to avoid applying layers over electrical contacts. Burrows '901 at 1:47-67; 7:8-48 (describing use of "decoupling" layer to "improve surface planarity"; Burrows '217 at 1:47-67; Biebuyck (discussing use of curable Siloxane encapsulant" to "planarize" devices); Harvey '360 at Abstract (describing multi-layer overcoating); Graff at Abstract ("there can be additional overcoat layers on top of the barrier stack, such as organic or inorganic players, planarizing layers"); *id.* at 3:5-15 ("the polymer smoothing layer decreases surface roughness, and

encapsulates surface defects, such as pits scratches and digs. This produced a planarized surface which is ideal for subsequent deposition of layers.") ; Silvernail (discussing "polymeric planarizing sublayer" to be placed under other barrier layers); Pagano at 8:43-9:67 (discussing thickening of layer to approve "planarization."); Eida '121 at (discussing planarizing layers); Weaver '347 at [0054]-[0057] (discussing use of planarization layers and alternating use of planarizing and high density layers in an encapsulation). Ghosh at Fig. 3 (showing planarizing effect of layer over OLED cells).

It was known to use a bi-layer to improve the protective properties of the barrier layers, as OLEDs are environmentally sensitive and require protection, especially from water and oxygen. *See, e.g.*, Burrows '901 at 1:11-28; Silvernail at 1:12-27; ("One factor limiting the practical application of OLEDs is their Susceptibility to environmental elements Such as moisture and oxygen. Oxygen and moisture can produce deleterious effects on certain OLED structural components, Such as reactive metal cathode components."); Jones '443 at 1:57-66 ("Organic light emitting devices need to be protected from the atmosphere. The light emitting organic material in the light-emitting layer can be highly reactive. The material is Susceptible to water, oxygen, etc. Moisture and oxygen may cause a reduction in the useful life of the light emitting device. The cathode and anode may also be affected by oxidation. One disadvantage of oxygen and moisture penetration into the interior of the organic light emitting device is the potential to form metal oxides at the metal-organic interface."); Ni at [0003]: "Besides, a lighting layer formed by fluorescent organic Solid material and an electrons transport layer and emitting materials layer are also extremely Sensitive to humidity, oxygen, and some environmental factors, and any of which may render the organic Substance crystallized to result in detachment of the organic material layer from the cathode to have the so-called "dark spot" phenomenon happened. Therefore, a conventional

organic EL component can light only in a short lifetime if lacking a perfect package."); Komatsu at 2:40-44 ("Such cathode corrosion or oxidation gives rise to consider able growth of non-emitting regions, So called dark Spots (D.S.) in the light-emitting layer, and is a cause for characteristic degradation with time of organic electroluminescence devices."); Weaver '347 ("Moreover, moisture and oxygen are also known to increase "dark spot areas" in connection with OLEDs."); Harvey '360 ("the multi-layer overcoating and the dielectric material acts as a physical barrier to atmospheric elements which can corrode the organic device and are a detriment to the reliability of organic LEDs").

It was also well-known in the art to encapsulate individual electronic devices using selective application of protective layers, rather than applying the layers over the entire substrate. *See, e.g.*, Ghosh at Fig. 3; Harvey '360 at e.g. Fig. 5 (showing series of layers disposed only over electronic device 12) *id.* at Fig. 9 (similar); Harvey '562 (Similar); Jones at Fig. 1 (similar); Palanisamy at [0024] ("Turning next to FIG. 5, a screen printing technique may be utilized to passivate selectively"); Yamazaki '332 at [0035]: "As thus explained, because the same method is used in forming the EL layer and the cover layer, the layers may be selectively formed only at the desired positions and may be processed in the same chamber."; Burrows '901 at 7:49-8:22 (discussing "edge sealing" of multiple devices on a substrate so that they can be later diced); *Id.* at figs 1-2 (showing edge-sealing an that layers were applied only in select regions); Burrows '217 at 7:49-8:22 (discussing "edge sealing" of multiple devices on a substrate so that they can be later diced); *Id.* at figs 1-2 (showing edge-sealing an that layers were applied only in select regions); Komatsu at *e.g.* Figs 2-4 (showing application of layers over a small region); Suzuki at Fig. 1 (showing edge-sealed device); Ni at Fig. 4b (showing selective application of layers over a variety of devices); Forrest at Fig. 3 (similar).

As just one example of the need for "selective" application of barrier layers, electronic and OLED pixels have contacts that would need to be exposed in order to complete fabrication of the device, such that it was known that layers should be applied selectively. *See, e.g.*, Jones 443 at 7:4-9 ("The OLED layer 18 and the first and second passivation layers 191 and 192 are preferably evaporatively deposited through the use of a shadow mask onto the display. This avoids deposition of the OLED layer 18 on the substrate 2 in the areas where the end portion 111 of the electrode elements 11 are located."); Jones 220 at 5:18-22 (describing how "shadow masking may be employed to prevent deposition of material in areas where external electrical connections to the OLED may be required."); Ni at [0047] ("As shown in FIGS. 4A and 4B, a plurality of Sprayed or Screen-printed mask patterns 411 is the same with the EL component domains 401 formed on a substrate 40 in amount at corresponding positions, ***wherein each unit of the mask pattern 411 is slightly larger than each domain 401 in area***; the alignment symbols 412 in the mask or screen 41 must be exactly aligned with the alignment symbols 402 in the Substrate 40 when Spraying or Screen-printing, and the domains 401 comprise organic EL component's pixels 403 at least in thousands or up."); *Id.* at cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28-40 ("An additional barrier layer 20 is disposed over the active region 15, which can also be a multilayer structure, if desired. Composite barrier layer 22 is disposed on a top surface 11 of Substrate 10, Such that composite barrier layer 22 is positioned between substrate 10 and active region 15."); Ghosh at Fig. 3; Pagano at 14:15-32 ("the passivation is applied where needed leaving electrical contact areas uncoated"); Palanisamy at [0023] ("describing that "passivation is applied where needed leaving electrical contact areas uncoated.")

It was also known in the art that lithography and other methods of "subtracting" material were expensive, and thus a POSITA would know that applying planarization/barrier layers only in selected areas rather than everywhere and then performing a subtractive process would be costly and unnecessary. *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Duthaler '242 at 10. Ink-jet deposition was also understood to be a relatively inexpensive and accurate process. *See, e.g.* Shimoda at 5:45-55; Duthaler '242 at 10 ("The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. "). The use of ink-jet printing for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.* Shimoda at 5:45-55; Sturm at 5:17-37, 7:1-19; Duthaler at 10; Palanisamy (describing "selective" application of a passivation layer to areas using an "ink jet printer"). A POSITA would have expected to succeed in using ink-jet printing and would not have been required to perform undue experimentation to make use of ink-jet printing for application of a planarization or barrier layer.

The primary references above emphasize the need for cost savings in manufacturing techniques. *See, e.g.* Sturm at 1:25-60 (discussing cost of oleds and need to reduce costs); Shimoda at Shimoda at 5:45-55 (similar); Yamazaki '166 at [0235]((discussing cost savings from manufacturing methods in Yamazaki); Pagano at 8:43-9:67 (focusing on problems in manufacturing that increase costs); Biebuyck at 2:1-13 (discussing expense of manufacturing and ways to lower the same); Silvernail at 1:12-22 (discussing expense of manufacturing and efforts to lower it); Harvey '360 at 2:21-29; 1:10-19 (discussing how techniques of reference lower cost); Harvey '562 at 1:40–50 (similar); Weaver '347 at [0003] (discussing expense of manufacturing

and importance of lowering it); Jones ’220 at 7:14-30 (similar); Forrest at [0006] (discussing expense of existing sealing methods, and desire to reduce the same).

(ii) Claim 35: The method as recited in claim 34 wherein the step for selectively depositing at least one planarization layer further comprises depositing by ink jet of an organic layer.

A POSITA would have been motivated to combine the following references to disclose claim 35.

- Burrows ’901 (A-1) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Harvey ’360 (A-2) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Weaver ’347 (A-3) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Ghosh (A-4) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Yamazaki ’332 (A-5) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), or Palanisamy (A-20).
- Jones ’443 (A-6) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).

- Jones ’220 (A-7) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Komatsu (A-8) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Forrest (A-9) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Biebuyck (A-10) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Sturm (A-11) with one of Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Shimoda (A-12) with one of Sturm (A-11), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Ni (A-13) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20). Yamazaki ’166 (A-14) with one of Sturm (A-11)
- Silvernail (A-15) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).

- Pagano (A-16) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Graff (A-18) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Suzuki ’217 (A-19) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Palanisamy (A-20) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5).
- Harvey ’562 (A-21) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Duthaler (A-22) with one of Sturm (A-11), Shimoda (A-12), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Fujimori (A-26) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).

- Kijima (A-27) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- The Motorola Timeport P8767 with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Pioneer OLED Car Radios with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Burrows ’217 (A-30) with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Any combination described above with respect to claim 34 in combination with one of Sturm (A-11), Shimoda (A-12), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation of an OLED or other electronic device with a reference disclosing an ink-jet printing method to apply a planarization or other layer. A POSITA would understand that the use of an ink-jet printing method to pattern layers reduced costs and increased efficiency because photolithography and etching are expensive processes. *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Duthaler ’242 at 10. Ink-jet deposition was also understood to be a relatively inexpensive and

accurate process. *See, e.g.* Shimoda at 5:45-55; Duthaler ’242 at 10 (“The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. ”). The use of ink-jet printing for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.* Shimoda at 5:45-55; Sturm at 5:17-37, 7:1-19; Duthaler at 10; Palanisamy (describing “selective” application of a passivation layer to areas using an “ink jet printer”). A POSITA would have expected to succeed in using ink-jet printing and would not have been required to perform undue experimentation to make use of ink-jet printing for application of a planarization or barrier layer.

The primary references above emphasize the need for cost savings in manufacturing techniques. *See, e.g.* Sturm at 1:25-60 (discussing cost of oleds and need to reduce costs); Shimoda at Shimoda at 5:45-55 (similar); Yamazaki ’166 at [0235]((discussing cost savings from manufacturing methods in Yamazaki); Pagano at 8:43-9:67 (focusing on problems in manufacturing that increase costs); Biebuyck at 2:1-13 (discussing expense of manufacturing and ways to lower the same); Silvernail at 1:12-22 (discussing expense of manufacturing and efforts to lower it); Harvey ’360 at 2:21-29; 1:10-19 (discussing how techniques of reference lower cost); Harvey ’562 at 1:40–50 (similar); Weaver ’347 at [0003] (discussing expense of manufacturing and importance of lowering it); Jones ’220 at 7:14-30 (similar); Forrest at [0006] (discussing expense of existing sealing methods, and desire to reduce the same).

The use of ink-jet to deposit layers would also have been desirable to avoid the need for existing sealing methods which required use of cans or packaging which would increase size of the device. *See, e.g.*, Ni at [00016]; Forrest at [0006] (discussing expense of existing sealing methods, and desire to reduce the same).

A POSITA would further have been motivated to combine any of the above combinations with Komatsu, Forrest, Ni, or Burrows, which each disclose an organic planarization layer. Organics were known to be good planarizing layers. *See, e.g.*, Biebuyck 4:41-64 (describing use of siloxane organic barrier layers for OLED encapsulation, and citing nine earlier patents describing the same) Jones '220 at 5:305 ("The material for these layers may be selected from a number of acceptable organic or inorganic materials.:"); Ni at[0046] ("The passivation layer should comprise at least: a wet-adsorption or inorganic filler agent, and a Solvent or nonsolvent, thermo-curing or UV-curing, organic or inorganic polymer Sub-layer."); Burrows '901 at cl. 6 ("wherein at least one of the decoupling layers is selected from organic polymers"); Fujimori at [0028] ("Organic material or electrode material flying toward the substrate in vapor deposition or the like is deposited on the substrate through the mask opening placed in front of the substrate to achieve the patterning of the organic electroluminescent element corresponding to the mask opening shape.").

(iii) Claim 41:

A POSITA would have been motivated to combine the following references to disclose claim 41.

- Burrows '901 (A-1) with one of Ghosh (A-4), Yamazaki '332 (A-5), Jones '443 (A-6), Jones '220 (A-7), Ni (A-13), Yamazaki '166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida '121 (A-23), Eida '567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows '271 (A-30).
- Harvey '360 (A-2) with one of Burrows '901 (A-1), Ghosh (A-4), Yamazaki '332 (A-5), Jones '443 (A-6), Jones '220 (A-7), Ni (A-13), Yamazaki '166 (A-14),

Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).

- Weaver ’347 (A-3) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Ghosh (A-4) with one of Sturm (A-11), Burrows ’901 (A-1), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Yamazaki ’332 (A-5) with one of Burrows ’901 (A-1), Ghosh (A-4), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Jones ’443 (A-6) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Jones ’220 (A-7) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).

- Komatsu (A-8) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Forrest (A-9) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Biebuyck (A-10) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Sturm (A-11) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Shimoda (A-12) with one of Sturm (A-11), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), or Palanisamy (A-20).
- Ni (A-13) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).

- Silvernail (A-15) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Pagano (A-16) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Graff (A-18) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).).
- Suzuki ’217 (A-19) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Palanisamy (A-20) Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Harvey ’562 (A-21) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14),

Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).

- Duthaler (A-22) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Fujimori (A-26) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Kijima (A-27), or Burrows ’271 (A-30).
- Kijima (A-27) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), or Burrows ’271 (A-30).
- The Motorola Timeport P8767 with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22),

Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).

- Pioneer OLED Car Radios with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), Kijima (A-27), or Burrows ’271 (A-30).
- Burrows ’217 (A-30) with one of Burrows ’901 (A-1), Ghosh (A-4), Yamazaki ’332 (A-5), Jones ’443 (A-6), Jones ’220 (A-7), Ni (A-13), Yamazaki ’166 (A-14), Pagano (A-16), Tian (A-17), Palanisamy (A-20), Duthaler (A-22), Eida ’121 (A-23), Eida ’567 (A-14), Fujimori (A-26), or Kijima (A-27).

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would have been motivated to combine references disclosing bi-layers for encapsulation of an OLED or similar device with a references disclosing selective application of the bi-layer and the use a mask method to apply a planarization or other layer. A POSITA would understand that the use of a mask to pattern a layer reduced costs and increased efficiency because photolithography and etching are expensive processes. *See, e.g.* Shimoda at 5:45-55; Tian at 2975. Masking is also a relatively inexpensive and accurate process. *See, e.g.* Tian at 2975-2976; Duthaler ’242 at 10:10-13, 14:13:-23 and 15:5-9. (“The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. ”); Eida ’121; Palanisamy; Ni. A POSITA would have a reasonable expectation of success in using a mask to apply a planarization

or other barrier layer. The use of masks for deposition of layers was extremely well-known in the art, known to be inexpensive, accurate, and common. *See, e.g.*, *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Yamazaki at ¶¶ 82, 140; Sato at 198-99; Ghosh; Sturm at 4:53-5:3.

See also section IV.D.1.b.i (discussing motivations to prepare bi-layer and selective application of bilayer with respect to claim 24).

The primary references above emphasize the need for cost savings in manufacturing techniques. *See, e.g.*, Sturm at 1:25-60 (discussing cost of oleds and need to reduce costs); Shimoda at Shimoda at 5:45-55 (similar); Yamazaki '166 at [0235]((discussing cost savings from manufacturing methods in Yamazaki); Pagano at 8:43-9:67 (focusing on problems in manufacturing that increase costs); Biebuyck at 2:1-13 (discussing expense of manufacturing and ways to lower the same); Silvernail at 1:12-22 (discussing expense of manufacturing and efforts to lower it); Harvey '360 at 2:21-29; 1:10-19 (discussing how techniques of reference lower cost); Harvey '562 at 1:40–50 (similar); Weaver '347 at [0003] (discussing expense of manufacturing and importance of lowering it); Jones '220 at 7:14-30 (similar); Forrest at [0006] (discussing expense of existing sealing methods, and desire to reduce the same).

(iv) Claim 43: The method as recited in claim 41 wherein the step of depositing said mask further comprises depositing said mask such that said mask is in contact with said substrate.

A POSITA would have been motivated to combine the following references to disclose claim 43.

- Burrows '901 (A-1) with one of U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows '217.

- Harvey ’360 (A-2) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Weaver ’347 (A-3) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Ghosh (A-4) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Yamazaki ’332 (A-5) Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Jones ’443 (A-6) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Jones ’220 (A-7) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Komatsu (A-8) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.

- Forrest (A-9) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Biebuyck (A-10) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Sturm (A-11) with one of with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Shimoda (A-12) with one of with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Ni (A-13) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.Yamazaki ’166 (A-14) with one of Sturm (A-11)
- Silvernail (A-15) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Pagano (A-16) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.

- Graff (A-18) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Suzuki ’217 (A-19) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Palanisamy (A-20) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Harvey ’562 (A-21) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Duthaler (A-22) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- or Fujimori (A-26) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.

- Kijima (A-27) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- The Motorola Timeport P8767 with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Pioneer OLED Car Radios with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.
- Burrows ’217 (A-30) with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26).
- Any combination described above with respect to claim 41 in combination with one of Burrows ’901, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140, U.S. Pat. No. 7,282,240 (Jackman), or Fujimori (A-26), or Burrows ’217.

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing a mask in contact with the substrate in applying a planarization layer. A POSITA would understand that the use of a mask in contact with a substrate was known in the art. *See, e.g.*, U.S. Pat. No. 6,592,933 (Himeshima) at Abstract; KR100276140 at Abstract; U.S. Pat. No. 7,282,240 (Jackman) at 22:6-22 (“In cases when using solvents was not problematic, a drop of 2-propanol was often placed on a mask in contact with a substrate. This procedure made

it easier to ensure that the mask was lying flat on the Substrate. In the cases where registration of the mask to an existing pattern was required, the sealing steps were performed under a stereoscope (Wild M26 stereoscope, Leica, Heidelberg, Germany) using a set of translation and rotation stages (Newport Corp., Irvine, Calif.)."); Burrows '217 at 2:19-26 (disclosing ridges/mask on the substrate). Using a mask in contact with the substrate creates a method for ensuring that the deposited material is deposited only in gaps in the substrate. *Id.*; Fujimori at [0030]. A POSITA would also have a reasonable expectation of success in using a mask in contact with the substrate. It was a standard method to use a mask attached to the substrate, including for example a magnetic mask. *See, e.g.* Fujimori at [0030] ("the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing."); Fujimori at "Means to solve the problem" (discussing need for adhesion between the substrate and the mask, including using magnetism, and that "it is advantageous to use a mask with high planarity in order to achieve uniform adhesion between the mask and substrate."); Burrows '217 at 2:19-26 (disclosing ridges/mask on the substrate).

A POSITA would further understand that the primary references above contemplate the use of a mask, and understand that a mask often refers to a stamp in contact with the substrate.

(v) Claim 44: The method as recited in claim 41 wherein the step of depositing said mask further comprises depositing a mask, said mask comprising a material substantially non-sucking to OLED substrate over the areas in between the active areas.

A POSITA would have been motivated to combine at least the following references to disclose claim 44.

- Burrows ’901 (A-1) with one of Ghosh (A-4) Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Harvey ’360 (A-2) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Weaver ’347 (A-3) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Ghosh (A-4) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Yamazaki ’332 (A-5) Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Jones ’443 (A-6) with one of Burrows (A-1), Ghosh (A-4), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”

- Jones ’220 (A-7) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Komatsu (A-8) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Forrest (A-9) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Biebuyck (A-10) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Sturm (A-11) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Shimoda (A-12) with one of Sturm (A-11), Duthaler (A-22), Yamazaki ’166 (A-14), Eida ’121 (E-23), Yamazaki ’332 (A-5), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”

- Ni (A-13) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Yamazaki ’166 (A-14) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Silvernail (A-15) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Pagano (A-16) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Graff (A-18) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Suzuki ’217 (A-19) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”

- Palanisamy (A-20) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Harvey ’562 (A-21) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Duthaler (A-22) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Fujimori (A-26) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 (“Cohen”), or Ilic , “Topographical Patterning.”
- Kijima (A-27) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows ’271 (A-30), Tian

(A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 ("Cohen"), or Ilic , "Topographical Patterning."

- The Motorola Timeport P8767 with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows '271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 ("Cohen"), or Ilic , "Topographical Patterning."
- Pioneer OLED Car Radios with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows '271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 ("Cohen"), or Ilic , "Topographical Patterning."
- Burrows '217 (A-30) with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Burrows '271 (A-30), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 ("Cohen"), or Ilic , "Topographical Patterning."
- Any combination described above with respect to claim 41 in combination with one of Burrows (A-1), Ghosh (A-4), Jones 443 (A-6), Jones 220 (A-7), Forrest (A-9), Ni (A-13), Silvernail (A-15), Tian (A-17), Palanismay (A-20), U.S. Pat. No. 6,027,630 ("Cohen"), or Ilic , "Topographical Patterning."

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing the use of a mask with hole openings over the active areas. It was well-known in the art to provide an insulating layer only over the active areas and not over

areas such as electrical contacts that would need to be exposed in order to complete fabrication of the device. *See, e.g.*, Jones 443 at 7:4-9 ("The OLED layer 18 and the first and second passivation layers 191 and 192 are preferably evaporatively deposited through the use of a shadow mask onto the display. This avoids deposition of the OLED layer 18 on the substrate 2 in the areas where the end portion 111 of the electrode elements 11 are located."); Jones 220 at 5:18-22 (describing how "shadow masking may be employed to prevent deposition of material in areas where external electrical connections to the OLED may be required."); Ni at [0047] ("As shown in FIGS. 4A and 4B, a plurality of Sprayed or Screen-printed mask patterns 411 is the same with the EL component domains 401 formed on a substrate 40 in amount at corresponding positions, ***wherein each unit of the mask pattern 411 is slightly larger than each domain 401 in area***; the alignment symbols 412 in the mask or screen 41 must be exactly aligned with the alignment symbols 402 in the Substrate 40 when Spraying or Screen-printing, and the domains 401 comprise organic EL component's pixels 403 at least in thousands or up."); *Id.* at cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28-40 ("An additional barrier layer 20 is disposed over the active region 15, which can also be a multilayer structure, if desired. Composite barrier layer 22 is disposed on a top surface 11 of Substrate 10, Such that composite barrier layer 22 is positioned between substrate 10 and active region 15."); Ghosh at Fig. 3; Pagano at 14:15-32 ("the passivation is applied where needed leaving electrical contact areas uncoated"); Palanisamy "describing that "passivation is applied where needed leaving electrical contact areas uncoated.") A POSITA would have been motivated to combine any use of a mask with a mask with holes only over the active areas. Jones 443 at 7:4; Jones 220 at 5:18-22; Ni at [0047] ; *Id.* at

cl. 16 ("The method for packaging organic EL components according to claim 15, wherein the amount of mask pattern is equal to that of the EL component's domains, and each mask pattern is slightly larger than a paired off domain in area occupied at a correspondent position."); Silvernail at 2:28; Ghosh at Fig 3. A POSITA would also have had a reasonable expectation of success in doing so, as the use of masks to pattern was well known in the art. *Id.*

A POSITA would also have known to use a mask material which would not stick to the underlying material so as not to delaminate the underlying material. *Id.; see also* U.S. Pat. No. 6,027,630 ("Cohen") at 5:17-24 ("A variety of methods can be used to improve release of the mask from the Substrate to be plated So as to prevent delamination of the mask from the Support, gradually peeling the electroplating article (if flexible) off of the substrate with the aid of a dull blade; adding a non-Stick/lubricating compound to the electrolyte, coating the mask Surface with a non-Stick composition (e.g., Sputtered polytetrafluoroethylene); and vibration (e.g., ultrasound).)."); Tian at Fig. 1 (showing mask designed for "lift-off," which requires non-sucking/non-sticking properties); Ilic, "Topographical Patterning of Chemically Sensitive Materials Using a Polymer-based Dry Lift Off" (2000) (similar). A POSITA would have had a reasonable expectation of success in combining these methods, as masking was a known technique and changing the pattern of the mask would done with a very high likelihood of success.

(vi) Claim 45: The method as recited in claim 41 wherein the step of depositing said mask further comprises depositing a mask, said mask comprising a metal, a ceramic, a plastic, a polymer, PTFE, or poly-siloxane.

A POSITA would have been motivated to combine the following references to disclose claim 45.

- Burrows '901 (A-1) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), or Burrows '217 (A-30).

- Harvey ’360 (A-2) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Weaver ’347 (A-3) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Ghosh (A-4) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Yamazaki ’332 (A-5) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Jones ’443 (A-6) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Jones ’220 (A-7) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Komatsu (A-8) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Forrest (A-9) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Biebuyck (A-10) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Sturm (A-11) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).
- Shimoda (A-12) with one of Sato “Interface and Material Considerations of OLEDs” Fujimori (A-26), Burrows ‘901 (A-1) or Burrows ‘217 (A-30).

- Ni (A-13) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Silvernail (A-15) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Pagano (A-16) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Graff (A-18) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Suzuki '217 (A-19) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Palanisamy (A-20) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Harvey '562 (A-21) Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Duthaler (A-22) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Fujimori (A-26) with one of Sato "Interface and Material Considerations of OLEDs"
- Kijima (A-27) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).

- The Motorola Timeport P8767 with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Pioneer OLED Car Radios with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Burrows '217 (A-30) with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).
- Any combination described above with respect to claim 41 in combination with one of Sato "Interface and Material Considerations of OLEDs" Fujimori (A-26), Burrows '901 (A-1) or Burrows '217 (A-30).

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would also have been motivated to combine any of the references in Exs. A1-A-30 with any reference disclosing a mask of a metal, ceramic, polymer, PTFE, a plastic, or poly-siloxane. A POSITA would also understand that the use a mask of a mask of a metal, ceramic, polymer, PTFE, a plastic, or poly-siloxane. Such masks were well known in the art, and would have had a reasonable expectation of success in using a metal, ceramic, or polymer mask in fabrication of an OLED or other electronic device. *See, e.g.* Sato's "Interface and Material Considerations of OLEDs" (disclosing the use of a "metal shadow mask which defines 2mm stripe cathode pattern."); Fujimori at [0034]: (" the mask desirably contains a total of at least 1% of at least one of the magnetic elements Fe, Co, and Ni (at least 1% if an element is used alone) and more desirably a total of least 20%."). A POSITA would know that metal, ceramic, and polymer were standard materials for masks and manufacturing and cover a wide range or materials. A

POSITA would further understand that magnetic masks, which are generally metal, were common and known in the art. *See, e.g.* Fujimori at [0030] "the mask is attached to the substrate by means of a magnet…given, but when the mask is affixed with mechanical contact, the magnetic force should be adequate to obtain the mask adhesiveness required, and if the mask is affixed with magnetic force, the magnetic force should be adequate for mask adhesion and positional affixing."); at 2:19-26: "The ridge R can be made of any suitable material, including … barrier materials, such as previously described." Burrows '217 at 9:43-45. ("[s]uitable barrier materials include, but are not limited to, ***metals***, metal oxides, metal nitrides, metal carbides, metal oxynitrides, metal oxyborides, and combinations thereof. Suitable barrier materials also include, but are not limited to, ***opaque metals***, ***opaque ceramics***, ***opaque polymers***, and opaque cermets, and combinations thereof."); Burrows '901 (same).

A POSITA could have expected to combine a mask made of any of the above materials without undue experimentation.

(vii) Claim 46: The method as recited in claim 41 wherein the step of depositing at least one planarization layer further comprises depositing an organic layer over the entire mask.

A POSITA would have been motivated to combine the following references to disclose claim 46.

- Burrows '901 (A-1) with Harvey '360 (A-2); Weaver' 347 (A-3); Ghosh (A-4); Jones '443 (A-6); Jones '220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows '217 (A-30).
- Harvey '360 (A-2) with Burrows '901 (A-1); Weaver' 347 (A-3); Ghosh (A-4); Jones '443 (A-6); Jones '220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows '217 (A-30).

- Weaver ’347 (A-3) with Burrows ’901 (A-1); Harvey ’360 (A-2); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Ghosh (A-4) with Sato Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Yamazaki ’332 (A-5) with Sato Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Jones ’443 (A-6) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Jones ’220 (A-7) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Komatsu (A-8) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Forrest (A-9) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).

- Biebuyck (A-10) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Sturm (A-11) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Shimoda (A-12) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Ni (A-13) with Sato Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Silvernail (A-15) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Fujimori (A-26); or Burrows ’217 (A-30).
- Pagano (A-16) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Graff (A-18) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).

- Suzuki ’217 (A-19) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Palanisamy (A-20) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Harvey ’562 (A-21) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Duthaler (A-22) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- eMagin SVGA+ and/or SVGA-3D Microdisplays (A-25) Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); Burrows ’217 (A-30).
- Fujimori (A-26) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); or Burrows ’217 (A-30).
- Kijima (A-27) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).

- The Motorola Timeport P8767 Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Pioneer OLED Car Radios with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); or Burrows ’217 (A-30).
- Burrows ’217 (A-30) with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); or Fujimori (A-26).
- Any combination described above with respect to claim 41 in combination with Burrows ’901 (A-1); Harvey ’360 (A-2); Weaver’ 347 (A-3); Ghosh (A-4); Jones ’443 (A-6); Jones ’220 (A-7); Forrest (A-9); Biebuyck (A-10); Ni (A-13); Silvernail (A-15); Fujimori (A-26); Burrows ’217 (A-30).

Each of the references listed above is in the same field and addresses the same problems regarding the encapsulation and fabrication of OLED devices.

A POSITA would also have been motivated to use an organic planarizing layer in combination with any of the techniques and methods disclosed in Exs. A1-A-30. Organics were known to be good planarizing layers. *See, e.g.*, Biebuyck 4:41-64 (describing use of siloxane organic barrier layers for OLED encapsulation, and citing nine earlier patents describing the same) Jones ’220 at 5:305 (“The material for these layers may be selected from a number of acceptable organic or inorganic materials”); Jones ’220 at 5:3-5 (“The material for these layers may be

selected from a number of acceptable organic or inorganic materials"); Ni at [0046] ("The passivation layer should comprise at least: a wet-adsorption or inorganic filler agent, and a Solvent or nonsolvent, thermo-curing or UV-curing, organic or inorganic polymer Sub-layer."); Burrows '901 at cl. 6 ("wherein at least one of the decoupling layers is selected from organic polymers"); Fujimori at [0028] ("Organic material or electrode material flying toward the substrate in vapor deposition or the like is deposited on the substrate through the mask opening placed in front of the substrate to achieve the patterning of the organic electroluminescent element corresponding to the mask opening shape."); Harvey '360 at 3:4-6 (describing use of a "parylene" which is organic); Weaver '347 at [0035] (same); Ghosh at [0044] (same); Forrest at [0046]; (same); Silvernail at 8:1-13 (same); Burrows '901 at 6:11-34 (same). A POSITA would also understand that when a layer is applied over a mask, the layer is applied over the whole mask in most if not all cases. *See also, e.g.*, Burrows '901 at 7:65-8:9; Jones '443 7:4-9, Burrows '217 at 8:8-30; 8:56-9:9 (describing deposition of planarizing layer over "substantially all" of a barrier layer); Weaver '347 at Figs. 8-9 (showing spraying of material over a wide area).

2. '547 patent

(a) Background And State Of The Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the '547 patent for the general subject matter of the '547 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the '547 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that "the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that

must be consulted when considering whether a claimed invention would have been obvious"). Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the '547 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung's obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the '547 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

The principle of generating white light from a blue or ultraviolet (UV) optical source, such as an OLED or LED has been known long before the filing date of the '547 patent. For example, the "down conversion" of high-energy photons (e.g. blue or UV light) into lower-energy photons (e.g., green, yellow, orange, or red light), using materials known as phosphors was well-known in the art. It was well-known that, after blue or UV light is absorbed by a phosphor, green, yellow, orange, and/or red light is emitted by the phosphor, with the emission color depending on the chemical composition of the phosphor. The fluorescent lamps introduced by General Electric (GE)

at the 1938 International Exposition in Chicago were the first commercial lighting products to be based on the conversion of UV or blue light into white light.

Likewise, it was well-known in the art long before the filing date of the ’547 patent to use an OLED that includes the process of light not being transmitted through a material bu using optical scattering. For example, it was well known in the art to use polycrystalline materials such as alumina, where the material contains many individual “grains” or microcrystals (also known as crystallites), and the boundaries between these grains are known as grain boundaries. Such materials also often have pores or voids between the grains, depending on the process by which the material was manufactured.

The ’547 patent admits that it was well-known in the art before the filing date of the ’547 patent to use light-emitting devices that include “blue OLEDs and a phosphor conversion substance.” ’547 patent, 4:3–13. Similarly, U.S. Patent Application Publication No. 2007/0023734 (“Igarashi”) discloses “a phosphor, an optical device including the phosphor, and a display device including the phosphor.” Igarashi, ¶ [0002]. Igarashi discloses that it was well-known in the art to use an OLED display that includes a plurality of cyan, red, green, and blue pixels (labelled 28C, 28R, 28G, and 28B, respectively). .Japanese Published Application No. H10-170918 (“Shiotani”) also discloses “a display device, and in further detail, relates to a liquid crystal display device provided with a color conversion layer capable of color display, which can be used for both reflective and transmissive applications.” Shiotani, ¶ (0001).

(b) Motivation to Combine

A person of ordinary skill in the art would have been motivated to combine any of the references in the obviousness chart as they all discuss OLEDs, color filters, and/or encapsulation layers of light-emitting devices. A person of ordinary skill in the art would have been aware of

the well-known benefits of using OLEDs with color filters and encapsulations for desired color output and protection and would have thus looked to any of these references. Moreover, these references are analogous because they all discuss OLEDs, color filters, and/or encapsulation layers of light-emitting devices.

For example, a POSITA would have been motivated to use transparent filters in order to produce a display that is as bright and energy efficient as possible. A filter that is "transparent to the electromagnetic radiation having the first wavelength spectrum" would allow more light to reach the viewer than a filter that is not transparent. If the filter were not transparent, it would have been necessary to increase the current through an organic electroluminescent element to generate more light in order to compensate for the light that was not transmitted by the filter. This would increase the power consumed by the display, making it less energy efficient and reducing the lifetime of the OLED emitters because increasing current heats OLEDs and LEDs. A POSITA would understand that the use of a filter that is "transparent to the electromagnetic radiation having the first wavelength spectrum" would extend the life of the display and increase its value to the customer because of its increased brightness. A POSITA would have a reasonable expectation of success using a transparent filter. Color filters having the required optical properties were commercially available and it would have been a routine matter to replace one color filter with another. In addition, the prior art references like Igarashi teach that the color filters are formed on a glass plate, separate from the substrate on which the OLEDs are formed. Igarashi ¶ [0109]. The glass plate and the substrate are only bonded at the end of the manufacturing process. *Id*. Replacing one type of filter with another would be a simple matter that would not require any significant changes to the manufacturing process, and would employ conventional optical materials according to their accepted use.

Likewise, a POSITA would have been motivated to use a phosphor that emits "a yellow wavelength range," as it would have been obvious for a POSITA to use a green phosphor in a display that emits light in a yellow wavelength range including, for example, either zinc sulfide or the thiogallate phosphor having the "known composition SrGa2S4:Eu." A POSITA would have been motivated to use such phosphors because they were commercially available with well-known properties. Using a commercially available and well-known phosphor would avoid the expense and extra manufacturing steps required to manufacture a custom phosphor. A POSITA would have a reasonable expectation of success in using such a commercially-available phosphor. Replacing one phosphor with another would have been a routine matter and Igarashi had already demonstrated that the "known composition" could be successfully used in his display. Indeed, it was well known in the art that a wide variety of phosphors could be used in OLED displays. Boerner, for example, identifies several "suitable color converting materials" for use in OLED displays, including strontium thiogallate. Boerner ¶ [0032], Table 1.

Similarly, A POSITA would have been motivated to use thin-film encapsulation. For example, Pilcher discloses "[i]t is well known in the art to encapsulate an OLED device by physically mating a top glass (or other suitable material) layer over, but usually not touching, the OLED device with an epoxy border. . . . Of late, there has been some discussion in the art to provide a cheaper and better manner of encapsulation, called "direct thin-film" encapsulation. In this manner, thin film encapsulation is typically described as a "polymer multi-layer" (PML) comprising alternating and repeating layers of an organic (usually acrylate or the like) and a barrier layer." Pilcher at 1:10-22. "The advantages of direct thin-film encapsulation over the prior art are primarily cost reduction and improved reliability. Using direct thin-film encapsulation, the package may also be thinner and/or lighter and/or mechanically more flexible. Several structures

and steps of the prior art may be excluded with this process. For example, there is no need for a separate glass plate, no need for an epoxy seal, no need for a getter (which is typical in the prior art)." *Id*. at 1:48-55.A POSITA would have been motivated to combine the prior art references in order to achieve these advantages and the reduction in weight. Another advantage of adopting thin film encapsulation is that much of the structure of the OLED display is maniufactured in the prior art references by using thin film deposition techniques. Since thin film encapsulation was known to be effective (not requiring a relatively thick glass plate encapsulation), employing thin film deposition processes and tools to produce the encapsulation would be very attractive to a POSITA. Additionally, a POSITA would have had a reasonable expectation of success in adopting thin-film encapsulation. The replacement of other encapsulation techniques, like glass encapsulation, with thin-film encapsulation replaces one well-known method with another that is clearly superior for commercial products such as the manufacture of flat-panel displays.

Additionally, a POSITA would have been motivated to implement a display with rectangular pixels arranged as "RGB stripes" and would have had a reasonable expectation of success in doing so. A POSITA implementing a display would necessarily choose a shape and an arrangement for the pixels in the display. The use of rectangular pixels arranged in RGB stripes was a well-known practice in the design of OLED displays, used in many prior art displays. Not only was this arrangement common, it would also have been straightforward and least expensive to implement. For example, an active matrix display requires data lines to provide signals to each of the pixels. Arranging the pixels in an orderly striped arrangement simplifies the routing of the data lines across the display.

A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's

knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

(i) Claim 1

A POSITA would have been motivated to combine the following references to disclose claim 1.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine color filters with an OLED. A POSITA would understand that the use of a filter layer, including an opaque and transparent layer, with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract.

The use of color filters was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using color filters, including an opaque and transparent layer, with an OLED and would not have been required to perform undue experimentation to make use of the color filter with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

(ii) Claim 2

A POSITA would have been motivated to combine the following references to disclose claim 2.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).

- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine the use of blue wavelength range and yellow wavelength range with an OLED. A POSITA would understand that the use of blue wavelength range and yellow wavelength range with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of blue wavelength range and yellow wavelength range was extremely well-known in the art, known to be suitable wavelength ranges for the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using a blue wavelength range and yellow wavelength range with an OLED and would not have been required to perform undue experimentation to make use of these wavelength ranges with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2. The use of well-known blue wavelength range and yellow wavelength range would result in cost savings and an more efficient display, as these are suitable ranges for the intended use. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract.

(iii) Claim 3

A POSITA would have been motivated to combine the following references to disclose claim 3.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Beeson ’664 (B-4).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Beeson ’664 (B-4).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Beeson ’664 (B-4).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7), Ko ’648 (B-9), or Beeson ’664 (B-4).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Ko ’648 (B-9), or Beeson ’664 (B-4).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Aoyama ’043 (B-3), or Beeson ’664 (B-4).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Beeson ’664 (B-4).

A POSITA would also have been motivated to make any of the combinations above to combine the use of non-yellow color impression with an OLED. A POSITA would understand that the use of non-yellow color impression with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract;

Beeson at [0381]. The use of non-yellow color impression was extremely well-known in the art, known to be suitable wavelength ranges for the OLED. *See, e.g.* Igarashi '734 at [0089]; Shiotani at Abstract; Aoyama '043 at Abstract; Park '696 at Abstract; Boerner '150 at Abstract; Ko '648 at Abstract; Beeson at [0381]. A POSITA would have expected to succeed in using non-yellow color impression with an OLED and would not have been required to perform undue experimentation to make use of these wavelength ranges with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi '734 at [0089]; Shiotani at Abstract; Aoyama '043 at Abstract; Park '696 at Abstract; Boerner '150 at Abstract; Ko '648 at Abstract; iRiver Clix2 Exhibit B-10 at 2; Beeson at [0381]. The use of well-known non-yellow range would result in cost savings and an more efficient display, as these are suitable ranges for the intended use. *See, e.g.* Igarashi '734 at [0089]; Shiotani at Abstract; Aoyama '043 at Abstract; Park '696 at Abstract; Boerner '150 at Abstract; Ko '648 at Abstract; Beeson at [0381].

(iv) Claim 4

A POSITA would have been motivated to combine the following references to disclose claim 4.

- Igarashi '734 (B-1) with any one of Shiotani '918 (B-2), Aoyama '043 (B-3), Park '696 (B-6), Boerner '150 (B-7), or Ko '648 (B-9).
- Shiotani '918 (B-2) with any one of Aoyama '043 (B-3), Park '696 (B-6), Boerner '150 (B-7), or Ko '648 (B-9).
- Aoyama '043 (B-3) with any one of Park '696 (B-6), Boerner '150 (B-7), or Ko '648 (B-9).
- Park '696 (B-6) with any one of Boerner '150 (B-7) or Ko '648 (B-9).

- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine the use of a filter layer configured to convert the electromagnetic radiation into a non-visible wavelength range with an OLED. A POSITA would understand that the use of a filter layer configured to convert the electromagnetic radiation into a non-visible wavelength range with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of a filter layer configured to convert the electromagnetic radiation into a non-visible wavelength range was extremely well-known in the art, known to be suitable wavelength ranges for the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using a filter layer configured to convert the electromagnetic radiation into a non-visible wavelength range with an OLED and would not have been required to perform undue experimentation to make use of these wavelength ranges with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2

Exhibit B-10 at 2. The use of well-known filter layer configured to convert the electromagnetic radiation into a non-visible wavelength range would result in cost savings and an more efficient display, as these are suitable ranges for the intended use. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract.

(v) Claim 5

A POSITA would have been motivated to combine the following references to disclose claim 5.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine the use of a filter layer configured to absorb non-visible wavelength range with an OLED.

A POSITA would understand that the use of a filter layer configured to absorb non-visible wavelength range with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of a filter layer configured to absorb non-visible wavelength range was extremely well-known in the art, known to be suitable wavelength ranges for the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using a filter layer configured to absorb non-visible wavelength range with an OLED and would not have been required to perform undue experimentation to make use of these wavelength ranges with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2. The use of well-known filter layer configured to absorb non-visible wavelength range would result in cost savings and an more efficient display, as these are suitable ranges for the intended use. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract.

(vi) Claim 8

A POSITA would have been motivated to combine the following references to disclose claim 8.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine color filters with an OLED. A POSITA would understand that the use of a filter layer, including an opaque and transparent layer, with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of color filters was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using color filters, including an opaque and transparent layer, with an OLED and would not have been required to perform undue experimentation to make use of the color filter with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

(vii) Claim 9

A POSITA would have been motivated to combine the following references to disclose claim 9.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine color filters with an OLED. A POSITA would understand that the use of a filter layer, including an opaque and transparent layer, with an OLED would allow for the output of a desired

color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of color filters was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using color filters, including an opaque and transparent layer, with an OLED and would not have been required to perform undue experimentation to make use of the color filter with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

(viii) Claim 10

A POSITA would have been motivated to combine the following references to disclose claim 10.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).

- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine color filters with an OLED. A POSITA would understand that the use of a filter layer, including an opaque and transparent layer, with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of color filters was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using color filters, including an opaque and transparent layer, with an OLED and would not have been required to perform undue experimentation to make use of the color filter with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

(ix) Claim 11

A POSITA would have been motivated to combine the following references to disclose claim 11.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3), or Pilcher ’389 (B-5).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9), or Pilcher ’389 (B-5).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulations with an OLED. A POSITA would understand that the use of encapsulations with an OLED would allow for protection of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Pilcher ’389 at 1:6-29. The use of encapsulations was extremely well-known in the art, known to be inexpensive and protect the OLED. *See, e.g.* Igarashi ’734 at

[0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Pilcher ’389 at 1:6-29. A POSITA would have expected to succeed in using encapsulations with an OLED and would not have been required to perform undue experimentation to make use of the encapsulations with the OLED.

The primary references above emphasize the need for cost savings and efficient and robust OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2; Pilcher ’389 at 1:6-29.

(x) Claim 12

A POSITA would have been motivated to combine the following references to disclose claim 12.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Ko ’648 (B-9), or Pilcher ’389 (B-5).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3), or Pilcher ’389 (B-5).

- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9), or Pilcher ’389 (B-5).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulations with an OLED. A POSITA would understand that the use of encapsulations with an OLED would allow for protection of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Pilcher ’389 at 1:6-29. The use of encapsulations was extremely well-known in the art, known to be inexpensive and protect the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Pilcher ’389 at 1:6-29. A POSITA would have expected to succeed in using encapsulations with an OLED and would not have been required to perform undue experimentation to make use of the encapsulations with the OLED.

The primary references above emphasize the need for cost savings and efficient and robust OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2; Pilcher ’389 at 1:6-29.

(xi) Claim 13

A POSITA would have been motivated to combine the following references to disclose claim 13.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7) or Ko ’648 (B-9).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Ko ’648 (B-9).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), or Aoyama ’043 (B-3).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9).

A POSITA would also have been motivated to make any of the combinations above to combine superimposing radiation with an OLED. A POSITA would understand that the use of superimposing radiation with an OLED would allow for the output of a desired color or color combination from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. The use of superimposing radiation was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract. A POSITA would have expected to succeed in using superimposing radiation with an OLED and would not have been required to perform undue experimentation to make use of the superimposing radiation with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

(xii) Claim 14

A POSITA would have been motivated to combine the following references to disclose claim 14.

- Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Dresevic ’828 (B-8).
- Shiotani ’918 (B-2) with any one of Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Dresevic ’828 (B-8).
- Aoyama ’043 (B-3) with any one of Park ’696 (B-6), Boerner ’150 (B-7), or Ko ’648 (B-9), or Dresevic ’828 (B-8).
- Park ’696 (B-6) with any one of Boerner ’150 (B-7), Ko ’648 (B-9), or Dresevic ’828 (B-8).
- Boerner ’150 (B-7) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Ko ’648 (B-9), or Dresevic ’828 (B-8).
- Ko ’648 (B-9) with any one of Igarashi ’734 (B-1), Shiotani ’918 (B-2), Aoyama ’043 (B-3), or Dresevic ’828 (B-8).
- iRiver Clix2 with any one of Igarashi ’734 (B-1) with any one of Shiotani ’918 (B-2), Aoyama ’043 (B-3), Park ’696 (B-6), Boerner ’150 (B-7), Ko ’648 (B-9), or Dresevic ’828 (B-8).

A POSITA would also have been motivated to make any of the combinations above to combine structured layers that include striped, crossed-striped, circular, triangular, and rectangular regions with an OLED. A POSITA would understand that the use of structured layers that include striped, crossed-striped, circular, triangular, and rectangular regions with an OLED would allow for the output of a desired pattern from the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Dresevic ’828 at 1:66-2:18. The use of structured layers that include striped, crossed-striped, circular, triangular, and rectangular regions was extremely well-known in the art, known to be inexpensive, accurate, and able to reduce the size of the OLED. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; Dresevic ’828 at 1:66-2:18. A POSITA would have expected to succeed in using structured layers that include striped, crossed-striped, circular, triangular, and rectangular regions with an OLED and would not have been required to perform undue experimentation to make use of the structured layers that include striped, crossed-striped, circular, triangular, and rectangular regions with the OLED.

The primary references above emphasize the need for cost savings and efficient OLEDs used with displays. *See, e.g.* Igarashi ’734 at [0089]; Shiotani at Abstract; Aoyama ’043 at Abstract; Park ’696 at Abstract; Boerner ’150 at Abstract; Ko ’648 at Abstract; iRiver Clix2 Exhibit B-10 at 2.

3. ’223 patent

(a) Background and State of the Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the ’223 patent for the general subject matter of

the ’223 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the ’223 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that “the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious”). Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the ’223 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung’s obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the ’223 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

The Need for a More Efficient Electron-Conducting Layer Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that it was advantageous to

improve the efficiency of electrical conduction in an electron-conducting layer in an OLED (*cf.* ’223 patent at 1:23-25 (“A common problem in organic electronic components is to provide a layer which has a very high degree of electron conductivity.”)). *See, e.g.*, Kido713 at [0006] (“Furthermore, it has been already acknowledged in the development of high efficiency EL devices that the technology for introducing electrons from a cathode layer and holes from an anode layer into an organic layer of the devices without an energy barrier are important.”); Itai at [0006] (“Particularly, one problem is to improve luminance and driving power. First of all, it is a problem to realize high luminance in many of the above-described devices, when Small thickness, light weight and Small size thereof are aimed for. When the small thickness and the light weight are aimed for, it is demanded to realize compactness and light weight of not only the devices but also the driving power sources thereof. Particularly, when the power is supplied from a primary or secondary cell, power saving is a major problem, and it is strongly desired to obtain a high luminance with a low driving Voltage.”); Ma at 810 (“In order to lower driving voltage and enhance power efficiency, it is critical to enhance the carrier injection from the electrode to the transporting layer and to increase the transport conductivity.”); Ma at 814 (“A good carrier balance is considered to be one of the most important factors in getting an excellent performance in OLEDs.”).

The Use of Joint Vaporization or Co-Evaporation to Co-Deposit a Metal Complex Including a Central Metal Atom with an Organic Compound Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that a metal complex, including a central metal atom, could be jointly vaporized with an organic compound in order to co-deposit the two materials in the same layer. *See, e.g.*, Nakashima at Abstract (“The present invention is having a characteristic of, even for a material for which deposition or wet coating is difficult in a

state of a metal complex, co-deposition an organic compound (ligand) and a metal salt constituting raw materials of the metal complex to execute complex formation on a substrate thereby forming a film containing such metal complex and preparing an electroluminescent device utilizing thus formed co-decomposition film.”); Nakashima at [0012] (“The present inventor has therefore conceived to co-deposit a ligand and a metal salt which are raw materials of a metal complex essentially, thereby forming a complex on a substrate and obtaining a film containing such metal complex.”); Kido713 at [0069] (“In the combination of low resistance electron-transporting layer/metal complex-contained layer/reducing reaction generating layer, an organic compound used in the formation of each layer, a metal doped (or mixed) in the low resistance electron-transporting layer or a thermally reducible metal used in the formation of the reducing reaction generating layer may be formed into a desired layer by using any one of the conventional layer formation methods. For example, a vapor deposition method and a sputtering method can be used as the layer formation method.”); Kido209 at 3:9-11 (“Preferably, the mixed layer is a layer formed upon co-deposition of the organic metal complex compound and the electron-transporting organic compound.”); Kido209 at 4:2-4 (“The organic metal complex compound and the electron transporting organic compound were co-deposited and mixed to form a mixed layer.”); Nakamura at [0040] (“The metal-containing organic compound layer of the present invention is preferably produced by co-vapor-deposition according to a vacuum vapor deposition method.”); Kumaki at 7:13-22 (“A layer containing a plurality of materials such as the layer including the material doped with an electron-supplying material to an organic compound can be formed by depositing each material simultaneously. The layer containing a plurality of materials is desirably formed by combining the same kinds of methods or the different kinds of methods such as a co-evaporation method with resistance heating evaporation methods, a co-evaporation method with electron beam

evaporation methods, a co-evaporation method with a resistance heating evaporation method and an electron beam evaporation method, deposition with a resistance heating evaporation method and a sputtering method, or deposition with an electron beam evaporation method and a sputtering method."); Sato at [0086] ("In the case of the vacuum deposition method, as in the deposition of the light emitting layer 5, the metal complex as the host material is placed in a crucible that is set in a vacuum vessel, a substance selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives as the dopant material to be co-deposited is placed in a separate crucible, the vacuum vessel is evacuated to about 10-6 Torr using an appropriate vacuum pump, and then each crucible is simultaneously heated to cause deposition and form the electron transport layer 7 on the substrate placed facing the crucibles."); Werner501 at 38:37-42 ("The doping of the respective matrix material with the n-dopant to be used in accordance with the invention can be achieved by means of one or a combination of the following processes: (a) Mixed vaporization in a vacuum with one source for the matrix material and one for the dopant.").

The Use of Doping to Improve the Electrical Characteristics of an Electron-Conducting Layer Was Well Known in the Art: It was well known as of the priority date of the '223 patent that an electron-conducting layer could be doped with a variety of materials, including metal complexes or materials that included metal complexes, and that this could improve the conductivity and other electrical characteristics of the electron-conducting layer. *See, e.g.*, Werner501 at 1:43-54 ("It is known to modify organic semiconductors with regard to their electrical characteristics, especially their electrical conductivity, by doping them, which is also the case with inorganic semiconductors such as silicon semiconductors. In the process, charge carriers are generated in the matrix material in order to increase its conductivity, which is initially quite low, and, depending on the nature of the dopant used, to produce a change in the Fermi level of

the semiconductor. In this context, doping leads to an increase in the conductivity of charge transport layers, thus reducing ohmic losses, and to an improved passage of the charge carriers between the contacts and the organic layer."); Ma at 810 ("Compared with the referenced device (without doping), the current efficiency and power efficiency of the p-i-n device are enhanced by approximately 51% and 89%, respectively. This improvement is attributed to the improved conductivity of the transport layer and the efficient charge balance in the emission zone.").

Coordination Between a Metal Complex Including a Central Metal Atom and an Organic Compound in an Electron-Conducting Layer Was Well Known in the Art: It was well known as of the priority date of the '223 patent that a metal complex, including a central metal atom, could be coordinated with an organic compound in order to form an electron-conducting layer in an OLED device. *See, e.g.*: Seo693 at [0103] ("In the composite material according to the present invention in the present embodiment, an electron injecting or transporting organic compound as a chelate ligand is bound to part or all of metals in a first metal oxide skeleton forming a binding network, and a second metal oxide that is able to donate electrons to the organic compound is further added."); Nakashima at [0013] ("A metal complex employed in an electroluminescent device is, as represented by Alq, principally a metal complex having an anionic chelate ligand. Such ligand is characterized in having a functional group capable of easily releasing a proton thereby showing an anionic property (thus bonding with a metal), and a functional group having a non-covalent electron pair for coordination bonding with a metal. Thus, in the present invention, an organic compound (ligand) to be co-evaporated with a metal Salt is required to have at least one each of the aforementioned two functional groups."); Itai at [0032] ("The term 'acceptor' as used herein means an electron acceptor and electric conductivity is exhibited by transferring an electric charge from an organic compound which constitutes a basic material to the

acceptor. By such charge transfer, the acceptor and the organic compound which constitutes a basic material form a charge transfer complex.”).

The Use of Metal Complexes With Particular Central Metal Atoms Coordinated with Additional Organic Ligands Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that electron-conducting layers in OLED devices could include a metal complex containing a variety of central metal atoms could be coordinated with additional organic ligands. *See, e.g.*, ’223 patent at 3:3-45 (describing a Cotton publication from 2002 and noting that “Cotton also shows that the central atoms in this complex can have very high oxidation numbers. Therefore, many electrons can be donated by the two central W-atoms.”); Nakashima at [0013] (describing use of Alq as a metal complex); Seo180 at [0009] (describing use of an Alq_3 metal complex); Igarashi at Abstract (“A light-emitting element having excellent light-emitting properties and with which it is possible to emit blue light at a high luminance for a long period of time, and an iridium complex for realizing the same.”); Kumaki at 4:16-20 (“Here, the organic compound is preferably an organic compound having electron transportability and, particularly a metal complex having a ligand including a π-conjugated skeleton.”); Kumaki at 22:3-6 (“A metal complex used as a dopant, a metal complex in which platinum, which is a third transition series element, serves as a center metal, a metal complex in which iridium serves as a center metal, or the like is known as an example of a triplet excited light-emitting material.”); Werner501 at (“Furthermore, compared to other n-dopants in the form of organic compounds, the provision of a neutral electron-rich metal complex makes it possible to vary the donor characteristics of the compound by selecting a suitable central atom, and thus to vary its oxidation potential.”); Werner501 at 2:66-3:4 (“The complexed central atom may have a formal number of valence electrons VE or 16 or more, such as 18 or 19 or 20 or 21 or more valence electrons. The central

atom may in this case in particular be a metal atom from the first transition metal period, a metal atom from the second transition metal period or a metal atom from the third transition metal period.”). Additionally, it was well-understood by a POSITA at the time of the invention of the ’223 patent that the degree of coordination in such multi-metal complexes could be controlled by the ratio between the metal complex and the organic compound during vaporization. *See, e.g.*, Nakamura at [0027] (“The inventors of the present invention have made extensive studies while paying attention to a coordinating metal ratio. As a result, the inventors have found that light emitting property and a lifetime can be improved by controlling the coordinating metal ratio.”); Nakamura at [0028] (“In addition, a molar ratio of the metal to the organic compound can be obtained by calculating the number of moles of the organic compound from the total number of nitrogen atoms. The molar ratio of the metal to the organic compound is preferably 0.5 or more to 3.0 or less.”). In particular, the use of Liq as a metal complex in an electron-conducting layer in an OLED device was well-known. *See, e.g.*, Ma at 810 (“In this paper, we have demonstrated a device with an new n-doping (ee wt.% Liq:BPhen) layer as ETL and p-type (*m*-MTDATA:*x* wt.% F_4-TCNQ) layer as HTL. Here, 33 wt.% Liq demonstrates the best current density vs voltage (*J-V*) curve among all the electron only devices.”).

Coordination of a Metal Complex With an Organic Compound During Joint Vaporization Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that certain types of metal complexes and organic compounds could coordinate due to joint vaporization or co-evaporation, including potential interactions during the gas phase. *See, e.g.*, Kido713 at [0012] (“In the electron injection layer having the above structure, during vapor deposition of the thermally reducible metals such as aluminum and zirconium under a vacuum, the thermally reducible metals in the atomized state, i.e., in highly reactive condition, can come down

to the organometallic complex compound, thereby reducing and liberating metal ions in the complex compound. Furthermore, the reduced and liberated metals are being doped, in-situ, into the electron-transporting organic compound organic compound layer and reduce the electron-transporting organic compound (the reduction caused herein means the reduction defined by Lewis and thus acceptance of electrons).”); Seo693 at [0079] (“In the composite material according to the present invention in the present embodiment, an electron injecting or transporting organic compound as a chelate ligand is bound to part or all of metals in a first metal oxide skeleton forming a binding network, and further, the metal oxide is able to donate electrons to the organic compound.”); Kido209 at 3:40-53 (“Therefore, when a thermally reducible metal Such as aluminum, silicon, zirconium, and the like, in an atomic state is applied onto the alkali metal compound, alkali earth metal compound or rare earth metal compound, the above-described reduction reaction in vacuum results So as to produce a reduced and liberated metal from the corresponding metal compound. In this reduction process, if the electron injection layer is constituted from a mixed layer including the organic metal complex compound and the electron transporting organic compound; the alkali metal, alkali earth metal or rare earth metal produced upon reduction and liberation of the organic metal complex compound can effectively reduce the adjacent electron transporting organic compound, thereby forming a metal doping layer.”); Nakamura at [0041] (“Examples of an approach to controlling a coordinating metal ratio include the control of an interaction between the organic compound and a metal element based on the selection of the structure of the organic compound and the metal element, and the control of each of a substrate temperature, a degree of vacuum, and the partial pressure of a gas in a chamber at the time of vapor deposition.”).

The Use of an Organic Compound Comprising a Heteroaromatic Compound Which is Conjugated with an Aromatic Compound via a C—C Bond Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that electron-conducting layers in OLED devices could include an organic compound comprising a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond. *See, e.g.*, Nakashima at [0017]-[0022]; ’223 patent at 3:53-67 (again citing to Cotton1999 and noting that “a heteroaromatic compound has the advantage that it is not only able to coordinate to a metal complex via the aromatic system (π-electrons), as described in the publication by Cotton in Organometallics which is cited above”); Matsuo at 4:10-13 (“It is preferable in the above-mentioned EL device that the organic compound layer further comprises an aromatic-substituted amine or a derivative thereof. With such a structure, an EL device having high luminance and emitting a blue light that has high color purity can be obtained.”); Matsuo at 6:1-5 (“For the ligand R1 and R2, a bridging ligand having a nitrogen-containing aromatic ring containing at least two nitrogen atoms or a derivative thereof can be used, respectively. In this case, two nitrogen atoms in the nitrogen-containing aromatic ring are coordination atoms.”); Kumaki at 6:26-29 (“The organic compound here is preferably an electron-transporting material such as 2-(4-biphenylyl)-5-(4-tert-butylphenyl)-1,3,4-oxadiazole (abbreviated to PBD), OXD-7, TAZ, p-EtTAZ, BPhen, or BCP.”); Toguchi at [0007] (“As an electron transporting material, oxadiazole derivatives, triazole derivatives and the like are well known.”); Sato at cl. 2 (“The organic electroluminescent element set forth in claim 1, wherein the dopant material of the electron transport layer is one, two, or more substances selected from a group comprising oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives.”); Sato at [0075] (“As dopant materials, substances selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives are favorable.”).

The Use of Multiple Metal Complexes Joined by an Organic Compound Was Well Known in the Art: It was well known as of the priority date of the ’223 patent that multiple metal complexes could be coordinated with an additional organic compound. *See, e.g.*, Werner501 at 8:5-19 (“According to one advantageous embodiment, the metal complex of the invention is a polynuclear metal complex. In particular, the metal complex may be a polynuclear metal complex with at least one, two, three or four or optionally even more ligands which bind to at least two metal central atoms.”); Cotton1999 at 2724 (“Crystals of **1** adopt the triclinic *P*1h space group with both the dirhodium molecule and the arene ring residing on inversion centers. The alternating arrangement of Rh2(O2CCF3)4 and C6Me6 units forms a chain structure (Figure 1) extended along the [100] direction of the unit cell.”); ’223 patent at 2:28-38 (admitting prior art status of Cotton1999 and that it was understood by Cotton and his co-authors “that the coordination of the aromatic system can lead to a chain formation, wherein two metal complexes are linked by an organic compound.”); Matsuo at 6:1-9 (“For the ligand R1 and R2, a bridging ligand having a nitrogen-containing aromatic ring containing at least two nitrogen atoms or a derivative thereof can be used, respectively. In this case, two nitrogen atoms in the nitrogen-containing aromatic ring are coordination atoms. Furthermore, it is preferable that two nitrogen atoms are coordinated with a plurality of central metals M, thereby forming a ring structure consisting of central metals and ligands.”). It was also well-understood that varying the ratio of the metal complex to the organic compound affected the degree of resulting coordination. *See, e.g.*, Sato at [0070] (“In the present invention, if the ratio of the dopant material to be doped in the electron transport layer is too low, a high electron mobility cannot be obtained, conversely, too much dopant material results in inferior film quality, and therefore, it is preferable that the mole ratio of the host material to the dopant material is between 99:1 and 50:50.”).

(b) Motivation to Combine

A person of ordinary skill in the art would have been motivated to combine any of the references in Ex. C-Obviousness chart as they all discuss methods and systems for forming an electron-conducting layer consisting of a metal complex and an organic compound. A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

A POSITA would also have been motivated to combine the references discussed in Exhibits C-1-C-19 because many of them share inventors. For example, the individuals below are inventors on multiple of the references discussed in Exhibits C-1-C-19.

Inventor	**References**
Satoshi Seo	Seo180, Seo693, Kumaki, Nakashima
Junji Kido	Kido713, Kido209, Kido712, Kido015
Harue Nakashima	Nakashima, Seo693

Further non-limiting examples as to motivation to combine are discussed below.

A POSITA would have been motivated to combine references to achieve the '223 patent asserted claims in order to achieve a more efficient electron-conducting layer in an OLED. *See, e.g.*: Ma at 810 ("In order to lower driving voltage and enhance power efficiency, it is critical to enhance the carrier injection from the electrode to the transporting layer and to increase the transport conductivity."); Werner501 at 39:66-40:3 ("Using the metal complexes of the invention

as n-dopants, for example, it is possible to improve the conductivity of the doped layers and/or the injection of the charge carriers of contacts into the doped layer.”).

A POSITA would have been motivated to combine references to achieve the ’223 patent asserted claims in order to achieve a better balance of holes and electrons and consequently better efficiency. *See, e.g.*, Nakashima at [0004] (“Since the light emission of the electroluminescent layer relies on injection and recombination of the carriers, a well-balanced injection of the electrons and the holes is key to a higher efficiency.”).

A POSITA would have been motivated to combine references to achieve the ’223 patent asserted claims in order to decrease the power consumption of the OLED display via a more efficient electron-conducting layer in an OLED. *See, e.g.*, Kido713 at [0013] (“As a result, the emission efficiency of the EL devices could be drastically improved and also it became possible to drive the devices at a lower voltage. Accordingly, at present, the above electron injection-related factors have been recognized to be important technologies for improving the properties of the devices in the production of the organic EL device.”). In particular, lower power consumption drives device adoption for mobile applications such as smartphones. Sato at [0005] (“One of the major challenges in applying such organic electroluminescent elements to the field of flat panel displays is the improvement of luminous efficiency. In particular, low power consumption is a key point in the application to display elements for portable devices.”).

A POSITA would have been motivated to combine references to achieve the ’223 patent asserted claims in order to increase the service lifetime of the display via a more efficient electron-conducting layer in an OLED. *See, e.g.*, Seo180 at [0025] (more efficient carrier transport lowers drive voltage and extends service life), [0027] (same); Itai at [0013] (“[H]igh driving durability can be attained while maintaining high light emitting efficiency by including an organic layer

containing a first acceptor and a second acceptor between the light emitting layer and the anode, wherein the first acceptor is a metal compound and the second acceptor is an organic compound which does not contain any metal."); Nakamura at [0005] ("In particular, an improvement in property with which charge is injected from an electrode into an organic compound layer is indispensable for alleviating the low light emitting property and the short lifetime."); Igarashi at [0007] ("An object of the invention is to provide a light-emitting element that can reduce energy consumption when light is emitted, that has excellent light-emitting properties, and with which it is possible to emit blue light at a high luminance for a long period of time.");

A POSITA would have been motivated to combine references to achieve the '223 patent asserted claims in order to increase the brightness of the OLED display via a more efficient electron-conducting layer. *See, e.g.*, Nakamura at [0005] ("In particular, an improvement in property with which charge is injected from an electrode into an organic compound layer is indispensable for alleviating the low light emitting property and the short lifetime."). Alternatively or in addition to increasing the brightness, the surface area or display size of the OLED display panel could also be increased, which would motivate a POSITA to accomplish the combination. Igarashi at [0018] ("Particularly when the light-emitting element of the present invention is used as a display element, it becomes possible to increase surface area.").

A POSITA would have been motivated to use co-evaporation of a metal complex and an organic compound to form an electron-conducting layer. Co-evaporation was well-understood at the time of the invention of the '223 patent and co-evaporation of materials for OLED display layers was routine and conventional activity. *See, e.g.*: Kido713 at [0069] ("In the combination of low resistance electron-transporting layer/metal complex-contained layer/reducing reaction generating layer, an organic compound used in the formation of each layer, a metal doped (or

mixed) in the low resistance electron-transporting layer or a thermally reducible metal used in the formation of the reducing reaction generating layer may be formed into a desired layer by using any one of the conventional layer formation methods. For example, a vapor deposition method and a sputtering method can be used as the layer formation method."); Nakamura at [0041] ("Examples of an approach to controlling a coordinating metal ratio include the control of an interaction between the organic compound and a metal element based on the selection of the structure of the organic compound and the metal element, and the control of each of a substrate temperature, a degree of vacuum, and the partial pressure of a gas in a chamber at the time of vapor deposition."); Sato at [0086] ("In the case of the vacuum deposition method, as in the deposition of the light emitting layer 5, the metal complex as the host material is placed in a crucible that is set in a vacuum vessel, a substance selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives as the dopant material to be co-deposited is placed in a separate crucible, the vacuum vessel is evacuated to about 10-6 Torr using an appropriate vacuum pump, and then each crucible is simultaneously heated to cause deposition and form the electron transport layer 7 on the substrate placed facing the crucibles."). At the time of the invention of the '223 patent, many different commercially-available machines were available for performing the co-evaporation. *See, e.g.*, Kido713 at [0078] ("In the following examples, the layer formation of the organic compound and the metal as well as the formation of the charge-generation layer were carried out by using a vapor deposition apparatus 'VPC-400', product of Shinkuu Kikou Co., or a vapor deposition apparatus of Anelva Co., and an NFTS sputtering apparatus of FTS Corp."); Shtein at 4005 ("Since small-molecule organics often have poor solubility in common solvents, different thin-film deposition methods are generally employed, the most common being vacuum thermal evaporation (VTE). Here, the prepurified organic source materials are evaporated from

heated containers in vacuum onto substrates placed directly above the sources, allowing for precise control of the deposition of multilayer structures. Vacuum deposition can also follow the processes described above to obtain hybrid polymer–small molecule structures.”).

A POSITA would have been further motivated to use co-evaporation of a metal complex and an organic compound to coordinate the metal complex to the organic compound to form an electron-conducting layer. The coordination chemistry of these materials was well-understood at the time of the invention of the ’223 patent, and the electron-conducting benefits of the coordination would have motivated a POSITA to achieve the coordination via co-evaporation. *See, e.g.,* Seo693 at [0080] (“This composite material has the metal oxide skeleton, and is thus a heat-resistant and durable material. In addition, since the electron injecting or transporting organic compound as a chelate ligand is bound to the metal in the skeleton, the composite material is able to possess the electron injecting or transporting property of the organic compound. Further, since the organic compound is composed of a material that is able to be given electrons from the metal oxide skeleton, the electron injecting or transporting property and conductivity of the composite material can be improved.”); Shtein at 4006 (“Recently, the technique of organic vapor phase deposition (OVPD) was introduced as an alternative to VTE growth of small-molecular weight organic thin films, heterostructures, and devices. In OVPD, a hot, nonreactive carrier gas is used to transport an organic vapor toward a cooled substrate onto which the organic materials condense, as shown in Fig. 1(a). The method affords precise control over the layer thickness and dopant concentration, while increasing the materials use efficiency over that obtained by VTE.”).

A POSITA would have been motivated to combine any of the references in Exs. C-1-C-19 with any reference disclosing a metal complex with a central metal atom to achieve the ’223 patent asserted claims. For example, the ’223 patent notes that Cotton had already observed that metal

complexes with two central tungsten atoms displayed favorable characteristics for use in an electron-conducting layer in an OLED device. ’223 patent at 3:49-45 (“In his publication, Cotton shows that this complex [W_2(TBD-A)$_4$] belongs to the compounds whose electron configuration comprises closed, i.e. filled, electron shells and still has an extremely low ionization potential. Cotton also shows that the central atoms in this complex can have very high oxidation numbers. Therefore, many electrons can be donated by the two central W-atoms.”). *See also, e.g.*, Sato at [0013] (“First, a metal complex represented by an aluminum complex of 8-hydroxyquinoline was used as the host material for the electron transport layer, and an electron transport compound that is a substance selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives, in particular whose molecular weight is less than 400, was used as the dopant material, the use of both materials making it possible to achieve both high electron mobility and excellent film quality.”).

A POSITA would have been motivated to use an organic compound comprising a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond, in order to achieve the ’223 patent asserted claims. For example, the ’223 patent itself acknowledges that the advantages of such an organic compound were already well-known in the art, including due to publications by Cotton. ’223 patent at 3:53-67 (citing to Cotton1999 and noting that “a heteroaromatic compound has the advantage that it is not only able to coordinate to a metal complex via the aromatic system (π-electrons), as described in the publication by Cotton in Organometallics which is cited above”); Matsuo at 4:9-13 (“It is preferable in the above-mentioned EL device that the organic compound layer further comprises an aromatic-substituted amine or a derivative thereof. With such a structure, an EL device having high luminance and emitting a blue light that has high color purity can be obtained.”); Sato at [0075] (“As dopant materials, substances

selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives are favorable."); Werner501 at 37:61-67 ("Heteroaromatic compounds can also be used as matrix materials, such as in particular triazoles, optionally also pyrroles, imidazoles, triazoles, pyridines, pyrimidines, pyridazines and the like. The heteroaromatic compounds are preferably substituted, in particular aryl-substituted, such as phenyl or naphthyl-substituted. In particular, the triazole shown below can be used as the matrix material."). The synthesis of many different types of organic compounds comprising a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond was routine and conventional at the time of the invention of the '223 patent, and therefore a POSITA would have been able to implement any such modification of a base reference with a reasonable expectation of success.

A POSITA would have been motivated to employ metal complexes that can coordinate with each other via an organic compound to produce an electron-conducting layer in an OLED display, including because of better electron transport capabilities of the resulting layer. *See, e.g.*, Matsuo at Abstract (metal complex including two joined metal atoms); Werner501 at 8:5-19 ("According to one advantageous embodiment, the metal complex of the invention is a polynuclear metal complex. In particular, the metal complex may be a polynuclear metal complex with at least one, two, three or four or optionally even more ligands which bind to at least two metal central atoms."); Cotton1999 at 2724 ("Crystals of **1** adopt the triclinic *P*1h space group with both the dirhodium molecule and the arene ring residing on inversion centers. The alternating arrangement of Rh2(O2CCF3)4 and C6Me6 units forms a chain structure (Figure 1) extended along the [100] direction of the unit cell."). Additionally, a POSITA would have been aware that varying the ratio of the metal complex and organic compound during vaporization would influence the degree of cross-linking between the multi-metal complexes.

A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

(i) Claim 1

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 1 of the '223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Seo693 (C-13), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).

- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(ii) Claim 2

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 2 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Shtein (C-16), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased

manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(iii) Claim 10

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 10 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Seo693 (C-13), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), or Sato (C-14).

- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Seo693 (C-13), Sato (C-14), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(iv) Claim 11

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 11 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).

- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Shtein (C-16), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art

references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(v) Claim 12

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 12 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Shtein (C-16), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(vi) Claim 13

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 13 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Shtein (C-16), or Seo693 (C-13).
- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

(vii) Claim 14

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 1 of the ’223 patent:

- Nakashima (C-1) with any one of Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Ma (C-2) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Seo180 (C-3) with any one of Nakashima (C-1), Ma (C-2), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido713 (C-4) with any one of Kido209 (C-5), Kido712 (C-7), or Kido015 (C-15).
- Kido209 (C-5) with any one of Kido713 (C-4), Kido712 (C-7), or Kido015 (C-15).
- Kido712 (C-7) with any one of Kido713 (C-4), Kido209 (C-5), or Kido015 (C-15).
- Kumaki (C-11) with any one of Nakashima (C-1), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Shtein (C-16), or Seo693 (C-13).

- Seo693 (C-13) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Sato (C-14) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).
- Kido015 (C-15) with any one of Kido713 (C-4), Kido209 (C-5), or Kido712 (C-7).
- Werner501 (C-17) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- Werner251 (C-18) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Shtein (C-16), or Sato (C-14).
- iRiver Clix2 (C-19) with any one of Nakashima (C-1), Ma (C-2), Seo180 (C-3), Itai (C-6), Nakamura (C-8), Seo693 (C-13), Sato (C-14), Shtein (C-16), Werner501 (C-17), or Werner251 (C-18).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the electron-conducting layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’223 patent specification, or apparent to a POSITA in light of the particular combinations.

4. ’164 patent

(a) Background And State Of The Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the ’164 patent for the general subject matter of the ’164 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the ’164 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that “the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious”). Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the ’164 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung’s obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the ’164 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

The Separation of OLED Displays into Organic Functional Layers Was Well Known in the Art: At the time of the purported invention of the ’164 patent, it was well-understood int the field of OLEDs that various advantages could be obtained by separation of the displays into various organic functional layers. *See, e.g.*, Seo180 at [0013]-[0014] (“Also, it can be said that the organic luminescent element described in Literature 1 is based on, so to speak, that though of functional separation, according to which carrying of holes is performed by the hole transporting layer and carrying and luminescence of electrons are performed by the electron transporting luminescent layer. . . . Such functional separation has an advantage in that the functional separation makes it unnecessary for a kind of organic material to have a variety of functions (luminescence, carrier carrying quality, filling quality of carrier from electrode, and so on) at a time, which provides a wide freedom in molecular design or the like . . . .”); Seo180 at [0024] (“[T]he laminated structure has an advantage in enabling easily enhancing the recombination efficiency of a carrier and enlarging a range of material selection in terms of functional separation . . . .”); Itai at [0029] (“The organic electroluminescence device of the present invention has at least one organic compound layer including a light-emitting layer. Examples of the organic compound layers other than the light-emitting layer include, as mentioned above, respective layers of a positive hole-injection layer, a positive hole-transport layer, a positive hole transporting intermediate layer, a light-emitting layer, an electron transporting intermediate layer, an electron-transport layer, an electron injection layer and the like.”); Kumaki at 22:10-14 (“The substances mentioned above that forms the light-emitting layer are just an example, and a light-emitting element can be formed by stacking appropriately each functional layer such as a hole-injecting-transporting layer, a hole-transporting layer, an electron-injecting-transporting layer, an electron-transporting layer, a light-emitting layer, an electron-blocking layer, or a hole-blocking layer.”);

Hoffmann at [0112] ("In OLED structures there are occasionally further layers that are introduced between the contacts and the layer structures described here. These layers can, for example, serve the improvement of the charge carrier injection or a better adhesion of the contact at the organic layers."); Fong at 1:30-39 ("Heterojunction OLED's are often composed by multilayers of amorphous organic thin films, sandwiched between two electrodes. Conventionally, the device structure has consisted of a hole injecting layer (HIL), a hole transporting layer (HTL), a light emitting layer (EML), an electron transporting layer (ETL), and an electron injecting layer, as well as an ITO, or other substantially transparent conductor, anode and a cathode (i.e. an ITO/HIL/HTL/EML/ETL/EIL/cathode structure).").

The Use of an Emissive Dopant in an Emission Layer in an OLED Display Was Well-Known in the Art: At the time of the purported invention of the '164 patent, it was well-understood that an emission layer could be prepared by using a matrix host and doping that matrix with an emissive material. *See, e.g.*, Choulis at [0041]-[0043] (The "organic material that emits light" "may be organic or organo-metallic in nature" with the "[l]ight-emission in these materials…occur[ing] as a result of fluorescence or phosphorescence or both," and "[e]xamples of electroluminescent small molecule materials include chelates, such as tris(8-hydroxyquinolate) aluminum (Alq_3) and tris(2-phenylpyridine) iridium ($Ir(ppy)_3$), organic materials, such as anthracene, rubrene or triazine, or any metal-chelate compounds or derivatives of any of the organic materials or small molecule materials."); Kashiwabara at [0048]; Hofmann at [0021] ("An organic matrix material in the sense of the invention is every organic host material to which further materials such as dopant or emitter substances, typically in the molar concentrations 1:100 000 to 5:1 can be admixed (doping).").

Varying the Concentration of an Emissive Dopant in an Emission Layer in an OLED Display Was Well-Known in the Art: At the time of the purported invention of the '164 patent, it was well-understood that various advantages could be obtained for an OLED display by varying the concentration of an emissive dopant in an emission layer. *See, e.g.*: Yong at Abstract (The emission layer "comprises a host material and a phosphorescent dye, and the doping concentration of the phosphorescent dye gradually increases or decreases along the direction from the anode layer to the cathode layer with the increase of the thickness of the organic light emitting layer, forming a construction with gradient doping."); Yong at 3 ("The gradient distribution of the doping concentration of phosphorescent dyes in the organic light emitting layer in the host material in the above technical solution is to make the distribution trend of phosphorescent dyes in the host material conform to the distribution trend of electrons in the host material, and such concentration distribution expands the luminescent region of the device, improves the utilization rate of phosphorescent dyes, and is also conducive to the combination of electrons and holes to form excitons."); Yong at 2 ("Gradient doped constructions have been widely used in traditional II-V semiconductor devices. . . . Gradient constructions are also used in small molecule fluorescent OLEDs."); Kijima at [0028] ("[T]he light-emitting layer contains a first luminescent material and a second luminescent material and the dosage of the second luminescent material changes continuously from the cathode side toward the anode side, and a display device obtained by arraying and forming the display elements on a substrate."); Ara at [0010] ("[T]he content ratio of the dopant material is varied such that at least one terminal region including surfaces opposing the electrodes is a low-recombination region, and an intermediate region interposed between the terminal regions includes a high-recombination region."). Additionally, varying the concentration of the emissive dopant to achieve a gradient could have been performed by a POSITA with a

reasonable expectation of success. Varying the concentration of the emissive dopant could have been achieved using commercially-available vapor deposition systems and adjusting the outflow rate of a crucible containing the emissive dopant.

Use of an Electron Transport Matrix Material Together With a Hole Transport Matrix Material in an Emission Layer in an OLED Device Was Well-Known in the Art: At the time of the purported invention of the ’164 patent, it was well-understood that it was beneficial to include distinct matrix materials in an emission layer, including a hole transport material and an electron transport material. *See, e.g.*, Seo180 at [0038] (“[A] luminescent layer may be provided by a bipolar layer (referred below to as ‘bipolar]natured mixed layer’), which is obtained by mixing a hole transporting material of high hole mobility and an electron transporting material of high electron mobility together. In this case, the luminescent layer decreases in carrier blocking function at interfaces on both ends thereof, but frequency of recombination of carrier is higher due to differences of mobility between an electron transporting layer and a bipolar-natured mixed layer, and between a hole transporting layer and a bipolar-nature mixed layer.”); Seo180 at [0065] (“In FIG. 24, provided in an organic compound layer 2403 composed of two kinds of materials including a hole transporting material and an electron transporting material . . . .”); Thompson at [0008] (“[T]he emissive layer comprises a wide gap host material doped with both a charge carrying dopant material and a phosphorescent dopant material. The charge carrying dopant material is capable of transporting a hole or an electron, and the phosphorescent dopant material is capable of transporting a charge opposite to the charge carried by the charge carrying dopant material. Each dopant material, thus, carries charge, though of opposite polarity.”). For example, Yang and Neher, *Polymer electrophosphorescence devices with high power conversion efficiencies*, 84 Appl. Phys. Lett. 2476–2478 (2004), demonstrated a single-layer polymer

phosphorescent OLED combining hole- and electron- transporting materials of TPD and PBD with the phosphorescent emitter Ir(mppy)3 in a common PVK host. As another example, Choulis described that "[t]he light emitting layer 305 includes a host material 310, poly(9-vinylcarbazole) (PVK), a light emitting material 320, ($Ir(mppy)_3$), a first organic moiety 330, triphenyldiamine (TPD) and a second organic moiety 335, PBD," [Choulis at [0030], and that this configuration "improv[ed] the efficiency of an OLED by adding organic moieties to the light emitting layer," Choulis at [0007]. It was well-understood at the time of the invention of the '164 patent that a more efficient OLED display could be created when hole and electron transport matrix materials were included in an emission layer. *See, e.g.*, Choulis at [0032] ("When organic moieties are mixed in with the light emitting material and host, the moieties can move the holes and electrons throughout the layer, as well as inject them to the light emitting material. The holes and electrons can therefore be transferred into the core of the light emitting layer, where combination and exciton formation can occur. Thus, the organic moieties in the light emitting layer expand the recombination zone, and thus increase the efficiency of the light emitting layer over other light emitting layers in OLED devices without such moieties.").

Selection of Matrix Materials and Dopants for an Emission Layer in an OLED Device Based on HOMO and LUMO Values Was Well-Known in the Art: At the time of the purported invention of the '164 patent, it was well-understood in the OLED display field that electron and hole transport characteristics were dependent on the HOMO and LUMO values of the participating materials, and therefore that matrix materials in an emission layer could be selected based on their HOMO and LUMO values, both alone and in relationship to other materials in the layer. *See, e.g.*, Thompson at [0043] ("When the above requirements and preference are applied to the materials used according to the invention, the constraints on the HOMO and LUMO levels of the inert host

material layer 40 relative to the levels of the electron and hole transporter dopants typically result in an inert host material layer having a wide energy gap between the HOMO and the LUMO energy levels.”); Thompson at [0047] (“When the electron transporting is carried out by the phosphorescent dopant material, the charge carrying dopant material can include hole transporting materials such as triarylamines, metal coordination complexes, donor substituted napthalenes and other wide gap materials with suitably high energy HOMO levels.”); Sugiura at [0047] (“[A]s depicted in FIG. 5, both carriers are injected into substances having a lower injection barrier, that is, holes are injected into the hole transporting polymer inside the light-emitting layer, and electrons are injected into the electron transporting material inside the light-emitting layer. Here, the lower the injection barrier for both carriers (holes and electrons), the more easily injection occurs, and the lower the driving voltage. Therefore, even if current efficiencies are the same, the power efficiency of light emission (efficiency of light emission relative to input power) can be improved by reducing the driving voltage. Therefore, for example, when a hole injecting layer having an ionization potential between the positive electrode and the hole transporting polymer– is inserted, the hole injection barrier is relaxed, as depicted in FIG. 6, and the driving voltage can also be reduced. Furthermore, when the hole injection barrier is large compared to the electron injection barrier, as depicted in FIG. 5, by reducing the hole injection barrier, the balance between hole injection quantity and electron injection quantity improves, and as a result of effects such as those described above, current efficiency improvement can also be expected.”); Sugiura at [0041] (“In addition, for the light-emitting material, a substance having an ionization potential of the light-emitting material less than an ionization potential of the hole transporting polymer, and an electron affinity of the light-emitting material greater than an electron affinity of the electron transporting material is preferable.”); Kashiwabara at Fig. 6; Kashiwabara at [0008] (“Particularly, the energy

of the excitons as above mentioned is liable to be transferred into a layer in which a material with a small HOMO (Highest Occupied Molecular Orbital)-LUMO (Lowest Unoccupied Molecular Orbital) energy gap is present, with the result of a lowering in the luminous efficacy of a light emitting layer which has a great HOMO-LUMO energy gap. In view of this, it is preferable that the HOMO-LUMO energy gap in the intermediate layer provided between the light emitting layers is set to be greater than the HOMO-LUMO energy gaps of the materials constituting the light emitting layers adjacent to the intermediate layer. This configuration ensures that the transfer of the above-mentioned energy between the light emitting layers is securely prevented from occurring. In addition, the energy is prevented from being transferred into the intermediate layer to be released in the intermediate layer. Incidentally, the HOMO-LUMO energy gap in the intermediate layer may not necessarily be greater than the HOMO-LUMO energy gaps of all the materials constituting the light emitting layers adjacent to the intermediate layer; in the case where there is a material having a HOMO-LUMO energy gap so small as to permit easy transfer of the energy of the excitons, it suffices that the HOMO-LUMO energy gap in the intermediate layer is greater than the HOMO-LUMO energy gap of this material. It should be noted here, however, that if the HOMO-LUMO energy gap in the intermediate layer is greater than the HOMO-LUMO energy gaps of all the materials constituting the light emitting layers adjacent to the intermediate layer, the above-mentioned energy transfer between the light emitting layers is securely prevented from occurring."); Hofmann at [0006] ("The energy levels HOMO ('Highest Occupied Molecular Orbital') and LUMO ('Lowest Unoccupied Molecular Orbital') are preferably selected in such a way that both charge carriers are 'captured' in the emission zone in order to ensure an efficient recombination of electrons and holes. The restriction of the charge carriers to the emission zone is realized by a suitable selection of the ionization potentials and/or electron affinities for the

emission layer and/or the charge carrier transport layer, as will be explained later.”). For example, Kim et al., *Relationship between host energy levels and device performances of phosphorescent organic light-emitting diodes with triplet mixed host emitting structure*, 91 Appl. Phys. Lett. 083511 (2007) demonstrated phosphorescent OLEDs based on a variety of mixed EMLs, with the combination of TCTA as a hole-transport material, TPBi as an electron-transport material, and Ir(ppy)3 as the emitter. Additionally, it was well-understood at the time of the invention of the ’164 patent that HOMO and LUMO levels of materials could be accurately characterized, and determined with a reasonable expectation of success. D’Andrade et al., *Relationship between the ionization and oxidation potentials of molecular organic semiconductors*, 6 Organic Electronics 11–20 (2005) tabulated HOMO levels measured via the ionization potential for a variety of OLED materials. D’Andrade et al., *Relationship between the ionization and oxidation potentials of molecular organic semiconductors*, 6 Organic Electronics 11–20 (2005), performed an extensive study of LUMO levels extracted via the electron affinity measured by inverse photoelectron spectroscopy (IPES). Many OLED display systems in the prior art selected matrix materials and dopants for an emission layer based on their HOMO and LUMO values. *See, e.g.*, Choulis at Fig. 4;

Use of a High Bandgap Matrix Material in an Emission Layer in an OLED Device Was Well-Known in the Art: At the time of the purported invention of the ’164 patent, it was well-understood that it was beneficial to include a high bandgap or electrically inert material in an emission layer in order to improve various electrical characteristics of the layer and the device. *See, e.g.*, Seo180 at [0080] (“When the blocking material 2609 is added to the mixed region 2607, the recombination efficiency of carrier in the mixed region 2607 is enhanced and dispersion of molecule excitons is prevented, so that a high luminescent efficiency can be expected.”);

Thompson at [0008] ("[T]he emissive layer comprises a wide gap host material doped with both a charge carrying dopant material and a phosphorescent dopant material. The charge carrying dopant material is capable of transporting a hole or an electron, and the phosphorescent dopant material is capable of transporting a charge opposite to the charge carried by the charge carrying dopant material. Each dopant material, thus, carries charge, though of opposite polarity."); Choulis at [0030] ("Thus, the PVK has a large band gap and can confine the triplet excited state of the $Ir(mppy)_3$ phosphorescent molecule, preventing luminescence quenching."); Choulis at [0044] ("In some embodiments, the light emitting layer includes materials that are insulated matrices, that is, the host does not have transport properties, such as polycarbonate (PC), polymethyl methacrylate (PMMA) or polystyrene sulphonate (PSS)."); Thompson at [0042] ("Preferably, the HOMO level of the inert host material is lower than the HOMO level of any of the dopant materials. . . . In addition, the LUMO level of the inert host material Is higher than the LUMO level of any of the dopant materials."). The use of ultra-wide energy gap (UGH) hosts to act as matrix hosts that do not participate in charge transport was also well-established, especially in the context of phosphorescent blue OLEDs, where the first devices based on UGH hosts were first demonstrated by Holmes et al., *Efficient, deep-blue organic electrophosphorescence by guest charge trapping,* 83 Appl. Phys. Lett. 3818–3820 (2003), as was the ability to tune charge transport in the EML by tuning the concentration of the guest in a UGH host. It was also well-understood at the time of the invention that high bandgap matrix materials included in an emission layer in an OLED device should have the highest LUMO and the lowest HOMO out of the matrix materials in the layer. *See, e.g.*, Seo180 at [0096] ("In this case, it is preferable that the blocking material be maximum in excitation energy level among materials contained in the mixed region 2707 and be one having the function of blocking a carrier or preventing dispersion of molecule excitons.").

Use of an Emissive Dopant, a High Bandgap Matrix Material, a Hole Transport Matrix Material, and an Electron Transport Matrix Material Together in an Emission Layer of an OLED Device Was Well-Known in the Art: The use of three different matrix materials with specific hole and electron transport characteristics, plus an emissive dopant, to form an emission layer, was common practice in the OLED display art at the time of the invention of the '164 patent. *See, e.g.*, Sugiura at [0062] (teaching a combination of PVK, Alq3, TPD, and Nile red); Choulis at [0027]-[0031]; Thompson at Figs. 4-5, [0018]-[0019]; Kashiwabara at [0042].

The Simultaneous Joint Deposition or Co-Evaporation of Materials to Form an Emission Layer of an OLED Device Was Well-Known in the Art: The use of standardized co-evaporation processes was common practice in the OLED display art at the time of the invention, including using co-evaporation to simultaneously deposit matrix materials and an emitter material dopant to form an emissive layer in an OLED display. *See, e.g.*: Forrest at [0054] ("Unless otherwise specified, any of the layers of the various embodiments may be deposited by any suitable method. For the organic layers, preferred methods include thermal evaporation, ink-jet, such as described in U.S. Pat. Nos. 6,013,982 and 6,087,196, which are incorporated by reference in their entireties, organic vapor phase deposition (OVPD), such as described in U.S. Pat. No. 6,337,102 to Forrest et al., which is incorporated by reference in its entirety, and deposition by organic vapor jet printing (OVJP), such as described in U.S. patent application Ser. No. 10/233,470, which is incorporated by reference in its entirety."); Hofmann at [0120] ("For the manufacture of such layer arrangements, one or several evaporation sources for further matrix materials can be saved, which have to be vapour-deposited in known processes."); Hofmann at cl. 29 ("Method according to claim 28, characterized in that, during the formation of the continuous matrix from the first organic matrix material, in an intermediate step, a doped charge carrier transport layer is formed by means

of co-evaporation of a doping material and/or a block layer is formed and/or an emission layer is formed by means of co-evaporation of an emitter material and/or an additional block layer is formed and/or an additional doped charge carrier transport layer is formed by means of co-evaporation of an additional doping material."); Kashiwabara at [0066] ("Besides, the organic layer 4 configured to have the above-described laminate structure can be formed by applying a known method, such as vacuum evaporation and spin coating, while using the organic materials synthesized by known methods."); Nakashima at Abstract ("The present invention is having a characteristic of, even for a material for which deposition or wet coating is difficult in a state of a metal complex, co-deposition an organic compound (ligand) and a metal salt constituting raw materials of the metal complex to execute complex formation on a substrate thereby forming a film containing such metal complex and preparing an electroluminescent device utilizing thus formed co-decomposition film."); Nakashima at [0012] ("The present inventor has therefore conceived to co-deposit a ligand and a metal salt which are raw materials of a metal complex essentially, thereby forming a complex on a substrate and obtaining a film containing such metal complex."); Kido713 at [0069] ("[A] vapor deposition method and a sputtering method can be used as the layer formation method."); Kido209 at 3:9-11 ("Preferably, the mixed layer is a layer formed upon co-deposition of the organic metal complex compound and the electron-transporting organic compound."); Kido209 at 4:2-4 ("The organic metal complex compound and the electron transporting organic compound were co-deposited and mixed to form a mixed layer."); Nakamura at [0040] ("The metal-containing organic compound layer of the present invention is preferably produced by co-vapor-deposition according to a vacuum vapor deposition method."); Kumaki at 7:13-22 ("A layer containing a plurality of materials such as the layer including the material doped with an electron-supplying material to an organic compound can be formed by depositing each

material simultaneously. The layer containing a plurality of materials is desirably formed by combining the same kinds of methods or the different kinds of methods such as a co-evaporation method with resistance heating evaporation methods, a co-evaporation method with electron beam evaporation methods, a co-evaporation method with a resistance heating evaporation method and an electron beam evaporation method, deposition with a resistance heating evaporation method and a sputtering method, or deposition with an electron beam evaporation method and a sputtering method."); Sato at [0086] ("In the case of the vacuum deposition method, as in the deposition of the light emitting layer 5, the metal complex as the host material is placed in a crucible that is set in a vacuum vessel, a substance selected from oxadiazole derivatives, quinoxaline derivatives, and phenanthroline derivatives as the dopant material to be co-deposited is placed in a separate crucible, the vacuum vessel is evacuated to about 10-6 Torr using an appropriate vacuum pump, and then each crucible is simultaneously heated to cause deposition and form the electron transport layer 7 on the substrate placed facing the crucibles."); Werner501 at 38:37-42 ("The doping of the respective matrix material with the n-dopant to be used in accordance with the invention can be achieved by means of one or a combination of the following processes: (a) Mixed vaporization in a vacuum with one source for the matrix material and one for the dopant.").

(b) Motivation to Combine

A person of ordinary skill in the art would have been motivated to combine any of the references in Ex. D-Obviousness chart as they all discuss methods and systems for forming an emission layer in an OLED display consisting of a variety of matrix materials doped with an emitter material. A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the

POSITA's knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

A POSITA would also have been motivated to combine the references discussed in Exhibits D-1-D-12 because many of them share inventors. For example, the individuals below are inventors on multiple of the references discussed in Exhibits D-1-D12.

Inventor	**References**
Mark Thompson	Thompson, Forrest
Stephen Forrest	Thompson, Forrest

Further non-limiting examples as to motivation to combine are discussed below.

A POSITA would have been motivated to combine references to achieve the '164 patent asserted claims in order to achieve a more efficient emission layer in an OLED. *See, e.g.*: Thompson at Abstract ("An OLED includes a wide gap inert host material doped with two dopants. . . . The device is capable, in particular, of efficiently emitting light in the blue region of the visible spectrum."); Thompson at [0001] ("The present invention relates to highly efficient organic light emitting devices (OLEDs) that are, for example, capable of emitting blue light, and in particular to OLEDs that have an emitting layer comprising a phosphorescent dopant material and a charge carrying dopant material that are doped in an inert host material."); Choulis at [0007] ("In some implementations, the invention is directed to improving the efficiency of an OLED by adding organic moieties to the light emitting layer. The organic moieties within the light emitting layer have energy level similar to that of the matching layers. Combinations of the techniques descried herein can be used to form an OLED device."); Kashiwabara at [0005] ("Accordingly, it is an object of the present invention to provide an organic EL device having light emission components of three colors of red, green and blue in a good balance suited to use for a full-color display, having

a high efficiency and being capable of stable light emission for a long time, and a display excellent in color reproduction performance and capable of being driven for a long time."); Hofmann at [0022] ("The simplified layer arrangement for pin-type OLEDs indicate no relevant disadvantages with regard to the usual characteristic data and in this respect are of equal standing with the known complex structures. Light-emitting diodes with the use of such layer arrangements have a high efficiency in the range of the required brightness."); Kitamura at 3:19-29 ("Since the organic electroluminescent (EL) device has such a configuration, it has high luminous efficiency and excellent chromaticity. . . . Such a configuration can reduce the height of the potential barrier between adjacent layers, and can enhance luminous efficiency and luminous brilliance.").

A POSITA would have been motivated to add hole transport and/or electron transport matrix materials to an emission layer of a reference that lacked them to achieve the '164 patent asserted claims. As one example, this configuration was known to improve electron and hole transport characteristics of the OLED display. *See, e.g.*, Seo180 at [0038] ("[A] luminescent layer may be provided by a bipolar layer (referred below to as 'bipolar]natured mixed layer'), which is obtained by mixing a hole transporting material of high hole mobility and an electron transporting material of high electron mobility together. In this case, the luminescent layer decreases in carrier blocking function at interfaces on both ends thereof, but frequency of recombination of carrier is higher due to differences of mobility between an electron transporting layer and a bipolar-natured mixed layer, and between a hole transporting layer and a bipolar-nature mixed layer."); Choulis at [0032] ("As noted herein, the light emitting layer can be co-doped with organic moieties, that is, matching material. Mixing in organic moieties can increase the recombination zone within the light emitting layer, allowing for more recombination to occur and more light to be emitted."); Thompson at [0008] ("[A]n OLED, and to methods of preparing the same, in which the emissive

layer comprises a wide gap host material doped with both a charge carrying dopant material and a phosphorescent dopant material. The charge carrying dopant material is capable of transporting a hole or an electron, and the phosphorescent dopant material is capable of transporting a charge opposite to the charge carried by the charge carrying dopant material. Each dopant material, thus, carries charge, though of opposite polarity."); Kitamura at 5:28-37 ("The light-emitting layer in the invention may include one or more host materials. When the light-emitting layer includes two or more host materials, these host materials include, for example, at least one electron-transporting host material and at least one hole-transporting host material. Alternatively, the light-emitting layer may contain at least one host material which has no charge-transporting property and which does not emit light in addition to at least one charge-transporting host material.").

A POSITA would have been motivated to add a high bandgap matrix material to an emission layer of a reference that lacked it to achieve the '164 patent asserted claims. This configuration was known to isolate electron and hole transport to other matrix materials that were deliberately selected as electron and hole transport materials. A high bandgap host material in which other components are dispersed in should have a wide energy gap so as not to interfere with the charge transport among the guest materials. *See, e.g.*, Seo180 at [0080] ("When the blocking material 2609 is added to the mixed region 2607, the recombination efficiency of carrier in the mixed region 2607 is enhanced and dispersion of molecule excitons is prevented, so that a high luminescent efficiency can be expected."); Thompson at [0008] ("[T]he emissive layer comprises a wide gap host material doped with both a charge carrying dopant material and a phosphorescent dopant material. The charge carrying dopant material is capable of transporting a hole or an electron, and the phosphorescent dopant material is capable of transporting a charge opposite to the charge carried by the charge carrying dopant material. Each dopant material, thus, carries

charge, though of opposite polarity."); Kitamura at 5:28-37 ("The light-emitting layer in the invention may include one or more host materials. When the light-emitting layer includes two or more host materials, these host materials include, for example, at least one electron-transporting host material and at least one hole-transporting host material. Alternatively, the light-emitting layer may contain at least one host material which has no charge-transporting property and which does not emit light in addition to at least one charge-transporting host material."); Thompson at [0042] ("Preferably, the HOMO level of the inert host material is lower than the HOMO level of any of the dopant materials. . . . In addition, the LUMO level of the inert host material Is higher than the LUMO level of any of the dopant materials."). In particular, a POSITA would have been motivated to add a high bandgap matrix material in order to prevent luminescence quenching of the emissive dopant. *See, e.g.*, Choulis at [0030] ("Thus, the PVK has a large band gap and can confine the triplet excited state of the $Ir(mppy)_3$ phosphorescent molecule, preventing luminescence quenching."). Moreover, a POSITA would have been motivated to add a high bandgap matrix material in order to expand the possible universe of other materials that could be used in conjunction with the high bandgap matrix material. *See, e.g.*, Thompson at [0027] ("It is further believed that by using an inert host matrix in combination with the prescribed charge carrying dopant material and the prescribed charge carrying phosphorescent dopant material, such a combination of materials permits selection from a much wider range of OLED materials."). A POSITA would have had a reasonable expectation of success in adding a high bandgap material, because the synthesis techniques for such materials were well-understood, as were their impacts on the electrical characteristics of the emission layer.

A POSITA would have been motivated to select matrix materials or emissive dopants for an emission layer in an OLED display based on their HOMO and LUMO characteristics. *See, e.g.*,

Thompson at [0042] ("Preferably, the HOMO level of the inert host material is lower than the HOMO level of any of the dopant materials. . . . In addition, the LUMO level of the inert host material Is higher than the LUMO level of any of the dopant materials."); Choulis at [0021] ("Materials used in forming OLED devices typically have properties, such as a work function, a lowest unoccupied molecular orbital level (LUMO), and/or a highest occupied molecular orbital level (HOMO) that can be quantified, at least approximately. The work function describes the minimal amount of energy that must be acquired by an electron before the electron can escape from a surface of a material. The LUMO is the lowest energy molecular orbital of a molecule that does not contain an electron. If the molecule were to accept an electron, it would be most likely to do it with this orbital. The HOMO is the highest energy molecular orbital of a molecule that contains an electron. If the molecule were to loose an electron, it would most likely loose the electron from this orbital."); Choulis at [0028] ("The work function of PEDOT:PSS is -4.9 eV. TFB bridges the jump between the HOMO level of the phosphorescent material and the work function of PEDOT:PSS, making the injection of holes from PEDOT:PSS to the Ir(mppy)3 more favorable."); Hofmann at [0006] ("The energy levels HOMO ('Highest Occupied Molecular Orbital') and LUMO ('Lowest Unoccupied Molecular Orbital') are preferably selected in such a way that both charge carriers are 'captured' in the emission zone in order to ensure an efficient recombination of electrons and holes. The restriction of the charge carriers to the emission zone is realized by a suitable selection of the ionization potentials and/or electron affinities for the emission layer and/or the charge carrier transport layer, as will be explained later."). In particular, a POSITA would understand that holes are transported along the HOMO level of the hole-transporting guest material while electrons are transported along the LUMO level of the electron-transporting guest material. This requires that the HOMO and LUMO levels of the hole-

transporting guest material (second matrix material) be higher than the HOMO and LUMO levels of the electron-transporting guest material (third matrix material), respectively. Additionally, in order to ensure that all charges ultimately travel to the guest emitter material to form excitons, the HOMO level of the guest emitter material should be higher than that of the hole-transporting guest material (second matrix material, whose HOMO level in turn should be higher than that of the third matrix material) and the LUMO of the guest emitter material should be lower than that of the electron-transporting guest material (third matrix material, whose LUMO level in turn should be lower than that of the second matrix material). Therefore, a POSITA would have known that the LUMO of the emitter material should be energetically lower than the LUMO of the second and third matrix materials, and would have similarly known that the HOMO of the emitter material should be energetically higher than the HOMO of the second and third matrix materials. A POSITA would also have known that the LUMO of the emitter material should be energetically lower than the LUMO of the first matrix material, and the HOMO of the emitter material should be energetically higher than the HOMO of the first matrix material because a host material should have a wide energy gap (high LUMO and low HOMO) so as not to interfere with the charge transport among the guest materials. A POSITA would have had a reasonable expectation of success in selecting matrix materials or emissive dopants based on the HOMO and LUMO values, because the HOMO and LUMO values for common compounds were well-documented or could be derived, and the use of the appropriate matrix materials or dopants with the correct HOMO and LUMO values would improve electron and hole transport in the OLED display, without meaningful downsides.

A POSITA would have been motivated to employ joint vaporization or co-evaporation techniques to simultaneously deposit matrix materials and dopants in an emission layer of an

OLED device. *See, e.g.*, Choulis at [0043] ("Unlike polymeric materials that are applied as solutions or suspensions, small-molecule light emitting materials are preferably deposited through evaporation, sublimation, or organic vapor phase deposition methods."); Fong at 6:49-57 ("As described below with reference to FIG. 6, an organic semiconductor structure may be formed in one or more thin film organic semiconductor layer(s). The thin film organic semiconductor layer(s) may be deposited on substrate 100 and/or electrode 102 using a vacuum deposition technique, such as CVD, LACVD, or MOCVD."). Processes and apparatuses for co-evaporation of materials for organic functional layers in OLED displays were well-developed by the time of the invention of the '164 patent, so a POSITA would have had a reasonable expectation of success in employing such co-evaporation techniques during the manufacturing of an emission layer.

A POSITA would have been motivated to vary the concentration of an emitter material in an emission layer to form a gradient, including areas where the concentration of the emitter material is less than or equal to 10 wt %. Gradient doping was a well-known practice at the time of the invention of the '164 patent, and served as an alternative to the uniform doping of materials. A POSITA would have been familiar with the standard manufacturing techniques for producing a gradient composition. To a POSITA, forming a gradient of the emitter material in the emission layer would merely be replacing one well-known method of doping (uniform doping) with an alternative well-known doping method (gradient doping). Such an implementation of a predictable variation of the concentration structure of the emitter material using well-known methods would have been a routine matter and would be within a POSITA's ability. For example, such gradient techniques were well-understood and routine at the time of the invention of the '164 patent. Yong at 2 ("Gradient doped constructions have been widely used in traditional II-V semiconductor devices. . . . Gradient constructions are also used in small molecule fluorescent OLEDs.").

Additionally, there were several benefits to an emitter gradient, which would have motivated a POSITA to use them. *See, e.g.*, Yong at Abstract ("In the organic light emitting layer of the device, phosphorescent dyes are doped into the host material in a gradient doping manner, expanding the luminescent region of the device, improving the utilization rate of the phosphorescent dyes, and facilitating the combination of electrons and holes to form excitons, thereby improving the device's luminescence efficiency and brightness, improving its stability, and overcoming the disadvantages of low luminescence efficiency and poor stability under high current."); Yong at 3 ("The gradient distribution of the doping concentration of phosphorescent dyes in the organic light emitting layer in the host material in the above technical solution is to make the distribution trend of phosphorescent dyes in the host material conform to the distribution trend of electrons in the host material, and such concentration distribution expands the luminescent region of the device, improves the utilization rate of phosphorescent dyes, and is also conducive to the combination of electrons and holes to form excitons."). Using a gradient for the emitter material concentration also overcomes deficiencies with a uniform distribution, including limited efficiency and brightness. Yong at 3 ("Therefore, uniformly doped phosphorescent devices can only emit light from dyes located in the emitting region, and their luminescence efficiency and brightness are limited to a certain extent."). A POSITA would have had a reasonable expectation of success in forming an emitter material gradient, including because the concentration of the emitter material could be granularly adjusted by altering the outflow rate of a crucible containing the emitter material over time during the co-evaporation of the emission layer materials.

A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's

knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

(i) Claim 1

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 1 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(ii) Claim 2

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 2 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(iii) Claim 3

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 3 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(iv) Claim 4

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 4 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(v) Claim 5

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 5 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(vi) Claim 6

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 6 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(vii) Claim 7

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 7 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing

time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(viii) Claim 8

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 8 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Yong (D-8), Ara (D-9), Kijima (D-10), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(ix) Claim 9

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 9 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Yong (D-8), Ara (D-9), Kijima (D-10), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Yong (D-8), Ara (D-9), Kijima (D-10), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references,

acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(x) Claim 10

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 10 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing

time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xi) Claim 11

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 11 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan,

larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xii) Claim 12

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 12 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display

and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xiii) Claim 13

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 13 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Hofmann (D-5), Kijima (D-10), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xiv) Claim 14

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 14 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Hofmann (D-5), Kijima (D-10), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).

- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), Hofmann (D-5), Kijima (D-10), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xv) Claim 15

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 15 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).
- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).

- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

(xvi) Claim 16

As non-limiting examples, a POSITA would have been motivated to combine the following references to disclose claim 16 of the ’164 patent:

- Thompson (D-1) with any one of Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Choulis (D-2) with any one of Thompson (D-1), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- Forrest (D-3) with any one of Thompson (D-1), Choulis (D-2), Kashiwabara (D-4), or Sugiura (D-11).
- Kashiwabara (D-4) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Sugiura (D-11).

- Sugiura (D-11) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), or Kashiwabara (D-4).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).
- iRiver Clix2 (D-12) with any one of Thompson (D-1), Choulis (D-2), Forrest (D-3), Kashiwabara (D-4), or Sugiura (D-11).

Among other reasons, a POSITA would have been motivated to make any of the combinations above in order to improve the efficiency of the emission layer in an OLED display and thereby to realize improved brightness, lower driving voltage, improved service lifespan, larger displays, less risk of short-circuits, manufacturing cost savings, decreased manufacturing time, improved manufacturing quality, and other benefits listed in the prior art references, acknowledged by the ’164 patent specification, or apparent to a POSITA in light of the particular combinations.

5. ’492 patent

(a) Background and State of the Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the ’492 patent for the general subject matter of the ’492 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the ’492 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that “the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious”).

Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the ’492 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung’s obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the ’492 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

It Was Well-Known in the Art to Form Capacitors and Other Electronic Components Using Deposition and Printing Techniques: Forming capacitors on a substrate using printing techniques has been known in the art since the 1960s. *See, e.g.*, Sikina at Abstract. Capacitors are formed via deposition of electrodes and dielectrics on a substrate. *See, e.g.*, Hanamura ’582 at [0008]-[0010], [0018] (“Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a

dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified"); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.")

It Was Well-Known in the Art to Form Capacitors in Proximity to OLED Cells: It was known in the art as of the priority date of the '492 patent to form capacitors in close proximity to OLED cells. In an Active Matrix Organic Light Emitting Diode display, *See, e.g.*, Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs. As Lin describes the "typical pixel design used in current AM-OLED displays [as of 2011] … consist[ed] of two TFTs, one capacitor, and one OLED … The TFT functions as a switch for determining whether the data from data_line should be written in the capacitor … according to signal of scan_line." Lin at 942; *see also* e.g. Kawai at 22:53-23:53 (describing use for storage capacitor in proximity to OLED cell); Jillek, Embedded components in printed circuit boards: a processing technology review) at 351 (discussing embedded capacitors via printing). As of the priority date of the '492 patent, the use of storage capacitors in AMOLED displays was well known, and a POSITA would expect to use such techniques in formation of circuit without undue experimentation.

It Was Well-Known in the Art to Use Narrowing Of a Conducting Region to Form a Resistance Region. It has been well-known for decades to form an area with higher resistance by tapering or narrowing an electrically conducing area. For example, in 1967, P.M. Hall published "Resistance Calculations for Thin Film Patterns," Hall described the calculation of the resistance of an area on a thin film, including explicit calculation on corners, u-bends, and other shapes. Hall

at 293-94. As a further example, Buehler's 1978 paper "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" explored the use of various shaped of thin films the calculation of the resistance of those shapes and narrow regions. Buelher at 650-651; Jillek, Embedded components in printed circuit boards: a processing technology review) at 351 (discussing embedded resistors, showing use of etching to shape resistors using trenches). A POSITA would know how to form resistance region by etching or otherwise forming an electrically conductive layer without undue experimentation.

It Was Well-Known in the Art to Deform Dielectrics and Other Materials Using Heat: It has been well-known for decades to deform a substance during fabrication of electronic devices on a substrate. For example, it was well-known to use heat to deform a dielectric. *See, e.g.* Ingle '089 at 17:3–38 (describing using heat to place insulator into a "partially … flowable state" and allowing it to flow "into at least one section of the separation region between the first electrode region and the second electrode region."); *see also* Umezaki, Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989) (describing using heat for "reflow"); Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997) describing use of resin capable of reflowing as an interlayer dielectric material and "gap filling" properties"); Hanamura '582 at [0017] (describing sintering of layers); Tanba at claim 5: ("… a step for heating the charge injection layer to make part of the charge injection layer flow to fill the aforementioned gap with part of the charge injection layer, a step for forming an organic luminescent layer on the charge injection layer positioned directly above the first electrode layer, and a step for forming a second electrode layer from the top of the organic luminescent layer to the top of the charge injection layer positioned directly above the conductive layer"); id. at

[0013] (describing "a step for heating the charge injection layer to make part of the charge injection layer flow to fill the aforementioned gap with part of the charge injection layer").

It was Well Known in The Art To Use Printing Techniques to Apply Layers: It was well known in the art to apply layers using printing techniques which apply material only in certain areas rather than using photolithography. Ingle '089 at 18:7–18 ("The method according to the invention is usually free of photolithographic steps and can therefore be used as a cost-effective method for producing an electronic component, such as an organic light-emitting diode. By means of the method according to the invention, it is possible to produce an electronic component with a robust design. The method according to the invention can therefore also be used for the mass production of electronic components."); Lim at ¶¶ 133-139 (" In addition, the process is relatively simple and does not require expensive equipment for laser patterning as in the prior art, thereby reducing the manufacturing costs."); Yanagi at ¶ 12 (describing cost savings from using less material, and high expense of etching); Hasei at ¶ 3 (similar); Jillek, Embedded components in printed circuit boards: a processing technology review) at 351-53 (using printing to form embededed resistors an capacitors).

(b) Motivation to Combine

Further non-limiting examples as to motivation to combine are discussed below.

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing heating a dielectric material to deform it, including but not limited to Ingle '089, Hanamura '582, Mills, Umezaki, and Tanba. A POSITA would understand that by heating a dielectric material, the dielectric material can flow, and fill any holes created between layers, improving the characteristics of the structure. Ingle '089 at 17:3–38; Hanamura '582 at [0017]; Tanba at claim 5. Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer

dielectric (ILD) material (1997) describing use of resin capable of reflowing as an interlayer dielectric material and "gap filling" properties"). The use of materials which are capable of being slightly deformed by heating (also known as slumping) was well-known in the art and a POSITA could have used such a technique with without undue experimentation and with an expectation of success.

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the manufacture of OLED structures formed by delimiting an OLED region with a dielectric, applying an organic layer, and applying an electrically conducting layer over the organic layer such as Schwab 856, Kim, Schwab 335, and Watanabe. A POSITA would understand that the positioning of an OLED in a region adjacent to or on a substrate with a capacitor or other passive component was well-known in the art. In an Active Matrix Organic Light Emitting Diode display, *See, e.g.*, Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs. As Lin describes the "typical pixel design used in current AM-OLED displays [as of 2011] … consist[ed] of two TFTs, one capacitor, and one OLED … The TFT functions as a switch for determining whether the data from data_line should be written in the capacitor … according to signal of scan_line." Lin at 942; *see also* e.g. Kawai at 22:53-23:53 (describing use for storage capacitor in proximity to OLED cell). As of the priority date of the '492 patent, the use of storage capacitors in AMOLED displays was well known, and a POSITA would expect to use such techniques in formation of circuit without undue experimentation. AMOLED screen were well known in the art as of the priority date of the '492 patent and had been on sale for years, including in the Galaxy S, Galaxy S II, and Galaxy Note.

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the application of a dielectric layer and/or an electrode layer

by using printing methods. A POSITA would understand that the use of a printing method to pattern layers reduced costs and increased efficiency because photolithography and etching are expensive processes, and because the use of printing methods can reduce the amount of material required by reducing the application area, which in turn saves cost. *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Duthaler '242 at 10 ("The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. "); Ingle '089 at 18:7–18 ("The method according to the invention is usually free of photolithographic steps and can therefore be used as a cost-effective method for producing an electronic component, such as an organic light-emitting diode. By means of the method according to the invention, it is possible to produce an electronic component with a robust design. The method according to the invention can therefore also be used for the mass production of electronic components."); Lim at ¶¶ 133-139 (" In addition, the process is relatively simple and does not require expensive equipment for laser patterning as in the prior art, thereby reducing the manufacturing costs."); Yanagi at ¶ 12 (describing cost savings from using less material, and high expense of etching); Hasei at ¶ 3 (similar).

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the use of etching or otherwise removing material in order to form a resistance region in an conductive layer. It has been well-known for decades to form an area with higher resistance by tapering or narrowing an electrically conducting area. For example, in 1967, P.M. Hall published "Resistance Calculations for Thin Film Patterns," Hall described the calculation of the resistance of an area on a thin film, including explicit calculation on corners, u-bends, and other shapes. Hall at 293-94. As a further example, Buehler's 1978 paper "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" explored

the use of various shaped of thin films the calculation of the resistance of those shapes and narrow regions. Buelher at 650-651. A POSITA would know how to form resistance region by etching or otherwise forming an electrically conductive layer without undue experimentation.

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura ’582 (E-11) and Schwab (E-7) and Schwab ’856 (E-13).

(i) Claims 1 and 16

A POSITA would have been motivated to combine the following references to disclose claims 1 and 16.

- Hanamura (A-1) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Nomura (E-2) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Muenz (E-4) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).

- Tandon (E-5) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Sikina (E-6) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Schwab (E-7) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Kim (E-8) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Watanabe (E-10) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Hanamura ’582 (E-11) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Lim (E-12) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).

- Tanba (E-14) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Azuma (E-15) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Watanabe (E-10), Hanamura ’582 (E-11), or Azuma (E-15), Yanagi (E-16), Schindler (E-17), or Hasei (E-18).

It was known in the art to form passive electronic components using printing techniques. Forming capacitors on a substrate using printing techniques has been known in the art since the 1960s. *See, e.g.*, Sikina at Abstract. Capacitors are formed via deposition of electrodes and dielectrics on a substrate. *See, e.g.*, Hanamura ’582 at [0008]-[0010], [0018] (“Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified”); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a

capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.")

A POSITA would have understood that using the "selective" deposition of certain layers (e.g., the dielectric) and avoiding lithography would have provided cost savings. A POSITA would have been motivated to achieve cost savings. Ingle '089 at 18:7–18 ("The method according to the invention is usually free of photolithographic steps and can therefore be used as a cost-effective method for producing an electronic component, such as an organic light-emitting diode. By means of the method according to the invention, it is possible to produce an electronic component with a robust design. The method according to the invention can therefore also be used for the mass production of electronic components."); Lim at ¶¶ 133-139 (" In addition, the process is relatively simple and does not require expensive equipment for laser patterning as in the prior art, thereby reducing the manufacturing costs."); Yanagi at ¶ 12 (describing cost savings from using less material, and high expense of etching); Hasei at ¶ 3 (similar).

A POSITA also would have been motivated to create a electrode layer with a first conducting layer and second conducting layer for a variety of reasons. For example, the first electrically conductive layer in many devices is ITO (indium tin oxide). ITO is very sensitive to heat and other manufacturing issues, so it is desirable to protect it with an additional electrically conductive layer. *See, e.g.*, Ingle '089 at 13: 7-21, 7:29-37 ("By applying the second electrically conductive layer over the entire surface of the first electrically conductive layer in accordance with the invention, it is also possible to prevent the first electrically conductive layer, such as a sensitive ITO layer, from coming into contact with the insulator to be printed and/or the protective material and possibly being damaged or impaired."); Lim '383 (disclosing same scrutuce with a lower layer

of ITO or similar and an upper layer of aluminum, silver, gold, copper or similar); Tanba (describing ITO layer); Tandon at 3:37-56: (describing dual layer structure); Kawai (similar).

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura ’582 (E-11) and Schwab (E-7) and Schwab ’856 (E-13).

(ii) Claim 2: The method as claimed in claim 1, wherein a first electrode of a capacitor is formed by the first contact region between the dielectric and the substrate and a second electrode of a capacitor is formed by the electrode layer on a side of the dielectric facing away from the first contact region.

A POSITA would have been motivated to combine the following references to disclose claim 2.

- Hanamura (E-1) with one of Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Nomura (E-2) with one of Hanamura (E-1), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Nomura (E-2), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Muenz (E-4) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).

- Tandon (E-5) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Sikina (E-6) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Schwab (E-7) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Kim (E-8) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Watanabe (E-10) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Hanamura ’582 (E-11) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), or Azuma (E-15), or Hasei (E-18).
- Lim (E-12) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).

- Schwab 856 (E-13) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Tanba (E-14) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15).
- Azuma (E-15) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), or Hanamura ’582 (E-11), or Hasei (E-18).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), v
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), Azuma (E-15), or Hasei (E-18).
- Any combination described above with respect to claim 1 in combination with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), Azuma (E-15), or Hasei (E-18).

Forming capacitors on a substrate using printing techniques has been known in the art since the 1960s. *See, e.g.*, Sikina at Abstract. Capacitors are formed via deposition of electrodes and dielectrics on a substrate. *See, e.g.*, Hanamura ’582 at [0008]-[0010], [0018] (“Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material,

and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified"); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.").

A POSITA would have been motivated to combine the printing techniques of claim 1 with fabrication of a capacitor as in claim 2 because capacitors are one of a small set of "passive" electronic components, and because a POSITA would understand that creating a passive electronic component with two electrically conductive electrodes with a dielectric between them would be one method of forming a capacitor. *See, e.g.* Sikina at Abstract; Hanamura '582 at [0008]-[0010], [0018] ("Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified"); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.").

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and

Hanamura ’582 (E-11) and Schwab (E-7) and Schwab ’856 (E-13); Jillek, Embedded components in printed circuit boards: a processing technology review) at 351-53 (using printing to form embededed resistors an capacitors).

(iii) Claim 3: The method as claimed in claim 1, wherein, before the dielectric is applied, a second trench and at least one third trench are formed, which delimit a resistance region, which comprises a part of the first and second electrically conductive layers and which has a taper in a direction parallel to the electrically conductive layers and which leads into the first contact region on a first side of the taper.

A POSITA would have been motivated to combine the following references to disclose claim 3.

- Hanamura (E-1) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall “Resistance Calculations for Thin Film Patterns” (1967), Buehler’s “Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers” (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Nomura (E-2) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall “Resistance Calculations for Thin Film Patterns” (1967), Buehler’s “Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers” (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall “Resistance Calculations for Thin Film Patterns” (1967), Buehler’s “Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers” (1978),

Jillek, Embedded components in printed circuit boards: a processing technology review).

- Muenz (E-4) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Tandon (E-5) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Sikina (E-6) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Schwab (E-7) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).

- Kim (E-8) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Watanabe (E-10) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Hanamura '582 (E-11) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Lim (E-12) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Schwab 856 (E-13) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting

Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).

- Tanba (E-14) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Azuma (E-15) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).

- Any combination described above with respect to claim 1 in combination with one of Hanamura (E-1), Muenz (E-3), P.M. Hall "Resistance Calculations for Thin Film Patterns" (1967), Buehler's "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" (1978), Jillek, Embedded components in printed circuit boards: a processing technology review).

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the use of etching or otherwise removing material in order to form a resistance region in an conductive layer. It has been well-known for decades to form an area with higher resistance by tapering or narrowing an electrically conducting area. For example, in 1967, P.M. Hall published "Resistance Calculations for Thin Film Patterns," Hall described the calculation of the resistance of an area on a thin film, including explicit calculation on corners, u-bends, and other shapes. Hall at 293-94. As a further example, Buehler's 1978 paper "Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers" explored the use of various shaped of thin films the calculation of the resistance of those shapes and narrow regions. Buelher at 650-651. A POSITA would know how to form resistance region by etching or otherwise forming an electrically conductive layer without undue experimentation.

A POSITA would understand that performing a single etching step to create a resistance region would be one way to manufacture a resistor or resistance region which could then be place in series with a capacitor or other passive electronic component manufactured using the steps recited in claim 2. Jillek, Embedded components in printed circuit boards: a processing technology review) at 351-53 (using printing to form embededed resistors an capacitors).

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using

deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura ’582 (E-11) and Schwab (E-7) and Schwab ’856 (E-13).

(iv) Claim 6: The method as claimed in claim 2, wherein a plurality of capacitors and/or resistors are formed electrically in parallel with one another and/or electrically in series one after another.

A POSITA would have been motivated to combine the following references to disclose claim 6.

- Hanamura (E-1) with one of Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Nomura (E-2) with one of Hanamura (E-1), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Nomura (E-2), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Muenz (E-4) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Tandon (E-5) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).

- Sikina (E-6) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Schwab (E-7) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Kim (E-8) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Watanabe (E-10) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Hanamura ’582 (E-11) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), or Azuma (E-15), or Hasei (E-18).
- Lim (E-12) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).
- Schwab 856 (E-13) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15), or Hasei (E-18).

- Tanba (E-14) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), or Azuma (E-15).
- Azuma (E-15) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), or Hanamura ’582 (E-11), or Hasei (E-18).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), v
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Muenz (E-4), Sikina (E-6), Kim (E-8), Kawai (E-9), Hanamura ’582 (E-11), Azuma (E-15), or Hasei (E-18).
- Any combination described above with respect to claim 2.

Forming capacitors and capacitors on a substrate using printing techniques has been known in the art since the 1960s. *See, e.g.*, Sikina at Abstract. Capacitors are formed via deposition of electrodes and dielectrics on a substrate. *See, e.g.*, Hanamura ’582 at [0008]-[0010], [0018] (“Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified”); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know

how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.").

A POSITA would have been motivated to combine the printing techniques of claim 1 with fabrication of a capacitor as in claim 2 because capacitors are one of a small set of "passive" electronic components, and because a POSITA would understand that creating a passive electronic component with two electrically conductive electrodes with a dielectric between them would be one method of forming a capacitor. *See, e.g.* Sikina at Abstract; Hanamura '582 at [0008]-[0010], [0018] ("Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified"); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.").

A POSITA would have been further motivated to combine capacitors and resistors in parallel because a POSITA would understand that in order to make many or most useful circuits, multiple electronic components must be formed. Further, resistors and capacitors must either be formed in parallel or in sequence. A POSITA would further understand that on an OLED screen or any device, there are many cells and pixels that are connected in series or parallel, and thus that for any manufacturing process, many of these devices would be formed in series or parallel. *See, e.g.* Circuit Design and Parameters in Thin-Film technology (Jenny) at 20-21; Jillek, Embedded

components in printed circuit boards: a processing technology review) at 351-53 (using printing to form embededed resistors an capacitors).

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura ’582 (E-11) and Schwab (E-7) and Schwab ’856 (E-13).

(v) Claim 8: The method as claimed in claim 1, wherein the dielectric is applied by a printing method.

A POSITA would have been motivated to combine the following references to disclose claim 9.

- Hanamura (E-1) with one of Nomura (E-2), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Nomura (E-2) with one of Hanamura (E-1), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Nomura (E-2), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Muenz (E-4) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).

- Tandon (E-5) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Sikina (E-6) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Schwab (E-7) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Kim (E-8) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Watanabe (E-10) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Hanamura ’582 (E-11) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Lim (E-12) with one of with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Azuma (E-15), Schindler (E-17), or Hasei (E-18).

- Schwab 856 (E-13) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Tanba (E-14) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Azuma (E-15) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).
- Any combination described above with respect to claim 1 in combination with one of Hanamura (E-1), Nomura (E-2), Ingle ’089 (E-3), Tandon (E-5), Schwab (E-7), Kawai (E-9) Schwab 856 (E-13), Hanamura ’582 (E-11), Lim (E-12), Azuma (E-15), Schindler (E-17), or Hasei (E-18).

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the application of a dielectric layer and/or an electrode layer by using printing methods. A POSITA would understand that the use of a printing method to pattern layers reduced costs and increased efficiency because photolithography and etching are

expensive processes, and because the use of printing methods can reduce the amount of material required by reducing the application area, which in turn saves cost. *See, e.g.* Shimoda at 5:45-55; Tian at 2975; Duthaler '242 at 10 ("The invention discloses the use of inexpensive additive (i.e., printing) processes to replace expensive subtractive (i.e., resists plus etching) processing methods to form patterned electronic devices. "); Ingle '089 at 18:7–18 ("The method according to the invention is usually free of photolithographic steps and can therefore be used as a cost-effective method for producing an electronic component, such as an organic light-emitting diode. By means of the method according to the invention, it is possible to produce an electronic component with a robust design. The method according to the invention can therefore also be used for the mass production of electronic components."); Lim at ¶¶ 133-139 (" In addition, the process is relatively simple and does not require expensive equipment for laser patterning as in the prior art, thereby reducing the manufacturing costs."); Yanagi at ¶ 12 (describing cost savings from using less material, and high expense of etching); Hasei at ¶ 3 (similar); Jillek, Embedded components in printed circuit boards: a processing technology review) at 351-53 (using printing to form embededed resistors an capacitors).

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura '582 (E-11) and Schwab (E-7) and Schwab '856 (E-13).

(vi) Claim 9: The method as claimed in claim 1, wherein the dielectric firstly is applied in a structured fashion to the second electrically conductive layer in such a way that it adjoins the first trench, and wherein then the dielectric is heated in such a way that it deforms and encapsulates edges and/or side surfaces of the first and second electrically conductive layers in the first trench.

A POSITA would have been motivated to combine the following references to disclose claim 9.

- Hanamura (E-1) with one of Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Nomura (E-2) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Ingle ’089 (E-3) with one of Hanamura (E-1), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Muenz (E-4) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Tandon (E-5) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).

- Sikina (E-6) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Schwab (E-7) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Kim (E-8) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Watanabe (E-10) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Hanamura ’582 (E-11) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Lim (E-12) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer

dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).

- Schwab 856 (E-13) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Tanba (E-14) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Azuma (E-15) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- Galaxy Devices (E-19) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).
- iRiver Clix2 (E-20) with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).

- Any combination described above with respect to claim 1 in combination with one of Hanamura (E-1), Ingle ’089 (E-3), Tanba (E-5), Hanamura ’582 (E-11), Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997), or Umezaki Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989).

A POSITA would understand that by heating a dielectric material, the dielectric material can flow, and fill any holes created between layers, improving the characteristics of the structure. Ingle ’089 at 17:3–38; Hanamura ’582 at [0017]; Tanba at claim 5. Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997) describing use of resin capable of reflowing as an interlayer dielectric material and “gap filling” properties”); Umezaki , Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989). The use of materials which are capable of being slightly deformed by heating (also known as slumping) was well-known in the art and a POSITA could have used such a technique with without undue experimentation and with an expectation of success.

It has been well-known for decades to deform a substance during fabrication of electronic devices on a substrate. For example, it was well-known to use heat to deform a dielectric. *See, e.g.* Ingle ’089 at 17:3–38 (describing using heat to place insulator into a “partially … flowable state” and allowing it to flow “into at least one section of the separation region between the first electrode region and the second electrode region.”); *Id.* at 17:12-27 (describing that rounding of the dielectric is “advantageous”); *see also* Umezaki, Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989) (describing using heat for “reflow”); Mills, Benzocyclobutene (DVC-BCB) polymer as an interlayer dielectric (ILD) material (1997) describing use of resin capable of reflowing as an interlayer dielectric material and “gap filling”

properties"); Hanamura '582 at [0017] (describing sintering of layers); Tanba at claim 5: ("… a step for heating the charge injection layer to make part of the charge injection layer flow to fill the aforementioned gap with part of the charge injection layer, a step for forming an organic luminescent layer on the charge injection layer positioned directly above the first electrode layer, and a step for forming a second electrode layer from the top of the organic luminescent layer to the top of the charge injection layer positioned directly above the conductive layer"); id. at [0013] (describing "a step for heating the charge injection layer to make part of the charge injection layer flow to fill the aforementioned gap with part of the charge injection layer"). The use of "slumping" or thermal reflow can improve planarizing properties as well, and create a more rounded structure for the dielectric which is advantageous for application of additional layers. Ingle '089 at 17:12-27 (describing that rounding of the dielectric is "advantageous"); Umezaki, Planar Process for 16 Mb Bubble Memory Devices Using thermal Reflow-type Polyimide (1989) at 2360 (describing improved planarization and smoothing after using layer with thermal reflow, and a superior bias field margin).

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura '582 (E-11) and Schwab (E-7) and Schwab '856 (E-13).

(vii) Claim 10

- Hanamura (A-1) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs

- Nomura (E-2) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Ingle ’089 (E-3) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Muenz (E-4) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Tandon (E-5) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Sikina (E-6) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Schwab (E-7) with one of Watanabe (E-10), Kim (E-8), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Kim (E-8) with one of Watanabe (E-10), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs

- Watanabe (E-10) with one of Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Hanamura ’582 (E-11) one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Lim (E-12) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Schwab ’856 with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Tanba (E-14) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Azuma (E-15) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Galaxy Devices (E-19) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs

- iRiver Clix2 (E-20) with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs
- Any combination listed above with respect to claims 1 and 16 in combination with one of Watanabe (E-10), Kim (E-8), Schwab (E-7), Schwab 856 (E-13), Lim (E-12), Kawai (E-9), Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs

It was known in the art to form passive electronic components using printing techniques. Forming capacitors on a substrate using printing techniques has been known in the art since the 1960s. *See, e.g.*, Sikina at Abstract. Capacitors are formed via deposition of electrodes and dielectrics on a substrate. *See, e.g.*, Hanamura '582 at [0008]-[0010], [0018] ("Each of the above layers can be formed by printing, drying, and sintering in the respective formation processes, but it is also possible to form two or all layers in a small number of sintering processes, such as printing and drying a paste dielectric material, followed by printing and drying a paste conductor material, and then sintering to simultaneously form a dielectric layer 3 and an upper conductor layer 4. In this way, the processes can be simplified"); Azuma at [0017]-[0020]; Hanamura at 1:35-48, 5:33-36, 6:15-26, 7:26-38; Nomura at 1:7-32; 4:55-5:16. A POSITA would be able to form such a capacitor without undue experimentation. A POSITA would also know how to form capacitors and resistors in parallel or series. *Id.*; *see also* Muenz at Abstract (describing fabrication of a circuit with "at least one capacitor and/or one resistor.")

A POSITA would have understood that using the "selective" deposition of certain layers (e.g., the dielectric) and avoiding lithography would have provided cost savings. A POSITA would have been motivated to achieve cost savings. Ingle '089 at 18:7–18 ("The method according

to the invention is usually free of photolithographic steps and can therefore be used as a cost-effective method for producing an electronic component, such as an organic light-emitting diode. By means of the method according to the invention, it is possible to produce an electronic component with a robust design. The method according to the invention can therefore also be used for the mass production of electronic components."); Lim at ¶¶ 133-139 (" In addition, the process is relatively simple and does not require expensive equipment for laser patterning as in the prior art, thereby reducing the manufacturing costs."); Yanagi at ¶ 12 (describing cost savings from using less material, and high expense of etching); Hasei at ¶ 3 (similar).

A POSITA also would have been motivated to create a electrode layer with a first conducting layer and second conducting layer for a variety of reasons. For example, the first electrically conductive layer in many devices is ITO (indium tin oxide). ITO is very sensitive to heat and other manufacturing issues, so it is desirable to protect it with an additional electrically conductive layer. *See, e.g.*, Ingle '089 at 13: 7-21, 7:29-37 ("By applying the second electrically conductive layer over the entire surface of the first electrically conductive layer in accordance with the invention, it is also possible to prevent the first electrically conductive layer, such as a sensitive ITO layer, from coming into contact with the insulator to be printed and/or the protective material and possibly being damaged or impaired."); Lim '383 (disclosing same scrutuce with a lower layer of ITO or similar and an upper layer of aluminum, silver, gold, copper or similar); Tanba (describing ITO layer); Tandon at 3:37-56: (describing dual layer structure); Kawai (similar).

A POSITA would also have been motivated to combine any of the references in Exs. E1-E-20 with any reference disclosing the manufacture of OLED structures formed by delimiting an OLED region with a dielectric, applying an organic layer, and applying an electrically conducting layer over the organic layer such as Schwab 856, Kim, Schwab 335, and Watanabe. A POSITA

would understand that the positioning of an OLED in a region adjacent to or on a substrate with a capacitor or other passive component was well-known in the art. In an Active Matrix Organic Light Emitting Diode display, *See, e.g.*, Lin, A Novel Pixel Design for AM-OLED Displays Using Nanocrystalline Silicon TFTs. As Lin describes the "typical pixel design used in current AM-OLED displays [as of 2011] … consist[ed] of two TFTs, one capacitor, and one OLED … The TFT functions as a switch for determining whether the data from data_line should be written in the capacitor … according to signal of scan_line." Lin at 942; *see also* e.g. Kawai at 22:53-23:53 (describing use for storage capacitor in proximity to OLED cell). As of the priority date of the '492 patent, the use of storage capacitors in AMOLED displays was well known, and a POSITA would expect to use such techniques in formation of circuit without undue experimentation. AMOLED screen were well known in the art as of the priority date of the '492 patent and had been on sale for years, including in the Galaxy S, Galaxy S II, and Galaxy Note.

A POSITA would also have been motivated to combine the references in Exhibits E-1-E-20 due to the similar subject matter regarding manufacture of electronic components using deposition techniques. Several references also share inventors, such as Hanamura (E-1) and Hanamura '582 (E-11) and Schwab (E-7) and Schwab '856 (E-13).

6. '425 patent

(a) Background And State Of The Art

Samsung sets forth below a summary of their current understanding of the state of the art as understood as of the asserted priority date of the '425 patent for the general subject matter of the '425 patent. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the '425 patent was invented and may have been used in determining whether and how to combine references to achieve the claimed

inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that "the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious"). Samsung expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to the Asserted Patent.

Samsung contends that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims of the '425 patent, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section or in Samsung's obviousness charts with those primary references. Samsung also reserves the right to rely on the discussions of the state of the art and prior art in the '425 patent specification and its file history including file histories of related patents and foreign file histories of related patents in explaining the state of the art. Samsung further expressly reserve the right to supplement its summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Samsung also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Plaintiff, regarding the state of the art.

It was well-known in the art long before the filing date of the '425 patent to use an OLED with a stacked structure including a substrate, electrode, organic layer stack including a doped layer with a dopant, which acts as an electron donor. *See, e.g.*, Diekammn at 92, 94; Suzuki at ¶ [0274]; Ma at Abstract; Lee at ¶ [0022]. It was well-known in the art long before the filing date

of the ’425 patent that such OLEDs could generate radiation within a specific wavelength range based on the dopant. *Id*.

Likewise, it was well-known in the art long before the filing date of the ’547 patent to use an OLED that includes an encapsulation layer to prevent degradation and protect from outside contaminants. For example, Suzuki discloses “an organic electroluminescent device” using a “gas barrier resin substrate material” and encapsulation having two buffer films and one barrier film, but Suzuki specifies that the encapsulation may “comprise two or more barrier films and two or more buffer films.” Suzuki ¶¶ [0001], [0274]. Additionally, Lee discloses “an organic light emitting device having a barrier for protection against environmental degradation.” Lee ¶ [0002].

Similarly, it was well-known in the art long before the filing date of the ’547 patent to use an OLED that includes touch sensors. For example, Koshihara discloses a “touch–sensitive organic EL device.” Koshihara ¶¶ [0002], [0028]. Koshihara discloses a touch panel unit integrated into the sealing substrate that protects the OLED from water and oxygen. *Id.*, ¶¶ [0030]–[0031]. Specifically, “[a] combination of the first detection electrode 14, the second detection electrode 18, the dielectric film 15, and the detection unit 16” operates as a touch panel unit to detect touch inputs. *Id.*, ¶ [0031]. Similarly, Harada discloses “a display technology capable of receiving light in parallel with emitting light,” which can be applied to an “organic EL (Electro-Luminance) display.” Harada ¶ [0003]. Harada’s “I/O display” can “detect not only a touch that is a state of the screen being touched, but also an object approached to the screen.” *Id.*, ¶ [0039]. Similarly, Caldwell discloses “integration of touch sensors with light emitting devices,” Caldwell ¶ [0007], where light emission can be provided by OLEDs, *id.*, ¶¶ [0004]–[0006].

(b) Motivation to Combine

A person of ordinary skill in the art would have been motivated to combine any of the references in the obviousness chart as they all discuss OLEDs, color filters, and/or encapsulaiton layers of light-emitting devices. A person of ordinary skill in the art would have been aware of the well-known benefits of using OLEDs with color filters and encapsulations for desired color output and protection and would have thus looked to any of these references. Moreover, these references are analogous because they all discuss OLEDs, organic layers, encapsulation layers, and/or touch or gesture sensors for light-emitting devices.

For example, a POSITA would have been motivated to include an n-doped electron transport layer to promote injection of electrons from the cathode and improve transportation of electrons to the light-emitting region. A POSITA would have understoof that doing so results in improved device characteristics, such as lower driving voltage and better power efficiency. *See, e.g.*, Ma at 810. A POSITA would have had a reasonable expectation of success, as n-doped electron transport layers were widely used at the time in OLEDs for this reason. *See, e.g.*, Ma at 810.

Likewise, a POSITA would have been motivated to use an Liq-doped electron transport layer in the organic layer stack due to the known benefits of an Liq-doped electron transport layer. For example, Ma explains, "[s]ince the discovery of organic light-emitting devices (OLEDs), there has been a considerable interest in developing OLEDs with high efficiency." Ma at 810. "In order to lower driving voltage and enhance power efficiency, it is critical to enhance the carrier injection from the electrode to the transporting layer and to increase the transport conductivity." *Id*. Ma discloses that a "doping concentration of Liq" in the electron transport layer results in increased current density and reduced driving voltage, compared to the undoped device. *Id*. at 813. Ma further dislcoses that "a certain doping ratio of Liq to Bphen can improve the electron transport

ability of the co-deposited layer." *Id*. A POSITA would have been motivated to use a Liq-doped electron transport layer in an OLED to achieve these benefits. Further, Liq was known to have good electron injection and transport properties. *Id*. A POSITA thus would have recognized that Liq would be an advantageous dopant for the doped layer. A POSITA would also have reasonably expected success in using an Liq-doped electron transport layer. Electron transport layers doped with Liq were well known for OLEDs. *See, e.g.*, Ma at 813.

Similarly, a POSITA would have been motivated to use multi-layered encapsulation with an OLED. For example, Lee teaches the benefits of its encapsulation for OLEDs as "the low work function metals typically used as cathodes in OLEDs are environmentally sensitive, and may be easily oxidized by moisture or oxygen from air. Therefore, it is important to protect these materials from air both during processing and during use." Lee at ¶ [0005]. Thus, a POSITA understood encapsulation formed of semi-crystalline and highly-crystalline polymer barrier layers may provide "a significantly improved lifetime compared to prior OLEDs having polyacrylate or amorphous parylene barrier layers." *Id.* Applying multi-layered encapsulation to an OLED is also the mere application of a known technique to a piece of prior art ready for improvement.

Additionally, a POSITA would have been motivated to incorporate touch sensing functionality in an OLED device. Using touch sensors as input devices for controlling electronic devices was well known by the time of the '425 patent. *See, e.g.*, Koshihara, ¶ [0004]. A POSITA would have been motivated to incorporate touch sensors to "allow[] a user to manually input instructions" intuitively by touch. Koshihara at ¶ [0004]. Further, a POSITA would have reasonably expected success in incorporating touch sensing functionality in an OLED device. OLEDs with integrated touch sensors were well known, with applications for controlling the functionality of devices including OLED displays and OLED light sources. *See, e.g.*, Koshihara,

¶ [0004]. Implementing a touch sensor would have been a routine matter well within the ability of a POSITA.

A POSITA would have had a reasonable expectation of success in making any such modifications. A POSITA would have understood that these references, as well as the POSITA's knowledge, disclose interrelated teachings based on routine technologies and would have been amenable to various well-understood and predictable combinations.

(i) Claim 1

A POSITA would have been motivated to combine the following references to disclose claim 1.

- Suzuki '631 (F-1) with any one of Hatwar '587 (F-2), Kim '483 (F-3), Diekmann '323 (F-4), Kondo '305 (F-14), Takashima '469 (F-19), or iRiver Clix2 (F-20).
- Hatwar '587 (F-2) with any one of Kim '483 (F-3), Diekmann '323 (F-4), Kondo '305 (F-14), Takashima '469 (F-19), or iRiver Clix2 (F-20).
- Kim '483 (F-3) with any one of Diekmann '323 (F-4), Kondo '305 (F-14), Takashima '469 (F-19), or iRiver Clix2 (F-20).
- Diekmann '323 (F-4) with any one of Kondo '305 (F-14), Takashima '469 (F-19), or iRiver Clix2 (F-20).
- Kondo '305 (F-14) with any one of Takashima '469 (F-19), or iRiver Clix2 (F-20).
- Takashima '469 (F-19) with any one of iRiver Clix2 (F-20).
- iRiver Clix2 (F-20) with any one of Suzuki '631 (F-1), Hatwar '587 (F-2), Kim '483 (F-3), Diekmann '323 (F-4), Kondo '305 (F-14), or Takashima '469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation layers, n-doped electron transport layers, and emitting radiation in a

spectral range from infrared radiation to UV radiation during operation with an OLED. A POSITA would understand that the use of encapsulation layers, n-doped electron transport layers, and emitting radiation in a spectral range from infrared radiation to UV radiation during operation with an OLED would allow for better protection of the OLED and a wider range of desired color or color combination from the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. The use of encapsulation layers, n-doped electron transport layers, and emitting radiation in a spectral range from infrared radiation to UV radiation during operation was extremely well-known in the art, known to be inexpensive, accurate, and able to protect the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. A POSITA would have expected to succeed in using encapsulation layers, n-doped electron transport layers, and emitting radiation in a spectral range from infrared radiation to UV radiation during operation with an OLED and would not have been required to perform undue experimentation to make use of the encapsulation layers, n-doped electron transport layers, and radiation spectral range during operation with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2.

(ii) Claim 2

A POSITA would have been motivated to combine the following references to disclose claim 2.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of Ma (F-16), or iRiver Clix2 (F-20).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Ma (F-16), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine an electron transport layer comprising 8-hydroxyquinolinolato-lithium with an OLED. A POSITA would understand that the use an electron transport layer comprising 8-hydroxyquinolinolato-lithium with an OLED would allow for desired performance and output characteristics of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Ma at Abstract, 810–811. The use of an electron transport layer comprising 8-hydroxyquinolinolato-lithium was extremely well-known in the art, known to be

inexpensive, accurate, and able to produce desired performance characteristics for the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; Ma at Abstract, 810–811; iRiver Clix2 Exhibit F-20 at 2. A POSITA would have expected to succeed in using an electron transport layer comprising 8-hydroxyquinolinolato-lithium with an OLED and would not have been required to perform undue experimentation to make use of the electron transport layer comprising 8-hydroxyquinolinolato-lithium with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; Ma at Abstract, 810–81;1 iRiver Clix2 Exhibit F-20 at 2.

(iii) Claim 3

A POSITA would have been motivated to combine the following references to disclose claim 3.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), or iRiver Clix2 (F-20).

- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation layers with an OLED. A POSITA would understand that the use of encapsulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. The use of encapsulation layers was extremely well-known in the art, known to be inexpensive, accurate, and able to protect the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. A POSITA would have expected to succeed in using encapsulation layers with an OLED and would not have been required to perform undue experimentation to make use of the encapsulation layers with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2.

(iv) Claim 4

A POSITA would have been motivated to combine the following references to disclose claim 4.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20), Lee ’267 (F-5), Koichi ’095 (F-6), or Takagi ’841 (F-17).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Lee ’267 (F-5), Koichi ’095 (F-6), Takagi ’841 (F-17), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation layers and volume structures with an OLED. A POSITA would understand that the use of encapsulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2;

Lee ’267 at Abstract; Koichi ’095 at Abstract; Takagi ’841 at Abstract. The use of encapsulation layers and volume structures was extremely well-known in the art, known to be inexpensive, accurate, and able to protect the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Lee ’267 at Abstract; Koichi ’095 at Abstract; Takagi ’841 at Abstract. A POSITA would have expected to succeed in using encapsulation layers and volume structures with an OLED and would not have been required to perform undue experimentation to make use of the encapsulation layers and volume structures with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Lee ’267 at Abstract; Koichi ’095 at Abstract; Takagi ’841 at Abstract.

(v) Claim 9

A POSITA would have been motivated to combine the following references to disclose claim 9.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8),

Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).

- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), or Iwase ’878 (F-18).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine touch sensors with an OLED. A POSITA would understand that the use of encapsulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki ’631 at

[0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara ’394 at [0006]; Cok ’267 at Abstract; Koshihara ’395 at [0010]; Kim ’070 at [0007]; Caldwell ’910 at Abstract; Harada ’892 at [0039]; Iwase ’878 at Abstract. The use of touch sensors was extremely well-known in the art, known to be inexpensive, accurate, and able to provide input to the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara ’394 at [0006]; Cok ’267 at Abstract; Koshihara ’395 at [0010]; Kim ’070 at [0007]; Caldwell ’910 at Abstract; Harada ’892 at [0039]; Iwase ’878 at Abstract. A POSITA would have expected to succeed in using touch sensors with an OLED and would not have been required to perform undue experimentation to make use of the touch sensors with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2.

(vi) Claim 10

A POSITA would have been motivated to combine the following references to disclose claim 10.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).

- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), or Iwase ’878 (F-18).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine touch sensors with an OLED. A POSITA would understand that the use of encapsulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki '631 at [0001]; Hatwar '587 at Abstract, [0003]; Kim '483 at Abstract; Diekmann '323 at 1; Kondo '305 at Abstract; Takashima '469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara '394 at [0006]; Cok '267 at Abstract; Koshihara '395 at [0010]; Kim '070 at [0007]; Caldwell '910 at Abstract; Harada '892 at [0039]; Iwase '878 at Abstract. The use of touch sensors was extremely well-known in the art, known to be inexpensive, accurate, and able to provide input to the OLED. *See, e.g.* Suzuki '631 at [0001]; Hatwar '587 at Abstract, [0003]; Kim '483 at Abstract; Diekmann '323 at 1; Kondo '305 at Abstract; Takashima '469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara '394 at [0006]; Cok '267 at Abstract; Koshihara '395 at [0010]; Kim '070 at [0007]; Caldwell '910 at Abstract; Harada '892 at [0039]; Iwase '878 at Abstract. A POSITA would have expected to succeed in using touch sensors with an OLED and would not have been required to perform undue experimentation to make use of the touch sensors with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki '631 at [0001]; Hatwar '587 at Abstract, [0003]; Kim '483 at Abstract; Diekmann '323 at 1; Kondo '305 at Abstract; Takashima '469 at Abstract; iRiver Clix2 Exhibit F-20 at 2.

(vii) Claim 12

A POSITA would have been motivated to combine the following references to disclose claim 12.

- Suzuki '631 (F-1) with any one of Hatwar '587 (F-2), Kim '483 (F-3), Diekmann '323 (F-4), Kondo '305 (F-14), Takashima '469 (F-19), Koshihara '394 (F-7), Cok

’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or iRiver Clix2 (F-20).

- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Harada ’266 (F-9), DeJule ’240 (F-10), or Iwase ’878 (F-18).

- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Koshihara ’394 (F-7), Cok ’267 (F-8), Koshihara ’395 (F-11), Kim ’070 (F-12), Caldwell ’910 (F-13), Harada ’892 (F-15), Iwase ’878 (F-18), Harada ’266 (F-9), DeJule ’240 (F-10), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine gesture control with an OLED. A POSITA would understand that the use of encapsulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara ’394 at [0006]; Cok ’267 at Abstract; Koshihara ’395 at [0010]; Kim ’070 at [0007]; Caldwell ’910 at Abstract; Harada ’892 at [0039]; Iwase ’878 at Abstract; Harada ’266 at [0119]; DeJule ’240 at Abstract. The use of gesture control was extremely well-known in the art, known to be inexpensive, accurate, and able to provide input to the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Koshihara ’394 at [0006]; Cok ’267 at Abstract; Koshihara ’395 at [0010]; Kim ’070 at [0007]; Caldwell ’910 at Abstract; Harada ’892 at [0039]; Iwase ’878 at Abstract; Harada ’266 at [0119]; DeJule ’240 at Abstract. A POSITA would have expected to succeed in using gesture control with an OLED and would not have been required to perform undue experimentation to make use of the gesture control with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract,

[0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Harada ’266 at [0119]; DeJule ’240 at Abstract.

(viii) Claim 17

A POSITA would have been motivated to combine the following references to disclose claim 17.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), Ma (F-16), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of Ma (F-16), or iRiver Clix2 (F-20).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Ma (F-16), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine an electron transport layer comprising 8-hydroxyquinolinolato-lithium with an OLED. A POSITA would understand that the use an electron transport layer comprising 8-

hydroxyquinolinolato-lithium with an OLED would allow for desired performance and output characteristics of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2; Ma at Abstract, 810–811. The use of an electron transport layer comprising 8-hydroxyquinolinolato-lithium was extremely well-known in the art, known to be inexpensive, accurate, and able to produce desired performance characteristics for the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; Ma at Abstract, 810–811; iRiver Clix2 Exhibit F-20 at 2. A POSITA would have expected to succeed in using an electron transport layer comprising 8-hydroxyquinolinolato-lithium with an OLED and would not have been required to perform undue experimentation to make use of the electron transport layer comprising 8-hydroxyquinolinolato-lithium with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; Ma at Abstract, 810–81;1 iRiver Clix2 Exhibit F-20 at 2.

(ix) Claim 18

A POSITA would have been motivated to combine the following references to disclose claim 18.

- Suzuki ’631 (F-1) with any one of Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Hatwar ’587 (F-2) with any one of Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).

- Kim ’483 (F-3) with any one of Diekmann ’323 (F-4), Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Diekmann ’323 (F-4) with any one of Kondo ’305 (F-14), Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Kondo ’305 (F-14) with any one of Takashima ’469 (F-19), or iRiver Clix2 (F-20).
- Takashima ’469 (F-19) with any one of iRiver Clix2 (F-20).
- iRiver Clix2 (F-20) with any one of Suzuki ’631 (F-1), Hatwar ’587 (F-2), Kim ’483 (F-3), Diekmann ’323 (F-4), Kondo ’305 (F-14), or Takashima ’469 (F-19).

A POSITA would also have been motivated to make any of the combinations above to combine encapsulation layers and insulation layers with an OLED. A POSITA would understand that the use of encapsulation layers and insulation layers with an OLED would allow for better protection of the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. The use of encapsulation layers and insulation layers was extremely well-known in the art, known to be inexpensive, accurate, and able to protect the OLED. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract, [0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2. A POSITA would have expected to succeed in using encapsulation layers and insulation layers with an OLED and would not have been required to perform undue experimentation to make use of the encapsulation layers and insulation layers with the OLED.

The primary references above emphasize the need for cost savings, robust protection, and efficient OLEDs used with displays. *See, e.g.* Suzuki ’631 at [0001]; Hatwar ’587 at Abstract,

[0003]; Kim ’483 at Abstract; Diekmann ’323 at 1; Kondo ’305 at Abstract; Takashima ’469 at Abstract; iRiver Clix2 Exhibit F-20 at 2.

E. <u>Lack of Secondary Indicia of Nonobviousness</u>

Samsung is not aware of any evidence that would tend to establish any secondary considerations of non-obviousness. This lack of evidence further renders the Asserted Claims obvious. Proving any such secondary considerations is Pictiva’s burden. *See, e.g.*, *ZUP, LLC v. Nach Mfg., Inc.*, 896 F.3d 1365, 1373 (Fed. Cir. 2018) (“[A] patentee bears the burden of production with respect to evidence of secondary considerations of nonobviousness.”). Accordingly, Samsung reserves all rights regarding its full contention in this respect until after Pictiva completes its final and binding disclosure of any such evidence and contentions. In the meantime, Samsung note the complete lack of any such evidence in the record.

Pictiva has disclosed no evidence of, and Samsung knows of no viable evidence to suggest:

- **<u>The alleged invention’s commercial success</u>**. Indeed, no products are known to practice the Asserted Claims. To the extent Pictiva asserts that Samsung’s products practice the Asserted Patents, Samsung denies that assertion and incorporates its responses to date and any future contentions, expert reports, and testimony. Further, Samsung knows of no nexus between any commercial success and the Asserted Claims. *See, e.g., Windsurfing Int’l Inc. v. AMF* , 782 F.2d 995 (Fed. Cir. 1986) (considerations such as intervening, non-covered technological innovations, popularity of accessories, and advertising expense are all relevant to the nexus determination). If any commercial success is due to any of the concepts discussed in the Asserted Patents, those concepts are also present in the prior art, as described above, and thus do not support any commercial success that is relevant to the question of obviousness. *See Tokai Corp. v.*

Easton Enters, Inc. , 632 F.3d 1358, 1369–70 (Fed. Cir. 2011) ("If commercial success is due to an element in the prior art, no nexus exists."); *In re Huai-Hung Kao* , 639 F.3d 1057, 1068 (Fed. Cir. 2011) ("Where the offered secondary consideration actually results from something other than what is both claimed and *novel* in the claim, there is no nexus to the merits of the claimed invention."); *Ormco Corp. v. Align Tech., Inc.* , 463 F.3d 1299, 1312 (Fed. Cir. 2006) ("[I]f the feature that creates the commercial success was known in the prior art, the success is not pertinent.").

- **Alleged commercial success via licensing**. Pictiva has presented no evidence of commercial success via a licensing program.
- **Long felt but unresolved needs**. Pictiva has presented no evidence of any long felt and unresolved need.
- **No industry praise.** There is also no evidence of industry praise for the alleged invention of the Asserted Patents or any functionality that allegedly practices the Asserted Patents. To the extent any praise is related to any functionality that allegedly practices the Asserted Patents, that praise is not due to the allegedly novel features of the Asserted Patents, but instead only to features present in the prior art, which is not a sufficient nexus to be relevant to the question of industry praise for purposes of obviousness. *See Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318, 1328 (Fed. Cir. 2008). Praise of Samsung's mobile phones or other Samsung products is not praise of the Asserted Patents.
- **Unexpected results**: No evidence of any such unexpected results is known. As discussed above, the concepts contained in the Asserted Claims were already combined in the same manner as the asserted. These prior art systems, as described in the above-

referenced exhibits, disclosed the same combination of elements, and the same result of that combination, that is recited in the claim. Thus, there were no unexpected results that arose from combining the well-known elements in the Asserted Claims.

- **The failure of others**. No evidence of any such failure is known.
- **Skepticism by experts**. No experts or person of skill expressed skepticism about implementing the alleged inventions.
- **Teaching away by others**. No evidence of any such teaching is known.
- **Recognition of a problem**. As discussed above, the industry recognized the problem and had already discussed multiple approaches that implemented the Asserted Claims to solve that problem.
- **Copying of the alleged invention by competitors**. No evidence of any such copying is known. *See Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1366 (Fed. Cir. 2001) (allegedly copied feature must be an embodiment of the patented claims).

V. INVALIDITY UNDER 35 U.S.C. § 112

Pictiva has not yet provided a claim construction for many of the terms and phrases that Samsung anticipates will be in dispute. Samsung, therefore, cannot provide a complete list of its § 112 defenses because Samsung does not know whether Pictiva will proffer a construction for certain terms and phrases that is broader than, or inconsistent with, the construction that would be supportable by the disclosure set forth in the specification.

Nevertheless, Samsung contends that, at least under Pictiva's actual and/or apparent application of the claims, the Asserted Claims are invalid based on inadequate written description and/or a lack of enablement under 35 U.S.C. § 112 ¶ 1, and/or based on indefiniteness under 35 U.S.C. § 112 ¶ 2.

Samsung's aforementioned identification of prior art that anticipates and/or renders obvious particular claim elements, including the attached claim charts, should not be deemed as an admission that any claim element satisfies the requirements of 35 U.S.C. § 112. While Samsung asserts below that a claim is invalid under 35 U.S.C. § 112 (such as because of a failure to particularly point out and distinctly claim the alleged invention, failure to provide written description support in the specification, and/or failure to enable one of ordinary skill in the art to make and use the alleged invention), Samsung has nonetheless provided prior art disclosures that anticipate or render obvious the claim on the assumption that Pictiva will contend those claims are definite, are supported by an adequate written description, and are adequately enabled.

A. <u>Lack of Written Description and Enablement Under 35 U.S.C. § 112 ¶ 1</u>

Certain claims in the Asserted Patents are invalid for lack of written description. Section 112 requires that a patent specification "contain a written description . . . of the manner and process of making and using [the invention] in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same." 35 U.S.C. § 112 ¶ 1. A patent's written description "must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). The disclosure must "convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* The level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology, but a "mere wish or plan" for obtaining the alleged invention does not satisfy the written description requirement. *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1344 (Fed. Cir. 2013). Put another way, "a description that

merely renders the invention obvious does not satisfy the requirement." *Ariad*, 598 F.3d at 1351. Instead, "all the limitations must appear in the specification." *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997). Samsung contends that, at least under Pictiva's actual and/or apparent application of the claims, the specifications of at least one or more of the Asserted Patents do not include a sufficient written description supporting the claims. Moreover, Samsung contends that Pictiva's actual and/or apparent application of the Asserted Claims covers a broader scope than is justified and/or supported by the written description provided in the specifications of at least one or more of the Asserted Patents. *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1159 (Fed. Cir. 1998); *LizardTech, Inc. v. Earth Res. Mapping, Inc.*, 424 F.3d 1336, 1346 (Fed. Cir. 2005); *ICU Med., Inc. v. Alaris Med. Sys., Inc.*, 558 F.3d 1368 (Fed. Cir. 2009).

Section 112 likewise requires that the specification "enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the" alleged invention. 35 U.S.C. § 112 ¶ 1. A claim is not enabled if, "at the effective filing date of the patent, one of ordinary skill in the art could not practice their full scope without undue experimentation." *Wyeth and Cordis Corp. v. Abbott Labs.*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). "This important doctrine prevents both inadequate disclosure of an invention and overbroad claiming that might otherwise attempt to cover more than was actually invented." *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1381 (Fed. Cir. 2012). Samsung contends that, at least under Pictiva's actual and/or apparent application of the claims, the specifications of at least one or more of the Asserted Patents do not enable any person skilled in the relevant art to make and use the alleged inventions of the Asserted Claims without undue experimentation.

Furthermore, under Pictiva's actual and/or apparent application of the claims, the specifications of at least one or more of the Asserted Patents do not enable the broad scope of the

Asserted Claims as Pictiva asserts. Samsung contends that Pictiva's actual and/or apparent application of the Asserted Claims covers a broader scope than is justified, and certainly broader than is enabled in the specifications. As explained below, the specifications of at least one or more of the Asserted Patents have not enabled a person of ordinary skill in the art at the time of the alleged invention to perform the full scope of all Asserted Claims.

Each of the asserted claims below are invalid because, at least to the extent Pictiva contends any of the following limitations should be construed to encompass Samsung's accused instrumentalities, the specifications fail to provide written description and/or an enabling disclosure of at least the following limitations:

1. '389 patent (claims 34, 35, 41, 43-46)

- **Claim 34:** "fabricated upon a substrate"
- **Claim 34:** "selectively depositing"
- **Claim 34:** "selectively depositing at least one planarization layer upon said devices"
- **Claim 34:** "selectively depositing at least one barrier layer over said planarization layer"
- **Claim 41:** "mask openings are place on top of said devices"
- **Claim 41:** "depositing at least one planarization layer upon said mask and said plurality of devices"
- **Claim 41:** "selectively depositing at least one barrier layer over said planarization layer."
- **Claim 43:** "in contact with said substrate"
- **Claim 44:** "a material substantially non-sucking to OLED substrate over the areas in between the active areas"
- **Claim 46:** "depositing an organic layer over the entire mask"

2. '547 patent (claims 1-5, 8-14)

- **Claim 1:** “an organic layer sequence which emits an electromagnetic radiation having a first wavelength spectrum during operation”
- **Claim 1**: “a structured layer disposed downstream of the organic layer sequence in a beam path of the electromagnetic radiation emitted by the organic layer sequence and including first and second regions”
- **Claim 1**: “the first regions each include a wavelength conversion layer configured to convert at least partially electromagnetic radiation having a first wavelength spectrum into an electromagnetic radiation having a second wavelength spectrum”
- **Claim 1**: “the second regions each include a filter layer which is at least partially opaque to an electromagnetic radiation having a third wavelength spectrum which corresponds to at least one part of the second wavelength spectrum”
- **Claim 1**: “the first and second regions of the structured layer are arranged laterally in a beam path of the optoelectronic device”
- **Claim 1**: “the filter layer is transparent to the electromagnetic radiation having the first wavelength spectrum”
- **Claim 2**: “the first wavelength spectrum comprises a blue wavelength range and the second wavelength spectrum comprises a yellow wavelength range”
- **Claim 3**: “the optoelectronic device has a non-yellow color impression”
- **Claim 4**: “the filter layer is configured to convert the electromagnetic radiation having the third wavelength spectrum into an electromagnetic radiation from a non-visible wavelength range”
- **Claim 5**: “the filter layer is further configured to absorb the electromagnetic radiation having the third wavelength spectrum”

- **Claim 8**: " the first regions each have a second filter layer disposed downstream of the wavelength conversion layer in the beam path of the electromagnetic radiation emitted by the organic layer sequence and which is at least partially opaque to an electromagnetic radiation having a fourth wavelength spectrum which corresponds to at least one part of the first wavelength spectrum"
- **Claim 9**: "the second filter layer is configured at least partially to absorb the electromagnetic radiation having the fourth wavelength spectrum"
- **Claim 10**: " the second filter layer is configured at least partially to reflect the electromagnetic radiation having the fourth wavelength spectrum"
- **Claim 11**: "an encapsulation one of disposed upstream and disposed downstream of the structured layer in the beam path of the electromagnetic radiation emitted by the organic layer sequence"
- **Claim 12**: "the encapsulation comprises a thin-film encapsulation"
- **Claim 13**: "the electromagnetic radiation which is emitted by the optoelectronic device corresponds to a superimposition of the electromagnetic radiation having the first wavelength spectrum and the electromagnetic radiation having the second wavelength spectrum"
- **Claim 14:** "the structured layer has at least one of striped, crossed-striped, circular, triangular, and rectangular regions"

3. '223 patent (claims 1-2, 10-14)

- **Claim 1:** "electron-conducting layer"
- **Claim 1:** "electrically conductively connected"

- **Claim 1:** “an electron-conducting layer which is arranged in such a way that it is electrically conductively connected to at least one of the electrodes”
- **Claim 1:** “central metal atom”
- **Claim 1:** “metal complex”
- **Claim 1:** “joint vaporization”
- **Claim 1:** “organic compound”
- **Claim 1:** “wherein the electron-conducting layer is obtained by joint vaporization of a metal complex, which comprises a central metal atom, with an organic compound”
- **Claim 1:** “wherein the organic compound comprises a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond”
- **Claim 2:** “coordinates”
- **Claim 2:** “due to the joint vaporization”
- **Claim 2:** “herein the organic compound coordinates to the metal complex due to the joint vaporization”
- **Claim 10:** “providing”
- **Claim 10:** “applying”
- **Claim 10**: “electron-conducting layer”
- **Claim 10:** “simultaneous vaporization”
- **Claim 10**: “deposited by means of simultaneous vaporization”
- **Claim 10**: “metal complex”
- **Claim 10**: “organic compound”
- **Claim 10:** “wherein the electron-conducting layer is deposited by means of simultaneous vaporization of a metal complex and an organic compound”

- **Claim 10:** “wherein the organic compound comprises a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond”
- **Claim 11**: “coordinates”
- **Claim 11:** “in the gas phase”
- **Claim 11:** “metal complex”
- **Claim 11**: “organic compound”
- **Claim 12:** “electron-conducting layer”
- **Claim 12:** “chain-like”
- **Claim 12:** “network-like”
- **Claim 12:** “wherein the electron-conducting layer is deposited as a chain-like or network-like structure”
- **Claim 13:** “electron-conducting layer”
- **Claim 13:** “cross-linking”
- **Claim 13:** “metal complex”
- **Claim 13:** “organic compound”
- **Claim 13:** “herein the degree of cross-linking of the electron-conducting layer is controlled by the ratio between the metal complex and the organic compound during vaporization”
- **Claim 14:** “coordinate”
- **Claim 14:** “metal complex”
- **Claim 14:** “organic compound”
- **Claim 14:** “wherein the organic compound does not coordinate to the metal complex prior to vaporization”

4. ’164 Patent (claims 1-16)

- **Claim 1:** “organic functional layer”
- **Claim 1:** “wherein the at least one organic functional layer is located between the first electrode and the second electrode”
- **Claim 1:** “matrix material”
- **Claim 1:** “first matrix material”
- **Claim 1:** “second matrix material”
- **Claim 1:** “third matrix material”
- **Claim 1:** “wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material”
- **Claim 1:** “the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material”
- **Claim 1:** “wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material”
- **Claim 1**: “emission layer”
- **Claim 1:** “emitter material”
- **Claim 1:** “wherein the organic functional layer is an emission layer and is doped with at least one emitter material”
- **Claim 2**: “wherein the first matrix material has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material”

- **Claim 3:** “wherein the second matrix material has a LUMO which is energetically higher than the LUMO of the third matrix material, and a HOMO which is energetically higher than the HOMO of the third matrix material”
- **Claim 4**: “charge carrier mobility”
- **Claim 4:** “wherein the first matrix material has a charge carrier mobility which is lower than the charge carrier mobilities of the second and third matrix materials”
- **Claim 5:** “hole transport material”
- **Claim 6:** “electron transport material”
- **Claim 7:** “wherein the organic functional layer is selected from a group which comprises emission layers, electron transport layers, hole transport layers, electron blocking layers, hole blocking layers, hole injection layers, electron injection layers, and intermediate layers”
- **Claim 8:** “wherein the emitter material in the emission layer has a concentration of ≦10 wt %”
- **Claim 9**: “wherein the concentration of the emitter material in the emission layer has a gradient”
- **Claim 10:** “wherein the LUMO of the emitter material is energetically lower than the LUMO of the first, second, and third matrix materials, and the HOMO of the emitter material is energetically higher than the HOMO of the first, second, and third matrix materials”
- **Claim 11**: “constructed as a radiation-emitting device”
- **Claim 12**: “wherein the device is selected from a group which comprises an organic light-emitting device, a solar cell, and a transistor”
- **Claim 13**: “preparation”

- **Claim 13:** “organic functional layer”
- **Claim 13**: “matrix material”
- **Claim 13:** “first matrix material”
- **Claim 13:** “second matrix material”
- **Claim 13:** “third matrix material”
- **Claim 13:** “simultaneously applied”
- **Claim 13:** “herein in method step C), at least the first matrix material, the second matrix material, and the third matrix material are simultaneously applied”
- **Claim 14**: “applied by evaporation coating”
- **Claim 15:** “organic functional layer”
- **Claim 15**: “matrix material”
- **Claim 15:** “first matrix material”
- **Claim 15:** “second matrix material”
- **Claim 15:** “third matrix material”
- **Claim 15:** “wherein the at least one organic functional layer is located between the first electrode and the second electrode”
- **Claim 15:** “wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material”
- **Claim 15:** “the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material and the LUMO of the first matrix material”

- **Claim 15:** “wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material”
- **Claim 15:** “wherein the first matrix matrial has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material”
- **Claim 16:** “organic functional layer”
- **Claim 16**: “matrix material”
- **Claim 16:** “first matrix material”
- **Claim 16:** “second matrix material”
- **Claim 16:** “third matrix material”
- **Claim 16:** “wherein the at least one organic functional layer is located between the first electrode and the second electrode”
- **Claim 16:** “wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material”
- **Claim 16:** “the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material and the LUMO of the first matrix material**”**
- **Claim 16:** “wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material”

- **Claim 16:** "wherein the first matrix material has a charge carrier mobility which is lower than the charge carrier mobilities of the second and third matrix materials"

5. '492 Patent (claims 1, 2, 6, 8-10, 16)

- **Claim 1:** "forming a first electrically conductive layer on a substrate"
- **Claim 1:** "forming a second electrically conductive layer on the first electrically conductive layer"
- **Claim 1:** "forming a first trench in the first and second electrically conductive layers"
- **Claim 1:** "wherein the first trench separates a first contact region from a second contact region"
- **Claim 1:** "applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region"
- **Claim 1:** "applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region"
- **Claim 2:** "wherein a first electrode of a capacitor is formed by the first contact region between the dielectric and the substrate and a second electrode of a capacitor is formed by the electrode layer on a side of the dielectric facing away from the first contact region."
- **Claim 3:** "a second trench and at least one third trench are formed, which delimit a resistance region,"
- **Claim 3:** "which comprises a part of the first and second electrically conductive layers and which has a taper in a direction parallel to the electrically conductive layers and which leads into the first contact region on a first side of the taper."

- **Claim 9:** “wherein the dielectric firstly is applied in a structured fashion to the second electrically conductive layer in such a way that it adjoins the first trench”
- **Claim 9:** “wherein then the dielectric is heated in such a way that it deforms and encapsulates edges and/or side surfaces of the first and second electrically conductive layers in the first trench.”
- **Claim 10:** “forming a first electrically conductive layer on a substrate”
- **Claim 10:** “forming a second electrically conductive layer on the first electrically conductive layer”
- **Claim 10:** “forming a first trench in the first and second electrically conductive layers
- **Claim 10:** “wherein the first trench separates a first contact region from a second contact region”
- **Claim 10:** “applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region”
- **Claim 10:** “applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region”
- **Claim 10**: ‘applying the dielectric in a structured fashion to the second layer such that the dielectric demarcates a component region for forming an optoelectronic component relative to the second contact region”
- **Claim 10:** “forming an optically functional layer in the component region”
- **Claim 10:** “applying the electrode layer in a structured fashion”
- **Claim 16:** “forming a first electrically conductive layer on a substrate”

- **Claim 16:** “forming a second electrically conductive layer on the first electrically conductive layer”
- **Claim 16:** “forming a first trench in the first and second electrically conductive layers
- **Claim 16:** “wherein the first trench separates a first contact region from a second contact region”
- **Claim 16:** “applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region”
- **Claim 16:** “applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region”

6. ’425 Patent (claims 1-4, 9-12, 17-18)

- **Claim 1:** “an organic layer sequence”
- **Claim 1:** “a radiation exit area”
- **Claim 1:** “an encapsulation”
- **Claim 1:** “the organic layer sequence and the encapsulation are disposed on a carrier”
- **Claim 1:** “the organic layer sequence comprises at least one radiation-emitting region configured to generate electromagnetic radiation in a spectral range from infrared radiation to UV radiation during operation”
- **Claim 1:** “the organic layer sequence comprises an electron transport layer that is n-doped”
- **Claim 1:** “the organic layer sequence comprises an emission layer comprising an iridium-containing compound”

- **Claim 2:** " the electron transport layer comprises 8-hydroxyquinolinolato-lithium"
- **Claim 3:** "at least one part of the encapsulation is formed by an insulation layer"
- **Claim 3:** "the insulation layer comprises at least one of: resin, silicon oxide, silicon nitride"
- **Claim 4:** "the encapsulation comprises a first encapsulation layer and a second encapsulation layer, the first and the second encapsulation layer each having a respective volume structure, wherein the volume structure of the second encapsulation layer is independent of the volume structure of the first encapsulation layer, and the volume structure of the second encapsulation layer has a higher amorphicity than the volume structure of the first encapsulation layer"
- **Claim 9:** "wherein the device comprises at least one touch-sensitive operating element, and wherein the at least one touch-sensitive operating element comprises at least one touch sensor"
- **Claim 10:** "the at least one touch sensor is integrated into the organic light-emitting diode"
- **Claim 12:** " the device is drivable by means of a gesture control"
- **Claim 17:** "the electron transport layer comprises at least 8-hydroxyquinolinolato-lithium"
- **Claim 18:** "at least one part of the encapsulation is formed by an insulation layer, which can contain at least one of the following electrically insulating materials: resin, silicon oxide, silicon nitride, and wherein at least one part of the encapsulation is formed by a PECVD method"

B. <u>Indefiniteness Under 35 U.S.C. § 112 ¶ 2</u>

35 U.S.C. § 112, ¶ 2 requires that a patent claim "particularly point[] out and distinctly claim[] the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. Claim terms that fail to inform those skilled in the art "with reasonable certainty . . . about the

scope of the invention" fail the definiteness requirement of 35 U.S.C. § 112, ¶ 2. *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Samsung contends that, at least under Pictiva's actual and/or apparent application of the claims, the Asserted Claims of the Asserted Patents fail to distinctly claim what the inventors regard as their alleged invention.

Each of the asserted claims are invalid as indefinite under 35 U.S.C. § 112 because they fail to particularly point out and distinctly claim the subject matter which the applicant regards as his invention. In particular, the following limitations, read in light of the intrinsic evidence, fail to inform those skilled in the art with reasonable certainty about the scope of the claimed inventions:

1. '389 Patent (claims 34, 35, 41, 43-46;)

- **Claim 34:** "encapsulating a plurality of devices"
- **Claim 34:** "fabricated upon a substrate"
- **Claim 34:** "selectively depositing"
- **Claim 34:** "selectively depositing at least one planarization layer upon said devices"
- **Claim 34:** "selectively depositing at least one barrier layer over said planarization layer"
- **Claim 41:** "encapsulating a plurality of devices"
- **Claim 41:** "depositing a mask on top of said substrate"
- **Claim 41:** "mask openings are place on top of said devices"
- **Claim 41:** "depositing at least one planarization layer upon said mask and said plurality of devices"
- **Claim 41:** "selectively depositing at least one barrier layer over said planarization layer."
- **Claim 43:** "in contact with said substrate"
- **Claim 44:** "a material substantially non-sucking to OLED substrate over the areas in between the active areas"

- **Claim 46:** “depositing an organic layer over the entire mask”

2. ’547 patent (claims 1-5, 8-14)

- **Claims 1:** “an organic layer sequence which emits an electromagnetic radiation having a first wavelength spectrum during operation”
- **Claim 1**: “a structured layer disposed downstream of the organic layer sequence in a beam path of the electromagnetic radiation emitted by the organic layer sequence and including first and second regions”
- **Claim 1**: “the first regions each include a wavelength conversion layer configured to convert at least partially electromagnetic radiation having a first wavelength spectrum into an electromagnetic radiation having a second wavelength spectrum”
- **Claim 1**: “the second regions each include a filter layer which is at least partially opaque to an electromagnetic radiation having a third wavelength spectrum which corresponds to at least one part of the second wavelength spectrum”
- **Claim 1**: “the first and second regions of the structured layer are arranged laterally in a beam path of the optoelectronic device”
- **Claim 1**: “the filter layer is transparent to the electromagnetic radiation having the first wavelength spectrum”
- **Claim 2**: “the first wavelength spectrum comprises a blue wavelength range and the second wavelength spectrum comprises a yellow wavelength range”
- **Claim 3**: “the optoelectronic device has a non-yellow color impression”
- **Claim 4**: “the filter layer is configured to convert the electromagnetic radiation having the third wavelength spectrum into an electromagnetic radiation from a non-visible wavelength range”

- **Claim 5**: “the filter layer is further configured to absorb the electromagnetic radiation having the third wavelength spectrum”
- **Claim 8**: “ the first regions each have a second filter layer disposed downstream of the wavelength conversion layer in the beam path of the electromagnetic radiation emitted by the organic layer sequence and which is at least partially opaque to an electromagnetic radiation having a fourth wavelength spectrum which corresponds to at least one part of the first wavelength spectrum”
- **Claim 9**: “the second filter layer is configured at least partially to absorb the electromagnetic radiation having the fourth wavelength spectrum”
- **Claim 10**: “ the second filter layer is configured at least partially to reflect the electromagnetic radiation having the fourth wavelength spectrum”
- **Claim 11**: “an encapsulation one of disposed upstream and disposed downstream of the structured layer in the beam path of the electromagnetic radiation emitted by the organic layer sequence”
- **Claim 12**: “the encapsulation comprises a thin-film encapsulation”
- **Claim 13**: “the electromagnetic radiation which is emitted by the optoelectronic device corresponds to a superimposition of the electromagnetic radiation having the first wavelength spectrum and the electromagnetic radiation having the second wavelength spectrum”
- **Claim 14:** “the structured layer has at least one of striped, crossed-striped, circular, triangular, and rectangular regions”

3. ’223 patent (claims 1-2, 10-14)

- **Claim 1:** “electron-conducting layer”

- **Claim 1:** “electrically conductively connected”
- **Claim 1:** “an electron-conducting layer which is arranged in such a way that it is electrically conductively connected to at least one of the electrodes”
- **Claim 1:** “central metal atom”
- **Claim 1:** “metal complex”
- **Claim 1:** “joint vaporization”
- **Claim 1:** “organic compound”
- **Claim 1:** “wherein the electron-conducting layer is obtained by joint vaporization of a metal complex, which comprises a central metal atom, with an organic compound”
- **Claim 1:** “wherein the organic compound comprises a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond”
- **Claim 2:** “coordinates”
- **Claim 2:** “due to the joint vaporization”
- **Claim 2:** “herein the organic compound coordinates to the metal complex due to the joint vaporization”
- **Claim 10:** “providing”
- **Claim 10:** “applying”
- **Claim 10**: “electron-conducting layer”
- **Claim 10:** “simultaneous vaporization”
- **Claim 10**: “deposited by means of simultaneous vaporization”
- **Claim 10**: “metal complex”
- **Claim 10**: “organic compound”

- **Claim 10:** “wherein the electron-conducting layer is deposited by means of simultaneous vaporization of a metal complex and an organic compound”
- **Claim 10:** “wherein the organic compound comprises a heteroaromatic compound which is conjugated with an aromatic compound via a C—C bond”
- **Claim 11**: “coordinates”
- **Claim 11:** “in the gas phase”
- **Claim 11:** “metal complex”
- **Claim 11**: “organic compound”
- **Claim 12:** “electron-conducting layer”
- **Claim 12:** “chain-like”
- **Claim 12:** “network-like”
- **Claim 12:** “wherein the electron-conducting layer is deposited as a chain-like or network-like structure”
- **Claim 13:** “electron-conducting layer”
- **Claim 13:** “cross-linking”
- **Claim 13:** “metal complex”
- **Claim 13:** “organic compound”
- **Claim 13:** “herein the degree of cross-linking of the electron-conducting layer is controlled by the ratio between the metal complex and the organic compound during vaporization”
- **Claim 14:** “coordinate”
- **Claim 14:** “metal complex”
- **Claim 14:** “organic compound”

- **Claim 14:** "wherein the organic compound does not coordinate to the metal complex prior to vaporization"

4. '164 Patent (claims 1-16)

- **Claim 1:** "organic functional layer"
- **Claim 1:** "wherein the at least one organic functional layer is located between the first electrode and the second electrode"
- **Claim 1:** "matrix material"
- **Claim 1:** "first matrix material"
- **Claim 1:** "second matrix material"
- **Claim 1:** "third matrix material"
- **Claim 1:** "wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material"
- **Claim 1:** "the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material"
- **Claim 1:** "wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material"
- **Claim 1**: "emission layer"
- **Claim 1:** "emitter material"
- **Claim 1:** "wherein the organic functional layer is an emission layer and is doped with at least one emitter material"
- **Claim 2**: "wherein the first matrix material has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and

a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material"

- **Claim 3:** "wherein the second matrix material has a LUMO which is energetically higher than the LUMO of the third matrix material, and a HOMO which is energetically higher than the HOMO of the third matrix material"
- **Claim 4**: "charge carrier mobility"
- **Claim 4:** "wherein the first matrix material has a charge carrier mobility which is lower than the charge carrier mobilities of the second and third matrix materials"
- **Claim 5:** "hole transport material"
- **Claim 6:** "electron transport material"
- **Claim 7:** "wherein the organic functional layer is selected from a group which comprises emission layers, electron transport layers, hole transport layers, electron blocking layers, hole blocking layers, hole injection layers, electron injection layers, and intermediate layers"
- **Claim 8:** "wherein the emitter material in the emission layer has a concentration of ≦10 wt %"
- **Claim 9**: "wherein the concentration of the emitter material in the emission layer has a gradient"
- **Claim 10:** "wherein the LUMO of the emitter material is energetically lower than the LUMO of the first, second, and third matrix materials, and the HOMO of the emitter material is energetically higher than the HOMO of the first, second, and third matrix materials"
- **Claim 11**: "constructed as a radiation-emitting device"

- **Claim 12**: “wherein the device is selected from a group which comprises an organic light-emitting device, a solar cell, and a transistor”
- **Claim 13**: “preparation”
- **Claim 13:** “organic functional layer”
- **Claim 13**: “matrix material”
- **Claim 13:** “first matrix material”
- **Claim 13:** “second matrix material”
- **Claim 13:** “third matrix material”
- **Claim 13:** “simultaneously applied”
- **Claim 13:** “herein in method step C), at least the first matrix material, the second matrix material, and the third matrix material are simultaneously applied”
- **Claim 14**: “applied by evaporation coating”
- **Claim 15:** “organic functional layer”
- **Claim 15**: “matrix material”
- **Claim 15:** “first matrix material”
- **Claim 15:** “second matrix material”
- **Claim 15:** “third matrix material”
- **Claim 15:** “wherein the at least one organic functional layer is located between the first electrode and the second electrode”
- **Claim 15:** “wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material”

- **Claim 15:** “the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material and the LUMO of the first matrix material”
- **Claim 15:** “wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material”
- **Claim 15:** “wherein the first matrix matrial has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material”
- **Claim 16:** “organic functional layer”
- **Claim 16**: “matrix material”
- **Claim 16:** “first matrix material”
- **Claim 16:** “second matrix material”
- **Claim 16:** “third matrix material”
- **Claim 16:** “wherein the at least one organic functional layer is located between the first electrode and the second electrode”
- **Claim 16:** “wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material”
- **Claim 16:** “the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material and the LUMO of the first matrix material**”**

- **Claim 16:** "wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material"
- **Claim 16:** "wherein the first matrix material has a charge carrier mobility which is lower than the charge carrier mobilities of the second and third matrix materials"

7. '492 Patent (claims 1, 2, 6, 8-10, 16)

- **Claim 1:** "forming a first electrically conductive layer on a substrate"
- **Claim 1:** "forming a second electrically conductive layer on the first electrically conductive layer"
- **Claim 1:** "forming a first trench in the first and second electrically conductive layers"
- **Claim 1:** "wherein the first trench separates a first contact region from a second contact region"
- **Claim 1:** "applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region"
- **Claim 1:** "applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region"
- **Claim 2:** "wherein a first electrode of a capacitor is formed by the first contact region between the dielectric and the substrate and a second electrode of a capacitor is formed by the electrode layer on a side of the dielectric facing away from the first contact region."
- **Claim 3:** "a second trench and at least one third trench are formed, which delimit a resistance region,"

- **Claim 3:** “which comprises a part of the first and second electrically conductive layers and which has a taper in a direction parallel to the electrically conductive layers and which leads into the first contact region on a first side of the taper.”
- **Claim 9:** “wherein the dielectric firstly is applied in a structured fashion to the second electrically conductive layer in such a way that it adjoins the first trench”
- **Claim 9:** “wherein then the dielectric is heated in such a way that it deforms and encapsulates edges and/or side surfaces of the first and second electrically conductive layers in the first trench.”
- **Claim 10:** “forming a first electrically conductive layer on a substrate”
- **Claim 10:** “forming a second electrically conductive layer on the first electrically conductive layer”
- **Claim 10:** “forming a first trench in the first and second electrically conductive layers
- **Claim 10:** “wherein the first trench separates a first contact region from a second contact region”
- **Claim 10:** “applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region”
- **Claim 10:** “applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region”
- **Claim 10**: ‘applying the dielectric in a structured fashion to the second layer such that the dielectric demarcates a component region for forming an optoelectronic component relative to the second contact region”

- **Claim 10:** “forming an optically functional layer in the component region”
- **Claim 10:** “applying the electrode layer in a structured fashion”
- **Claim 16:** “forming a first electrically conductive layer on a substrate”
- **Claim 16:** “forming a second electrically conductive layer on the first electrically conductive layer”
- **Claim 16:** “forming a first trench in the first and second electrically conductive layers
- **Claim 16:** “wherein the first trench separates a first contact region from a second contact region”
- **Claim 16:** “applying a dielectric in a structured fashion to the second electrically conductive layer in the first contact region and at least partly to the substrate in the first trench such that the dielectric electrically insulates the first contact region from the second contact region”
- **Claim 16:** “applying an electrically conductive electrode layer in a structured fashion to the dielectric above the first contact region and to the second contact region”

5. ’425 Patent (claims 1-4, 9-10, 12, 17-18)

- **Claim 1:** “an organic layer sequence”
- **Claim 1:** “a radiation exit area”
- **Claim 1:** “an encapsulation”
- **Claim 1:** “the organic layer sequence and the encapsulation are disposed on a carrier”
- **Claim 1:** “the organic layer sequence comprises at least one radiation-emitting region configured to generate electromagnetic radiation in a spectral range from infrared radiation to UV radiation during operation”

- **Claim 1:** “the organic layer sequence comprises an electron transport layer that is n-doped”
- **Claim 1:** “the organic layer sequence comprises an emission layer comprising an iridium-containing compound”
- **Claim 2:** “ the electron transport layer comprises 8-hydroxyquinolinolato-lithium”
- **Claim 3:** “at least one part of the encapsulation is formed by an insulation layer”
- **Claim 3:** “the insulation layer comprises at least one of: resin, silicon oxide, silicon nitride”
- **Claim 4:** “the encapsulation comprises a first encapsulation layer and a second encapsulation layer, the first and the second encapsulation layer each having a respective volume structure, wherein the volume structure of the second encapsulation layer is independent of the volume structure of the first encapsulation layer, and the volume structure of the second encapsulation layer has a higher amorphicity than the volume structure of the first encapsulation layer”
- **Claim 9:** “wherein the device comprises at least one touch-sensitive operating element, and wherein the at least one touch-sensitive operating element comprises at least one touch sensor”
- **Claim 10:** “the at least one touch sensor is integrated into the organic light-emitting diode”
- **Claim 12:** “ the device is drivable by means of a gesture control”
- **Claim 17:** “the electron transport layer comprises at least 8-hydroxyquinolinolato-lithium”
- **Claim 18:** “at least one part of the encapsulation is formed by an insulation layer, which can contain at least one of the following electrically insulating materials: resin, silicon oxide, silicon nitride, and wherein at least one part of the encapsulation is formed by a PECVD method”

VI. INVENTORSHIP

A. <u>'492 patent</u>

The Asserted Claims of the '492 patent are invalid under 35 U.S.C. §101 because Andrew Ingle did not, or at least did not alone invent the subject matter sought to be patented. In this regard, 35 U.S.C. § 101 states that "[w]hoever invents … may obtain a patent …." Here, different inventors, including at least Tilman Schlenker and Karsten Heuser.

The Ingle '089 patent discloses the elements of the Asserted Claims of the '492 patent and lists as inventors all of Andrew Ingle, Tilman Schlenker and Karsten Heuser. Thus Andrew Ingle is not the proper sole inventor of the '492 patent.

B. <u>'425 patent</u>

The Asserted Claims of the '425 patent are invalid under 35 U.S.C. §101 because Ulrich Kastner-Jung, Markus Klein, Stan Maes, Romana Sigl, Annette Haid, Stephan Lintner, Julian Herget, Gregor Matjan did not, or at least did not alone invent the subject matter sought to be patented. In this regard, 35 U.S.C. § 101 states that "[w]hoever invents … may obtain a patent …." Here, different inventors, including at least Dieter Lang, Georg Lechermann, Michael Reithmeier, Carsten Plumeyer, Makarand Chipalkatti, Udo Custodis, Diane Seymour, Karsten Diekmann, and Dmytro Poplavskyy.

The Diekmann '323 patent application discloses the elements of the Asserted Claims of the '425 patent and lists as inventors all of Dieter Lang, Georg Lechermann, Michael Reithmeier, Carsten Plumeyer, Makarand Chipalkatti, Udo Custodis, Diane Seymour, Karsten Diekmann, and Dmytro Poplavskyy. Thus Ulrich Kastner-Jung, Markus Klein, Stan Maes, Romana Sigl, Annette Haid, Stephan Lintner, Julian Herget, Gregor Matjan is not the proper sole inventor of the '425 patent.

VII. INEQUITABLE CONDUCT

A. <u>’425 patent</u>

The ’425 patent is unenforceable based on inequitable conduct for at least the following reasons.

The asserted claims of the ’425 patent are unenforceable due to one or more of the individuals associated with the filing or prosecution of the patent application that became the ’425 patent failing to comply with the duty to disclose to the U.S. Patent and Trademark Office all information known to that individual to be material to patentability, resulting in inequitable conduct. During prosecution, one or more of the individuals associated with the filing or prosecution of the patent application that became the ’425 patent failed to comply with the duty to disclose to the U.S. Patent and Trademark Office all information known to that individual to be material to patentability, as they withheld the materiality of the Diekmann ’323 patent application to the issued claims and also included improper inventors for the ’425 patent. The ’425 patent is a continuation of Application No. 16/790,198 (“’198 Application”), which is a continuation of Application No. 15/651,508 (“’508 Application”), which is a continuation of Application No. 13/139,514 (“’514 Application”), filed as PCT Application No. PCT/DE2009/001741 on December 9, 2009. During prosecution of the ’514 Application, the then-pending claims were subject to numerous Section 112 and 103 rejections, including a rejection of some claims as anticipated by, or obvious over, Diekmann in view of other references. Specifically, the Examiner determined that Diekmann teaches an “organic light-emitting diode” comprising a “plurality of functional layers” with “at least one radiation-emitting region in which electromagnetic radiation is generated . . . in the spectral range from infrared radiation to UV radiation during operation,” an “encapsulation” with layers having “unique volume structure,” comprising “silicon oxide and silicon nitride,” and formed by a “PECVD method.” *Id.*, 1406–1411. The Examiner also indicated

that some claims were allowable because they included features not taught by the references of record. The allowed claims included narrowly defined limitations such as a "first encapsulation layer being in crystalline or poly-crystalline form and having lattice defects which form a permeation path for moisture and/or oxygen" and a "second encapsulation layer is amorphous and does not continue the lattice defects of the first encapsulation layer." Applicants did not dispute the Examiner's findings. Instead, Applicants amended the claims so each independent claim included the allowable subject matter identified by the Examiner, and the claims were allowed. *Id.*, 2038–2042, 2050–2056. Thus, the '514 Application claims were only allowed over Diekmann because they included highly specific limitations about encapsulation or pre-encapsulation layers. During prosecution, the '198 Application was reassigned to a different Examiner who withdrew all rejections and allowed the claims to issue. The same Examiner allowed the '425 Patent to issue without any rejections.

The individuals associated with the filing or prosecution of the patent application that became the '425 patent knew Diekmann '323 was material to the pending claims in the '425 patent as the '514 Examiner considered it highly relevant to the claims of the '514 Application with substantively identical limitations to those in the '425 Patent. OSRAM, the named inventors of the '425 patent, and the individuals responsible for prosecuting the '425 patent knew the '425 patent subject matter that was not invented by the named inventors but was instead invented by other inventors named in OSRAM assigned Diekmann '323 patent application. Diekmann '323 was commonly owned and assigned to OSRAM when OSRAM filed the '425 patent application. OSRAM, the named inventors of the '425 patent, and the individuals associated with the filing or prosecution of the '425 patent committed inequitable conduct by failing to identify the proper

named inventors in the ’425 patent and by obtaining claims that were identical in scope to Diekmann ’323.

B. <u>’164 patent</u>

The ’164 patent is unenforceable based on inequitable conduct for at least the following reasons.

The asserted claims of the ’164 patent are unenforceable due to one or more of the individuals associated with the filing or prosecution of the patent application that became the ’164 patent failing to comply with the duty to disclose to the U.S. Patent and Trademark Office all information known to that individual to be material to patentability, resulting in inequitable conduct. During prosecution, one or more of the individuals associated with the filing or prosecution of the patent application that became the ’164 patent failed to comply with the duty to disclose to the U.S. Patent and Trademark Office all information known to that individual to be material to patentability, as they withheld the materiality of U.S. Patent Publication No. 2007/0069636 (“Choulis”) to the issued claims and also included improper inventors for the ’164 patent. As described in more detail in Ex. D-2, Choulis anticipates and renders obvious each asserted claim of the ’164 patent.

The individuals associated with the filing or prosecution of the patent application that became the ’164 patent knew Choulis was material to the pending claims in the ’164 patent as Choulis disclosed all relevant limitations of the pending claims, in particular the claimed HOMO and LUMO values of matrix materials and dopants. *E.g.*, Choulis at Fig. 4. OSRAM, the named inventors of the ’164 patent, and the individuals responsible for prosecuting the ’164 patent knew the ’164 patent subject matter that was not invented by the named inventors but was instead invented by other inventors named in the OSRAM-assigned Choulis application. Choulis was

commonly owned and assigned to OSRAM when OSRAM filed the ’164 patent application. OSRAM, the named inventors of the ’164 patent, and the individuals associated with the filing or prosecution of the ’164 patent committed inequitable conduct by failing to identify the proper named inventors in the ’164 patent and by obtaining claims that were identical in scope to Choulis.

VIII. DOCUMENT PRODUCTION

Pursuant to Patent Rule 3-4, Samsung is concurrently producing the prior art identified in these Invalidity Contentions.

In addition, based on investigations to date, Samsung is concurrently documentation sufficient to show the operation of any aspects or elements of the Accused Instrumentalities identified by Pictiva in its P.R. 3-1(c) chart.

Samsung reserves the right to supplement these productions with additional documentation, in accordance with the Federal Rules of Civil Procedure, the Local Rules, the Court’s orders and other applicable rules and statutes.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that all counsel of record who have consented to electronic service are being served with a copy of the document by electronic mail on this 11th day of June, 2024.

*/s/ Lance Yang*_____
Lance Yang