

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

PICTIVA DISPLAYS INTERNATIONAL
LTD., *ET AL.*,

Plaintiffs,

vs.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA,
INC.,

Defendants.

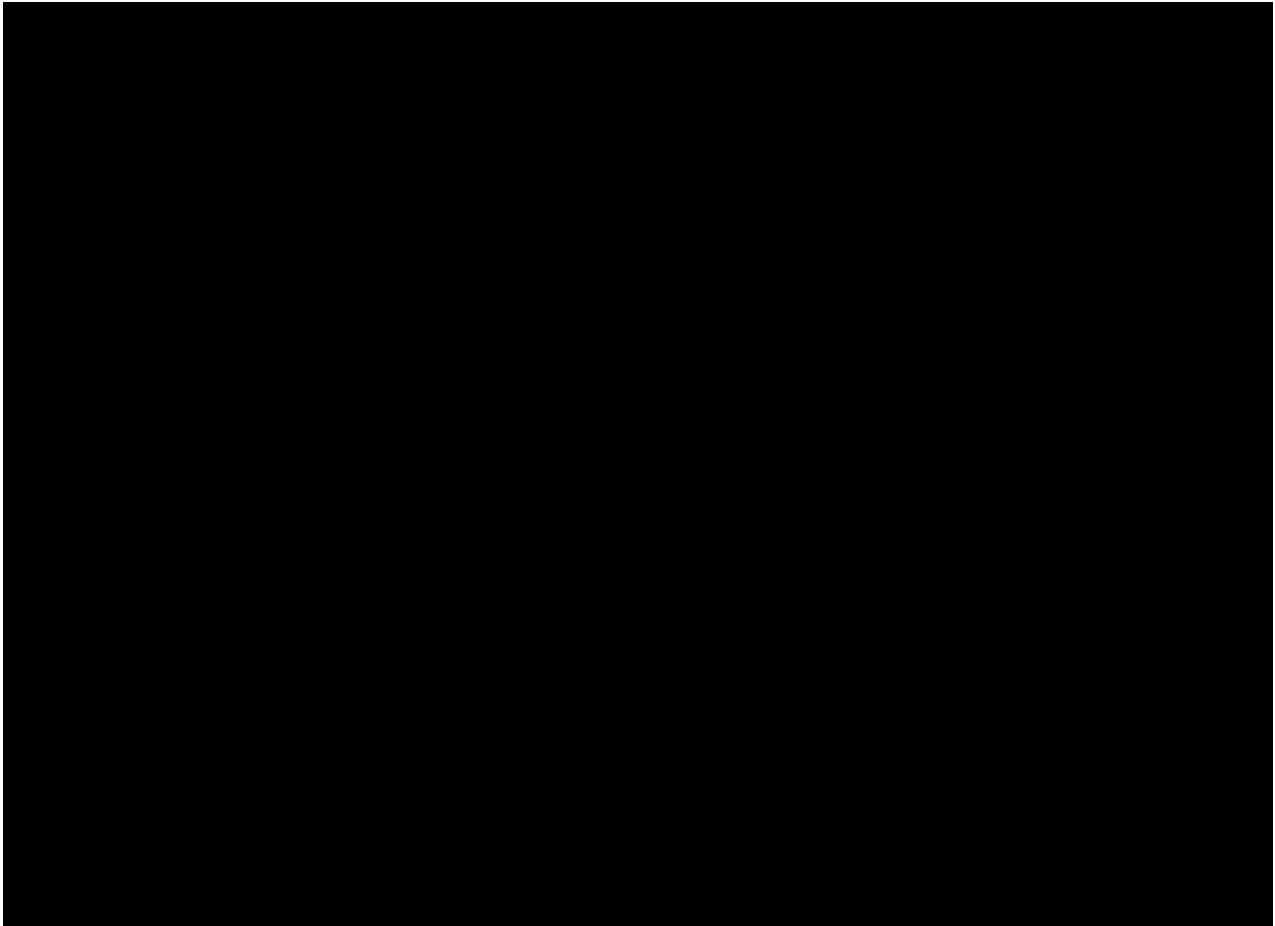
Civil Action Nos.
2:23-cv-00945-JRG
2:24-cv-00532-JRG

**EXPERT REPORT OF IOANNIS KYMISSIS, PH.D.,
REGARDING THE NON-INFRINGEMENT OF
U.S. PATENT NOS. 8,558,223 AND 8,723,164**

the writing of this report, I understand that the Court has not yet issued a claim construction order.

77. In the event that the Court adopts Samsung’s proposed construction of “metal complex,” Liq and other metal complexes accused by Dr. Schanze would not qualify as claimed “metal complexes,” because they contain an oxygen atom.

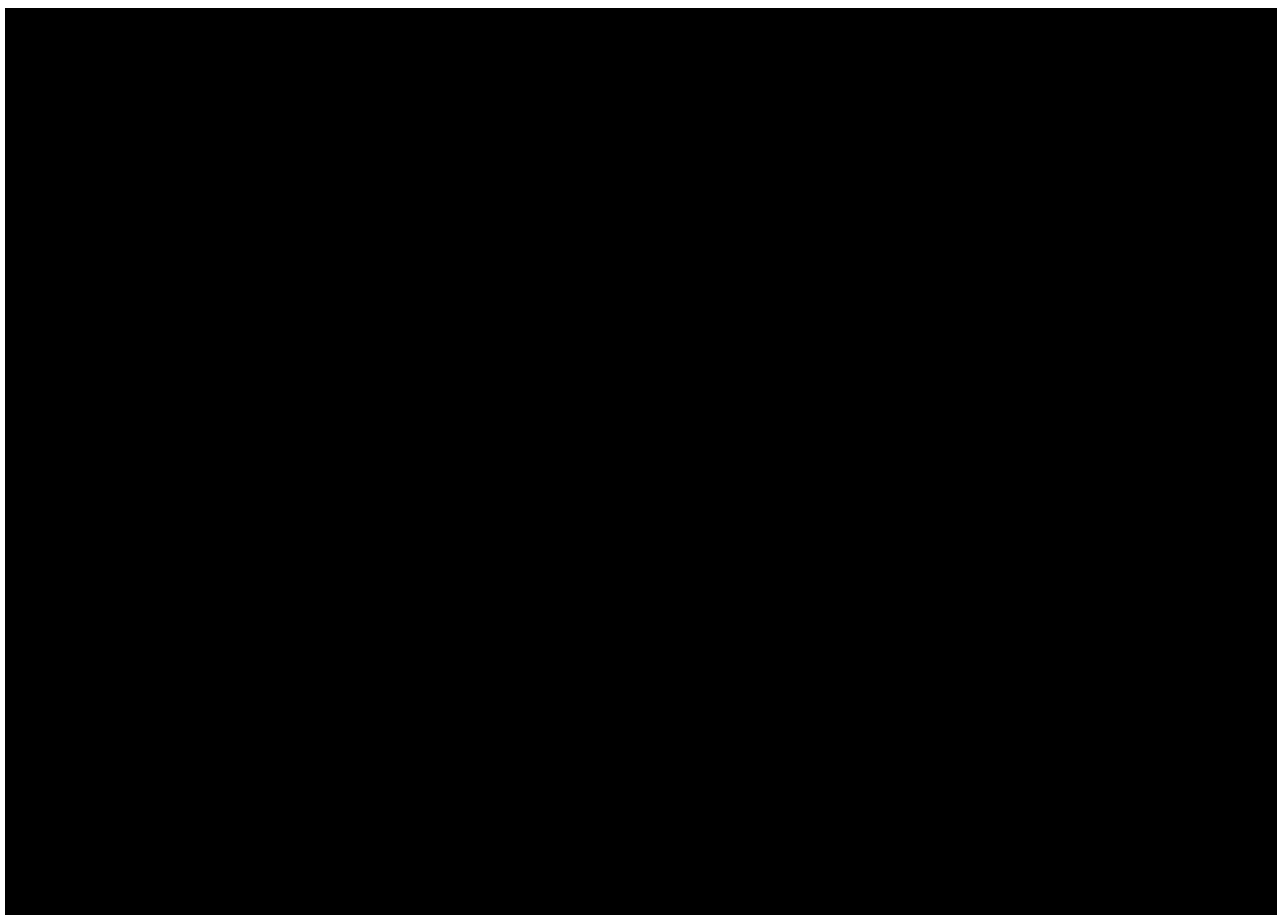
78. Liq contains an oxygen atom and is therefore not a claimed “metal complex” under Samsung’s proposed claim construction.⁵⁷



⁵⁷ SDC_00074296.

2. Lithium Is Not Centrally Located in Liq

100. The lithium atom in Liq is not located at the center of the molecule, but rather on an arm on the side:⁷⁷

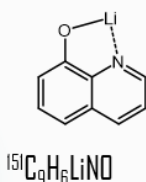


⁷⁷ SDC_00074296.

101. Dr. Schanze’s cited material agrees with the location of the lithium atom in Liq.⁷⁸

Molecular Fragments – 151 (ETL)

45



Positive Secondary Ions	Negative Secondary Ions
⁷ Li ⁺ *, ¹⁵¹ [Liq] ⁺ *, ¹⁵⁸ [Li ₂ q] ⁺ *, ³⁰⁹ [Li ₃ q ₂] ⁺ *, ⁴⁶⁰ [Li ₄ q ₃] ⁺ *	¹⁴⁴ [q] ⁻ *, ²⁹⁵ [Liq ₂] ⁻ *
GCIB-TOF-SIMS	*Matching Ions

NovaTeq Teardown

102. A POSITA would first note that the lithium atom in Liq occupies a position dictated by its strong ionic attraction to both the nitrogen and oxygen atoms of the quinolinolate ligand, rather than being situated at the center of the ring system. This chelating geometry pulls lithium toward one edge of the molecule, aligning it closer to the donor sites and away from a hypothetical molecular center. Such an off-center arrangement contrasts with classical coordination complexes where a metal is encircled symmetrically by ligands.

⁷⁸ PICTIVA00042502 at 42545.

103. Additionally, the aromaticity of the quinolinolate ring structure means that the planar arrangement of the ring carbons, nitrogen, and oxygen does not include lithium in that same plane. The aromatic ring framework remains distinctly flat, while the lithium lies slightly outside or above the plane of the ring in order to form stable coordinate bonds with the heteroatoms. This geometric configuration underscores that lithium is not central or equidistant from the ring atoms.

104. Moreover, in Liq, the lithium atom is engaged in a two-point chelation with one nitrogen atom and one oxygen atom, producing what is essentially a five- or six-membered chelate ring. There is neither a symmetrical distribution of donor atoms around lithium nor a classical octahedral, tetrahedral, or square-planar arrangement, indicating that the lithium atom is not “central” in any sense relevant to the ’223 patent.

105. Finally, the small ionic radius of lithium and its single positive charge drive it toward tight binding with the negatively charged atoms rather than favoring a large, centralized binding mode. The coordinating atoms exert a focused pull on the lithium cation, resulting in a localized binding pocket within the molecule. Rather than balancing equidistant ligands in a central arrangement, the lithium in Liq occupies a localized pocket near the heteroatoms, reinforcing that it is in no way centrally located.

3. Lithium Does Not Enable Liq to Coordinate with Additional Ligands

106. The ’223 patent specification describes the role of the central metal atom in providing “free coordination sites” for the metal complex: “During or after coordination of the organic compound, preferably none of the previously present ligands of the metal complex is separated, thus, no ligand exchange takes place. So, the metal complex is able to accept further additional ligands and thus *comprises at the central atom free coordination sites which can be occupied by further ligands.*”⁷⁹

107. However, directly to the contrary, the lithium atom in Liq does not perform this critical role for the “central metal atom,” which would indicate to a POSITA that it is not a “central metal atom” as described and claimed in the ’223 patent.

108. First, a POSITA would recognize that the lithium atom in Liq exists as a Li^+ cation that is already stabilized by strong ionic interactions with the quinolinolate ligand. This stabilization results in a fully occupied coordination sphere that leaves no vacant orbitals for the addition of other ligands. The intrinsic cationic nature of lithium after electron loss makes further coordination unlikely

⁷⁹ ’223 patent at 2:21-27 (emphasis added).

because the ion is effectively “satisfied” by the current ligand arrangement. This analysis is true regardless of what claim construction of “coordinate[s]” is applied.

109. Second, the quinolinolate ligand in Liq forms a robust chelating environment around the lithium ion, resulting in a well-defined and saturated coordination structure. The strong binding interactions and geometry provided by the chelation impede the approach and binding of other potential ligands. This coordinative saturation means that any additional ligand would have to compete with the already strong and energetically favorable bonds established by the quinolinolate ligand.

110. Third, due to its small ionic radius and the nature of its valence orbital, lithium typically exhibits a limited coordination number and favors simple, predictable coordination geometries. The compact nature of the Li^+ ion contributes to the formation of a stable Liq molecule that does not readily accommodate extra ligands without significant perturbation of its electronic structure. Lithium’s tight electron cloud not only intensifies charge density but also leaves little spatial room for additional ligands, further discouraging coordination.

111. Fourth, from a thermodynamic and kinetic perspective, a POSITA would appreciate that disrupting the stable Li–quinolinolate interaction to allow additional ligand coordination is not favorable. The energy required to break or modify the existing ionic bonds far outweighs any potential benefit that might be

gained from binding an extra ligand. This energetic barrier, along with steric constraints imposed by the ligand framework, ensures that the lithium atom remains locked in its current coordination state rather than acting as a site for further ligand coordination.

112. Fifth, the extremely low molecular weight of lithium significantly limits its ability to facilitate the coordination of Liq with additional ligands. With an atomic weight of approximately 7 atomic mass units, lithium has a minimal electron cloud and limited orbital capacity compared to heavier metals. This low molecular mass correlates with a scarcity of available electron density for additional bonding interactions. As a consequence, lithium’s light and compact nature does not support the formation of further coordination bonds beyond those already present in Liq. Its valence shell consists only of the 2s orbital, so it has no low-lying d orbitals that could be recruited to enlarge its coordination sphere; second-row elements in general cannot “expand the octet” for precisely this reason. A standard undergraduate text on chemical bonding spells the point out explicitly, noting that “expansion of the valence shell is impossible for an atom in the second period because there is no such thing as a 2d orbital.”⁸⁰ By contrast, the preferred central

⁸⁰ LibreTexts Chemistry, 7.2: Exceptions to the Octet Rule, https://chem.libretexts.org/Bookshelves/General_Chemistry/ChemPRIME_%28Moore_et_al.%29/07%3A_Further_Aspects_of_Covalent_Bonding/7.02%3A_Exceptions_to_the_Octet_Rule.

metal atoms described by the ’223 patent, Cr, Mo, and W, all have significantly higher molecular weight and consequently higher orbital capacity.

4. Lithium Does Not Enable Liq to Have a High Disposition and Ability to Provide “Free” Electrons

113. The ’223 patent specification directly links the claimed central metal atom to the ability of its containing metal complex to have a “high disposition and ability to provide ‘free’ electrons” for use in coordinate bonds:⁸¹

In this case, W is a preferred central metal atom. It is particularly preferred if all of the central atoms in the metal complex are W. The elements Cr, Mo and W prove to be particularly advantageous for two reasons. On the one hand, they have the ability to coordinate with additional ligands and on the other hand, with a suitable selection of the ligands, their metal complexes have a very low ionization enthalpy. ***This means that these metal complexes have a high disposition and ability to provide “free” electrons.*** These electrons can be transferred for example to the additionally bonded ligands.

114. However, directly to the contrary, the lithium atom in Liq does not perform this critical role for the “central metal atom,” which would indicate to a POSITA that it is not a “central metal atom” as described and claimed in the ’223 patent.

115. First, a POSITA would understand that the lithium atom in Liq exists in a fully ionized state. In this compound, lithium is present as a Li⁺ cation, having already lost its single valence electron, which means it does not have extra, “free”

⁸¹ ’223 patent at 3:4-14 (emphasis added).

electrons available for further coordination. The loss of the valence electron and stabilization as a closed-shell cation precludes the possibility of being an active electron donor in coordination interactions.

116. Second, it is important to note the inherent chemical properties of lithium as an alkali metal. Because lithium is highly electropositive, its small ionic size and high charge density drive it to form strong ionic bonds with the anionic ligands. In Liq, the lithium ion is held in place by its robust electrostatic attractions with the electron-rich oxygen and nitrogen atoms of the ligand, which do not leave it with mobile electrons that could be utilized in additional coordination.

117. Third, the ligand environment of Liq reinforces the cationic nature of the lithium atom rather than promoting a disposition for free-electron donation. The quinolinolato ligand forms a stable complex with lithium, and this stabilization is achieved by drawing electron density toward the ligand's heteroatoms rather than away from lithium. Thus, the electronic structure of the complex is such that lithium's contribution to conductivity or additional electron donation is minimal or nonexistent.

118. Fourth, from a materials and device perspective, a POSITA would note that the design of organic electronics as taught in the '223 patent relies on components that inherently provide additional mobile electrons through specific mechanisms like metal–ligand charge transfer. In Liq, lithium is already in a closed-

shell Li^+ state tightly bound within its ligand framework, and does not offer additional “free” electrons. Consequently, lithium in this context would not be considered as having a high disposition and ability to supply free electrons for further coordination in the way that is beneficial for the intended electron transport enhancements.

5. For Similar Reasons, Metals in the Accused EML Metal Complexes Are Not Central Metal Atom

119. Dr. Schanze opines that “the jointly vaporized materials comprising the electron-conducting layer in Samsung’s accused products includes a metal complex, which comprises a central metal atom (e.g., Liq in the case of the METL, or Ir/Pt metal complexes in the case of the R/G-EMLs).”⁸² However, Dr. Schanze does not describe why any Ir or Pt atom in the accused EMLs is a “central metal atom” as described and claimed.

120. To the contrary, these are not “central metal atoms,” for reasons substantially similar to that reviewed above for Liq. A POSITA skilled in coordination chemistry would first observe that the iridium and platinum atoms found in phosphorescent red and green dopants are embedded in highly chelated complexes whose primary purpose is to harvest triplet excitons, not to act as expandable coordination nodes. In a typical red-emitting tris-cyclometallated Ir

⁸² Schanze Report Ex. C ¶ 47.

point to somehow be about the second point. But every instance of Mr. Noh's deposition testimony that Mr. Humphrey cites on this issue is uniformly talking about the process for depositing a single layer, and the diffusion of materials within that single layer. For example, Mr. Humphrey states that "[t]he red emitter may diffuse *into organic layers*."¹⁸⁷ Then Mr. Humphrey cites to three sections of Mr. Noh's deposition transcript, but all three of them are about how a host and dopant in a single EML layer may be intermixed.¹⁸⁸

242. Third, Dr. Schanze's opinion is not supported by any empirical evidence. Dr. Schanze does not claim to have inspected any of the accused EMLs to determine if his diffusion theory is correct. He could have performed teardowns or experiments to corroborate his opinion, but did not. His theories, if correct, could have been corroborated by electron microscopy or TOF-SIMS testing, among other things.

243. Fourth, the alleged diffusion of dopants from an EML into adjoining layers does not happen. SDC's manufacturing process ensures the confinement of dopant molecules within the emission layer. During sequential co-evaporation, the layers are deposited under conditions that promote the formation of sharply defined interfaces. Control over parameters such as substrate temperature and deposition

¹⁸⁷ Humphrey Report Ex. A ¶ 34 n.1.

¹⁸⁸ Noh Dep. Tr. at 61:17-20 (materials in a given layer may be mixed); 61:23-62:13 (same); 62:16-23 (same) (all cited by Mr. Humphrey).

rate plays a significant role in locking dopants into the host, thereby reducing any propensity of the dopants to migrate into adjacent layers. Once the dopant molecules have been co-evaporated with the host material, they become embedded in a molecular environment that is thermodynamically favorable, which prevents them from diffusing across the interfaces even under subsequent operating conditions. In addition to processing conditions, the molecular design of the adjacent layers contributes to the stability of the dopant's location. The interfaces between the emission layer and adjacent buffer, Prime, charge transport, or charge injection layers are engineered with materials that are chemically and morphologically distinct from those in the emission layer. These intentional differences create energy and diffusion barriers, which further inhibit any significant intermixing of dopant molecules.

244. Fifth, as another indication that the dopants from an EML do not diffuse to adjoining layers, the functionality of the EML would be compromised if this was true. The stability of the emissive dopants within their designated EML is necessary for maintaining color purity, emission efficiency, and overall device lifetime. A diffusion of dopants into neighboring layers could lead to undesirable shifts in the recombination zone or unwanted changes in the energy landscape, both of which would detract from device performance. Given the extensive body of research addressing these challenges, a POSITA would understand that careful material

789. In general, from a technical standpoint, I do not believe that Mr. Humphrey has raised any evidence that would indicate willful blindness by Defendants or SDC, or that Defendants or SDC had actual knowledge of infringement. Moreover, from a technical standpoint, there are several strong reasons to believe that neither Defendants nor SDC were willfully blind, and that neither Defendants nor SDC had actual knowledge of infringement. First, the '164 patent is invalid on its face, as I opined in my opening report. Second, the '164 patent is not infringed, and Pictiva's infringement allegations are exceptionally weak, as I opined in this report. Third, OSRAM was known to have failed at developing viable OLED display technology, and its OLED display products were generally recognized as not competitive in the marketplace.



DATED: April 21, 2025

Ioannis Kymissis, Ph.D.