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

PHENIX LONGHORN LLC, Plaintiff, v. AU OPTRONICS CORPORATION, HISENSE ELECTRONICA MEXICO, S.A. DE C.V., and DOES 1–10, Defendants.	**CIVIL ACTION NO. 2:23-cv-00477-RWS-RSP** **JURY TRIAL DEMANDED**

PLAINTIFF PHENIX LONGHORN LLC'S FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Phenix Longhorn, LLC ("Phenix") files this First Amended Complaint for infringement of U.S. Patent No. 7,233,305 ("the '305 Patent") and U.S. Patent No. 7,557,788 ("the '788 Patent") (collectively, the "Asserted Patents") against Defendants AUO Corporation f/k/a AU Optronics Corporation ("AUO"), Hisense Electronica Mexico, S.A. de C.V. ("Hisense Mexico"), and Does 1–10 (collectively, "Defendants") and alleges as follows:

NATURE OF ACTION

1. This is a patent infringement action to remedy Defendants' infringement of the Asserted Patents.

2. Phenix seeks injunctive relief and monetary damages.

THE PARTIES

3. Phenix is a limited liability company organized and existing under the laws of the State of Texas. Phenix maintains a registered agent and office located at 107 Austin Street, Martindale, Texas 78655.

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4. On information and belief, Defendant AUO is a multi-national corporation organized under the laws of the Republic of China (R.O.C. or Taiwan), with its principal place of business located at No. 1, Li-Hsin Road 2, Hsinchu Science Park, Hsinchu, 30078 Taiwan. On information and belief, AUO was previously known as "AU Optronics Corporation," the name that appears in the case caption, but changed its name to "AUO Corporation."

5. On information and belief, Defendant AUO manufacturers and sells liquid crystal display ("LCD") panel modules, including the LCD screen and the circuits that control the LCD screen. Defendant AUO sells its panels to manufacturers that incorporate Defendant AUO's panels into television sets sold and/or intended for sale throughout the United States, including the State of Texas and the Eastern District of Texas ("this District").

6. On information and belief, Defendant Hisense Mexico is a corporation organized and existing under the laws of the United Mexican States (Mexico) with a principal place of business at Boulevard Sharp 3510, Parque Industrial Rosarito, Playas de Rosarito, Baja California 22710 Mexico. On information and belief, Hisense Mexico is owned and/or controlled by Hisense Visual Technology Co., Ltd. f/k/a Hisense Electric Co., Ltd. ("Hisense Visual") and Hisense USA Corporation ("Hisense USA").

7. On information and belief, Defendant Hisense Mexico is a television manufacturer in the business of incorporating LCD panels into its products under at least the Hisense brand. On information and belief, the majority of Hisense Mexico's manufactured goods are sold in the United States, including throughout the State of Texas, and within this District, and as set forth below, Hisense Mexico has committed and continues to commit, tortious acts of infringement within and outside the State of Texas and within this District.

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8. On information and belief, and as acknowledged by Hisense Mexico in a declaration filed in this Court (Dkt. 26-1), unidentified—yet presumably known by Hisense Mexico—separate entities distribute Hisense-brand household electronics manufactured by Hisense Mexico throughout the world, including the United States. On information and belief, the referenced distribution, and importation into the United States, of many of the infringing Hisense television products is performed by Does 1–10 acting in concert with Hisense Mexico, with full knowledge by Does 1–10 and Hisense Mexico that the infringing Hisense television products are destined for importation and sale in the United States, including sales in this District. Hisense Mexico's failure to name these distributors necessitates suing the unnamed entities under the fictitious names Does 1–10 as importers of the infringing Hisense television products. Pursuant to Rule 11(b)(3), it is likely that discovery will lead to further facts supporting the foregoing allegations, and showing the manner in which Hisense Mexico is working in concert with Does 1–10.

9. On information and belief, Defendants place or contribute to placing infringing products, including one or more of those specifically accused of infringement below, into the stream of commerce via established distribution channels knowing or understanding that such products will be sold and used in the United States, including in this District.

10. On information and belief, Defendants have derived substantial revenue from infringing acts in this District, including from the sale and use of these infringing products like those specifically accused of infringement below.

11. Defendants are properly joined under 35 U.S.C. § 299(a)(2) because Defendants, through their own acts and/or through the acts of each other Defendant acting as its representative, alter ego, or agent, make, use, sell, and/or offer to sell in, and/or import into the United States the

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same or similar accused LCD panel modules that include a timing and control board and a programmable gamma integrated circuit ("Pgamma chip") with at least two banks for use in the same or similar television sets, such that questions of fact will arise that are common to all Defendants.

JURISDICTION AND VENUE

12. This is a civil action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1, including §§ 271 and 281-285.

13. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

14. Venue is proper in this judicial district pursuant to 28 U.S.C. § 1391(c). Defendants are foreign entities and may be sued in any judicial district under 28 U.S.C. § 1391(c)(3).

15. Personal jurisdiction exists generally over the Defendants because each has sufficient minimum contacts with the forum as a result of business conducted within the State of Texas and the Eastern District of Texas.

16. Personal jurisdiction exists over Defendants because they, directly or through affiliates, agents, subsidiaries, or intermediaries, make, use, sell, offer for sale, import, advertise, make available, and/or market products within the State of Texas and this District that infringe one or more claims of the Asserted Patents, as alleged more particularly below.

17. On information and belief, Defendant AUO owns and controls the subsidiary AU Optronics Corporation America, which maintains an active registration in the State of Texas under registration filing number 0800132316.

18. On information and belief, this Court has jurisdiction over the Defendants by virtue of their systematic and continuous contacts with this jurisdiction, as alleged herein, as well as because the injury to Phenix occurred in the State of Texas and the claim for relief possessed by

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Phenix against Defendants for this injury arose in the State of Texas. On information and belief, Defendants have purposely availed themselves of the privileges of conducting business within the State of Texas, such business including but not limited to: (i) at least a portion of the infringements alleged herein; (ii) purposely and voluntarily placing one or more infringing products into the stream of commerce through established distribution channels with the expectation, knowledge, and intent that those products be sold throughout the United States, including the State of Texas and this District; (iii) regularly transacting or soliciting business, engaging in other persistent courses of conduct, or deriving or attempting to derive substantial revenue and financial benefits from goods and services provided to individuals in the State of Texas and in this District. Thus, Defendants are subject to the Court's specific and general jurisdiction pursuant to due process and the Texas Long Arm Statute.

19. Personal jurisdiction also exists specifically over Hisense Mexico because Hisense Mexico, directly and through affiliates, subsidiaries, or intermediaries (including customers, distributors, retailers, alter egos, agents, and/or others) ships, distributes, offers for sale, sells, imports, advertises, or markets, or causes to be shipped, distributed, offered for sale, sold, imported, advertised, or marketed, into the United States, including into the State of Texas and into this District, one or more products that infringe the patents-in-suit, as described particularly below. Hisense Mexico has itself imported infringing Hisense television products into the United States, as described particularly below. Hisense Mexico also has purposefully and voluntarily placed one or more of its infringing Hisense television products, as described below, into the stream of commerce with the awareness and/or intent that these products will be purchased by consumers in this District. Hisense Mexico was established in Rosarito, Baja California, Mexico, to take advantage of Rosarito's proximity to the U.S. border, as described particularly below.

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Hisense-brand televisions, including those made by Hisense Mexico, are designed to conform, and do conform, with U.S. technical specifications, including FCC regulations, as described particularly below. Hisense Mexico has knowingly and purposefully sent its infringing products into the stream of commerce for sale within this District through an established distribution channel. Hisense Mexico's factory in Rosarito operates with the expectation that millions of the televisions it makes will be shipped into the U.S. each year, as described particularly below. Hisense Mexico knowingly and intentionally places its infringing Hisense television products into the stream of commerce with the awareness and intent that these infringing products will be purchased by consumers in the United States, including in this District, by assembling, manufacturing, testing, distributing, and/or selling televisions designed to conform, and that do conform, with U.S. technical specifications, as described particularly below. Hisense Mexico knowingly and intentionally induces others to directly infringe when it assembles, manufactures, and sells for importation infringing televisions intended for sale, and sold, in the United States, including in this District, as described particularly below. Hisense Mexico knowingly and intentionally induces others to directly infringe when it imports, or causes others to import, infringing products into and within the United States, including in this District, through an established distribution channel by which infringing products enter and/or have entered the United States, including this District, as described particularly below. Hisense Mexico's infringing products have been and continue to be purchased by consumers in this District.

20. Venue in this District is proper under 28 U.S.C. §§ 1400(b) and 1391(b) and (c) because Defendants are subject to personal jurisdiction in this District and have committed acts of infringement in this District. Defendants, through their own acts and/or through the acts of others acting as their representatives, alter egos, or agents, make, use, sell, and/or offer to sell infringing

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products within this District, have a continuing presence within the District, and have the requisite minimum contacts with the District such that this venue is a fair and reasonable one. On information and belief, Defendants have transacted, and at the time of the filing of the original Complaint (Dkt. 1), are continuing to transact business within this District.

THE ASSERTED PATENTS

21. The USPTO duly issued the '305 Patent, entitled "Gamma Reference Voltage Generator," on June 19, 2007, after full and fair examination of Application No. 10/746,333, which was filed on June 11, 2003. Phenix is the owner, by assignment, of all rights, title, and interest in the '305 Patent. A true and accurate copy of the '305 Patent is attached as **Exhibit A**.

22. The '788 Patent is a continuation of the '305 Patent. The USPTO duly issued the '788 Patent, entitled "Gamma Reference Voltage Generator," on July 7, 2009, after full and fair examination of Application No. 11/743,014, which was filed on May 1, 2007. Phenix is the owner, by assignment, of all rights, title, and interest in the '788 Patent. A true and accurate copy of the '788 Patent is attached as **Exhibit B**.

BACKGROUND FACTS

23. The Asserted Patents are directed to LCD panels using gamma reference voltage generator integrated circuits, also known as programmable gamma integrated circuits or "Pgamma chips." These chips are components of LCD panels and contributed to innovations in manufacturing that brought us the high-quality and low-cost LCD television sets we have today.

24. The co-inventors of the Asserted Patents, Richard V. Orlando and Trevor A. Blyth, founded the semiconductor company Alta Analog, Inc. ("Alta") in Silicon Valley in March 2002. Alta pioneered and sold the first Pgamma chip capable of generating two or more gamma reference voltage display conditions for LCD displays using an integrated circuit that would be part of a new LCD architecture.

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25. When fresh off the production line, the pictures produced from LCD panel displays vary noticeably, not only by batch, but also from display to display within the same batch. The problem is that the brightness of the pixels making up the LCD display is not a linear or straight-line function of the voltages applied. Compounding the problem is that the sensitivity of the human eye to light is also not linear. In order to obtain an acceptable LCD picture, a way is needed to drive the pixels with a voltage to correct for non-linear abnormalities. The correction is controlled by a set of voltages applied to the panel. These are gamma reference voltages, which refer to a gamma function that describes how smoothly black transitions to white on a digital display and serve to improve color and contrast.

26. The gamma reference voltages are fed to column drivers connected to LCD panels. The term column driver is a name used in the industry to refer to a specialized integrated circuit with two sets of inputs. This first input is for the digital picture data to be converted into analog voltages applied on the display column containing red, green, and blue pixels. The second input is for the gamma reference voltages coming from the gamma circuit that is used to correct or adjust the conversion occurring on the first input, resulting in the desired display condition.

27. The gamma reference voltages produce changes to the example display below using different gamma correction values:



28. Prior to the invention, gamma correction values were generated using a gamma voltage circuit that used resistor ladders. Replacing the gamma voltage circuit that existed in 2002 with an integrated circuit was a significant improvement that streamlined and saved manufacturing costs while also improving picture quality. The ’305 patent addressed the problem of providing a gamma correction solution to LCD panels by doing away with manually adjusted select-on-test resistors or other discrete components, such as, for example, microcontroller-based solutions, and replacing these components with an integrated circuit. The incorporation of the Pgamma chip also required LCD panel makers to redesign their products to accommodate the new technology and, in addition, allowed panel makers to automate the testing of their LCD products on the production line, as described in the ’788 Patent. As discussed below, Mr. Orlando made numerous trips to Asia to speak directly to Asian panel makers to promote this new LCD panel architecture.

29. Alta’s innovations in panel architecture design and manufacturing processes were adopted in Japan by Sharp Corporation, also known as Sharp Kabushiki Kaisha (“Sharp Japan”). Between 2010 and 2011, Alta sold over 200,000 units of one type of Pgamma integrated circuit to Sharp Japan for inclusion in panels for LCD television sets sold in Japan.

30. Disruption to the Japanese consumer market for television sets following the March 11, 2011, earthquake, tsunami, and nuclear disaster negatively impacted the sales of Sharp Japan and led to Alta’s bankruptcy in 2014. Alta’s patents, including the ’305 Patent and the ’788 Patent, were subsequently assigned to Phenix, where co-inventor Mr. Orlando serves as the Director and President. The panel design promoted by Mr. Orlando and used by Sharp Japan was eventually adopted by the television industry.

DEFENDANT AUO’S KNOWLEDGE OF THE ASSERTED PATENTS

31. On information and belief, AUO manufactures LCD panel modules in Asia and sells them to Hisense Mexico and others, either directly or through intermediaries. These LCD

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panel modules are incorporated by Hisense Mexico and other manufacturers into television sets. The LCD panel modules made by AUO include the LCD screen itself and electronic circuits to control the LCD screen. Electronic components that are part of the LCD panel module are mounted on one or more printed circuit boards ("PCBs" or "boards"). One of these PCBs is generally referred to as a timing and control board or "TCON" board, which is specially designed to accept one or more Pgamma integrated circuits. Placed inside the television housing, a TCON board is mated to the LCD display and bundled together. The TCON board connects to a main circuit board and to the LCD screen that displays an image to a user. Most, if not all, of the intricate timing and data control signals required to form an image on the LCD screen is performed by the TCON board. The TCON board can be a removeable board, but some functions of the TCON board, including Pgamma correction, may be located on boards permanently bonded into the LCD panel and not removeable, depending on the manufacturing process.

32. Defendant AUO's infringement of the '305 Patent and the '788 Patent is willful because Defendant has had knowledge of the Asserted Patents for over ten years.

33. The provisional patent application that became the '305 Patent was filed in June 2003, before Phenix's predecessor-in-interest Alta began to engage AUO and AUO engineers in talks regarding the use of panel architecture using Pgamma devices.

34. Alta engaged with AUO and AUO engineers regarding the use of panel architecture using Pgamma devices in 2003, 2005, 2007, and 2008; at each point, AUO declined to adopt the technology.

35. In November 2007, Alta met with AUO to present a PowerPoint slide show that specifically identified the '305 Patent.

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36. On or about June 12, 2012, AUO received product data sheets from Alta that contained technical information and a list of patents that included the ’305 Patent and the ’788 Patent.

37. Defendant AUO had knowledge of, or was willfully blind to the knowledge of, the ’305 Patent and the ’788 Patent and its infringement is willful.

38. On information and belief, despite having knowledge of the Asserted Patents and knowledge that it is infringing one or more claims of the Asserted Patents, Defendant AUO has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Defendant AUO’s infringing activities relative to the Asserted Patents have been, and continue to be, willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, and an egregious case of misconduct beyond typical infringement such that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

DEFENDANT HISENSE MEXICO’S HISTORY AND ROLE

39. On information and belief, Hisense Mexico was acquired from a Sharp Japan affiliate in July 2015 and began manufacturing television sets for import into the U.S. market. Hisense Mexico assembles and sells television sets for the U.S. market under the Hisense brand name and, for certain years, under the Sharp brand as well. These television sets have LCD screens and are popular consumer items sold through brick-and-mortar retail stores and over the Internet.

40. On information and belief, Sharp Electronica Mexico S.A. de C.V. (“Sharp Mexico”) is either the same entity as Hisense Mexico or, alternatively, is acting in concert with Hisense Mexico to cause the importation of the infringing Hisense television products into the United States.

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41. On information and belief, Sharp Mexico changed its name to "Hisense Electronica Mexico, S.A. de C.V." following the acquisition of its Rosarito facility. The acquired facility was located at Boulevard Sharp 3510, Parque Industrial Rosarito, the current address of Hisense Mexico. **Exhibit C**; **Exhibit D**. The facility was acquired by Hisense Visual, a partial subsidiary of Hisense Group Co., Ltd., involved in the research, design, development, testing, and manufacture of electronic devices, including televisions, and Hisense USA, another subsidiary of Hisense Group Co., Ltd. **Exhibit E**.

42. On information and belief, the Hisense entities invested in the Mexican manufacturing facility to target the U.S. consumer market. **Exhibit F**. For example, a Hisense CEO stated in a publicly available article that having a factory close to the U.S. border would shorten delivery times for Mexican-made televisions imported into the United States, which is a real advantage for long-term success in the U.S. market. **Exhibit G**.

43. In a publicly available article published by the China General Chamber of Commerce USA, it was estimated that, following the acquisition, the Hisense owners intended to ship as many as four million televisions into the United States from their factory in Rosarito, Baja California, each year. **Exhibit G**.

44. In a publicly available article, another source estimated that after the Hisense entities acquired the Rosarito factory, it increased its annual production capacity to 2.5 million units, and estimated it would quadruple production by 2021 to more than eight million Hisense-brand televisions each year. **Exhibit H**.

RELATED PROCEEDINGS

45. The '305 Patent was confirmed valid over an obviousness challenge brought before the Patent Trial and Appeal Board (PTAB) at the United States Patent & Trademark Office (USPTO). The challenger contended certain claims of the '305 Patent were obvious in view of

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four prior art references, either alone or in combination. The Board denied institution of the *Inter Partes* Review in its entirety. *Wistron Corporation v. Phenix Longhorn, LLC*, IPR2018-01255, Paper 14 (PTAB Jan. 24, 2019).

THE ACCUSED INSTRUMENTALITIES

46. Defendants are involved in the manufacture, use, sale (including sale for importation), offer to sell, and/or importation of LCD televisions that infringe one or more claims of the Asserted Patents.

47. On information and belief, Defendant AUO designs, manufactures, and sells LCD panel modules that include a TCON board with a programmable gamma integrated circuit, *i.e.*, Pgamma chip, with at least two banks, including but not limited to AUO-G201, AUO-G301, and AUO-G1422, which are implemented into LCD televisions. The AUO LCD panel modules that include a TCON board and a Pgamma chip with at least two banks are referred to herein as the "Infringing Panel Modules."

48. On information and belief, Defendant AUO sells the Infringing Panel Modules to Defendant Hisense Mexico (among others), who incorporates the Infringing Panel Modules into certain finished television models intended for sale and sold in the United States, and imports, or causes to be imported, finished television models incorporating the Infringing Panel Modules into the United States, including but not limited to the following: Hisense 50H6D, Hisense 50R6040E, Hisense 50R6E, Hisense 50R7E, Hisense 43H7C, Hisense 43H7C2, Hisense 55H5C, and Hisense 85A76H. All Hisense television models that incorporate the Infringing Panel Modules, including but not limited to those referenced above, are herein referred to as the "Hisense Infringing Models."

49. On information and belief, Defendant AUO sells certain of the Infringing Panel Modules to Samsung Mexicana S.A. de C.V. ("SAMEX"). On information and belief, SAMEX

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incorporates the Infringing Panel Modules into finished television models intended for sale and sold in the United States, and/or imports finished television models incorporating the Infringing Panel Modules into the United States, including but not limited to the following: Samsung UN65J6200AFXZA AA03, Samsung UN65J6300AFXZA BH02, Samsung UN65J630DAFXZA BH02, Samsung LH85QMNEBGC/ZA AA01, and Samsung LH85QMFPLGC/ZA AA01.

50. On information and belief, Defendant AUO sells certain of the Infringing Panel Modules to certain other unknown OEMs and manufacturers, who incorporate the Infringing Panel Modules into finished television models intended for, and imported into, the United States, including but not limited to the following: Vizio D55N-E2, Vizio E55-C1, Vizio E55-D0, Vizio E55U-D0, Vizio M55-D0, Vizio M55-E0, Insignia NS55DR710NA17, TCL 50UP120, Westinghouse WD50UT4300, Vizio M50-C1, and Vizio M50-D1 (collectively, the finished televisions that incorporate the Infringing Panel Modules manufactured by Hisense Mexico, SAMEX, and/or other unknown manufacturers are called the "Infringing TV Products").

51. On information and belief, Defendant AUO supplies the Infringing Panel Modules to at least Defendant Hisense Mexico, SAMEX, and other unknown manufacturers that incorporate the Infringing Panel Modules into Infringing TV Products sold throughout the United States, including the State of Texas and this District. On information and belief, the Infringing TV Products, including but not limited to the Hisense Infringing Models, are designed to incorporate and incorporate receivers (or tuners) that conform with FCC requirements and are sold and/or intended for sale in the United States. [1]

[1] The Advanced Television Systems Committee (ATSC) developed technical standards for digital television in the U.S. To comply, an LCD panel manufacturer supplies components designed to interface with an ATSC receiver (or tuner) required for the U.S. market. On information and belief, the Federal Communications Commission (FCC) mandated that after March 1, 2007, all

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52. On information and belief, Hisense-brand LCD televisions, including without limitation accused model numbers 50R6E and 50R7E, are certified by a Hisense entity for compliance with certain U.S. standards, including Part 15 of the FCC Rules. **Exhibit I**.

53. On information and belief, Defendant Hisense Mexico, SAMEX, and other unknown manufacturers test and calibrate the AUO LCD panel modules to compensate for panel to panel variations before the finished televisions are sold for importation, and/or imported into the United States.

54. Defendant AUO makes, uses, offers for sale, and sells the Infringing Panel Modules to television manufacturers that incorporate the Infringing Panel Modules into Infringing TV Products, *e.g.*, assembled televisions. Defendant Hisense Mexico, SAMEX, and other unknown television manufacturers incorporate the Infringing Panel Modules into Infringing TV Products, *e.g.*, assembled televisions, that are sold by brick-and-mortar and online retailers throughout the United States, including at least Best Buy and Amazon.

55. On information and belief, Defendant Hisense Mexico imports, and causes others (including Does 1–10) to import, the Hisense Infringing Models into the United States, including Texas and this District.

56. For example, publicly available importation records show that Hisense Mexico imported LCD televisions from Ensenada, Baja California, Mexico into the U.S. Port of San Juan, Puerto Rico. **Exhibit J**. In addition, importation records for 2021–2024 show that hundreds of shipments of LCD televisions were imported by Sharp Mexico into the United States from Hisense Mexico's facility located at Boulevard Sharp 3510, Parque Industrial Rosarito. **Exhibit K**.

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televisions regardless of screen size, and all interfaces that include a tuner (*e.g.*, VCR, DVD player/recorder, DVR) must include a built-in ATSC DTV tuner.

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57. Hisense Infringing Models, including the Hisense 50R7E, are available for purchase in the United States, including in Texas and this District, at Amazon.com. **Exhibit L**.

58. Hisense-brand LCD televisions, including but not limited to Hisense Infringing Models, bearing "Made in Mexico" stickers are available for purchase in the United States, including in Texas and this District at the Walmart located at 6801 South Broadway Avenue, Tyler, Texas 75703. **Exhibit M**.

59. Hisense USA, a subsidiary of Hisense Group Co., Ltd. advertises the Hisense Infringing Product Hisense 85A76H on its interactive website which identifies two Best Buy locations in Texas as a brick-and-mortar retailer location where this television is available for purchase. **Exhibit N**.

60. BestBuy.com identifies the Hisense 85A76H as available for purchase and pickup at 5514 South Broadway Avenue, Tyler, Texas 75703. **Exhibit O**.

61. The user manual for the Hisense 85A76H available on Hisense USA's website identifies both Hisense Mexico and Hisense USA as points of contact for customer care, maintenance, and service purposes. **Exhibit P**.

62. In summary, Defendant AUO supplies the Infringing Panel Modules to Defendant Hisense Mexico (among others), which assembles, or causes others to assemble, the Infringing Panel Modules into Infringing TV Products, and tests, or causes others to test such modules and products, and imports, or causes others (including Does 1–10) to import, the Infringing TV Products into the United States, including Texas and this District.

COUNT I: INDUCEMENT OF INFRINGEMENT OF THE '305 PATENT BY DEFENDANT AUO

63. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

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64. Defendant AUO directly and/or through subsidiaries or intermediaries, has induced and continues to induce infringement (literally or under the doctrine of equivalents) of one or more claims of the ’305 Patent. With knowledge of the ’305 Patent, Defendant AUO’s deliberate and/or willfully blind actions include, but are not limited to, actively marketing to, supplying, causing the supply to, encouraging, and instructing others such as businesses, distributors, agents, channel partners, resellers, sales representatives, and manufacturers to incorporate the Infringing Panel Modules into consumer products, including without limitation LCD televisions. These actions, individually and collectively, have induced and continue to induce the direct infringement of the ’305 Patent by others, such as television set manufacturers and assemblers, who import into the United States Infringing TV Products containing the Infringing Panel Modules. Defendant AUO knew and/or was willfully blind to the fact that the induced parties’ use, testing, making available for another’s use, promotion, marketing, distributing, importing, selling, and/or offering to sell the Infringing TV Products would infringe one or more claims of the ’305 Patent.

65. Phenix is the owner of the ’305 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the ’305 Patent against infringers, and to collect damages for all relevant times.

66. The ’305 Patent generally describes an integrated circuit used to calibrate LCDs to compensate for panel-to-panel manufacturing variations. The claims of the ’305 Patent, including Claim 1, recite a novel and inventive apparatus for producing voltage signals on a plurality of outputs comprising non-volatile storage cells, programming circuits coupled to a multiplexer that address the many inputs, drivers connected to the storage cells and outputs, and inputs connected to the multiplexer to address the storage cells, where the gamma reference voltage signals determine the driving voltages of columns of a display, the non-volatile storage cells are organized

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into banks with a predetermined gamma reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

67. For example, Claim 1 of the '305 Patent recites:

> An integrated circuit for producing Voltage signals on a plurality of outputs comprising:
>
> a plurality of non-volatile storage cells;
>
> circuits for programming coupled to a multiplexer for addressing and programming said storage cells, wherein the addressing is based on a plurality of inputs;
>
> drivers connected to said storage cells and to the plurality of outputs; and
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> the plurality of inputs connected to said multiplexer for addressing said storage cells,
>
> wherein said Voltage signals are gamma reference Voltage signals for determining actual driving Voltages of columns of a display, wherein said non-volatile storage cells are organized into two or more banks of cells wherein each bank contains a predetermined gamma reference Voltage signal display condition; and means to switch between the banks based on one or more external signals is provided on said integrated circuit.

68. The Infringing TV Products, including but not limited to Hisense 50R7E, Hisense 85A76H, Vizio D55N-E2, and Samsung UN65J6200AFXZA AA03, contain the Infringing Panel Modules, *i.e.*, AUO LCD panel modules that include a TCON board with an integrated circuit, *i.e.*, Pgamma chip, with at least two banks, including but not limited to AUO-G201, AUO-G301, AUO-G1422, for producing voltage signals on a plurality of outputs with a plurality of non-volatile storage cells and circuits for programming coupled to a multiplexer for addressing and programming said storage cells, where the addressing is based on a plurality of inputs, the drivers connect to the storage cells and the outputs, the inputs connect to the multiplexer for addressing the storage cells, the voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of display, the non-volatile storage cells are organized into banks of

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cells, each bank contains a predetermined gamma reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

69. In violation of 35 U.S.C. § 271(b), Defendant AUO has induced infringement and continues to induce infringement of one or more claims of the ’305 Patent by one or more direct infringers, either literally or by the doctrine of equivalents. Defendant AUO supplies, distributes, offers for sale, or sells the Infringing Panel Modules to Hisense Mexico, Hisense USA, Hisense Visual, SAMEX, and others who without authority use, offer to sell, or sell the Infringing Panel Modules within the United States, or import into the United States, or cause others (such as Does 1–10) to import into the United States, in violation of 35 U.S.C. § 271(a).

70. Defendant AUO has made, and continues to make, unlawful gains and profits from infringing the ’305 Patent.

71. As a consequence of Defendant AUO’s past dealings with Alta that pre-dated the filing and service of the original Complaint (Dkt. 1) as described above, Defendant AUO had knowledge of, or was willfully blind to knowledge of, the ’305 Patent and its infringement of the ’305 Patent before the filing of this lawsuit.

72. Defendant AUO has had knowledge of the ’305 Patent since at least as early as November 2007. Defendant AUO has been willfully infringing the ’305 Patent since it began designing, manufacturing, and selling its Infringing Panels.

73. Since at least as early as November 2007, Defendant AUO has actively, knowingly, and intentionally continued to induce infringement of the ’305 Patent, literally or by the doctrine of equivalents, by selling the Infringing Panel Modules to manufacturers, suppliers and/or distributors for use in the Infringing TV Products and, upon information and belief, distributing

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literature and materials inducing manufacturers, suppliers and/or distributors to use their Infringing Panel Modules in a manner that infringes one or more claims of the ’305 Patent.

COUNT II: INFRINGEMENT OF THE ’305 PATENT BY DEFENDANT HISENSE MEXICO

74. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

75. Defendant Hisense Mexico makes, uses, sells, and/or offers to sell in, and/or imports into, the United States, and knowingly and intentionally induces others to make, use, sell, offer to sell, or import into the United States, finished television sets that incorporate AUO LCD panel modules that infringe one or more claims of the Asserted Patents, including at least Claims 1, 2, and 5 of the ’305 Patent.

76. Phenix is the owner of the ’305 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the ’305 Patent against infringers, and to collect damages for all relevant times.

77. The ’305 Patent generally describes an integrated circuit used to calibrate LCDs to compensate for panel-to-panel manufacturing variations. The claims of the ’305 Patent, including Claim 1, recite a novel and inventive apparatus for producing voltage signals on a plurality of outputs comprising non-volatile storage cells, programming circuits coupled to a multiplexer that address the many inputs, drivers connected to the storage cells and outputs, and inputs connected to the multiplexer to address the storage cells, where the gamma reference voltage signals determine the driving voltages of columns of a display, the non-volatile storage cells are organized into banks with a predetermined gamma reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

78. For example, Claim 1 of the ’305 Patent recites:

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> An integrated circuit for producing voltage signals on a plurality of outputs comprising:
>
> a plurality of non-volatile storage cells;
>
> circuits for programming coupled to a multiplexer for addressing and programming said storage cells, wherein the addressing is based on a plurality of inputs;
>
> drivers connected to said storage cells and to the plurality of outputs; and
>
> the plurality of inputs connected to said multiplexer for addressing said storage cells,
>
> wherein said voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of a display, wherein said non-volatile storage cells are organized into two or more banks of cells wherein each bank contains a predetermined gamma reference voltage signal display condition; and means to switch between the banks based on one or more external signals is provided on said integrated circuit.

79. The Hisense Infringing Models each incorporate one of Defendant AUO's LCD panel modules that include a TCON board with an integrated circuit, *i.e.*, Pgamma chip, with at least two banks, for producing voltage signals on a plurality of outputs with a plurality of non-volatile storage cells and circuits for programming coupled to a multiplexer for addressing and programming said storage cells, where the addressing is based on a plurality of inputs, the drivers connect to the storage cells and the outputs, the inputs connect to the multiplexer for addressing the storage cells, the voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of display, the non-volatile storage cells are organized into banks of cells, each bank contains a predetermined gamma reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

80. In violation of 35 U.S.C. § 271(a), Defendant Hisense Mexico has directly infringed and continues to infringe the '305 Patent, either literally or by the doctrine of equivalents, by

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making, using, importing, supplying, distributing, offering for sale, or selling the Hisense Infringing Models within the United States.

81. In addition, Defendant Hisense Mexico is liable for inducement of infringement of the ’305 Patent under 35 U.S.C. § 271(b), literally or under the doctrine of equivalents, by supplying, distributing, offering for sale, and/or selling the Hisense Infringing Models to others, including but not limited to Does 1–10, who without authority use, offer to sell, or sell Hisense Infringing Models within the United States, or import into the United States, in violation of 35 U.S.C. § 271(a).

82. Defendant Hisense Mexico has made, and continues to make, unlawful gains and profits from infringing the ’305 Patent.

83. Defendant Hisense Mexico has had knowledge of the ’305 Patent and its infringing activities at least as early as the filing of the original Complaint (Dkt. 1). Nevertheless, Hisense Mexico has continued its infringement and inducement of infringement. Accordingly, Defendant has been willfully infringing the ’305 Patent at least since Phenix filed the original Complaint.

COUNT III: INDUCEMENT OF INFRINGEMENT OF THE ’788 PATENT BY DEFENDANT AUO

84. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

85. Defendant AUO directly and/or through subsidiaries or intermediaries, has induced and continues to induce infringement (literally or under the doctrine of equivalents) of one or more claims of the ’788 Patent. With knowledge of the ’788 Patent, Defendant AUO’s deliberate and/or willfully blind actions include, but are not limited to, actively marketing to, supplying, causing the supply to, encouraging, and instructing others such as businesses, distributors, agents, channel partners, resellers, sales representatives, and manufacturers to incorporate the Infringing Panel

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Modules into consumer products, including without limitation LCD televisions, and to test and use such modules and products. These actions, individually and collectively, have induced and continue to induce the direct infringement of the '788 Patent by others, such as television set manufacturers and assemblers, who import into the United States Infringing TV Products containing the Infringing Panel Modules. Defendant AUO knew and/or was willfully blind to the fact that the induced parties' use, testing, making available for another's use, promotion, marketing, distributing, importing, selling and/or offering to sell the Infringing TV Products would infringe one or more claims of the '788 Patent.

86. Phenix is the owner of the '788 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '788 Patent against infringers, and to collect damages for all relevant times.

87. The '788 Patent generally describes a method for calibrating an LCD to a desired gamma curve to compensate for panel-to-panel manufacturing variations. The claims of the '788 Patent, including Claim 1, recite a novel and inventive method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

88. For example, Claim 1 of the '788 Patent recites:

> A method of calibrating a liquid crystal display to a desired gamma curve to compensate for panel to panel manufacturing variations comprising the steps:
>
> providing said display with gamma reference control capability which is electrically reprogrammable and non-volatile;

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> testing said display with at least one sensor with optical input, wherein said sensor is separate from said display;
>
> varying gamma reference voltage levels on columns of said display by a control circuit, where said control circuit is separate from said display;
>
> optimizing said gamma reference voltage levels using means for executing a predetermined algorithm according to a predetermined criteria and data sensed by said at least one sensor, wherein said means for executing said predetermined algorithm is separate from said display to achieve the desired gamma curve; and
>
> storing said gamma reference voltage levels in said gamma reference control capability.

89. The Infringing Panel Modules and/or Infringing TV Products are made using a method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

90. In violation of 35 U.S.C. § 271(b), Defendant AUO has induced and continues to induce infringement of one or more claims of the ’788 Patent by one or more direct infringers either literally or by the doctrine of equivalents. By way of Defendant AUO’s designing, making, or testing the Infringing Panel Modules using a process claimed by the ’788 Patent, or causing others to do so, Defendant AUO has induced Hisense Mexico, Hisense USA, SAMEX and others to without authority import into the United States, or cause others (such as Does 1–10) to import into the United States, or offer to sell, sell, or use within the United States the Infringing Panel Modules, in violation of 35 U.S.C. § 271(g).

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91. Defendant AUO has made, and continues to make, unlawful gains and profits from infringing the ’788 Patent.

92. As a consequence of Defendant AUO’s past dealings with Alta that pre-dated the filing and service of the original Complaint (Dkt. 1) as described above, Defendant AUO had knowledge of, or was willfully blind to knowledge of, the ’788 Patent and its infringement of the ’788 Patent before the filing of this lawsuit.

93. Defendant AUO has had knowledge of the ’788 Patent and its infringement activities since at least as early as June 2012. Accordingly, Defendant AUO has been willfully infringing the ’788 Patent since at least as early as June 2012.

94. Since at least as early as June 2012, Defendant AUO has actively, knowingly, and intentionally continued to induce infringement of the ’788 Patent, literally or by the doctrine of equivalents, by selling the Infringing Panel Modules to manufacturers, suppliers, and/or distributors for use in the Infringing TV Products and, upon information and belief, distributing literature and materials inducing its suppliers and distributors to use their Infringing Panel Modules in a manner that infringes one or more claims of the ’788 Patent.

COUNT IV: INFRINGEMENT OF THE ’788 PATENT BY DEFENDANT HISENSE MEXICO

95. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

96. Defendant Hisense makes, uses, sells, and/or offers to sell in, and/or imports into, the United States, and knowingly and intentionally induces others to make, use, sell, offer to sell, or import into the United States, finished television sets that incorporate AUO LCD panel modules that infringe one or more claims of the Asserted Patents, including at least Claim 1 of the ’788 Patent.

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97. Phenix is the owner of the ’788 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the ’788 Patent against infringers, and to collect damages for all relevant times.

98. The ’788 Patent generally describes a method for calibrating an LCD to a desired gamma curve to compensate for panel-to-panel manufacturing variations. The claims of the ’788 Patent, including Claim 1, recite a novel and inventive method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

99. For example, Claim 1 of the ’788 Patent recites:

> A method of calibrating a liquid crystal display to a desired gamma curve to compensate for panel to panel manufacturing variations comprising the steps:
>
> providing said display with gamma reference control capability which is electrically reprogrammable and non-volatile;
>
> testing said display with at least one sensor with optical input, wherein said sensor is separate from said display;
>
> varying gamma reference voltage levels on columns of said display by a control circuit, where said control circuit is separate from said display;
>
> optimizing said gamma reference voltage levels using means for executing a predetermined algorithm according to a predetermined criteria and data sensed by said at least one sensor, wherein said means for executing said predetermined algorithm is separate from said display to achieve the desired gamma curve; and
>
> storing said gamma reference voltage levels in said gamma reference control capability.

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100. The Hisense Infringing Models each incorporate one of Defendant AUO's Infringing Panel Modules that are made using a method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

101. In violation of 35 U.S.C. § 271(g), Defendant Hisense Mexico has directly infringed and continues to infringe one or more claims of the '788 Patent, either literally or by the doctrine of equivalents, by without authority importing into the United States, offering to sell, selling, or using within the United States at least the Hisense Infringing Models which are made by a process patented in the '788 Patent.

102. In addition, Defendant Hisense Mexico is liable for inducement of infringement of the '788 Patent under 35 U.S.C. § 271(b), literally or under the doctrine of equivalents, by one or more direct infringers. Hisense Mexico has induced, and continues to induce, others to test and use the Infringing Panel Modules using a process claimed by the '788 Patent, in preparation for their importation into the United States or offers to sell, sales, or use within the United States of Hisense Infringing Models incorporating the Infringing Panel Modules, in violation of 35 U.S.C. § 271(g). Hisense Mexico also induces by supplying, distributing, offering for sale, and/or selling the Hisense Infringing Models (made using a process claimed by the '788 Patent) to others, including but not limited to Does 1–10, who without authority use, offer to sell, or sell Hisense Infringing Models within the United States, or import into the United States, in violation of 35 U.S.C. § 271(g).

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103. Defendant Hisense Mexico has made, and continues to make, unlawful gains and profits from infringing the ’788 Patent.

104. Defendant Hisense Mexico has had knowledge of the ’788 Patent and its infringing activities since at least as early as the filing of the original Complaint (Dkt. 1). Nevertheless, Hisense Mexico has continued its infringement and inducement of infringement. Accordingly, Defendant Hisense Mexico has been willfully infringing the ’788 Patent at least since Phenix filed the original Complaint.

COUNT V: DIRECT INFRINGEMENT OF THE ’305 PATENT BY DEFENDANTS DOES 1–10

105. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

106. Defendants Does 1–10 make, use, sell, and/or offer to sell in, and/or import into, the United States Hisense Infringing Models that incorporate AUO LCD panel modules that infringe one or more claims of the Asserted Patents, including at least Claims 1, 2, and 5 of the ’305 Patent.

107. Phenix is the owner of the ’305 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the ’305 Patent against infringers, and to collect damages for all relevant times.

108. The ’305 Patent generally describes an integrated circuit used to calibrate LCDs to compensate for panel-to-panel manufacturing variations. The claims of the ’305 Patent, including Claim 1, recite a novel and inventive apparatus for producing voltage signals on a plurality of outputs comprising non-volatile storage cells, programming circuits coupled to a multiplexer that address the many inputs, drivers connected to the storage cells and outputs, and inputs connected to the multiplexer to address the storage cells, where the gamma reference voltage signals

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determine the driving voltages of columns of a display, the non-volatile storage cells are organized into banks with a predetermined gamma reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

109. For example, Claim 1 of the '305 Patent recites:

> An integrated circuit for producing voltage signals on a plurality of outputs comprising:
>
> a plurality of non-volatile storage cells;
>
> circuits for programming coupled to a multiplexer for addressing and programming said storage cells, wherein the addressing is based on a plurality of inputs;
>
> drivers connected to said storage cells and to the plurality of outputs; and
>
> the plurality of inputs connected to said multiplexer for addressing said storage cells,
>
> wherein said voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of a display, wherein said non-volatile storage cells are organized into two or more banks of cells wherein each bank contains a predetermined gamma reference voltage signal display condition; and means to switch between the banks based on one or more external signals is provided on said integrated circuit.

110. The Hisense Infringing Models imported by Defendants Does 1–10 each incorporate one of Defendant AUO's LCD panel modules that include a TCON board with an integrated circuit, *i.e.*, Pgamma chip, with at least two banks, for producing voltage signals on a plurality of outputs with a plurality of non-volatile storage cells and circuits for programming coupled to a multiplexer for addressing and programming said storage cells, where the addressing is based on a plurality of inputs, the drivers connect to the storage cells and the outputs, the inputs connect to the multiplexer for addressing the storage cells, the voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of display, the non-volatile storage cells are organized into banks of cells, each bank contains a predetermined gamma

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reference voltage signal display condition, and the banks are able to be switched by external signals on the integrated circuit.

111. In violation of 35 U.S.C. § 271(a), Defendants Does 1–10 have directly infringed and continue to infringe the '305 Patent, either literally or by the doctrine of equivalents, by making, using, importing, supplying, distributing, offering for sale, or selling the Hisense Infringing Models within the United States.

112. Defendants Does 1–10 have made, and continue to make, unlawful gains and profits from infringing the '305 Patent.

COUNT VI: DIRECT INFRINGEMENT OF THE '788 PATENT BY DEFENDANTS DOES 1–10

113. Phenix realleges and incorporates herein the preceding allegations of this First Amended Complaint as if fully set forth herein.

114. Defendants Does 1–10 make, use, sell, and/or offer to sell in, and/or import into, the United States Hisense Infringing Models that incorporate AUO LCD panel modules that infringe one or more claims of the Asserted Patents, including at least Claim 1 of the '788 Patent.

115. Phenix is the owner of the '788 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '788 Patent against infringers, and to collect damages for all relevant times.

116. The '788 Patent generally describes a method for calibrating an LCD to a desired gamma curve to compensate for panel-to-panel manufacturing variations. The claims of the '788 Patent, including Claim 1, recite a novel and inventive method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control

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circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

117. For example, Claim 1 of the '788 Patent recites:

> A method of calibrating a liquid crystal display to a desired gamma curve to compensate for panel to panel manufacturing variations comprising the steps:
>
> providing said display with gamma reference control capability which is electrically reprogrammable and non-volatile;
>
> testing said display with at least one sensor with optical input, wherein said sensor is separate from said display;
>
> varying gamma reference voltage levels on columns of said display by a control circuit, where said control circuit is separate from said display;
>
> optimizing said gamma reference voltage levels using means for executing a predetermined algorithm according to a predetermined criteria and data sensed by said at least one sensor, wherein said means for executing said predetermined algorithm is separate from said display to achieve the desired gamma curve; and
>
> storing said gamma reference voltage levels in said gamma reference control capability.

118. The Hisense Infringing Models imported by Defendants Does 1–10 each incorporate Defendant AUO's Infringing Panel Modules that are made using a method for calibrating LCD to a desired gamma curve to compensate for manufacturing variations by providing a display with electrically reprogrammable and non-volatile gamma reference control capability, testing the display with a sensor, varying the gamma reference voltage levels on columns of the display with a control circuit, optimizing the gamma reference voltage levels with predetermined algorithms, criteria, and data to achieve the desired gamma curve, and storing the gamma reference voltage levels.

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119. In violation of 35 U.S.C. § 271(g), Defendants Does 1–10 have directly infringed and continue to infringe one or more claims of the '788 Patent, either literally or by the doctrine of equivalents, by without authority importing into the United States, offering to sell, selling, or using within the United States television models that incorporate Defendant AUO's Infringing Panel Modules which are made by a process patented in the '788 Patent.

120. Defendants Does 1–10 have made, and continue to make, unlawful gains and profits from infringing the '788 Patent.

NOTICE

121. With respect to all Defendants, Phenix has complied with the marking and notice requirements of 35 U.S.C. § 287, to the extent required.

ATTORNEYS' FEES

122. According to 35 U.S.C. § 285, Plaintiff is entitled to, and respectfully requests, its reasonable attorneys' fees in this case.

DEMAND FOR JURY TRIAL

123. According to Fed. R. Civ. P. 38(b), Plaintiff respectfully requests a trial by jury on all issues triable by a jury.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff prays for the following relief:

a. that this Court declare that Defendant Hisense Mexico has directly infringed and continues to directly infringe one or more claims of the Asserted Patents under 35 U.S.C. §§ 271(a) and (g);

b. that this Court declare that Defendant Hisense Mexico has indirectly infringed and continues to indirectly infringe one or more claims of the Asserted Patents under 35 U.S.C. § 271(b);

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c. that this Court declare that Defendant AUO has induced the infringement and continues to induce the infringement of one or more claims of the Asserted Patents under 35 U.S.C. § 271(b);

d. that this Court declare that Defendants Does 1–10 have directly infringed and continue to directly infringe one or more claims of the Asserted Patents under 35 U.S.C. §§ 271(a) and (g);

e. that this Court award Plaintiff all damages adequate to compensate Plaintiff for Defendants' above-mentioned infringements; and that interest and costs be assessed against Defendants according to 35 U.S.C. §§ 154(d) and 284;

f. that this Court declare Defendants' infringement was and is willful, and award treble damages for the period of the willful infringement of the Asserted Patents;

g. that this Court declare this an exceptional case and order that Defendants pay Plaintiff its reasonable attorneys' fees and costs according to 35 U.S.C. § 285;

h. that Defendants, their officers, directors, agents, servants, employees, attorneys, affiliates, divisions, branches, parents, and those persons in active concert or participation with any of them, be permanently restrained and enjoined from infringing the Asserted Patents; and

i. that this Court award any additional relief to Plaintiff that this Court deems just and proper.

August 19, 2024

Respectfully submitted,

By: /s/ Eric H. Findlay

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*Admitted to the Eastern District of Texas
**Admitted Pro Hac Vice

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CERTIFICATE OF SERVICE

The undersigned counsel hereby certifies that on August 19, 2024, a true and correct copy of the foregoing First Amended Complaint was served on all counsel of record who have appeared in this case *via* the Court's CM/ECF system.

/s/ Eric H. Findlay
Eric H. Findlay

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EXHIBIT A

US007233305B1

(12) **United States Patent**
Orlando et al.

(10) **Patent No.: US 7,233,305 B1**
(45) **Date of Patent: Jun. 19, 2007**

(54) **GAMMA REFERENCE VOLTAGE GENERATOR**

(75) Inventors: **Richard V. Orlando**, Los Gatos, CA (US); **Trevor A. Blyth**, Sandy, UT (US)

(73) Assignee: **Alta Analog, Inc.**, San Jose

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 540 days.

(21) Appl. No.: **10/746,333**

(22) Filed: **Dec. 23, 2003**

Related U.S. Application Data

(60) Provisional application No. 60/477,680, filed on Jun. 11, 2003.

(51) **Int. Cl.**
G09G 3/36 (2006.01)

(52) **U.S. Cl.** **345/89**; 345/690; 348/674; 358/519

(58) **Field of Classification Search** 345/89, 345/690; 348/254, 674; 358/519
See application file for complete search history.

(56) **References Cited**

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7,038,721	B2 *	5/2006	Stessen et al.	348/254
2002/0063666	A1 *	5/2002	Kang et al.	345/87

* cited by examiner

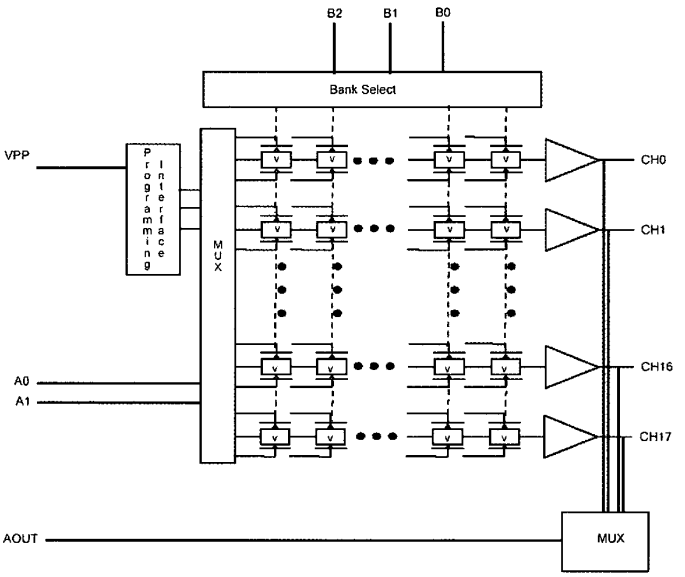
Primary Examiner—Amr A. Awad
Assistant Examiner—Tom Sheng
(74) *Attorney, Agent, or Firm*—Fernandez & Associates, LLP

(57) **ABSTRACT**

A programmable buffer integrated circuit which can be programmed to output a set of gamma correction reference voltages to be used in LCD displays. Once programmed, the buffers will continuously output the programmed value. The device incorporates a programming interface to allow the programming of the buffer outputs to the desired values during manufacturing and test of the panel. Multiple sets of values can be programmed to provide different gamma correction curves for different user or application requirements.

14 Claims, 6 Drawing Sheets

BLOCK DIAGRAM (AG1818)



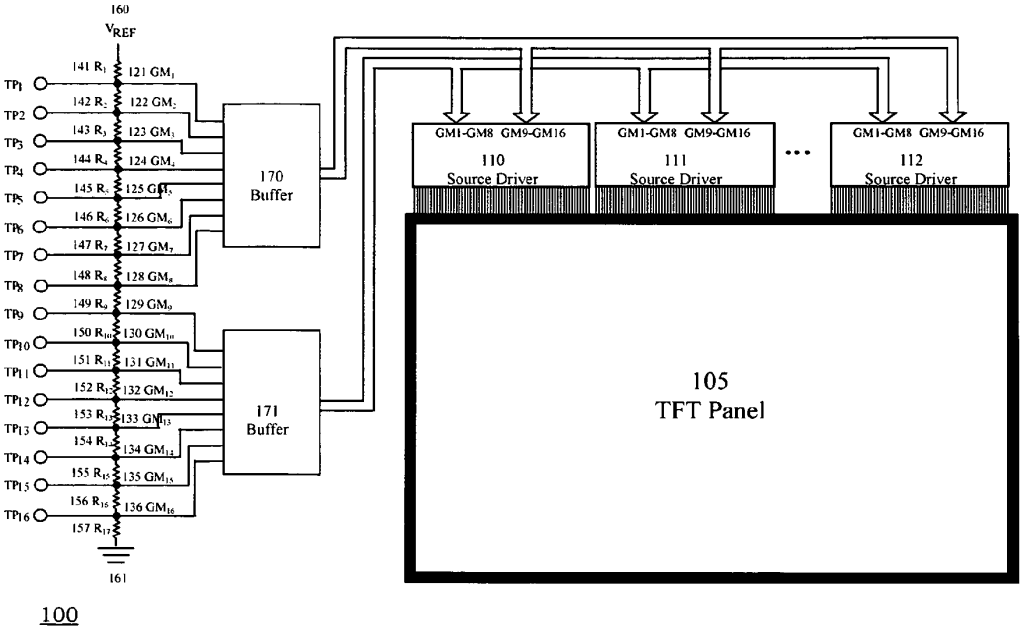


FIG. 1 -- Prior Art --

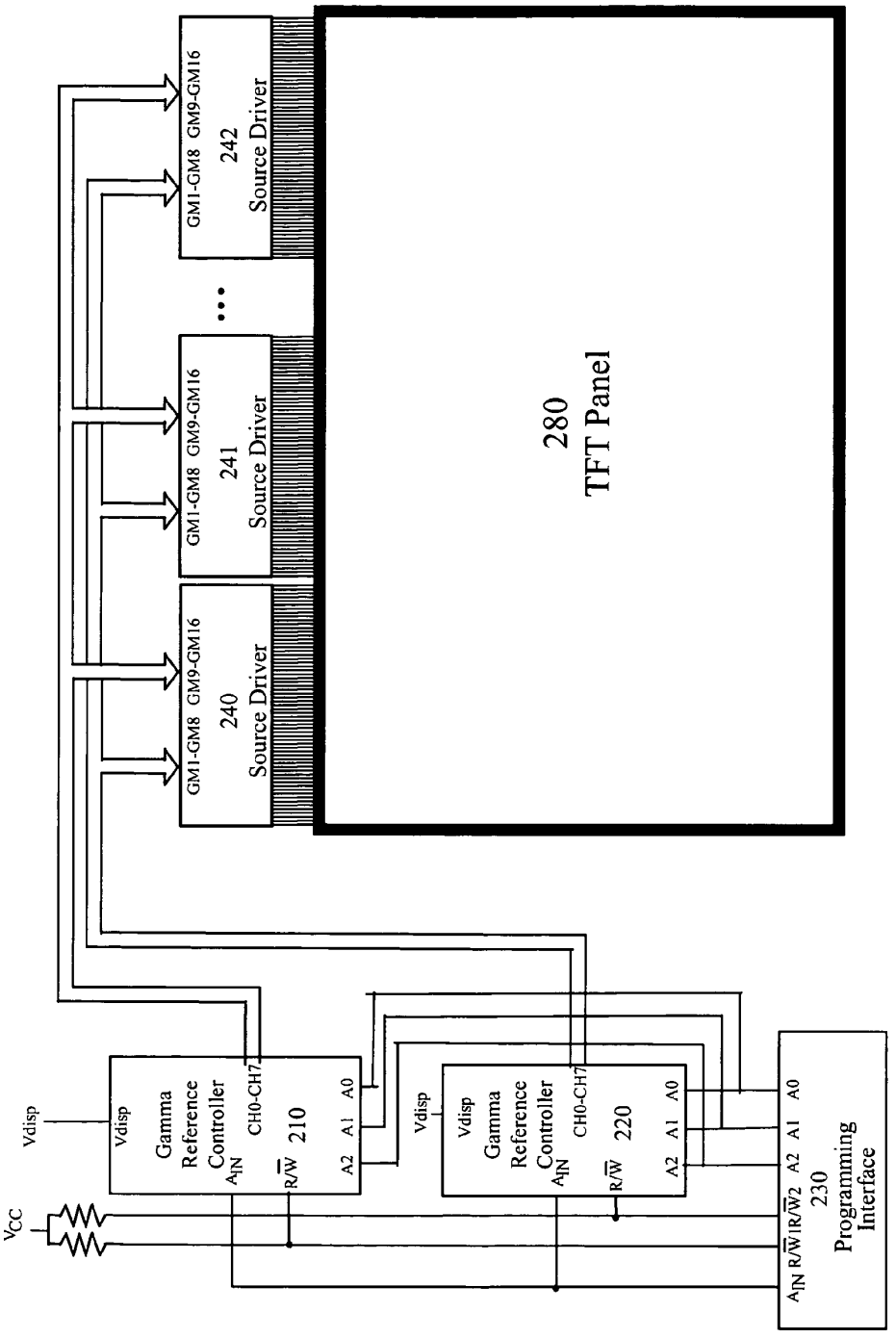

280
TFT Panel
GM1-GM8 GM9-GM16
240
Source Driver
GM1-GM8 GM9-GM16
241
Source Driver
GM1-GM8 GM9-GM16
242
Source Driver
Vdisp
Gamma Reference Controller
CH0-CH7
210
220
A0
A1
A2
R/W
VCC
230
Programming Interface
200

FIG. 2

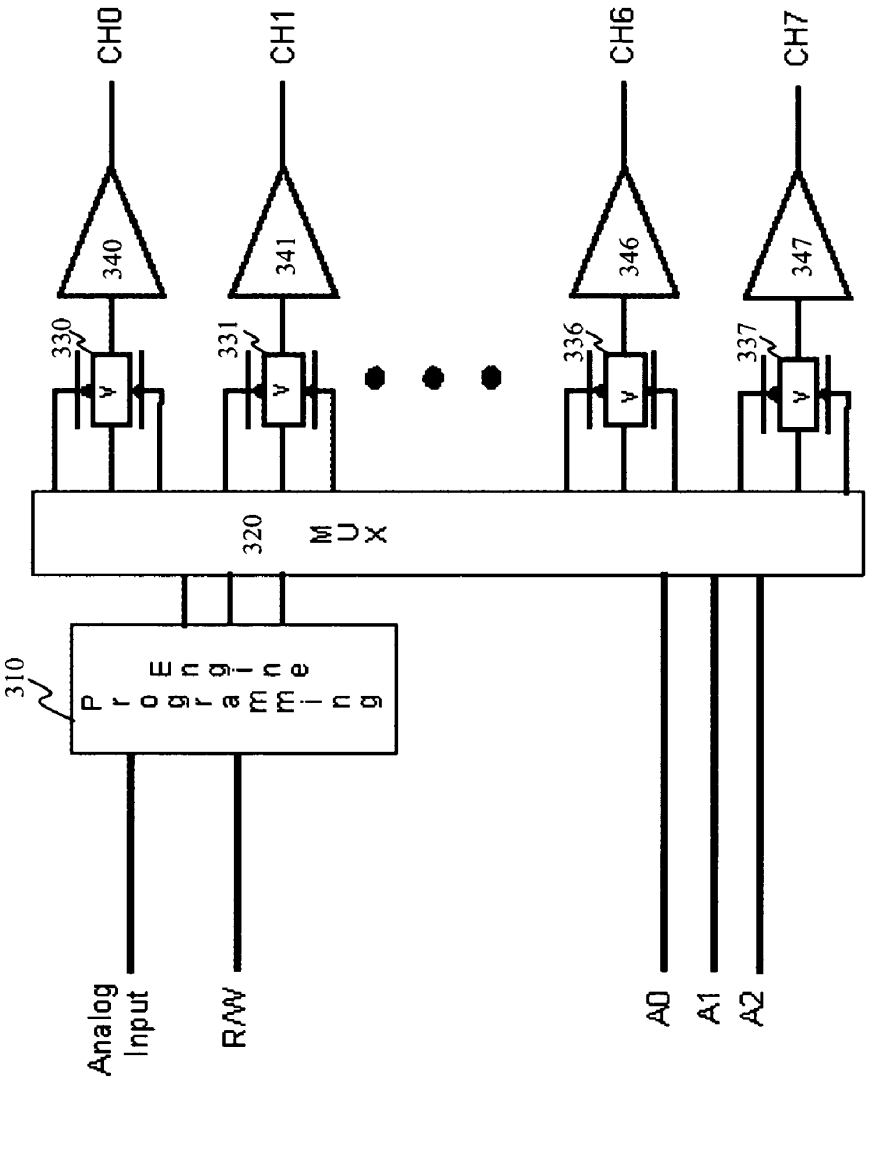

CH0
CH1
CH6
CH7
340
341
346
347
330
331
336
337
320
MUX
310
Programming
Analog Input
R/W
A0
A1
A2
300

FIG. 3

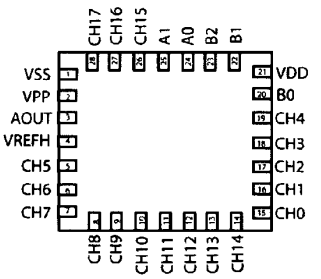
FIG. 4A

PIN DESCRIPTIONS

Name	Description	Value Range	Function
VDD	Digital Supply Input	3V to 3.3V	
CH0-CH17	Analog Outputs	0V –VREF-0.2	Analog Output Voltage Channels
B0-B2	Bank Select	CMOS Inputs	Selects which output is placed in tracking mode or is written to during a write operation
VREFH	Output High Level Reference	5-13.5 Volts	Sets the highest voltage for the output channels.
A_{OUT}	Analog Output	0.2V-VREFH-0.2	Outputs the current value of the selected channel of the selected bank during programming
V_{PP}	Programming Voltage	10-14Volts	Provides the programming voltage and timings needed to program the analog memory cells. Also used to enter operating modes other than read.
A0-A1	Address Inputs	TTL	Used to Select Programming Modes and Locations to be written

FIG. 4B

Pinout



AG1818

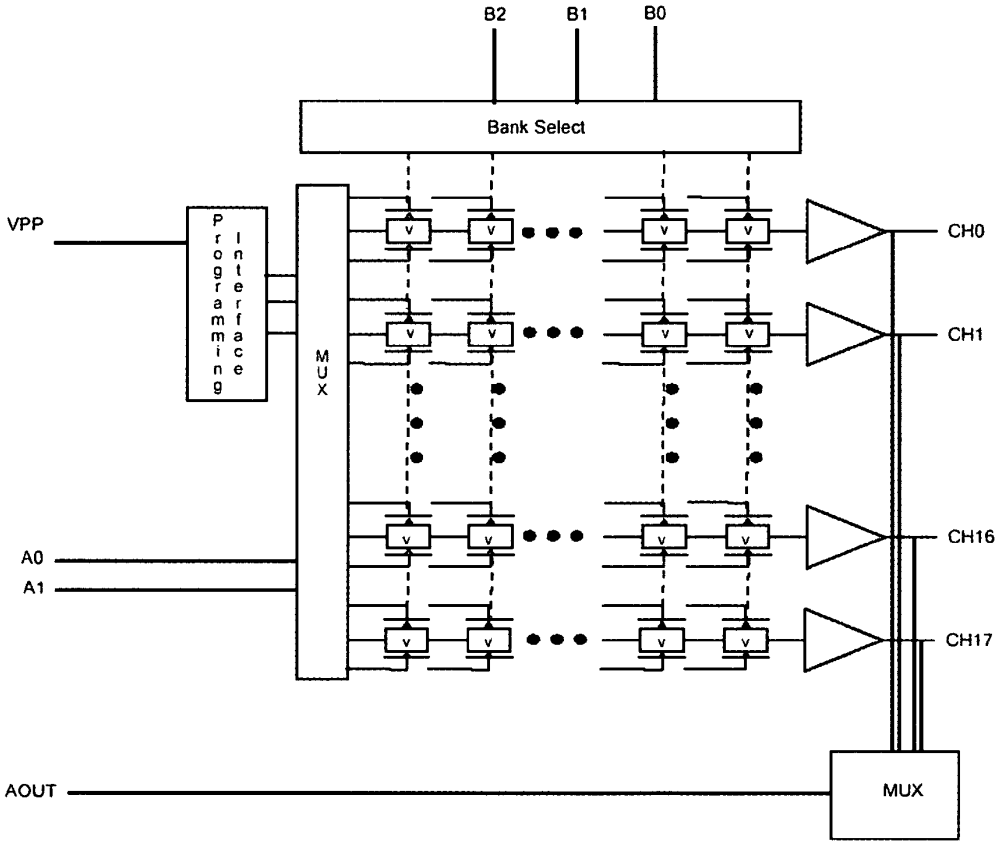
FIG. 5

ELECTRICAL PARAMETERS

Symbol	Parameter		Min	Typ	Max	Units	Condition
V_{IL}	Input Low Voltage	A0-A2			V_{DD} x 0.3	V	
V_{IH}	Input High Voltage	A0-A2	V_{DD} x 0.7			V	
V_{OLA}	Output Low Voltage	AOUT, CH0-CH17	0.2			V	I_{OL} = 10mA
V_{OHA}	Output High Voltage	AOUT, CH0-CH17			V_{REFH}-0.2	V	I_{OH} = -10mA
I_{IL}	Input Leakage Current				±1.0	µA	
I_{DD}	V_{DD} Current (Operating)				1.5	mA	R_{EXT} = ∞
I_{SB}	V_{DD} Current (Standby)				10	µA	
IVREH	VREF Current				190	mA	
V_{PP}	VPP Range		10		14	V	
VAC	Accuracy		15			mV	
Vdrift	Output Drift				70	µV	10 Years at 125 Deg C
PSRR	Power Supply Rejection Ratio		45	60		DB	VDD = 3.3-5.5V
Tdamp	Bank Switch Damp Time		10			msec	

FIG. 6

BLOCK DIAGRAM (AG1818)



GAMMA REFERENCE VOLTAGE GENERATOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from U.S. Provisional Application Ser. No. 60/477,680 filed on Jun. 11, 2003.

FIELD OF THE INVENTION

The invention relates generally to the field of liquid crystal displays, and more particularly to TFT flat panel displays and a method of generating a gamma reference voltage.

DESCRIPTION OF RELATED ART

Gamma Correction has long been a problem for the manufacturers of Thin Film Transistor (TFT) Flat Panel Displays. The Gamma Correction curve becomes more complex as the display resolution increases. Each display often has a different response to the gamma correction reference voltages, resulting in the need to generate specific gamma reference voltages for each model of display as well as compensating for display to display variation due to manufacturing process variations.

A traditional approach to the Gamma Reference Generation problem has been to use Select-On-Test Resistors. These resistors allow the reference voltages to be fine-tuned to the requirements of the individual display. The testing, selection and mounting of these resistors has become a major production problem since the process is a manual one and prohibits automated assembly and test. In addition, once the resistors are mounted on the display PC board, the resistors cannot be easily changed to meet the growing requirements of individual customers for a specific Gamma characteristic.

Of course, even with the manual labor involved, Select-On-Test resistors are still the least expensive solution to this problem. Devices such as potentiometers, Electrically Erasable Potentiometers (E2POTS), digitally-controlled potentiometers (DCPs) and Digital to Analog Converters (DACs) all could perform this function in some ways better than the Select-On-Test resistors, but the cost is unacceptable.

FIG. **1** is a block diagram illustrating a conventional gamma reference circuit for a TFT display **105** using Select-On-Test-Resistors. In this case, source drivers **110**, **111**, . . . and **112** require a total of 16 gamma reference voltages **121** GM_1, **122** GM_2, **123** GM_3, **124** GM_4, **125** GM_5, **126** GM_6, **127** GM_7, **128** GM_8, **129** GM_9, **130** GM_{10}, **131** GM_{11}, **132** GM_{12}, **133** GM_{13}, **134** GM_{14}, **135** GM_{15} and, **136** GM_{16}. The gamma reference voltages are derived by a resistive divider of 17 resistors **141** R_1, **142** R_2, **143** R_3, **144** R_4, **145** R_5, **146** R_6, **147** R_7, **148** R_8, **149** R_9, **150** R_{10}, **151** R_{11}, **152** R_{12}, **153** R_{13}, **154** R_{14}, **155** R_{15}, **156** R_{16}, **157** R_{17} connected between a reference voltage **160** and ground **161**. Since the loading of the source drivers **110**, **111**, and **112** changes dynamically, it is not possible to simply connect the resistive divider **141** R_1, **142** R_2, **143** R_3, **144** R_4, **145** R_5, **146** R_6, **147** R_7, **148** R_8, **149** R_9, **150** R_{10}, **151** R_{11}, **152** R_{12}, **153** R_{13}, **154** R_{14}, **155** R_{15}, **156** R_{16}, **157** R_{17} to the inputs of the source drivers **110**, **111**, and **112**, and some type of buffering are used, such gamma reference buffer ICs **170** and **171**.

Initially the PC board is assembled without the resistors. An external test apparatus drives the test points TP**1**–TP**16** until the desired Gamma correction is achieved. The values of the TP voltages are then used to calculate the resistors needed for the particular display under test (DUT) and the resistors are mounted on the PC board.

More recently quite complex approaches to Gamma correction have been published. U.S. Pat. No. 6,593,934 (1) and U.S. Pat. No. 6,046,719 (2) are examples of inventions which eliminate the "select-on-test" resistors. Both inventions teach quite complex digital approaches to this "analog" problem; consequently both inventions are quite expensive. Accordingly, it is desirable to design a gamma reference architecture that automates gamma adjustment and provides reprogrammable capability and achieves acceptable cost.

SUMMARY OF THE INVENTION

The invention is a programmable buffer integrated circuit which can be programmed to output a set of gamma correction reference voltages to be used in Liquid Crystal Displays (LCDs). Once programmed, the buffer will continuously output the programmed value; if power is removed, since the voltage value is stored in non-volatile, programmable memory, the gamma correction is retained. The device incorporates a programming interface to allow the programming of the buffer outputs to the desired values during manufacturing and test of the panel. Multiple sets of gamma values can be programmed and stored to provide optimized gamma correction curves for different user or application requirements.

In the preferred embodiment, the present invention allows automated assembly of an entire PC board, automated test and gamma adjustment, smaller and thinner physical size, lower power consumption, reprogrammable and non-volatile settings. Furthermore, the present invention advantageously allows a stand-alone solution such that it is not necessary to incorporate a micro controller unit (MCU).

Other structures and methods are disclosed in the detailed description below. This summary does not purport to define the invention. The invention is defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a prior art block diagram illustrating a conventional gamma reference circuit for a TFT display using Select-On-Test-Resistors.

FIG. **2** is an architectural diagram illustrating a gamma reference circuit employing gamma reference controllers for a TFT display in accordance with one embodiment of the invention.

FIG. **3** is a block diagram illustrating one embodiment of a gamma reference controller in accordance with the invention.

FIG. **4**A and FIG. **4**B are descriptions of one alternative pin out.

FIG. **5** shows exemplary electrical parameter specifications of one embodiment.

FIG. **6** is an alternative block diagram of one embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

FIG. **2** is an architectural diagram, **200**, illustrating a gamma reference circuit implementation employing gamma reference controllers, **210** and **220**, for a TFT panel **280**. The gamma reference circuit comprises a first gamma reference controller **210**, a second gamma reference controller **220**, a programming interface **230**, source drivers **240**, **241**, and

242, and a TFT panel 280. The gamma reference controller 210 drives a first set of eight gamma reference voltages GM1–GM8 to the source drivers 240, 241, . . . and 242. The gamma reference controller 220 drives a second set of eight gamma reference voltages GM9–GM 16 to the source drivers 240, 241, . . . and 242.

The Programming Interface 230 comprises a common Analog Input (A_{IN}) which will be used to set the reference voltage level, three address inputs (A_0, A_1, and A_2) to determine which reference level is being written and a R/W control signal for each of the first gamma reference controller 210 and second gamma reference controller 220, in this case two, that are on the board.

During normal operation, the R/W pin is pulled High and the reference voltage outputs will reflect the value last programmed into the nonvolatile memory cells.

The writing or programming operation is accomplished by first selecting the output or channel of the device to be programmed with the A2–A0 inputs. At this point, R/W on the device to be written is driven low and the device enters Tracking Mode. During Tracking Mode, the output of the selected channel tracks the input voltage on the Analog Input. (An optional internal voltage multiplier converts the 0–3V Analog Input to a 0–10 Volt output.)

Once the desired voltage is found by varying the Analog Input for a particular channel, the R/W signal is driven high and the value on the Analog Input is written into the nonvolatile memory for the output channel selected by the A2–A0 inputs.

In this manner, each of the gamma reference voltages can be written in a sequential manner during display testing.

Alternatively, the first gamma reference controller 210 and second gamma reference controller 220 can be preloaded with a default configuration, which is close to historical values for the majority of displays. In this approach, only those parameters that need to be adjusted are changed in testing.

The first gamma reference controller 210 and second gamma reference controller 220 provide the manufacturers of TFT displays a solution to the setting of the gamma reference voltages. Automated testing of the displays and re-programming of the gamma characteristics is enabled, even after the display is completed. The first gamma reference controller 210 and second gamma reference controller 220 provide reduced overall implementation costs, reduced power consumption, reduced physical size and flexibility over the traditional Select-On-Test resistor techniques.

FIG. 3 is a block diagram illustrating one embodiment of a gamma reference controller 300. The gamma reference controller 300 comprises a programming engine or interface 310, a mux 320, programmable analog floating gate memory cells 330, through 337, and drivers 340 through 347. The programming engine 310, coupled to the mux, comprises an Analog Input which will be used to set the reference voltage level and a R/W control signal for a corresponding gamma reference controller. The mux 320 connects signals from the programming engine 310 to any one of the programmable analog floating gate memory cells 330 through 337, depending on three address inputs (A_0, A_1, and A_2). Address inputs are used to select which cell is being written to at any time.

Each output is internally connected to an analog storage cell which can be written with analog values, for example, of 1024 step (10 Bit) resolution. The outputs, channel 0 (CH0), channel 1 (CH1), . . . channel 6 (CH6), and channel 7 (CH7), are intended to directly drive the reference voltage inputs of the source driver IC. An internal voltage multiplier, having a multiplication factor M, produces an output of zero up to typically 13.5 or alternatively 16 Volts. In FIG. 3, the channel 0, CH0, is driven by a driver 340, which connects to the programmable analog floating gate memory cells 330. The channel 1, CH1, is driven by a driver 341, which connects to the programmable analog floating gate memory cells 331. The channel 6, CH6, is driven by a driver 346, which connects to the programmable analog floating gate memory cells 336. The channel 7, CH7, is driven by a driver 347, which connects to the programmable analog floating gate memory cells 337.

During read mode, all channels continuously output their corresponding stored voltages. Applying a logic "0" to the R/W pin initiates a track and write cycle and the RDY\ pin goes to logic "1". The addressed channel now outputs a voltage which is equal to the voltage applied to the Vin pin, multiplied by the voltage multiplication factor M. The channel address may be changed during tracking mode. At the rising edge of R/W a write cycle is initiated and the present voltage applied to Vin is automatically stored in the analog memory corresponding to the addressed channel. Completion of the write cycle is indicated by a high to low transition at the RDY pin.

TABLE 1

Name	Description	Value Range	Function
VDD	Supply Input	3 V to 5.5 V	
Vdisp	Display Supply	10 V to 12 V	
R/W	Read/Write	CMOS Input	When driven to an active low input, places the selected output into tracking mode. The Rising Edge of R/W writes the voltage on the analog input into the appropriate analog memory location
Rdy	Device Ready	TTL Compatible Output	
VSS	Ground		
CH0–CH7	Analog Outputs	0 V–10 V	Analog Output Voltage Channels
VIN	Analog Input	0 V–3 V	Analog Input Voltage
A0–A3	Address Inputs	CMOS Inputs	Selects which output is placed in tracking mode or is written to during a write operation

Table 1 shows an alternative example of the pin descriptions for a gamma reference controller.

TABLE 2

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{IL}	Input Low Voltage			V_{DD} × 0.3	V	
V_{IH}	Input High Voltage	V_{DD} × 0.7			V	
V_{OutL}	Analog Output Low Voltage Vin = 0.1 V Vdisp = 10 V		0.33		V	I_{OL} = 10 mA

TABLE 2-continued

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{OutH}	Analog Output High Voltage Vin = 3 V Vdisp = 10 V		10		V	I_{OH} = −10 mA
V_{OL}	Logic Output Low Voltage			0.4	V	I_{OL} = 0.3 mA
V_{OH}	Logic Output High Voltage	V_{DD} − 0.8			V	I_{OH} = −250 μA
I_{IL}	Input Leakage Current			±1.0	μA	
I_{DD}	V_{DD} Current (Operating)			0.8	mA	R_{EXT} = ∞
				1.0	mA	R_{EXT} = ∞
				1.5	mA	R_{EXT} = ∞
I_{SB}	V_{DD} Current (Standby)			10	μA	
V_{IN}	V_{IN} Range	0		V_{DD} −	V	
R_{IN}	V_{IN} Input Resistance	1.0		0.8	MΩ	
AV_{IN}	Channel Gain		3.3		V/V	V_{IN} to V_{OUT}

Table 2 shows an alternative example of the electrical parameters for a gamma reference controller.

Examples of eight to eighteen channel Gamma reference controllers have been used; clearly larger ones, 256 channels and higher, are encompassed by the invention. Various output voltage ranges are optional as well, 0–5V up to 0–16V, depending on the display requirements. Specific ranges or limits of the various parameters are used herein as examples of different embodiments and are not intended to limit the scope of the invention.

In one embodiment of the invention, the integrated circuit, termed the AG1818, is a programmable gamma reference generator with integrated output buffers to directly drive the source driver inputs of a display; in one embodiment the display is a TFT LCD. The circuit requires a single 3.3 volt supply, 1.5 mA operating current and consumes 10 μA in standby mode. FIGS. **4**A and **4**B show an alternative pin out of this embodiment.

Eighteen output channels are provided with an output range of 0 to 13.5 Volts and a drive capability of 10 milli-amps. Each output is internally connected to an analog nonvolatile storage cell which can be written with 1,024 analog values, providing 10 bit resolution, or, said another way, to better than 15 mV resolution. The output of these analog nonvolatile memory cells is internally buffered to allow for the high voltages and current needed to directly drive the reference inputs on the source drivers. The outputs can be programmed from 0.2 volts to 0.2 volts below the VREFH value. FIG. **5** shows representative electrical specifications.

In one embodiment the AG1818 has capacity to store and retrieve eight independent banks or groups of reference voltages. The banks of gamma voltages are stored and selected through the three address inputs B**0**, B**1**, B**2**. This allows the gamma voltages to be changed either for dynamic gamma correction or application based gamma variation. This feature can also be used to switch between different gamma settings based on the information to be displayed for implementing dynamic gamma correction. A block diagram in FIG. **6** illustrates one alternative embodiment.

During read mode, all channels continuously output their corresponding stored voltages based on the bank selected by the B0–B2 address inputs. When deemed appropriate an internal damping circuit creates a slow transition, about 10 msec., between banks to prevent disruptive display artifacts caused by rapid transitions on the gamma reference voltages during operation. Alternative damping circuits may be employed which allow the transition between banks to be considerably slower, for instance, one second, as may be required by the display manufacturer's requirements.

An independent programming interface allows the device to be programmed in-situ thus providing the ability to individually program or adjust the gamma reference voltages for an individual display. The device can also be programmed prior to mounting on the pc board or display. The programming interface consists of four signals. The V_{PP} is a high voltage input used to select the programming mode and also provides the high voltage pulses used to program the individual cells. In the AG1818 embodiment, V_{PP} is supplied from an external source, an IC or other means. The A_{OUT} analog output is used to read the cell which is currently being programmed to verify the write operation and proper output voltage level. The A0 through A1 inputs are used in conjunction with the B0–B2 inputs to select the location to be written.

One alternative method of programming the individual cells starts by placing A0, A1, B0, B1, B2 lines in the (1, 1, 1, 1, 1) state and taking the V_{PP} pin high; this places the AG1818 in the Program mode; the read mode is the default mode. Next the particular bank is addressed through B0–B2; V_{PP} is pulsed again, latching the bank address. Next the cell to be programmed in the selected bank is addressed using the A0, A1, B0, B1, B2 lines; V_{PP} is pulsed again, a third time. At this point programming of the selected storage cell is initiated by pulsing V_{PP} with adjustable voltage pulses between approximately 8 and 14 volts. When the selected cell has achieved the desired voltage level the A0, A1, B0, B1, B2 lines are again placed in the (1, 1, 1, 1, 1) state; the V_{PP} pin is pulsed; this returns the AG1818 to the read mode. Programming of additional cells proceeds from the beginning sequence; any order of programming storage cells, random or sequential, can be applied.

Key variables in the programming process are programming voltage amplitude, rise and fall time of the pulse, and pulse duration; each of these variables is influenced by design and process parameters of the particular wafer fabrication facility. Real time monitoring of the cell voltage level is accomplished through the A_{OUT} pin which reflects the cell voltage as it is in the output buffer which is the voltage which will be applied to the display column. The use of the A_{OUT} pin provides an essential countermeasure to the vagaries of the design and fabrication processes. Independent of what voltage actually is stored in the cell the Aout pin gives the ability for closed loop programming such that a precise gamma reference voltage is provided to a specific column. As mentioned previously, this programming step

can take place prior to mating the gamma reference chip with a display wherein a predetermined set of voltage values is stored. Alternatively, the programming can take place after the gamma reference chip and display are mated; in this case the display quality can be evaluated as the gamma reference chip is being programmed if required.

One knowledgeable in the art that understands that other addressing schemes, such as a serial one, are possible, enabling an overall reduction in the pin count. Having bank switching capability ensures that the optimum gamma curve is used for each individual display and eliminates the need for re-work due to display manufacturing process variations. A PC based programming interface is available for prototyping and gamma optimization. This PC programming interface may be an alternative source of the V_{PP} signals. Display optimization algorithms may be located in such a PC which also may be connected to monitors feeding back data from the display during the optimization tuning at time of manufacture.

This invention also enables several additional features for the user and manufacturer. Automating the testing of a panel can be achieved with optical sensors and feedback to the gamma correction section of the display. Once the optical sensors have modulated gamma reference voltage levels for the columns to achieve the predetermined light matching for the display these values can be saved in the gamma reference circuitry. In this way different application conditions can be pretested and stored. For the user, a sensor can be supplied with the display which responds to the temperature, lighting or other conditions present. The output of the sensor can be matched to a predetermined application condition which selects the corresponding gamma value set.

The above embodiments are only illustrative of the principles of this invention and are not intended to limit the invention to the particular embodiments described. Although the above embodiment describes the application of a gamma trimster for a TFT display, one of skill in the art should know that the present invention can be practiced in various types of displays and screens. Accordingly, various modifications, adaptations, and combinations of various features of the described embodiments can be practiced without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. An integrated circuit for producing voltage signals on a plurality of outputs comprising:

a plurality of non-volatile storage cells;

circuits for programming coupled to a multiplexer for addressing and programming said storage cells, wherein the addressing is based on a plurality of inputs;

drivers connected to said storage cells and to the plurality of outputs; and

the plurality of inputs connected to said multiplexer for addressing said storage cells,

wherein said voltage signals are gamma reference voltage signals for determining actual driving voltages of columns of a display, wherein said non-volatile storage cells are organized into two or more banks of cells wherein each bank contains a predetermined gamma reference voltage signal display condition; and means to switch between the banks based on one or more external signals is provided on said integrated circuit.

2. The integrated circuit of claim **1** wherein said non-volatile storage cells are reprogrammable.

3. The integrated circuit of claim **2** wherein said means to switch between banks can have a switching time from about 10 msec to about one second.

4. The integrated circuit of claim **1** wherein said non-volatile storage cells hold analog voltage values which are a constant fraction of said gamma reference voltage signals.

5. The integrated circuit of claim **1** wherein said circuits for programming require an external source for the high voltage programming means.

6. A method of programming a gamma reference voltage generator integrated circuit comprising the steps:

a. selecting a predetermined address using all address lines;

b. taking a programming pin high;

c. selecting a predetermined group of storage addresses using a predetermined subset of the address lines;

d. taking the programming pin high to latch the predetermined group of storage address;

e. selecting a predetermined storage cell address using all of the address lines;

f. programming an applied gamma voltage in the selected storage cell by applying incremental voltage pulses from the programming pin;

g. monitoring the result of said incremental voltage pulses by reading an output buffer line associated with said selected storage cell; and

h. continuing the incremental voltage pulses from the programming pin until the output buffer line associated with said selected storage cell achieves a predetermined value.

7. The method of claim **6** wherein said gamma reference voltage generator integrated circuit requires an external source for supplying high voltage to the programming pin.

8. An integrated circuit for producing voltage signals on a plurality of outputs comprising:

a plurality of non-volatile storage cells;

circuits for programming coupled to a multiplexer for addressing and programming said storage cells, wherein the addressing is based on a plurality of inputs;

drivers connected to said storage cells and to the plurality of outputs;

the plurality of inputs connected to said multiplexer for addressing said storage cells; and

an output pin connected to an output through a second multiplexer connected to said plurality of outputs wherein said output pin is at an output buffer voltage level of said output when said integrated circuit is in a programming mode to program said storage for said output.

9. The integrated circuit of claim **8** wherein said non-volatile storage cells are reprogrammable.

10. The integrated circuit of claim **9** wherein said reprogrammable, non-volatile storage cells are organized into two or more banks of cells wherein each bank contains a predetermined gamma reference voltage signal display condition; and means to switch between the banks based on one or more external signals is provided on said integrated circuit.

11. The integrated circuit of claim **10** wherein said means to switch between banks can have a switching time from about 10 msec to about one second.

12. The integrated circuit of claim **8** wherein said voltage signals are gamma reference voltage signals for driving columns of a display.

13. The integrated circuit of claim **8** wherein said non-volatile storage cells hold analog voltage values which are a constant fraction of said gamma reference voltage signals.

14. The integrated circuit of claim **8** wherein said circuits for programming require an external source for supplying high voltage.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	: 7,233,305 B1
APPLICATION NO.	: 10/746333
DATED	: June 19, 2007
INVENTOR(S)	: Richard V. Orlando et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 8, line 5 (claim 5): please change “the” to “a”. Line 5 should read “for programming require an external source for a high voltage programming means”.

Signed and Sealed this
First Day of March, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office

EXHIBIT B

US007557788B1

(12) **United States Patent**
Orlando et al.

(10) **Patent No.: US 7,557,788 B1**
(45) **Date of Patent: Jul. 7, 2009**

(54) **GAMMA REFERENCE VOLTAGE GENERATOR**

(75) Inventors: **Richard V. Orlando**, Los Gatos, CA (US); **Trevor A. Blyth**, Sandy, UT (US)

(73) Assignee: **Alta Analog, Inc.**, San Jose, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/743,014**

(22) Filed: **May 1, 2007**

Related U.S. Application Data

(63) Continuation of application No. 10/746,333, filed on Dec. 23, 2003, now Pat. No. 7,233,305.

(60) Provisional application No. 60/477,680, filed on Jun. 11, 2003.

(51) **Int. Cl.**
G09G 3/36 (2006.01)

(52) **U.S. Cl.** **345/89**; 345/690; 348/674

(58) **Field of Classification Search** 345/89, 345/690; 348/254, 674; 358/519
See application file for complete search history.

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7,233,305	B1 *	6/2007	Orlando et al.	345/89

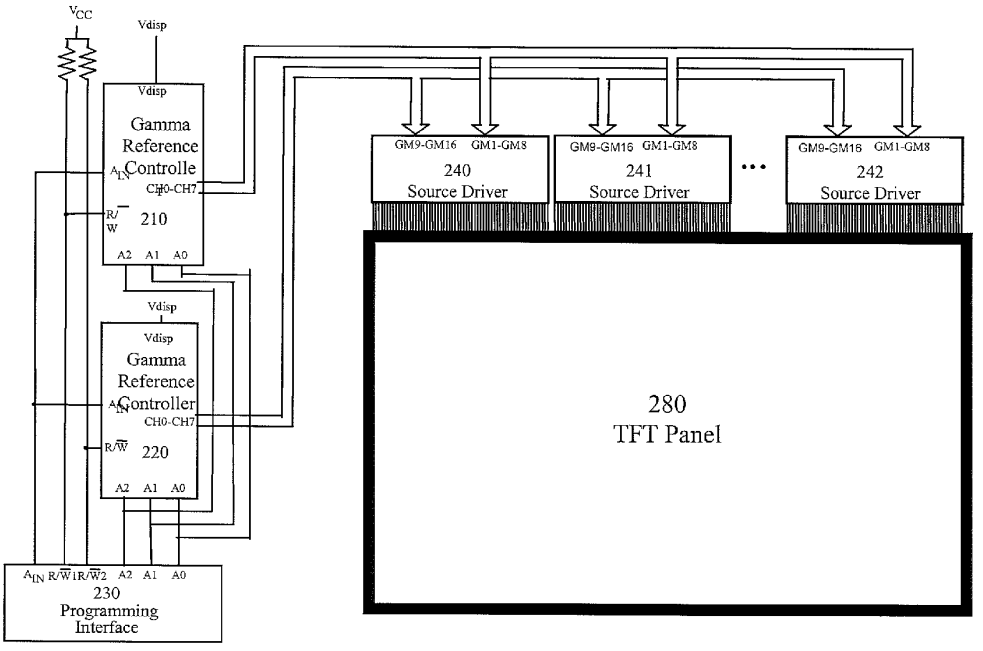
* cited by examiner

Primary Examiner—Richard Hjerpe
Assistant Examiner—Tom V Sheng
(74) *Attorney, Agent, or Firm*—Fernandez & Associates, LLP

(57) **ABSTRACT**

A programmable buffer integrated circuit which can be programmed to output a set of gamma correction reference voltages to be used in LCD displays. Once programmed, the buffers will continuously output the programmed value. The device incorporates a programming interface to allow the programming of the buffer outputs to the desired values during manufacturing and test of the panel. Multiple sets of values can be programmed to provide different gamma correction curves for different user or application requirements.

6 Claims, 6 Drawing Sheets



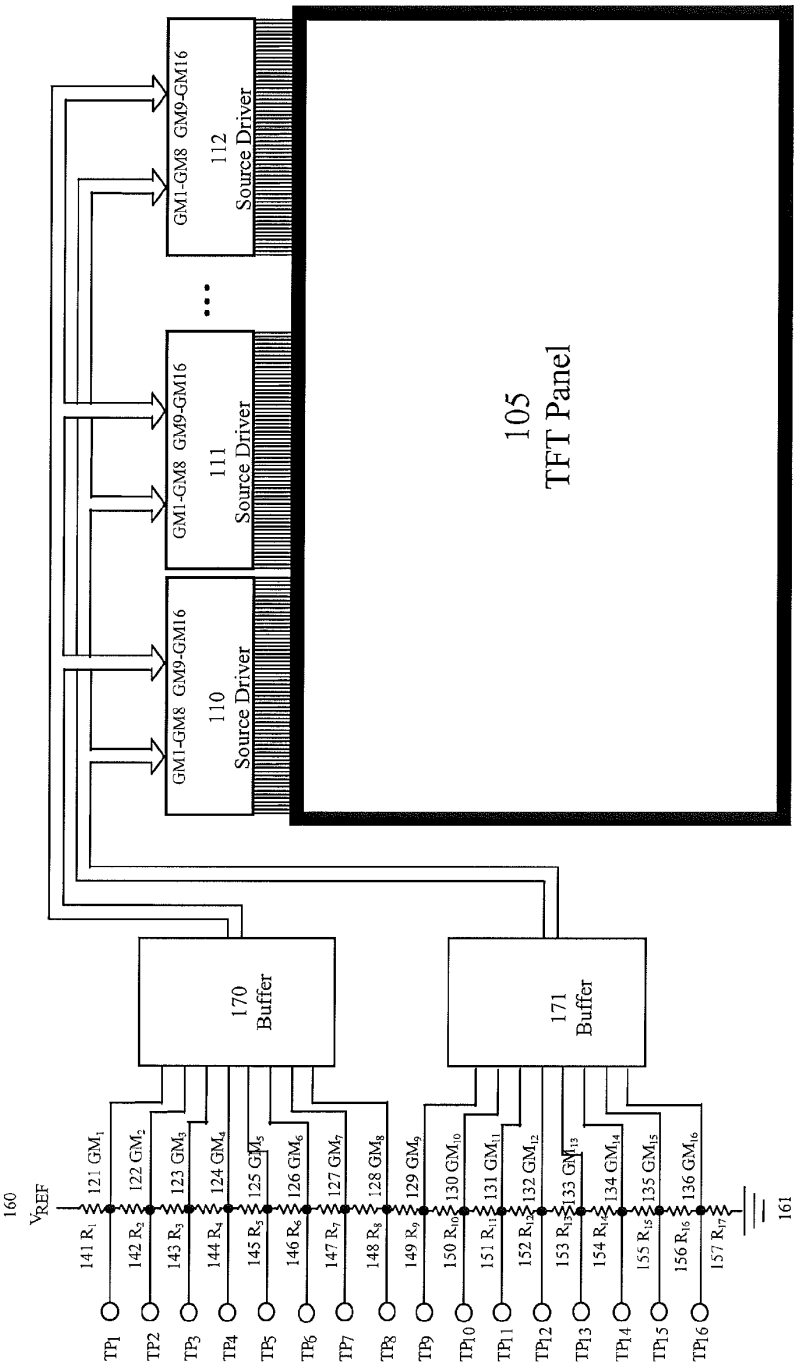

105
TFT Panel
112
Source Driver
111
Source Driver
110
Source Driver
GM1-GM8 GM9-GM16
170
Buffer
171
Buffer
160
V_{REF}
161
100

FIG. 1

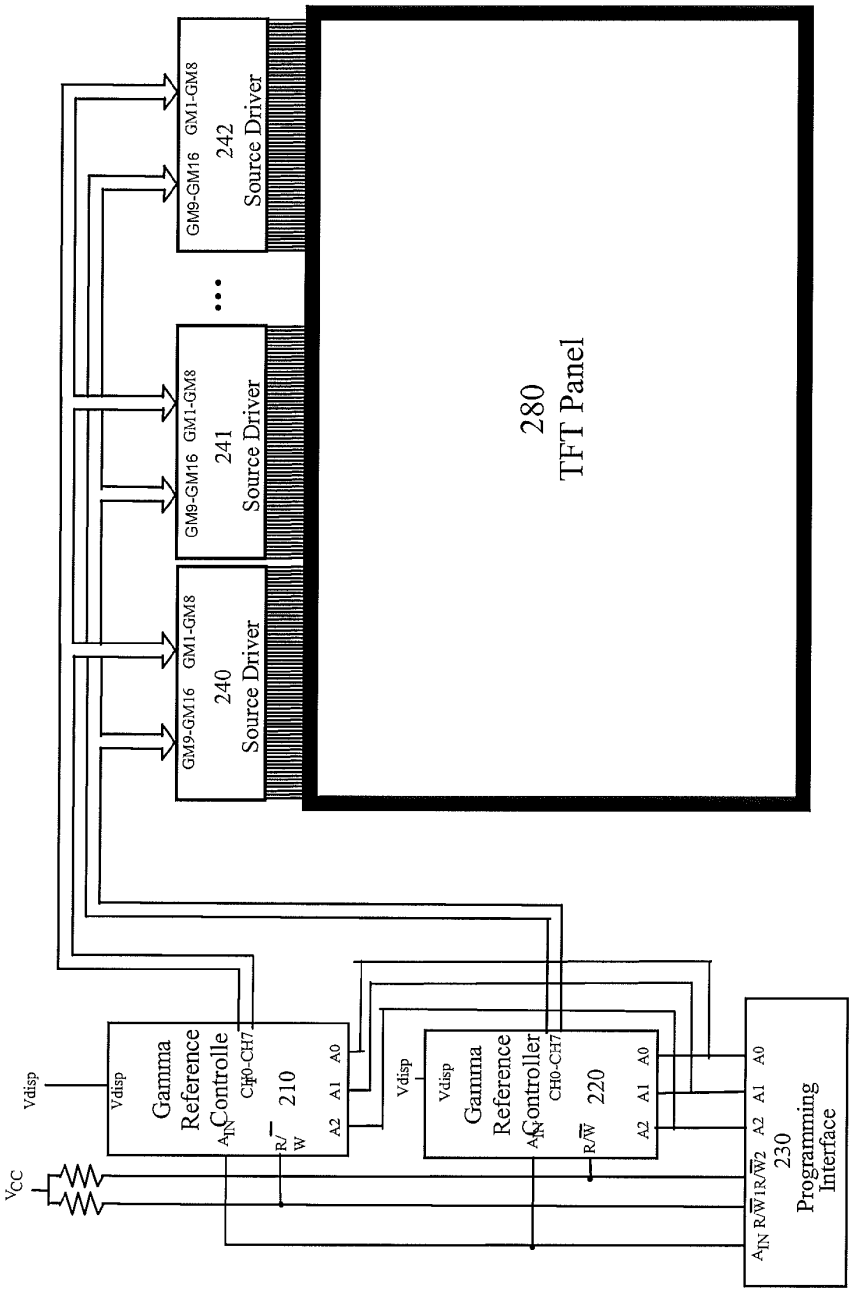

280
TFT Panel
240
Source Driver
241
Source Driver
242
Source Driver
GM1-GM8
GM9-GM16
Gamma Reference Controller
210
220
230
Programming Interface
Vdisp
V_{CC}
CH0-CH7
A0
A1
A2
R/W
200

FIG. 2

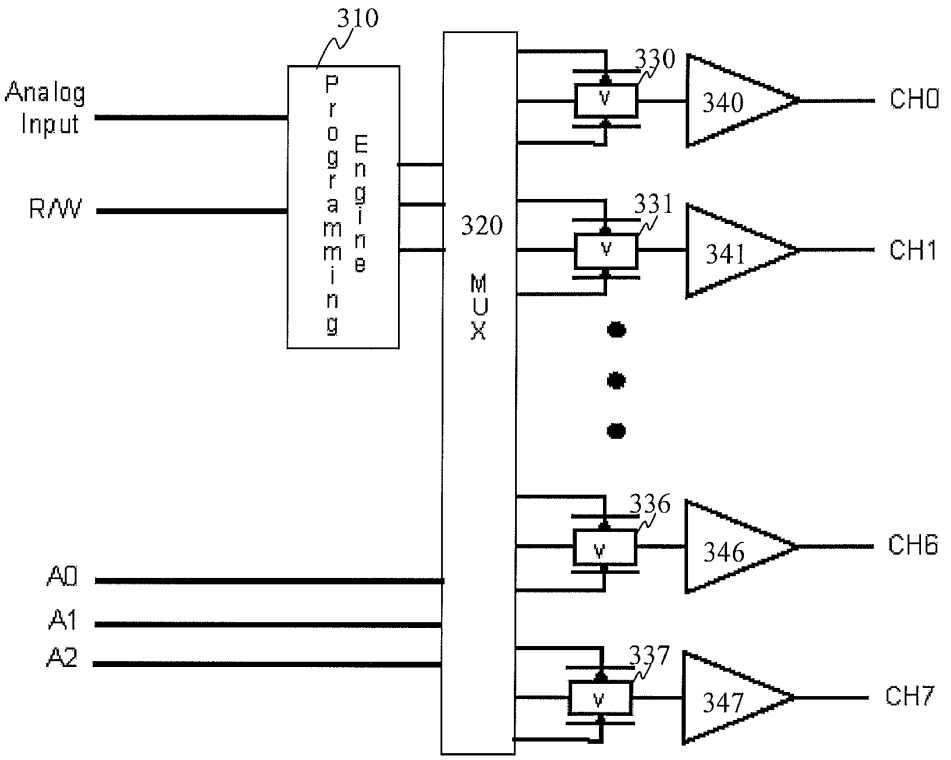

310
Analog Input
R/W
Programming Engine
320
MUX
330
331
336
337
340
341
346
347
CH0
CH1
CH6
CH7
A0
A1
A2
300

FIG. 3

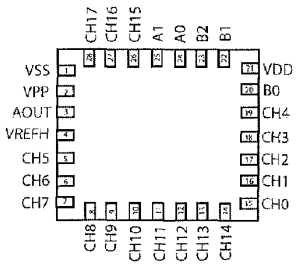
FIG. 4A

PIN DESCRIPTIONS

Name	Description	Value Range	Function
VDD	Digital Supply Input	3V to 3.3V	
CH0-CH17	Analog Outputs	0V –VREF-0.2	Analog Output Voltage Channels
B0-B2	Bank Select	CMOS Inputs	Selects which output is placed in tracking mode or is written to during a write operation
VREFH	Output High Level Reference	5-13.5 Volts	Sets the highest voltage for the output channels.
A_{OUT}	Analog Output	0.2V-VREFH-0.2	Outputs the current value of the selected channel of the selected bank during programming
V_{PP}	Programming Voltage	10-14Volts	Provides the programming voltage and timings needed to program the analog memory cells. Also used to enter operating modes other than read.
A0-A1	Address Inputs	TTL	Used to Select Programming Modes and Locations to be written

FIG. 4B

Pinout



AG1818

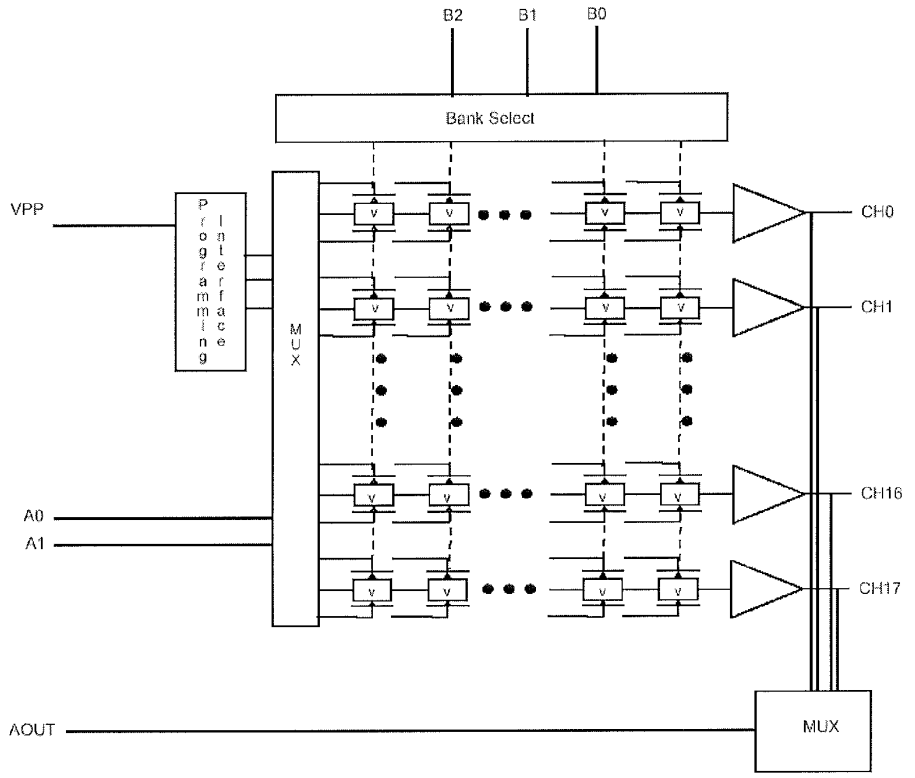
FIG. 5

ELECTRICAL PARAMETERS

Symbol	Parameter		Min	Typ	Max	Units	Condition
V_{IL}	Input Low Voltage	A0-A2			V_{DD} x 0.3	V	
V_{IH}	Input High Voltage	A0-A2	V_{DD} x 0.7			V	
V_{OLA}	Output Low Voltage	AOUT, CH0-CH17	0.2			V	I_{OL} = 10mA
V_{OHA}	Output High Voltage	AOUT, CH0-CH17			V_{REFH}-0.2	V	I_{OH} = -10mA
I_{IL}	Input Leakage Current				±1.0	µA	
I_{DD}	V_{DD} Current (Operating)				1.5	mA	$R_{EXT} = \infty$
I_{SB}	V_{DD} Current (Standby)				10	µA	
IVREH	VREF Current				190	mA	
V_{PP}	VPP Range		10		14	V	
VAC	Accuracy		15			mV	
Vdrift	Output Drift				70	µV	10 Years at 125 Deg C
PSRR	Power Supply Rejection Ratio		45	60		DB	VDD = 3.3-5.5V
Tdamp	Bank Switch Damp Time		10			msec	

FIG. 6

BLOCK DIAGRAM (AG1818)



GAMMA REFERENCE VOLTAGE GENERATOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority under 35 U.S.C. § 120 from and is a continuation application of U.S. patent application Ser. No. 10/746,333 filed Dec. 23, 2003 now U.S. Pat. No. 7,233,305, which claims priority from U.S. Provisional Application Ser. No. 60/477,680 filed on Jun. 11, 2003.

FIELD OF THE INVENTION

The invention relates generally to the field of liquid crystal displays, and more particularly to TFT flat panel displays and a method of generating a gamma reference voltage.

DESCRIPTION OF RELATED ART

Gamma Correction has long been a problem for the manufacturers of Thin Film Transistor (TFT) Flat Panel Displays. The Gamma Correction curve becomes more complex as the display resolution increases. Each display often has a different response to the gamma correction reference voltages, resulting in the need to generate specific gamma reference voltages for each model of display as well as compensating for display to display variation due to manufacturing process variations.

A traditional approach to the Gamma Reference Generation problem has been to use Select-On-Test Resistors. These resistors allow the reference voltages to be fine-tuned to the requirements of the individual display. The testing, selection and mounting of these resistors has become a major production problem since the process is a manual one and prohibits automated assembly and test. In addition, once the resistors are mounted on the display PC board, the resistors cannot be easily changed to meet the growing requirements of individual customers for a specific Gamma characteristic.

Of course, even with the manual labor involved, Select-On-Test resistors are still the least expensive solution to this problem. Devices such as potentiometers, Electrically Erasable Potentiometers (E2POTS), digitally-controlled potentiometers (DCPs) and Digital to Analog Converters (DACs) all could perform this function in some ways better than the Select-On-Test resistors, but the cost is unacceptable.

FIG. **1** is a block diagram illustrating a conventional gamma reference circuit for a TFT display **105** using Select-On-Test-Resistors. In this case, source drivers **110**, **111**, . . . and **112** require a total of 16 gamma reference voltages **121** GM_1, **122** GM_2, **123** GM_3, **124** GM_4, **125** GM_5, **126** GM_6, **127** GM_7, **128** GM_8, **129** GM_9, **130** GM_{10}, **131** GM_{11}, **132** GM_{12}, **133** GM_{13}, **134** GM_{14}, **135** GM_{15} and, **136** GM_{16}. The gamma reference voltages are derived by a resistive divider of 17 resistors **141** R_1, **142** R_2, **143** R_3, **144** R_4, **145** R_5, **146** R_6, **147** R_7, **148** R_8, **149** R_9, **150** R_{10}, **151** R_{11}, **152** R_{12}, **153** R_{13}, **154** R_{14}, **155** R_{15}, **156** R_{16}, **157** R_{17} connected between a reference voltage **160** and ground **161**. Since the loading of the source drivers **110**, **111**, and **112** changes dynamically, it is not possible to simply connect the resistive divider **141** R_1, **142** R_2, **143** R_3, **144** R_4, **145** R_5, **146** R_6, **147** R_7, **148** R_8, **149** R_9, **150** R_{10}, **151** R_{11}, **152** R_{12}, **153** R_{13}, **154** R_{14}, **155** R_{15}, **156** R_{16}, **157** R_{17} to the inputs of the source drivers **110**, **111**, and **112**, and some type of buffering are used, such gamma reference buffer ICs **170** and **171**.

Initially the PC board is assembled without the resistors. An external test apparatus drives the test points TP**1**-TP**16** until the desired Gamma correction is achieved. The values of the TP voltages are then used to calculate the resistors needed for the particular display under test (DUT) and the resistors are mounted on the PC board.

More recently quite complex approaches to Gamma correction have been published. U.S. Pat. No. 6,593,934 (1) and U.S. Pat. No. 6,046,719 (2) are examples of inventions which eliminate the "select-on-test" resistors. Both inventions teach quite complex digital approaches to this "analog" problem; consequently both inventions are quite expensive. Accordingly, it is desirable to design a gamma reference architecture that automates gamma adjustment and provides reprogrammable capability and achieves acceptable cost.

SUMMARY OF THE INVENTION

The invention is a programmable buffer integrated circuit which can be programmed to output a set of gamma correction reference voltages to be used in Liquid Crystal Displays (LCDs). Once programmed, the buffer will continuously output the programmed value; if power is removed, since the voltage value is stored in non-volatile, programmable memory, the gamma correction is retained. The device incorporates a programming interface to allow the programming of the buffer outputs to the desired values during manufacturing and test of the panel. Multiple sets of gamma values can be programmed and stored to provide optimized gamma correction curves for different user or application requirements.

In the preferred embodiment, the present invention allows automated assembly of an entire PC board, automated test and gamma adjustment, smaller and thinner physical size, lower power consumption, reprogrammable and non-volatile settings. Furthermore, the present invention advantageously allows a stand-alone solution such that it is not necessary to incorporate a micro controller unit (MCU).

Other structures and methods are disclosed in the detailed description below. This summary does not purport to define the invention. The invention is defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a prior art block diagram illustrating a conventional gamma reference circuit for a TFT display using Select-On-Test-Resistors.

FIG. **2** is an architectural diagram illustrating a gamma reference circuit employing gamma reference controllers for a TFT display in accordance with one embodiment of the invention.

FIG. **3** is a block diagram illustrating one embodiment of a gamma reference controller in accordance with the invention.

FIG. **4**A and FIG. **4**B are descriptions of one alternative pin out.

FIG. **5** shows exemplary electrical parameter specifications of one embodiment.

FIG. **6** is an alternative block diagram of one embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

FIG. **2** is an architectural diagram, **200**, illustrating a gamma reference circuit implementation employing gamma reference controllers, **210** and **220**, for a TFT panel **280**. The gamma reference circuit comprises a first gamma reference controller **210**, a second gamma reference controller **220**, a programming interface **230**, source drivers **240**, **241**, and **242**, and a TFT panel **280**. The gamma reference controller **210**

drives a first set of eight gamma reference voltages GM1-GM8 to the source drivers **240**, **241**, . . . and **242**. The gamma reference controller **220** drives a second set of eight gamma reference voltages GM9-GM16 to the source drivers **240**, **241**, . . . and **242**.

The Programming Interface **230** comprises a common Analog Input (A_{IN}) which will be used to set the reference voltage level, three address inputs (A_0, A_1, and A_2) to determine which reference level is being written and a R/W control signal for each of the first gamma reference controller **210** and second gamma reference controller **220**, in this case two, that are on the board.

During normal operation, the R/W pin is pulled High and the reference voltage outputs will reflect the value last programmed into the nonvolatile memory cells.

The writing or programming operation is accomplished by first selecting the output or channel of the device to be programmed with the A2-A0 inputs. At this point, R/W on the device to be written is driven low and the device enters Tracking Mode. During Tracking Mode, the output of the selected channel tracks the input voltage on the Analog Input. (An optional internal voltage multiplier converts the 0-3V Analog Input to a 0-10 Volt output.)

Once the desired voltage is found by varying the Analog Input for a particular channel, the R/W signal is driven high and the value on the Analog Input is written into the nonvolatile memory for the output channel selected by the A2-A0 inputs.

In this manner, each of the gamma reference voltages can be written in a sequential manner during display testing.

Alternatively, the first gamma reference controller **210** and second gamma reference controller **220** can be pre-loaded with a default configuration, which is close to historical values for the majority of displays. In this approach, only those parameters that need to be adjusted are changed in testing.

The first gamma reference controller **210** and second gamma reference controller **220** provide the manufacturers of TFT displays a solution to the setting of the gamma reference voltages. Automated testing of the displays and re-programming of the gamma characteristics is enabled, even after the display is completed. The first gamma reference controller **210** and second gamma reference controller **220** provide reduced overall implementation costs, reduced power consumption, reduced physical size and flexibility over the traditional Select-On-Test resistor techniques.

FIG. **3** is a block diagram illustrating one embodiment of a gamma reference controller **300**. The gamma reference controller **300** comprises a programming engine or interface **310**, a mux **320**, programmable analog floating gate memory cells **330**, through **337**, and drivers **340** through **347**. The programming engine **310**, coupled to the mux, comprises an Analog Input which will be used to set the reference voltage level and a R/W control signal for a corresponding gamma reference controller. The mux **320** connects signals from the programming engine **310** to any one of the programmable analog floating gate memory cells **330** through **337**, depending on three address inputs (A_0, A_1, and A_2). Address inputs are used to select which cell is being written to at any time.

Each output is internally connected to an analog storage cell which can be written with analog values, for example, of 1024 step (10 Bit) resolution. The outputs, channel **0** (CH**0**), channel **1** (CH**1**), . . . channel **6** (CH**6**), and channel **7** (CH**7**), are intended to directly drive the reference voltage inputs of the source driver IC. An internal voltage multiplier, having a multiplication factor M, produces an output of zero up to typically 13.5 or alternatively 16 Volts. In FIG. **3**, the channel **0**, CH**0**, is driven by a driver **340**, which connects to the programmable analog floating gate memory cells **330**. The channel **1**, CH**1**, is driven by a driver **341**, which connects to the programmable analog floating gate memory cells **331**. The channel **6**, CH**6**, is driven by a driver **346**, which connects to the programmable analog floating gate memory cells **336**. The channel **7**, CH**7**, is driven by a driver **347**, which connects to the programmable analog floating gate memory cells **337**.

During read mode, all channels continuously output their corresponding stored voltages. Applying a logic "0" to the R/W pin initiates a track and write cycle and the RDY\ pin goes to logic "1". The addressed channel now outputs a voltage which is equal to the voltage applied to the Vin pin, multiplied by the voltage multiplication factor M. The channel address may be changed during tracking mode. At the rising edge of R/W a write cycle is initiated and the present voltage applied to Vin is automatically stored in the analog memory corresponding to the addressed channel. Completion of the write cycle is indicated by a high to low transition at the RDY pin.

TABLE 1

Name	Description	Value Range	Function
VDD	Supply Input	3 V to 5.5 V	
Vdisp	Display Supply	10 V to 12 V	
R/W	Read/Write	CMOS Input	When driven to an active low input, places the selected output into tracking mode. The Rising Edge of R/W writes the voltage on the analog input into the appropriate analog memory location
Rdy	Device Ready	TTL Compatible Output	
VSS	Ground		
CH0-CH7	Analog Outputs	0 V-10 V	Analog Output Voltage Channels
VIN	Analog Input	0 V-3 V	Analog Input Voltage
A0-A3	Address Inputs	CMOS Inputs	Selects which output is placed in tracking mode or is written to during a write operation

Table 1 shows an alternative example of the pin descriptions for a gamma reference controller.

TABLE 2

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{IL}	Input Low Voltage			$V_{DD} \times 0.3$	V	
V_{IH}	Input High Voltage	$V_{DD} \times 0.7$			V	
V_{OutL}	Analog Output Low Voltage Vin = 0.1 V Vdisp = 10 V		0.33		V	I_{OL} = 10 mA
V_{OutH}	Analog Output High Voltage Vin = 3 V Vdisp = 10 V		10		V	I_{OH} = −10 mA
V_{OL}	Logic Output Low Voltage			0.4	V	I_{OL} = 0.3 mA
V_{OH}	Logic Output High Voltage	$V_{DD} - 0.8$			V	I_{OH} = −250 µA
I_{IL}	Input Leakage Current			±1.0	µA	

TABLE 2-continued

Symbol	Parameter	Min	Typ	Max	Units	Condition
I_{DD}	V_{DD} Current$_{(Operating)}$			0.8	mA	R_{EXT} = ∞
				1.0	mA	R_{EXT} = ∞
				1.5	mA	R_{EXT} = ∞
I_{SB}	V_{DD} Current$_{(Standby)}$			10	µA	
V_{IN}	V_{IN} Range	0		V_{DD} − 0.8	V	
R_{IN}	V_{IN} Input Resistance	1.0			MΩ	
AV_{IN}	Channel Gain		3.3		V/V	V_{IN} to V_{OUT}

Table 2 shows an alternative example of the electrical parameters for a gamma reference controller.

Examples of eight to eighteen channel Gamma reference controllers have been used; clearly larger ones, 256 channels and higher, are encompassed by the invention. Various output voltage ranges are optional as well, 0-5V up to 0-16V, depending on the display requirements. Specific ranges or limits of the various parameters are used herein as examples of different embodiments and are not intended to limit the scope of the invention.

In one embodiment of the invention, the integrated circuit, termed the AG1818, is a programmable gamma reference generator with integrated output buffers to directly drive the source driver inputs of a display; in one embodiment the display is a TFT LCD. The circuit requires a single 3.3 volt supply, 1.5 mA operating current and consumes 10 µA in standby mode. FIGS. **4**A and **4**B show an alternative pin out of this embodiment.

Eighteen output channels are provided with an output range of 0 to 13.5 Volts and a drive capability of 10 milliamps. Each output is internally connected to an analog nonvolatile storage cell which can be written with 1,024 analog values, providing 10 bit resolution, or, said another way, to better than 15 mV resolution. The output of these analog nonvolatile memory cells is internally buffered to allow for the high voltages and current needed to directly drive the reference inputs on the source drivers. The outputs can be programmed from 0.2 volts to 0.2 volts below the VREFH value. FIG. **5** shows representative electrical specifications.

In one embodiment the AG1818 has capacity to store and retrieve eight independent banks or groups of reference voltages. The banks of gamma voltages are stored and selected through the three address inputs B**0**, B**1**, B**2**. This allows the gamma voltages to be changed either for dynamic gamma correction or application based gamma variation. This feature can also be used to switch between different gamma settings based on the information to be displayed for implementing dynamic gamma correction. A block diagram in FIG. **6** illustrates one alternative embodiment.

During read mode, all channels continuously output their corresponding stored voltages based on the bank selected by the B0-B2 address inputs. When deemed appropriate an internal damping circuit creates a slow transition, about 10 msec., between banks to prevent disruptive display artifacts caused by rapid transitions on the gamma reference voltages during operation. Alternative damping circuits may be employed which allow the transition between banks to be considerably slower, for instance, one second, as may be required by the display manufacturer's requirements.

An independent programming interface allows the device to be programmed in-situ thus providing the ability to individually program or adjust the gamma reference voltages for an individual display. The device can also be programmed prior to mounting on the pc board or display. The programming interface consists of four signals. The V_{PP} is a high voltage input used to select the programming mode and also provides the high voltage pulses used to program the individual cells. In the AG1818 embodiment, V_{PP} is supplied from an external source, an IC or other means. The A_{OUT} analog output is used to read the cell which is currently being programmed to verify the write operation and proper output voltage level. The A0 through A1 inputs are used in conjunction with the B0-B2 inputs to select the location to be written.

One alternative method of programming the individual cells starts by placing A0, A1, B0, B1, B2 lines in the (1, 1, 1, 1, 1) state and taking the V_{PP} pin high; this places the AG1818 in the Program mode; the read mode is the default mode. Next the particular bank is addressed through B**0**-B**2**; V_{PP} is pulsed again, latching the bank address. Next the cell to be programmed in the selected bank is addressed using the A0, A1, B0, B1, B2 lines; V_{PP} is pulsed again, a third time. At this point programming of the selected storage cell is initiated by pulsing V_{PP} with adjustable voltage pulses between approximately 8 and 14 volts. When the selected cell has achieved the desired voltage level the A0, A1, B0, B1, B2 lines are again placed in the (1, 1, 1, 1, 1) state; the V_{PP} pin is pulsed; this returns the AG1818 to the read mode. Programming of additional cells proceeds from the beginning sequence; any order of programming storage cells, random or sequential, can be applied.

Key variables in the programming process are programming voltage amplitude, rise and fall time of the pulse, and pulse duration; each of these variables is influenced by design and process parameters of the particular wafer fabrication facility. Real time monitoring of the cell voltage level is accomplished through the A_{OUT} pin which reflects the cell voltage as it is in the output buffer which is the voltage which will be applied to the display column. The use of the A_{OUT} pin provides an essential countermeasure to the vagaries of the design and fabrication processes. Independent of what voltage actually is stored in the cell the A_{OUT} pin gives the ability for closed loop programming such that a precise gamma reference voltage is provided to a specific column. As mentioned previously, this programming step can take place prior to mating the gamma reference chip with a display wherein a predetermined set of voltage values is stored. Alternatively, the programming can take place after the gamma reference chip and display are mated; in this case the display quality can be evaluated as the gamma reference chip is being programmed if required.

One knowledgeable in the art that understands that other addressing schemes, such as a serial one, are possible, enabling an overall reduction in the pin count. Having bank switching capability ensures that the optimum gamma curve is used for each individual display and eliminates the need for re-work due to display manufacturing process variations. A PC based programming interface is available for prototyping and gamma optimization. This PC programming interface may be an alternative source of the V_{PP} signals. Display optimization algorithms may be located in such a PC which also may be connected to monitors feeding back data from the display during the optimization tuning at time of manufacture.

This invention also enables several additional features for the user and manufacturer. Automating the testing of a panel can be achieved with optical sensors and feedback to the

gamma correction section of the display. Once the optical sensors have modulated gamma reference voltage levels for the columns to achieve the predetermined light matching for the display these values can be saved in the gamma reference circuitry. In this way different application conditions can be pretested and stored. For the user, a sensor can be supplied with the display which responds to the temperature, lighting or other conditions present. The output of the sensor can be matched to a predetermined application condition which selects the corresponding gamma value set.

The above embodiments are only illustrative of the principles of this invention and are not intended to limit the invention to the particular embodiments described. Although the above embodiment describes the application of a gamma trimster for a TFT display, one of skill in the art should know that the present invention can be practiced in various types of displays and screens. Accordingly, various modifications, adaptations, and combinations of various features of the described embodiments can be practiced without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. A method of calibrating a liquid crystal display to a desired gamma curve to compensate for panel to panel manufacturing variations comprising the steps:

a. providing said display with gamma reference control capability which is electrically reprogrammable and non-volatile;

b. testing said display with at least one sensor with optical input, wherein said sensor is separate from said display;

c. varying gamma reference voltage levels on columns of said display by a control circuit, wherein said control circuit is separate from said display;

d. optimizing said gamma reference voltage levels using means for executing a predetermined algorithm according to a predetermined criteria and data sensed by said at least one sensor, wherein said means for executing said predetermined algorithm is separate from said display to achieve the desired gamma curve; and

e. storing said gamma reference voltage levels in said gamma reference control capability.

2. The method of claim **1** wherein the method is repeated more than once under different ambient display conditions to generate at least one different set of gamma reference voltage levels stored in said gamma reference control capability.

3. A method of programming one or more gamma reference voltage generator integrated circuits attached to a liquid crystal display comprising the steps:

a. selecting one or more columns on said liquid crystal display;

b. applying one or more different gamma voltages to said liquid crystal display columns;

c. storing said applied gamma voltages in reprogrammable, nonvolatile cells in said gamma reference voltage generator integrated circuits appropriate to said selected columns;

d. operating means for executing one or more optimization criteria algorithms based on optical emission corresponding to said selected columns, wherein said means for executing said one or more optimization criteria algorithms is separate from said liquid crystal display;

e. modifying said one or more different applied gamma voltages based on said one or more optimization criteria algorithms;

f. programming said applied gamma voltages in storage cells in said gamma reference voltage generator integrated circuits appropriate to said selected columns; and

g. repeating steps (d) through (f) until said one or more optimization criteria have been satisfied.

4. The method of claim **3** wherein said gamma reference voltage generator integrated circuit requires an external source for high voltage programming means.

5. A method for a liquid crystal display, comprising:

providing said liquid crystal display with gamma reference control capability which is electrically reprogrammable and non-volatile;

calibrating said liquid crystal display comprising:

a. testing said liquid crystal display with at least one sensor with optical input;

b. varying gamma reference voltage levels on columns of said liquid crystal display;

c. optimizing said gamma reference voltage levels using means for executing a predetermined algorithm according to a predetermined criteria and data sensed by said at least one sensor; and

d. storing said gamma reference voltage levels in said gamma reference control capability;

retrieving said gamma reference voltage levels from said gamma reference control capability; and

displaying an image on said liquid crystal display based on said gamma reference voltage levels.

6. The method of claim **5**, wherein the calibrating step is repeated more than once under different ambient display conditions to generate at least one different set of gamma reference voltage levels stored in said gamma reference control capability.

* * * * *

EXHIBIT C

S&P Capital IQ

Sharp Corporation México, S.A. de C.V. > Private Company Profile

Company Overview

Company Type: Private Company
Company Status: Operating Subsidiary
Website: www.sharp.com.mx
Number of Employees: 870
Year Founded: 1997
Total Amount Raised ($ mm)†: -
Total Rounds of Funding:-**
Latest Post-Money Valuation ($ mm) -
Latest Pre-Money Valuation ($ mm) -

† This number reflects the estimated value of the total new money raised through private placement rounds.
*** This value is an estimate of the total number of funding rounds this company has received.*

Business Description

Sharp Corporation México, S.A. de C.V. manufactures home electrical appliances and electronic components. The company was founded in 1997 and is based in Rosarito, Mexico. As of 2015 Sharp Corporation México, S.A. de C.V. operates as a joint venture of Hisense Electric Co., Ltd. and Hisense USA Corporation.

Primary Industry Classification

Consumer Electronics

Primary Office Location

Boulevard Sharp No. 3510 Parque Industrial | Rosarito, BJ | 22710 | Mexico
Phone: 52 661 613 5510 Fax: 52 661 613 1662

Parent Company

Hisense Visual Technology Co., Ltd. (SHSE:600060)

Current and Pending Investors

Investor	Initial Investment Date	Stake Type	Current Stake Amount	Round(s)
Hisense USA Corporation	Jul-31-2015	Minority	49.00 %	-

Prior Investors

Sharp Electronics Corporation

Financial Information (Currency: Reported Currency, in mm)

Total Revenue	165.5	**Operating Income**	-	**Total Assets**	-
Gross Profit	-	**EBITDA**	-	**Total Debt**	-
Net Income	-	**Estimated Number of Employees**	870	**Net Debt**	-

* Hover over data point numbers for date and source.

Company Notes

No Company Notes exist.

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S&P Capital IQ

Sharp Corporation México, S.A. de C.V. > Private Company Profile

Strategy Notes

No Strategy Notes exist.

Key Professionals

No Key Professionals have been profiled.

Last 5 Transactions

Announced Date	Closed Date	Transaction Type	Role	Target	Buyer/Investors	Sellers	Size($mm)
Jul-31-2015	Dec-31-2015	Merger/Acquisition	Target	Sharp Corporation México, S.A. de C.V.	Hisense USA Corporation,Qingdao Hisense Electronics Co., Ltd. (nka:Hisense Visual Technology Co., Ltd. (SHSE:600060))	Sharp Electronics Manufacturing Company of America, Inc.,Sharp Electronics Corporation	22.88

* denotes that the relationship is proprietary

Last 5 Key Developments

Date	Event Type	Headline
Dec-31-2015	M&A Transaction Closings	Hisense Electric Co., Ltd. (SHSE:600060) along with Hisense USA Corp. completed the acquisition of Sharp Electronica Mexico, S.A. de C.V. from Sharp Electronics Manufacturing Company of America, Inc. and others.
Jul-31-2015	M&A Transaction Announcements	Hisense Electric Co., Ltd. (SHSE:600060) along with Hisense USA Corp. signed an agreement to acquire Sharp Electronica Mexico, S.A. de C.V. from Sharp Electronics Manufacturing Company of America, Inc. and others for approximately $22.9 million.
Oct-16-2007	Business Expansions	Sharp Electronica Mexico Opens Second Factory in Baja California, Mexico

News Headlines

No News is currently available for the selected sources.

S&P Global Ratings Credit Ratings

No S&P Global Ratings Credit Ratings data available.

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Sharp Corporation México, S.A. de C.V. > Private Company Profile

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EXHIBIT D

D&B Finance Analytics

Printed By: Tim Turner
Date Printed: 09/01/2023
Endorsement: Tim.Turner@wbd-us.com |

Summary

HISENSE ELECTRÓNICA MÉXICO, S.A. DE C.V.

Tradestyle(s): No Trades Available

ACTIVE

D-U-N-S	81-252-5871	**Address:**	Blvd. Sharp No. 3510, 22710, Playas de Rosarito, Baja California Norte, MX
Registration Number:	SEM971127NA5		
Phone:	+52 1 661 613 5510		

D&B Report - Company Details

Comprehensive Report

Hisense Electrónica México, S.A. de C.V.

ACTIVE

Location:	Blvd. Sharp No. 3510, Col. Parque Industrial Rosarito, Playas de Rosarito, C.P. 22710, Baja California Norte, Mexico
Telephone:	+(52) 661 6135510
D-U-N-S Number:	81-252-5871

IDENTIFICATION & SUMMARY

D-U-N-S Number
81-252-5871

Country Tax ID
SEM971127NA5

Telephone(s)
+(52) 661 6135510
+(52) 55 55313515

E-Mail
miguel.sanchez@sharpsemex.com
miguel.sanchez@sharpsemex.com
cramos@hisense.com.mx
marco.esponda@sharpsemex.com

Website
www.sharp.com.mx

SUMMARY

Type of Business
Stock Company with Variable Capital

Established
1997

Line of Business
Manufacture of electronic components

Primary SIC
36790000

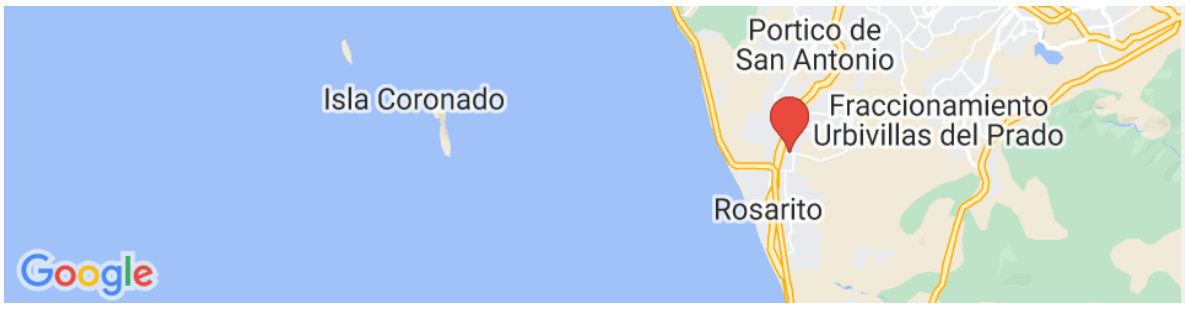
NAICS Code
334410

Imports
Yes

Exports
Yes

Employees
1700 (Total)

Principal
David Jonathan Gold
President



Address
Blvd. Sharp No. 3510
Col. Parque Industrial
Rosarito
Playas de Rosarito
C.P. 22710

RISK EVALUATION

Risk Indicator

3

Low Risk (1) High Risk (4)

After analyzing the risk factors, the subject obtained a risk assessment "3" showing slightly greater than average risk, so the transaction can be proceeded with by closely monitoring its performance.

EMMA Score

8

Low Risk (1) High Risk (10)

After analyzing the risk factors, the subject obtained an EMMA assessment of "8" which shows a high risk, therefore it requires thorough manual review of potential decline, or approval depending on the applicant's capacity, your internal policy and risk tolerance.

D&B Rating

D&B Rating: O3

Former Rating: O3

The Dun & Bradstreet Rating of O3 indicates:

- The Financial Strength is undetermined because the company’s balance sheet is not available
- A Risk Indicator which is slightly greater than average risk
- Hisense Electrónica México, S.A. de C.V. kept from a D&B Rating of O3 to O3. This means the company kept its Financial strenght and kept its Risk Level.

Paydex of This Business

100 0

55

Anticipated 120 days slow

After evaluating the subject's credit behavior against the industry´s behavior, a D&B Paydex® of "55" was obtained.

MAXIMUM CREDIT RECOMMENDATION (MCR)

There is insufficient information to determine a Maximum Credit Recommendation.

PRINCIPAL INFORMATION

Principal(s)	7

PAYMENT INFORMATION

Payment Record(s)	3

LEGAL EVENTS

Law Suit(s)	No

FINANCIAL SUMMARY

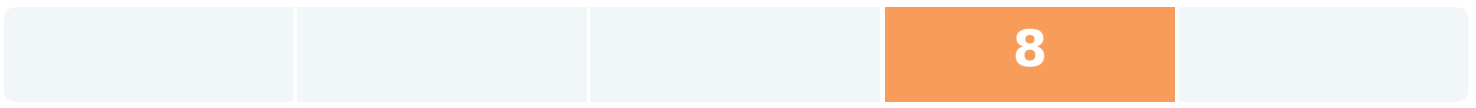
Sales	N/A
Net Worth	N/A
Capital	$ 248,411,000
Condition	Undetermined

Currency

All monetary amounts quoted in this report are shown in Mexican Pesos (MXN) unless otherwise stated

RISK ANALYSIS

EMMA SCORE



EMMA Score Analysis

Subject's EMMA score is mainly impacted by the following risk drivers:

- There are no lawsuits recorded against this company, which positively impacts its rating.
- Statistics suggest that the delay risk in this geographical area is generally low.
- The legal structure is available.

By evaluating all risk factors, the company is assigned with EMMA score of "8", indicating

Higher Risk

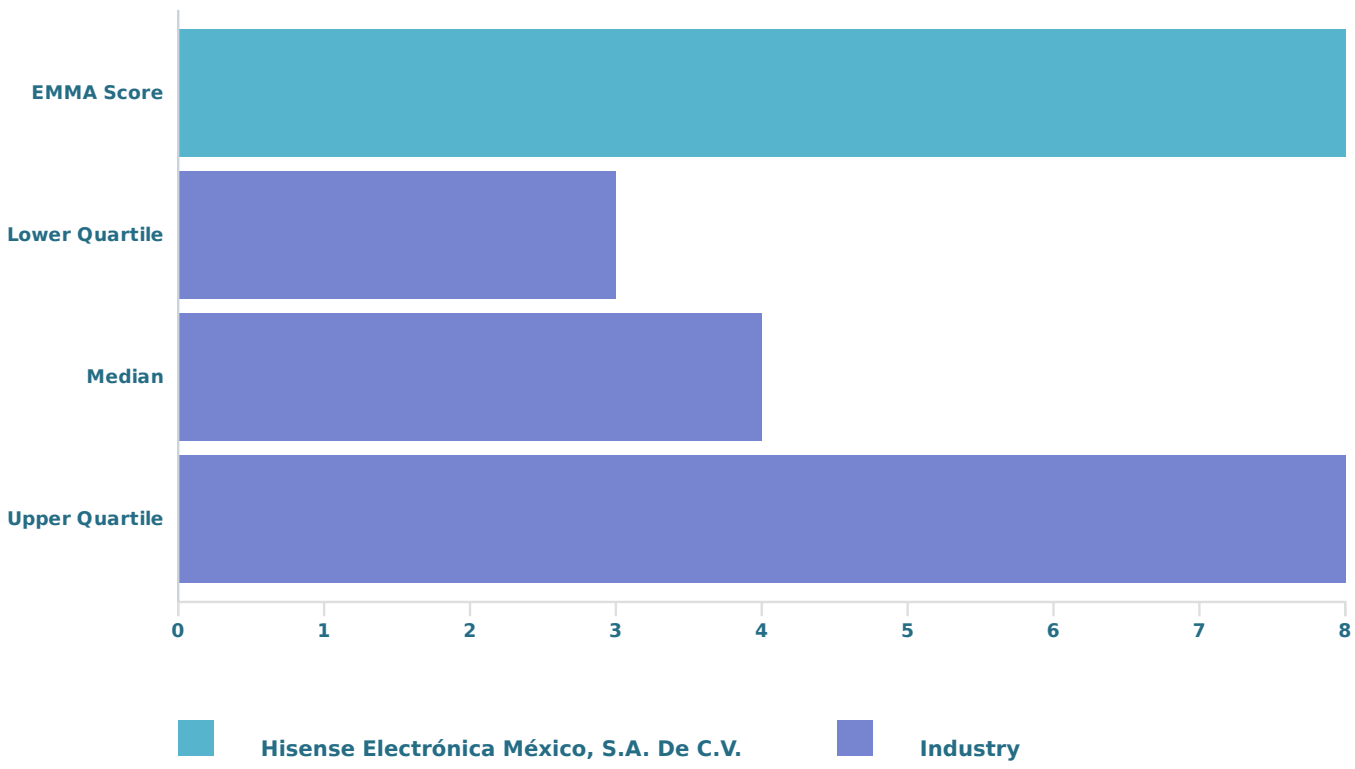
Industry Norm Grouping

Industry Group SIC	3679
Industry Group Description	Electronic components, nec

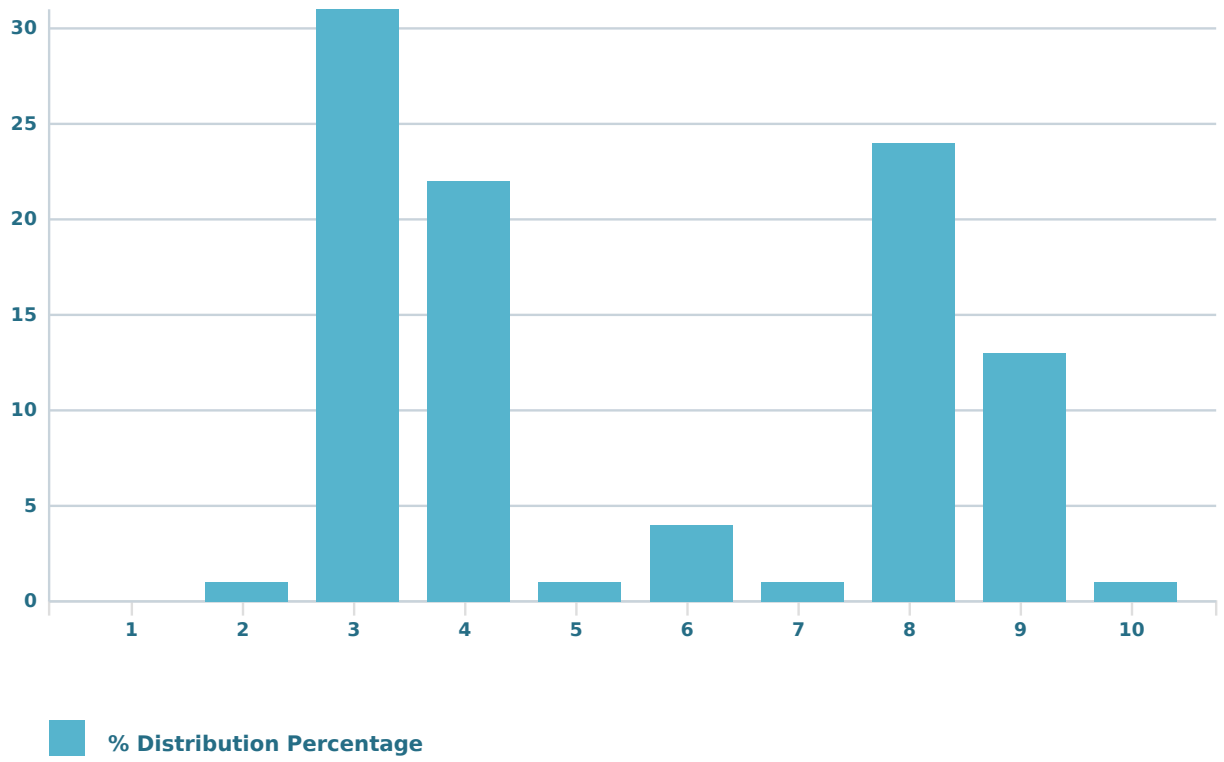
Industry Group EMMA Score Quartile Values

Lower Quartile	3
Median	4
Upper Quartile	8

Company Risk Vs Industry Norm Chart



Distribution of EMMA Score in D&B Mexico Database



The percentages on the graph may not always add up to 100 due to rounding.

Note: please refer to the report appendix for the principle and major factors of D&B Mexico EMMA Score.

TRADE PAYMENTS

D&B PAYDEX

The D&B Paydex is a unique indicator of payment performance weighted by the monetary value of payment experiences as reported to D&B by trade references. Should you require any further information or have any questions regarding Paydex, then please refer to the Appendices section for details on contacting your local D&B Customer Service Centre.

Paydex of This Business

100 0

55

Anticipated 120 days slow

This business has a **lower** paydex than its industry.

Paydex of This Industry

100 0

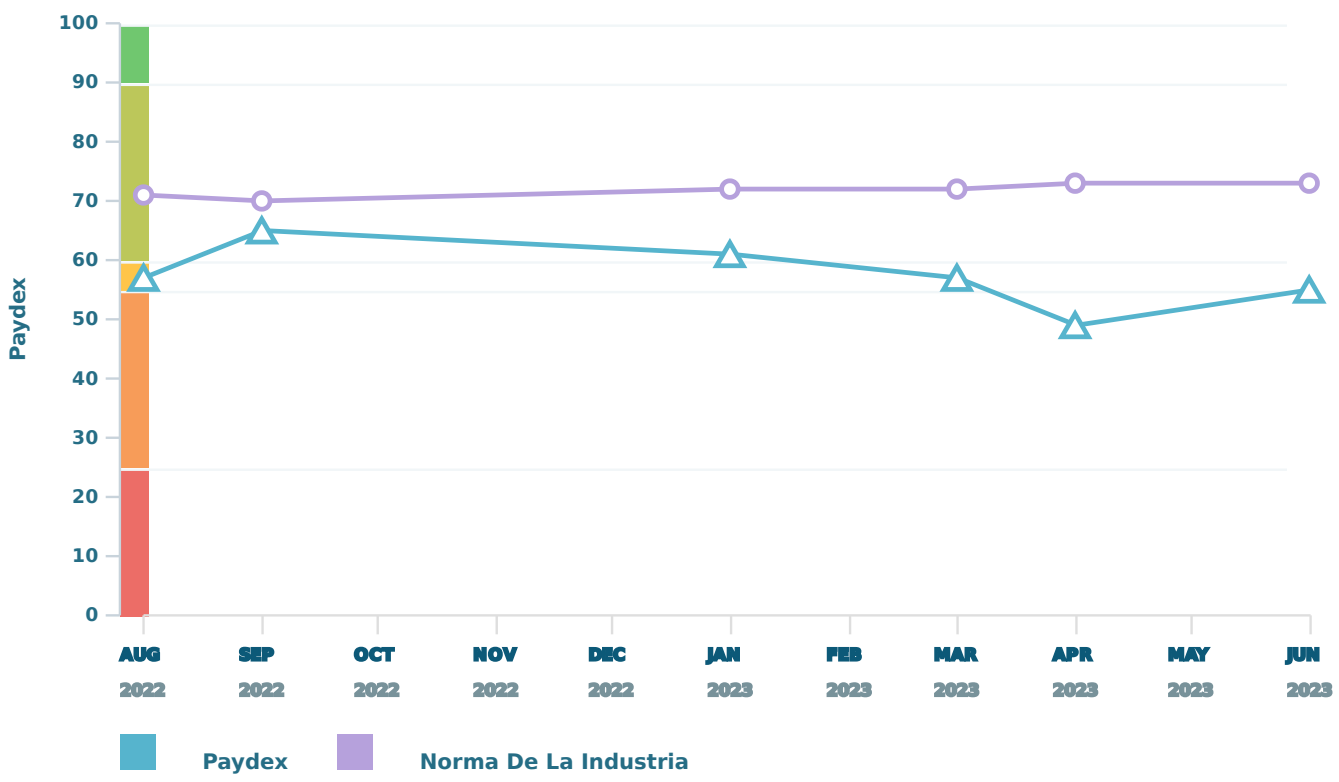
74

Anticipated 120 days slow

Industry Median	74
Upper/Lower Quartile	80/64
Based on	130 businesses

D&B PAYDEX YEARLY TREND WITH INDUSTRY COMPARISON

Is is based on payments collected over the past 12 months.



	Aug 2022	Sep 2022	Jan 2023	Mar 2023	Apr 2023	Jun 2023
Paydex	57	65	61	57	49	55
Ind Median	71	70	72	72	73	73
75th %ile	79	78	79	79	79	80
25th %ile	65	64	62	62	61	63

(0-50) High Risk of late payment (average 30 to 120 days beyond terms)

(51-80) Medium Risk of late payment (average 30 days or less beyond terms)

(81-100) Low Risk of late payment (average prompt to 30+ days sooner)

TRADE PAYMENT SUMMARY (MXN)

Value Bands	No of Exp	Total Value	Within Terms	1 - 30 Days	31 - 60 Days	61 - 90 Days	91+ Days
>= 4,000,000	0	0	0%	0%	0%	0%	0%
400,000 - 3,999,999	0	0	0%	0%	0%	0%	0%
200,000 - 399,999	0	0	0%	0%	0%	0%	0%
40,000 - 199,999	3	300,000	0%	0%	0%	0%	100%
20,000 - 39,999	0	0	0%	0%	0%	0%	0%
< 20,000	0	0	0%	0%	0%	0%	0%
TOTAL	3	300,000	0%	0%	0%	0%	100%

TRADE PAYMENT EXPERIENCES

D&B obtains payment references from local and international suppliers. References listed below may be from either or both sources. Amounts may be rounded to the nearest figure in prescribed ranges.

Date	Paying Record	Currency	High Credit	Now Owes	Past Due	Payment Terms	Last Sale
Jul 31, 2023	Prompt/Slow 150	MXN	100,000	100,000	0	30	Jul 01, 2023
Jun 30, 2023	Prompt/Slow 150	MXN	100,000	100,000	10,000	30	Jun 01, 2023
May 31, 2023	Prompt/Slow 150	MXN	100,000	40,000	10,000	30	May 01, 2023

Payment references contained in this report may have been obtained from the same source in different months and monetary units. In some instances, payment beyond terms can be the result of disputes over merchandise, lost invoices, etc.

Risk Assessment Matrix

		Risk Range	
PAYDEX	**Low (EMMA 1 - 3)**	**Medium (EMMA 4 - 7)**	**High (EMMA 8 - 10)**
PAYDEX >= 80	AA	BA	CA
80 > PAYDEX >= 60	AB	BB	CB
PAYDEX < 60	AC	BC	CC (Subject lies in this group)

Interpretation and Analysis of Risk Assessment Matrix

Classifications	Risk Level	Description	Credit Policy
Stable group	AA -> AB	The business is solid, and the bills are paid on time; therefore, it has a good credit reputation.	Credit policies can be granted with automatic approval.
Low risk group	BA -> BB -> AC	The business operates with little risk, although there are some delays in its payment history.	A pertinent credit policy is suggested, with some manual revisions.
Significant risk group	CA -> BC -> CB	The business operates with significant risk and there are some considerable delays in its payment history.	A strict credit policy is suggested, with a detailed manual review.
Monitoring group	CC	The business operates with a higher risk and there is the possibility of presenting a severe delay or failure to pay its bills.	It is suggested to avoid sales on credit and prefer cash agreements.

*Risk levels are listed in order of risk from low to high.

The results of the Risk Assessment Matrix show that the subject firm is assessed as **CC**; therefore, it belongs to monitoring group:

- The subject firm operates with a greater risk level, that is, its business risk is higher than the average of Mexican companies;
- The Paydex® of the subject firm / industry relation shows that its payment experiences are below the average level, and there are some significant delays in its payment behavior;
- In general, the business operations of the subject firm are below average, and its commercial risk level is relatively high. In addition, the subject firm / industry relation also shows a payment behavior with significant delays. Therefore, it is not recommended to grant credit facilities, but to adopt cash agreements or advance payments, considering the possible delays in its future payments.

SPECIAL EVENTS

News and Alerts

Government News and Alerts

On Dec 15, 2022, this firm is not registered in the list issued by the Office of Foreign Assets Control in the U.S.
For further information, visit the site:
https://www.treasury.gov/resource-center/sanctions/SDN-List/Pages/default.aspx

According to the Companet web site on Dec 14, 2022, we found the following: this business is not listed.

On the web page of sanctions from the Public Administration Ministry, we found the following: not listed

As of Oct 01, 2022, this business is not registered in the list of Not compliant Taxpayers issued by the Tax Administration Services (SAT). For more information visit the site: http://omawww.sat.gob.mx/cifras_sat/Paginas/datos/vinculo.html?page=ListCompleta69.html.

As of Oct 01, 2022, this business is not registered in the list of Not located Taxpayers issued by the Tax Administration Services (SAT). For more information visit the site: http://omawww.sat.gob.mx/cifras_sat/Paginas/datos/vinculo.html?page=ListCompleta69.html.

As of Oct 31, 2022, this business is not registered in the Taxpayers with Allegedly Non-existent Operations list issued by the Tax Administration Services (SAT). For more information visit the site: http://omawww.sat.gob.mx/cifras_sat/Paginas/datos/vinculo.html?page=ListCompleta69B.html.

This business is not listed on the REPSE website according to the search made on Dec 15, 2022.
For further information, visit the site:
https://repse.stps.gob.mx/app/

Additional Info

Although the commercial information indicates that the subject has business relationships with government entities and public institutions, it is not listed in the COMPRANET portal. For several days we tried to contact the subject, but it was not possible; It is likely that due to the contingency that the coronavirus pandemic is generating, all personnel is absent. At the time, the subject returns to normal activities and operations, an attempt will be made to conduct an interview

PUBLIC RECORD INFORMATION

On Dec 06, 2022 a match was made against our suits database and no suits were found filed against the subject.

BANKS

Hisense Electrónica México, S.A. de C.V. currently has accounts in the following bank(s):

Bank Name:	BANAMEX, S.A.
Location:	Tijuana, Baja California Norte, Mexico

Bank Name:	UNION BANK OF AMERICA
Location:	San Diego, United States

CURRENT INVESTIGATION

Investigation Information

It was not possible to make and appointment with the managers since they were absent.In the recent investigation ending on Dec 15, 2022

We have been in contact with the subject, but it has not been possible to interview anyone with the faculty to meet our request, since the contact provided is not available.
The information request was sent by email and messages were left on voicemail. However, to date there is no answer.
The content in this report was obtained through previous records and official sources.

HISTORY

Background

Established as a Stock Company with Variable Capital on Jan 08, 2016 registered by Notarys office 17 Bachelor Jalil Enrique Wehber Barreiro, registered in the Mercantile Registry in Tijuana, Baja California Norte Mercantile Folio 453*5

Duration of 99 years.

It was established in 1997.

This is a well established business.

Under present firm name since 2016.

Status active.

Object

Object: A.- Operate under a decree that establishes the operation and promotion of the export maquiladora industry, and in general, the manufacture, assembly, injection, sale, import, export, use and distribution of all types of plastic products, either by yes or through third parties. B.- The purchase, sale, import, export, storage, distribution, consignment, mediation or intermediation and general commercialization of machinery, equipment, spare parts, tools, raw materials and commercial goods in general that are related to subsection a) previous. C.- Purchase, sale or manufacture of all kinds of mechanical communication tools.

Changes

Former name: Sharp Electrónica México, S.A. de C.V. registered in Mercantile Folio No. 453*5 , deed 3992 , founded on Nov 27, 1997

On Jan 08, 2016 by charter amendment, the name was changed to Hisense Electrónica México, S.A. de C.V. , Notarys office No. 17, registered under Jalil Enrique Wehber Barreiro.

Capital

Capital Stock:	$248,411,000 Capital composition is divided into 248,411,000 shares of $1 .
Initial Capital Stock:	$50,000

Capital Distribution:

Capital distribution is as follows:

Shareholders	Stock Qty	% Capital
HISENSE USA CORPORATION	124205500	50 %
HISENSE ELECTRIC CO., LTD	121721390	49 %
HISENSE ELECTRONICS MANUFACTURING COMPANY OF AMERICA CORPORATION	2484110	1 %

Legal Representative

Por escritura número 33393 de fecha 28 de mayo de 2017 otorgada ante el Lic. Jalil Enrique Wehber Barreiro, Notario Público número 17 de la Ciudad de Tijuana, se acordó la escisión de Hisense Electrónica México, S.A. de C.V. como sociedad escindente, la cual sin extinguirse aporta parte de su activo, pasivo y capital social a una sociedad escindida de nueva creación Hisense México Property Management, S. de R.L. de C.V. Power of Attorney assigned to :

- The President who represent(s) the firm in all business transactions .

Associations

The subject is affiliated with:

Name:	CANIETI

CORPORATE STRUCTURE

Affiliates

The principals are:

Name:	Hisense Mexico Property Management, S. de R.L. de C.V.

D-U-N-S:	81-288-7608
Location:	Blvd. Sharp No. 3510 Playas de Rosarito Baja California Sur Mexico
Line of Business:	Wholesaler of electrical devices
SIC:	5065
Legal Status:	active
Year Started:	2018

PRINCIPALS

Name:	David Jonathan Gold
Position:	President Representative

Name:	Wei Li
Position:	Secretary

Name:	Tao Yu
Position:	Treasurer

Name:	Héctor Rubén Gutiérrez Uribe
Position:	Commissioner

Name:	Aotaki Masahiro
Position:	Finance Director

Name:	Miguel Sánchez González
Position:	Accountant

Name:	Claudia Ramos
Position:	Administrator

OPERATIONS

Line of Business

Manufacture of electronic components.

- SIC: 3679 - 0000 - Manufactures - Electronic components, nec
- NAICS: 334410 - Manufactures - Electronic components, nec

Mainly televisions, flat screens, etc

Company Size

N/A

Vehicles & Equipment

The subject owns the vehicles used by the business .

Vehicles including:

Quantity	Type	Make/Model	Manufactured	Cargo Capacity
8	vehicles of various models			

The company utilizes own equipment :

Quantity	Kind of Equipment
	office equipment and fixtures
	computer equipment
	assemblers

Sales

Sells mainly in national and international

- Mexico
- United States (100%)

Selling terms:

- 30 days

Sells private enterprises.

Sells government, 100%.

Sales are steady throughout the year.

Major Customers

Sells mainly to:

Name	%
SHARP ELECTRONIC MANUFACTURING COMPANY OF AMERICA	
HANIL ELECTRONICS MEXICO, S.A. DE C.V.	
SANYO MANUFACTURING, S.A. DE C.V.	
TREND SMART CE MEXICO, S. DE R.L. DE C.V.	
GOBIERNO MUNICIPAL DE PLAYAS DE ROSARITO	

Purchases

Purchases from 200 suppliers.

1% of purchases from national suppliers.

99% of purchases from foreign suppliers; payment terms from 30, 60 days.

Imports from :

- China
- Spain 100%

Purchases mainly from:

TELEFONOS DEL NOROESTE, S.A. DE C.V.

SIMBRES OCAÑA, ALFONOS ARNULFO

ARCALA VALLEJO, FABIAN

EPC INGENIERIA, S.A. DE C.V.

INDUSTRIAL SEISTE DE MEXICO, S.A. DE C.V.

PAPELERIA ANTONIOS, S.A. DE C.V

SUNGHO MECHATRONICS MEXICO, S.A. DE C.V.

SINIL INDUSTRY, S.A. DE C.V.

HISENSE ELECTRONICS MANUFACTURING COMPANY OF AMERICA CO

Employees

Total 1700.

Employees including:

- 200 office worker(s)

Insurance

- 1500 blue collar worker(s)

Insurance Company	Location	Risk
GRUPO NACIONAL PROVINCIAL, S.A.B.	Rosarito, Baja California Norte, Mexico	Covering various risks

LOCATION

Location

At this address the subject maintains the administrative offices, a sales office, a plant and a warehouse
Subject company owns a space.

CONCLUSION

Due to the lack of financial figures, subject's overall financial condition and trend can not be clearly determined
The subject firm has 25 years of commercial experience in the market.
According to the consulted suppliers, it has a record of prompt to slow payments. Registering an average delay of up to 60 days.
To date it has no lawsuits recorded.

APPENDICES

Customer Services

Should you require any further information or have any questions, please contact your local Customer Service Centre. Mexican subscribers please contact:

Dun & Bradstreet de Mexico, S.A. de C.V.
Durango 263, 5° Piso
Col. Roma
06700 México, Ciudad de México
Tel: +52 (55) 4166-3000
Tel: +52 (55) 5229-6900
Customer Service Portal: https://www.cialdnb.com/customer-support/
Website: https://www.cialdnb.com

Enquiries should **always** contain the below minimum details please:

- Full Company Name
- Full Headquarters Address
- Telephone Number
- Business Identification Number
- Contact Name
- Reference
- Order Date

D&B MEXICO EMMA Score

D&B EMMA Score (Emerging Market Mediation Alert Score) is a risk assessment model developed for emerging market countries. It is a score developed by data profiling approach and statistical modeling, which predicts the possibility of a business in perilous status of instability or unreliability, such as poor financials, delay payment, stale inventory, abnormal operational status, etc. The EMMA Score provides you with a quick assessment of a business' risk standing, and when used together with other information, allows you to make better risk decisions.

The EMMA Score is based on a scale of 1 to 10, where 1 represents a lower risk and 10 a higher risk.

EMMA Score for Mexico is initially rolled out in 2012, derived from the sample analysis of thousands of company records. When using the Score to make individual applicant decisions, a customized version of this table based on an analysis of the Score against your customer account portfolio is recommended. It does not necessarily mean doing business with a company,

which is assigned with higher Risk Score, will result in increased risk. EMMA Score for Mexico is calibrated on regular basis following D&B Global Modeling Methodology that captures business environmental change in Mexico caused by macro economy shift and particular systematic events.

MEXICO EMMA SCORE COMMENTARY

Risk Range	EMMA Score	% of report in Mexican Universe	Commentary
Low Risk Scores	1-3	28.27 %	Lower Risk Range
Medium Risk Scores	4-7	29.58 %	Average Risk Range
High Risk Scoress	8-10	42.15 %	Higher Risk Range

The Key Drivers of the EMMA Score include the following:

Business Information

- Legal Form
- Location
- Number of Employees
- Whether the Company has a parent
- Industry

Public Record

- Legal events - suits

Financial Information

- Total Liabilities
- Financial Ratios

Payment Information

- Delinquent Payment Data

EMMA SCORE APPLICATION

- *Low EMMA Score* **-**May proceed to process the applicant quickly with minimal or no manual review depending on the extent of score validation analysis.
- *Medium EMMA Score* **-**Medium Risk Scores - Recommend a manual review of the applicant based on the applicant's capacity, your internal policy and risk tolerance.
- *High EMMA Score* **-**High Risk Scores - Requires thorough manual review of potential decline, or approval depending on the applicant's capacity, your internal policy and risk tolerance.

D&B PAYDEX

The D&B Paydex is the payment performance indicator, weighted by the monetary value of the payment experiences as reported by D&B through credit references, which results in a numerical value. It is developed as a current performance measure based on the payment experiences in the D&B database. Its performance depends on the individual combination of payment experiences of a company, weighted according to their amounts in pesos or dollars.

The D&B Paydex identifies the internal factors that cause risks based on the company's payment records.

The D&B Paydex is based on a scale from 20 to 100.

LA CLAVE DEL D&B PAYDEX

Paydex	Payments
100	Advance payment
90	Discount
80	Prompt
70	15 days after term
60	22 Days after term
50	30 Days after term
40	60 Days after term
30	90 Days after term
20	120 Days after term
UN	Unavailable

INTERPRETATION AND ANALYSIS OF RISK ASSESSMENT MATRIX

Classifications	Risk Level	Description	Credit Policy
Quality group	AA->AB	The business is solid, and the bills are paid on time; therefore, it has a good credit reputation.	Credit policies can be granted with automatic approval.
Low risk group	BA->BB->AC	The business operates with little risk, although there are some delays in its payment history.	A pertinent credit policy is suggested, with some manual revisions.
High risk group	CA->BC->CB	The business operates with significant risk and there are some considerable delays in its payment history.	A strict credit policy is suggested, with a detailed manual review.
Monitoring group	CC	The business operates with a higher risk and there is the possibility of presenting a severe delay or failure to pay its bills.	It is suggested to avoid sales on credit and prefer cash agreements.

*Risk levels are listed in order of risk from low to high.

The Risk Assessment Matrix is a tool to investigate the insight of a subject and combined with EMMA Score and PAYDEX® EMMA Score can indicate the risk level of subject. With the help of PAYDEX® one can also further analyze subject's risk and find out the internal factors causing risks based on the payment records of subject. In summary, the assessment matrix can make further insightful analysis towards the enterprises with similar EMMA Scores.

When using EMMA Score and Risk Assessment Matrix, the combination of other information, such as internal assessment policy of enterprise, commercial information provided by D&B, and feedback from the people who directly contacts with subject, etc., is recommended. This information will allow you to make suitable risk decisions.

DETERMINING THE SIZE OF THE COMPANY

The size of the company presented is determined by the Ministry of Economy, which takes as factors the number of employees and the income generated by the company.

STRATIFICATION

Size	Sector	Number of Workers Range	Annual Sales Amount Range
Micro	All	Up to 10	Up to $4,000,000
Small	Commerce	From 11 to 30	From $4,000,001 to $100,000,000
	Industry	From 11 to 30	From $4,000,001 to $100,000,000
	Services	From 11 to 30	From $4,000,001 to $100,000,000
Medium	Commerce	From 31 to 100	From $100,000,001 to $250,000,000
	Industry	From 51 to 100	From $100,000,001 to $250,000,000
	Services	From 51 to 250	From $100,000,001 to $250,000,000
Big	Commerce	From 101	From $250,000,001
	Industry	From 101	From $250,000,001
	Services	From 251	From $250,000,001

MAXIMUM CREDIT RECOMMENDATION (MCR)

The Maximum Credit Recommendation is the maximum amount of debt that an individual or company can assume without putting their financial integrity at risk.

The key drivers of the Maximum Credit Recommendation include the following:

Firmographic information

- Tenure
- Number of Employees
- Capital Stock
- Corporate Structure
- Credit Behavior

Financial Information

- Financial Ratios
- Sales Amount

CONFIDENCE SCORE: MAXIMUM CREDIT RECOMMENDATION (MCR)

Score Indicator	Confidence Score Interpretation	Description
A	High	The Maximum Credit Recommendation is based on financial information less than 18 months old.
B	Medium High	The Maximum Credit Recommendation is based on financial information older than 18 months.
C	Medium Low	The Maximum Credit Recommendation is based on the amount of official sales of the company.
D	Low	The Maximum Credit Recommendation is based on the company's estimated sales amount.

D&B RATING GLOSSARY

The following ratings are available for businesses in Mexico:

D&B Rating- The D&B® Rating in Mexico consists of 2 parts, the Financial Strength Indicator and the Risk Indicator. The Financial Strength Indicator is based on Net Worth of a current fiscal balance sheet. The table below contains the values for the D&B Rating in Mexico.

Financial Strength Indicator

Range MXN			Composition of Risk Indicator			
Net Worth	**From**	**To**	**Strong**	**Good**	**Fair**	**Poor**
5A	511,490,000	And above	1	2	3	4
4A	102,298,000	511,489,999	1	2	3	4
3A	15,345,000	102,297,999	1	2	3	4
2A	7,672,000	15,344,9999	1	2	3	4
1A	3,836,000	7,671,999	1	2	3	4
A	1,923,000	3,835,999	1	2	3	4
B	962,000	1,922,999		2	3	4
C	481,000	961,999		2	3	4
D	246,000	480,999		2	3	4
E	123,000	245,999		2	3	4
F	61,000	122,999		2	3	4
G	Up to	60,999		2	3	4
O	Balance Sheet not available.					

Risk Indicator	Condition	Level Risk	Interpretation
1	Strong	Minimum Risk	Grant Credit - offer more enlarged terms if necessary
2	Good	Risk Low	Grant Credit
3	Fair	Slightly bigger than the average Risk	Grant Credit, but monitor
4	Poor	Meaningful Risk	Examine each case before granting credit, get more market information, and analyze other suppliers. Ask for assurance if necessary due to the high risk.
S	Service Companies	By the business nature, do not sign risk level	Companies that do not request credit in their normal activities (Banks, Brokerages, Insurance Co., Schools, Associations, Government, etc...)
-	Undetermined	Unknown Risk	Insufficient Information

An 'S' Risk Indicator is only assigned in conjunction with a Financial Strenght Indicator (e.g. 5A-S, 4A-S, F-S, O-S)

Risk Indicator- Used in conjunction with the Financial Strength Indicator. The Risk Indicator reflects D&B's opinion of the risk associated with trading with a specific business, notably the likelihood of business continuance or failure over the next 12 months.

ALTERNATE RATINGS USED

--	No information available
NB	New Business: Less than 30 months
BR	Local Branch
FB	Foreign Branch
NQ	Out of Business: Business has ceased to trade
N4	Negative Net Worth

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EXHIBIT E

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
SHERMAN DIVISION

FREEDOM PATENTS LLC,

Plaintiff,

v.

HISENSE COMPANY LTD., HISENSE VISUAL TECHNOLOGY CO. LTD. F/K/A QINGDAO HISENSE ELECTRIC CO. LTD., HISENSE INTERNATIONAL CO. LTD., HISENSE INTERNATIONAL (HONG KONG) AMERICA INVESTMENTS CO. LTD., and HISENSE INTERNATIONAL (HK) CO. LTD.,

Defendants.

CIVIL ACTION NO. 4:23-CV-00419-ALM

JURY TRIAL DEMANDED

ANSWER AND COUNTERCLAIMS TO COMPLAINT FOR PATENT INFRINGEMENT

Defendants Hisense Company Ltd., Hisense Visual Technology Co. Ltd. F/K/A Qingdao Hisense Electric Co. Ltd., Hisense International Co. Ltd., Hisense International (Hong Kong) America Investments Co. Ltd., and Hisense International (HK) Co. Ltd. (collectively "Hisense Defendants" or "Defendants"), by and through their undersigned counsel, hereby answers Freedom Patents LLC's ("Plaintiff" or "Freedom Patents") Complaint for Patent Infringement ("Complaint") (Dkt. No. 1). The headings and numbered paragraphs herein correspond to those set forth in the Complaint solely for ease of reference.

PARTIES

1. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

2. Defendant Hisense Company Ltd. ("Hisense Co. Ltd.") admits it is a Chinese corporation with a place of business at Hisense Tower No. 17, Donghaixi Road, Qingdao, Shandong Province, 266071, P.R.C. Defendants deny this paragraph's remaining allegations

3. Defendants admit certain Hisense entities manufacture and sell TVs and entertainment systems across the globe and that between January and October of 2022 nearly 20 million Hisense TVs shipped globally. Hisense Co. Ltd. admits that it is a subsidiary of Qingdao Huatong State-owned Capital Investment and Operation Group Co. Defendants deny this paragraph's remaining allegations.

4. Defendant Hisense Visual Technology Co. Ltd. f/k/a Qingdao Hisense Electric Co. Ltd. ("Hisense Visual") admits it is a Chinese corporation with a place of business at 218 Qianwangang Road, Qingdao Economic & Technological Development Zone, Qingdao, Shandong Province, 266555, P.R.C. Defendants deny this paragraph's remaining allegations.

5. Defendant Hisense Visual admits it is a partial subsidiary of Hisense Group Holding Co. Ltd. The Hisense Defendants admit that there are multiple subsidiaries. Hisense Visual admits it is involved in the research, design, development, testing, and manufacture of electronic devices, including TVs. Hisense Visual admits it was formerly known as Qingdao Hisense Electronics Co., Ltd., and before that, as Hisense Electric Co., Ltd. Defendants deny this paragraph's remaining allegations.

6. Defendant Hisense International Co. Ltd. admits it is a Chinese corporation. Defendants deny this paragraph's remaining allegations.

7. Defendant Hisense International Co. Ltd. admits it is a subsidiary of other entities. Defendant Hisense International Co. Ltd. admits that it is a subsidiary of Hisense Visual. Defendants deny this paragraph's remaining allegations.

8. Defendant Hisense International (Hong Kong) America Investments Co. Ltd. ("Hisense HK America") admits that it is a Hong Kong corporation with a place of business at Room 3101-3105, Singga Commercial Centre, No. 148 Connaught Road West, Hong Kong SAR, P.R.C. Defendants deny this paragraph's remaining allegations.

9. Defendant Hisense HK America admits it is a partial subsidiary of Hisense International America Holdings Co. Ltd. Defendants deny this paragraph's remaining allegations.

10. Defendant Hisense International (HK) Co. Ltd. ("Hisense International (HK)") admits that it is a Hong Kong corporation with a place of business at 3101-3105, Singga Commercial Centre, No. 148 Connaught Road West, Hong Kong SAR, P.R.C. Defendants deny this paragraph's remaining allegations.

11. Defendant Hisense International (HK) admits it is a partial subsidiary of Hisense International Co., Ltd. Defendants deny this paragraph's remaining allegations

12. Denied.

13. Denied.

14. Denied.

15. Denied.

16. Denied.

JURISDICTION AND VENUE

17. Defendants admit that the complaint purports to allege an action arising under the patent laws of the United States. Defendants admit this Court has subject matter jurisdiction over such actions. Defendants deny the remaining allegations of this paragraph.

18. Defendants do not contest whether personal jurisdiction over them properly lies in this District for purposes of this action only, but deny any allegations, suggestion, or inference that personal jurisdiction is proper in this District for all actions against any of the Hisense Defendants. Defendants deny the remaining allegations of this paragraph.

19. For purposes of this action only, Defendants do not contest whether venue in his District is proper, but Defendants do deny that venue is this District is clearly the most convenient. Defendants deny the remaining allegations of this paragraph.

BACKGROUND

20. Denied.

21. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

22. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

COUNT I

DIRECT INFRINGEMENT OF U.S. PATENT NO. 8,284,686

23. Defendants admit U.S. Patent No. 8,248,686 (the "'686 patent") was issued on October 9, 2012 and has a title of "Antenna/Beam Selection Training in MIMO Wireless LANS with Different Sounding Frames." Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's remaining allegations and therefore deny such allegations on that basis.

24. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

25. Defendants admit paragraph 25 of the complaint purports to list certain URLs. Defendants deny this paragraph's remaining allegations, and Defendants further deny they infringe any valid claim of the '686 patent.

26. Denied.

27. Denied.

28. Denied.

29. Denied.

30. Denied.

31. Denied.

32. Denied.

33. Denied.

34. Denied.

35. Denied.

36. Denied.

37. Denied.

38. Denied.

39. Denied.

40. Denied.

41. Denied.

42. Denied.

43. Denied.

44. Denied.

45. Denied.

46. Denied.

47. Denied.

48. Denied.

49. Denied.

50. Denied.

51. Denied.

52. Denied.

53. Denied.

54. Denied.

55. Denied.

56. Denied.

57. Denied.

58. Denied.

59. Defendants admit Freedom Patents never provided notice of the '686 patent before filing suit, and that Defendants only became aware of the '686 patent after it learned of the instant litigation.

60. Denied.

61. Defendants lack sufficient knowledge and information to form a belief as to whether Freedom Patents, or any prior owner of the '686 patent, made or sold unmarked articles that practiced the '686 patent. Defendants deny this paragraph's remaining allegations, and Defendants further deny they infringe any valid claim of the '686 patent, and Defendants further deny Freedom Patents is entitled to any damages.

COUNT II

DIRECT INFRINGEMENT OF U.S. PATENT NO. 8,374,096

62. Defendants admit U.S. Patent No. 8,374,096 (the "'096 patent") was issued on February 12, 2013 and has a title of "Method for Selecting Antennas and Beams in MIMO Wireless LANs." Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's remaining allegations and therefore deny such allegations on that basis.

63. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

64. Defendants admit paragraph 64 of the complaint purports to list certain URLs. Defendants deny this paragraph's remaining allegations, and Defendants further deny they infringe any valid claim of the '096 patent.

65. Denied.

66. Denied.

67. Denied.

68. Denied.

69. Denied.

70. Denied.

71. Denied.

72. Denied.

73. Denied.

74. Denied.

75. Denied.

76. Denied.

77. Denied.

78. Denied.

79. Denied.

80. Denied.

81. Defendants admit Freedom Patents never provided notice of the '096 patent before filing suit, and that Defendants only became aware of the '096 patent after it learned of the instant litigation.

82. Denied.

83. Defendants lack sufficient knowledge and information to form a belief as to whether Freedom Patents, or any prior owner of the '096 patent, made or sold unmarked articles that practiced the '096 patent. Defendants deny this paragraph's remaining allegations, and

Defendants further deny they infringe any valid claim of the '096 patent, and Defendants further deny Freedom Patents is entitled to any damages.

COUNT III

DIRECT INFRINGEMENT OF U.S. PATENT NO. 8,514,815

84. Defendants admit U.S. Patent No. 8,514,815 (the "'815 patent") was issued on August 20, 2013 and has a title of "Training Signals for Selecting Antennas and Beams in MIMO Wireless LANs." Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's remaining allegations and therefore deny such allegations on that basis.

85. Defendants lack sufficient knowledge and information to form a belief as to the truth of this paragraph's allegations and therefore deny such allegations on that basis.

86. Defendants admit paragraph 86 of the complaint purports to list certain URLs. Defendants deny this paragraph's remaining allegations, and Defendants further deny they infringe any valid claim of the '815 patent.

87. Denied.

88. Denied.

89. Denied.

90. Denied.

91. Denied.

92. Denied.

93. Denied.

94. Denied.

95. Denied.

96. Denied.

97. Denied.

98. Denied.

99. Denied.

100. Denied.

101. Denied.

102. Defendants admit Freedom Patents never provided notice of the '815 patent before filing suit, and that Defendants only became aware of the '815 patent after it learned of the instant litigation.

103. Denied.

104. Defendants lack sufficient knowledge and information to form a belief as to whether Freedom Patents, or any prior owner of the '815 patent, made or sold unmarked articles that practiced the '815 patent. Defendants deny this paragraph's remaining allegations, and Defendants further deny they infringe any valid claim of the '815 patent, and Defendants further deny Freedom Patents is entitled to any damages.

ADDITIONAL ALLEGATIONS REGARDING INFRINGEMENT

AND PERSONAL JURISDICTION

105. Denied.

106. Denied.

107. Denied.

108. Denied.

109. Denied.

110. Denied.

111. Denied.

112. Denied.

113. Denied.

114. Denied.

115. Denied.

116. Denied.

117. Denied.

118. Denied.

119. Denied.

120. Denied.

121. Denied.

122. Denied.

123. Denied.

124. Denied.

125. Denied.

126. Denied.

127. Defendants admit Freedom Patents never provided notice of the asserted patents before filing suit, and that Defendants only became aware of the asserted patents after it learned of the instant litigation. Defendants deny this paragraph's remaining allegations.

128. Denied.

129. Denied.

130. Denied.

131. Denied.

132. Denied.

JURY DEMAND

Freedom Patents' demand for jury trial does not require a response by Hisense Defendants. Hisense Defendants request a jury trial on all triable issues including without limitation its affirmative defenses to the extent allowed by law.

PRAYER FOR RELIEF

Hisense Defendants deny that Plaintiff is entitled to any relief whatsoever, including but not limited to, the relief sought in Paragraphs A-F of Freedom Patents' Prayer for Relief.

AFFIRMATIVE AND OTHER DEFENSES

Without assuming any burden other than imposed by operation of law, Defendants assert the following affirmative and other defenses in response to the allegations in the Complaint.

FIRST DEFENSE
(Failure to State a Claim)

133. Freedom Patents' complaint fails to state a claim upon which relief can be granted.

SECOND DEFENSE
(No Infringement)

134. Defendants do not infringe and have not infringed any valid and enforceable claim of any of the patents-in-suit, either directly, indirectly, literally, or under the doctrine of equivalents.

THIRD DEFENSE
(Invalidity)

135. Each asserted claim of the patents-in-suit is invalid for failing to satisfy the conditions for patentability set forth in Title 35 of the United States Code, including without limitation 35 U.S.C. §§ 101, 102, 103, and 112.

FOURTH DEFENSE
(Improper Inventorship)

136. Each asserted claim of the patents-in-suit fail to name all of the actual inventors of the claimed subject matter of the asserted claims rending all such claims invalid.

FIFTH DEFENSE
(Prosecution History Estoppel)

137. By reasons of statements, representations, admissions, concessions, arguments, and/or amendments made by and/or on behalf of the applicants to and by the United States Patent & Trademark Office during the prosecution of the patent applications that led to the issuance of the patents-in-suit, Freedom Patents claims of patent infringement are barred, in whole or in part, by the doctrine of prosecution history estoppel and/or disclaimer, because none of the claims can be properly construed as covering any of the Defendants' products.

SIXTH DEFENSE
(Limitation on Damages)

138. Freedom Patents' claims for relief are statutorily limited in who or in party by Title 35 of the United States Code, including without limitation, 35 U.S.C. §§ 286 and/or 287.

SEVENTH DEFENSE
(Equitable Defenses)

139. On information and belief, Freedom Patents' claims against Hisense are barred, in whole or in part, under the equitable doctrines of waiver, estoppel, and unclean hands, at least due to Freedom Patents and/or its predecessor(s) in interest's conduct with respect to the concealment of the true inventors of inventions claimed in the patents-in-suit.

RESERVATION OF RIGHTS

Defendants reserve all defenses under Rule 8(c) of the Federal Rules of Civil Procedure, the Patent Laws of the United States, and any other defenses, at law or in equity, which may now exist or in the future be available based on discovery or otherwise. Defendants reserve the right to amend its Answer to added further defenses, including instances of inequitable conduct, including as they become known throughout the course of discovery in this case.

COUNTERCLAIMS

1. Pursuant to Fed. R. Civ. P. 13, Counterclaim Plaintiffs Hisense Company Ltd., Hisense Visual Technology Co. Ltd. f/k/a Qingdao Hisense Electric Co. Ltd., Hisense International Co. Ltd., Hisense International (Hong Kong) America Investments Co. Ltd., and Hisense International (HK) Co. Ltd. (collectively, "Hisense" or "Counterclaimants") complain and allege against Counterclaim Defendant Freedom Patents LLC as follows:

NATURE OF THE LAWSUIT

2. This is an action for a declaration of non-infringement and invalidity of the claims of U.S. Patent No. 8,284,686 ("the '686 Patent"), U.S. Patent No. 8,374,096 ("the '096 Patent"), and U.S. Patent No. 8,514,815 ("the '815 Patent") (collectively, "the patents-in-suit"), arising under the Declaratory Judgment Act, 28 U.S.C. § 2201 *et seq*., and the patent laws of the United States, 35 U.S.C. § 1, *et seq*.

PARTIES

3. Hisense Company Ltd. is a Chinese company with a place of business at Hisense Tower No. 17, Donghaixi Road, Qingdao, Shandong Province, 266071, P.R.C.

4. Hisense Visual Technology Co. Ltd. f/k/a Qingdao Hisense Electric Co. Ltd is Chinese corporation with a place of business at No. 218 Qianwangang Road, Qingdao Economic & Technological Development Zone, Qingdao, Shandong Province, 266555, P.R.C.

5. Hisense International Co. Ltd is a Chinese corporation with a place of business at No. 218 Qianwangang Road Economic & Technical Development Zone, Qingdao, Shandong Province, P.R.C.

6. Hisense International (Hong Kong) America Investments Co. Ltd. is a Hong Kong corporation with a place of business at Room 3101-3105, Singga Commercial Centre, No. 148 Connaught Road West, Hong Kong SAR, P.R.C.

7. Hisense International (HK) Co. Ltd. is a Chinese corporation with a place of business at Room 3101-3105, Singga Commercial Centre, No. 148 Connaught Road West, Hong Kong SAR, P.R.C.

8. Freedom Patents LLC ("Freedom Patents") alleges that it is a limited liability company formed under the laws of the State of Texas, with its principal place of business at 2325 Oak Alley, Tyler, Texas, 75703.

JURISDICTION AND VENUE

9. This Court has subject matter jurisdiction over these counterclaims pursuant to 28 U.S.C. §§ 1331, 1338, 2201-02 and under Fed. R. Civ. P. 13(a). These counterclaims are compulsory counterclaims to the allegations of Freedom Patents' Complaint.

10. Venue is proper in this judicial district because the declaratory relief sought is based on compulsory counterclaims to the claims filed by Freedom Patents in this case and pursuant to 28 U.S.C. § 1391(b).

11. This Court has personal jurisdiction over Freedom Patents, *inter alia*, because Freedom Patents has submitted to personal jurisdiction in this venue by filing its Complaint here.

12. By virtue of the allegations in Freedom Patents' Complaint and Defendants' Answer thereto, an actual controversy exists between Counterclaimants and Freedom Patents as to whether the non-cancelled claims of the patents-in-suit are not infringed and invalid.

FIRST COUNTERCLAIM
Declaratory Judgment of Non-Infringement of the '686 Patent

13. Counterclaimants incorporate by reference the allegations in paragraphs 1 through 12 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

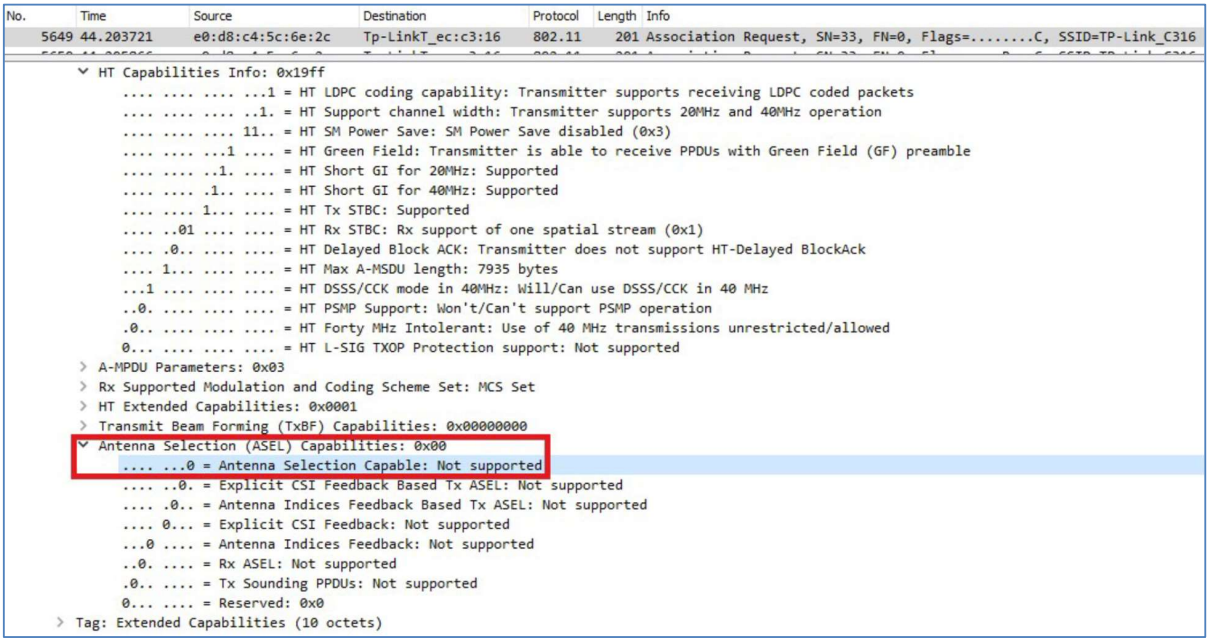
14. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '686 patent, and that this patent is valid.

15. Counterclaimants have not infringed and is not infringing the '686 patent, either directly, indirectly, literally, or under the doctrine of equivalents.

16. The antenna selection feature of the IEEE 802.11n standard that Freedom Patents accuses in paragraphs 23-61 of its Complaint is an optional feature.

17. The accused Hisense products do not support the accused antenna selection feature of the IEEE 802.11n standard.

18. The accused Hisense products indicate their lack of support for the accused antenna selection feature of the IEEE 802.11n standard via the Antenna Selection (ASEL) Capabilities field of the HT Capabilities field in certain frames such as an association request frame.



19. In a letter sent to counsel for Freedom Patents on July 5, 2023, Hisense explained that the accused products do not support the accused antenna selection feature and provided the image above as evidence.

20. Freedom Patents attempted to test the accused Hisense products to verify that the products do not support the accused antenna selection feature.

21. Freedom Patents has no evidence or factual basis to dispute that the accused Hisense products support the accused antenna selection feature in the IEEE 802.11n standard.

22. There accordingly is an actual, immediate, and justiciable controversy between the parties with respect to the alleged infringement of the ’686 patent.

23. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

SECOND COUNTERCLAIM
Declaratory Judgment of Invalidity of the '686 Patent

24. Counterclaimants incorporate by reference the allegations in paragraphs 1 through 23 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

25. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '686 patent, and that this patent is valid.

26. However, some or all of the claims of the '686 patent are invalid under the Patent Act, 35 U.S.C. §§ 1, *et seq.*, including, but not limited to, 35 U.S.C. §§ 101, 102, 103, and/or 112.

27. Asserted claims 1 and 21 of the '686 patent are anticipated and/or rendered obvious by various standards documents.

28. During prosecution of the '686 patent, the examiner initially rejected most of original claims 1-39 under §§ 102 and 103 as either anticipated or obvious over certain prior art.

29. The examiner indicated that certain dependent claims, including claims 8 and 30 recited allowable subject matter, however.

30. Original claim 8 recited:

> 8. The method of claim 1, wherein the receiving further comprises receiving a non-ZLF +HTC packet immediately followed by plural consecutive zero length frame (ZLF) sounding packets, the non-ZLF+HTC packet having an antenna selection control (ASC) field including a transmit antenna selection sounding indication (TXASSI) signal to initiate antenna selection and a number N of the plural consecutive ZLF sounding packets.

31. Original claim 30 similarly recited:

30. The station of claim 22, wherein the receiver is further configured to receive a non-ZLF +HTC control packet immediately followed by plural consecutive zero length frame (ZLF) sounding packets, the non-ZLF +HTC packet having an antenna selection control (ASC) field including a receive antenna selection sounding indication (RXASSI) signal to initiate antenna selection and a number N of the plural consecutive ZLF sounding packets.

32. In response to the examiner's rejection, the applicant amended the claims to incorporate the features of dependent claims 8 and 30 into independent claims 1 and 22, respectively.

33. The amended application claims 1 and 22 issued as claims 1 and 21 of the '686 patent, respectively.

34. The Enhanced Wireless Consortium (EWC) authored and published a series of High Throughput (HT) MAC Specifications in 2005 and early 2006.

35. Version 1.24 of the EWC HT MAC Specification contained Figure 41 below:

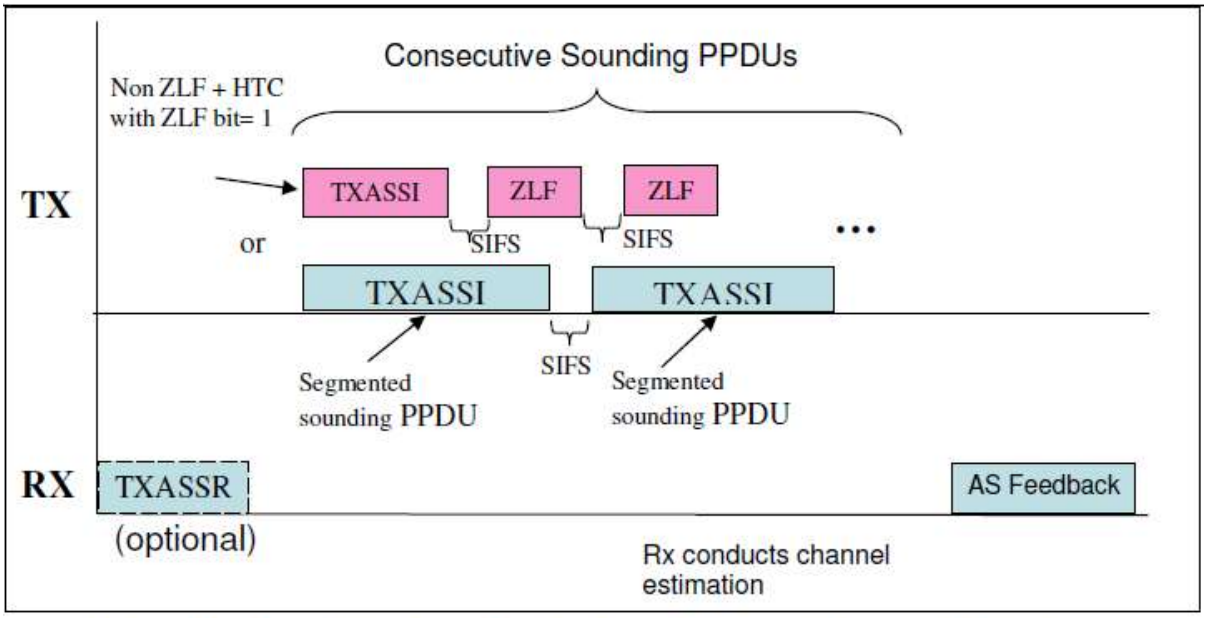


Figure 41 - Frame Exchange Sequence of Transmit Antenna Selection

36. Figure 41 above shows transmission of a non-ZLF+HTC packet immediately followed by plural consecutive zero length frame (ZLF) sounding packets, the non-ZLF+HTC packet having an antenna selection control (ASC) field including a transmit antenna selection sounding indication (TXASSI) signal to initiate antenna selection.

37. Figure 15 of the '686 patent is substantially similar to Figure 41 of the EWC HT MAC Specification above:

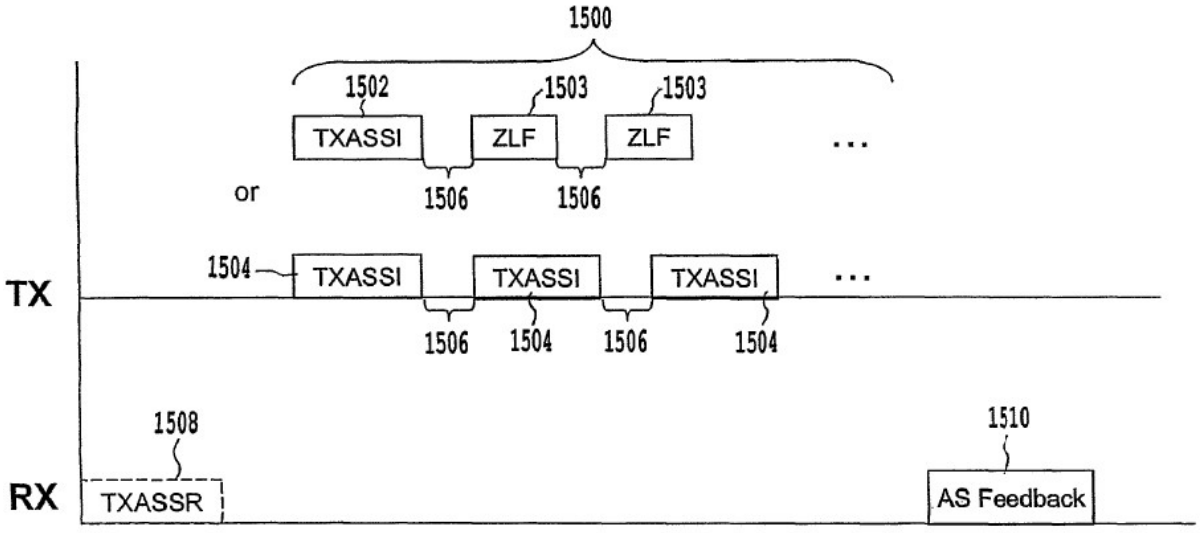


Fig. 15

38. Version 1.24 of the EWC HT MAC Specification contained Figure 42 below:

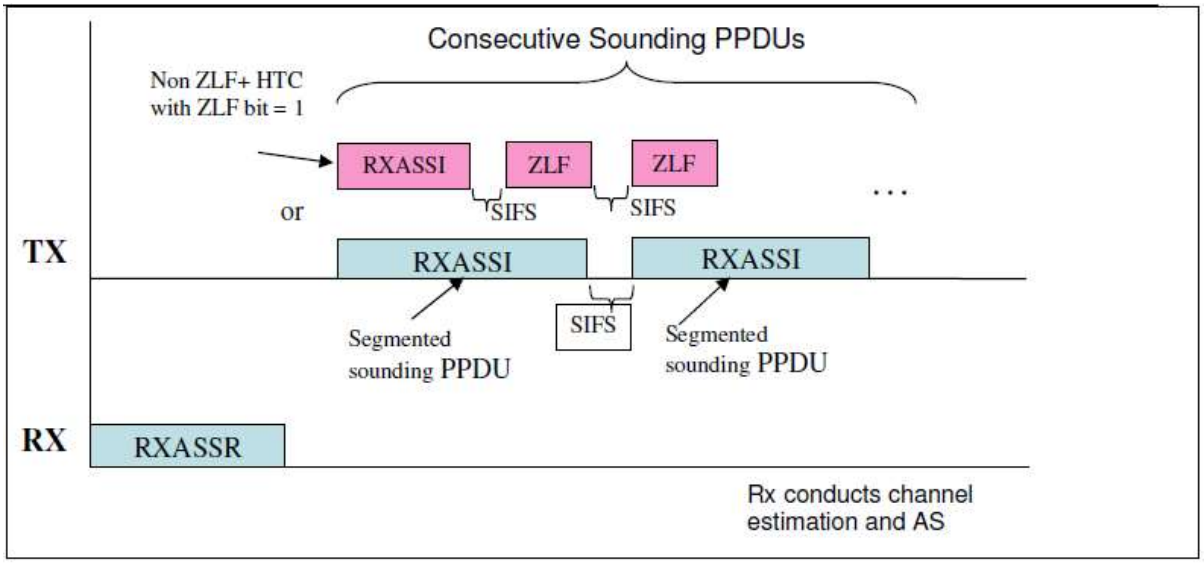


Figure 42 - Frame Exchange Sequence of Receive Antenna Selection

39. Figure 42 above shows transmission of a non-zero length frame (ZLF) +HTC control packet immediately followed by plural consecutive zero length frame (ZLF) sounding packets, the non-ZLF+HTC packet having an antenna selection control (ASC) field including a receive antenna selection sounding indication (RXASSI) signal to initiate antenna selection.

40. Figure 17 of the ’686 patent is substantially similar to Figure 42 of the EWC HT MAC Specification above:

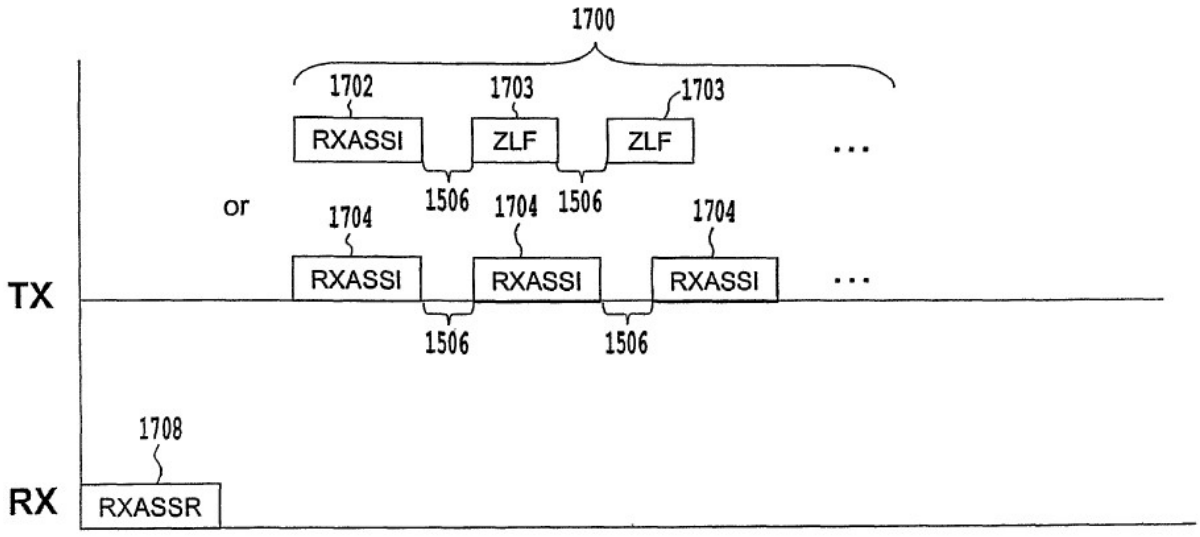


Fig. 17

41. Version 1.24 of the EWC HT MAC Specification discloses that the data portion of the TXASSI and RXASSI commands indicate the number of remaining sounding PPDUs:

Table 5 - The Command and Data Parts in ASC Subfield

Command (B9~B11)	Meaning of Command	Data (B12~B15)
000	Transmit Antenna Selection Sounding Indication (TXASSI)	Number of remaining sounding PPDUs
001	Transmit Antenna Selection Sounding Request (TXASSR)	Reserved
010	Receive Antenna Selection Sounding Indication (RXASSI)	Number of remaining sounding PPDUs
011	Receive Antenna Selection Sounding Request (RXASSR)	Total number sounding PPDUs required

42. Upon information and belief, the named inventors on the ’686 patent are not the true inventors of the claimed subject matter which was copied from standards documents including the EWC HT MAC Specification documents and/or related standards documents.

43. There accordingly is an actual, immediate, and justiciable controversy between the parties.

44. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

THIRD COUNTERCLAIM
Declaratory Judgment of Non-Infringement of the '096 Patent

45. Counterclaimants incorporate by reference the allegations in paragraphs 1 through 44 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

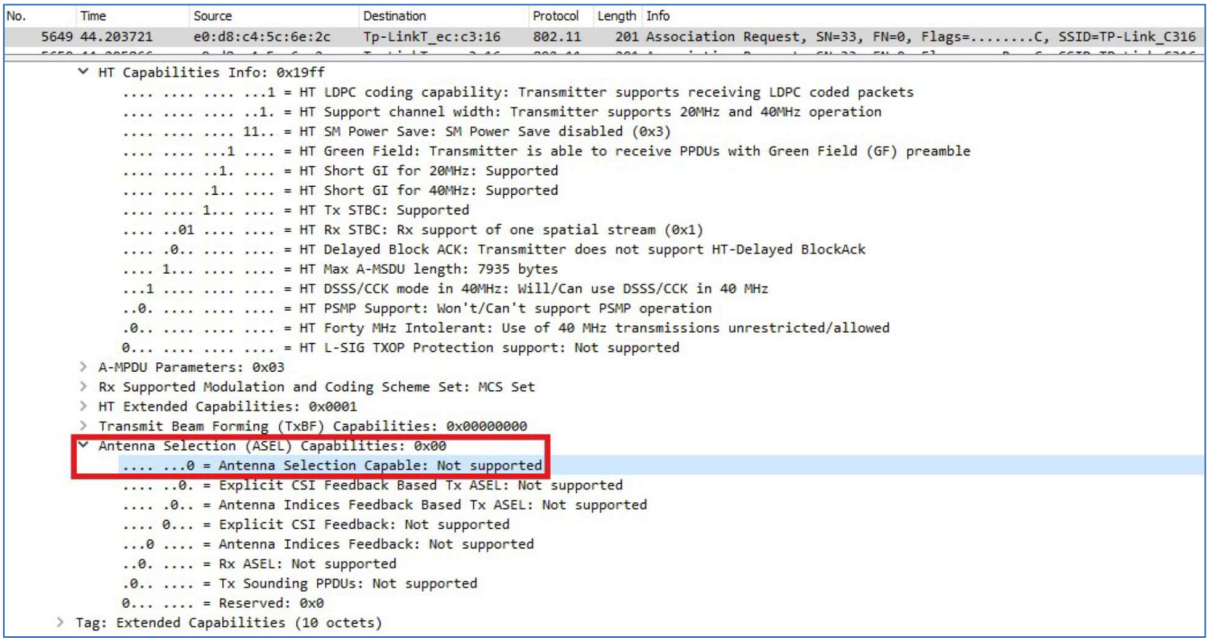
46. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '096 patent, and that this patent is valid.

47. Counterclaimants have not infringed and are not infringing the '096 patent, either directly, indirectly, literally, or under the doctrine of equivalents.

48. The antenna selection feature of the IEEE 802.11n standard that Freedom Patents accuses in paragraphs 62-83 of its Complaint is an optional feature.

49. The accused Hisense products do not support the accused antenna selection feature of the IEEE 802.11n standard.

50. The accused Hisense products indicate their lack of support for the accused antenna selection feature of the IEEE 802.11n standard via the Antenna Selection (ASEL) Capabilities field of the HT Capabilities field in certain frames such as an association request frame.



51. In a letter sent to counsel for Freedom Patents on July 5, 2023, Hisense explained that the accused products do not support the accused antenna selection feature and provided the image above as evidence.

52. Freedom Patents attempted to test the accused Hisense products to verify that the products do not support the accused antenna selection feature.

53. Freedom Patents has no evidence to contradict Hisense's evidence that its products do not support the accused antenna selection feature in the IEEE 802.11n standard.

54. There accordingly is an actual, immediate, and justiciable controversy between the parties with respect to the alleged infringement of the '096 patent.

55. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

FOURTH COUNTERCLAIM
Declaratory Judgment of Invalidity of the '096 Patent

56. Counterclaimants incorporate by reference the allegations in paragraphs 1 through 55 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

57. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '096 patent, and that this patent is valid.

58. However, some or all of the claims of the '096 patent are invalid under the Patent Act, 35 U.S.C. §§ 1, *et seq.*, including, but not limited to, 35 U.S.C. §§ 101, 102, 103, and/or 112.

59. There accordingly is an actual, immediate, and justiciable controversy between the parties.

60. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

FIFTH COUNTERCLAIM
Declaratory Judgment of Non-Infringement of the '815 Patent

61. Counterclaimants incorporates by reference the allegations in paragraphs 1 through 60 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

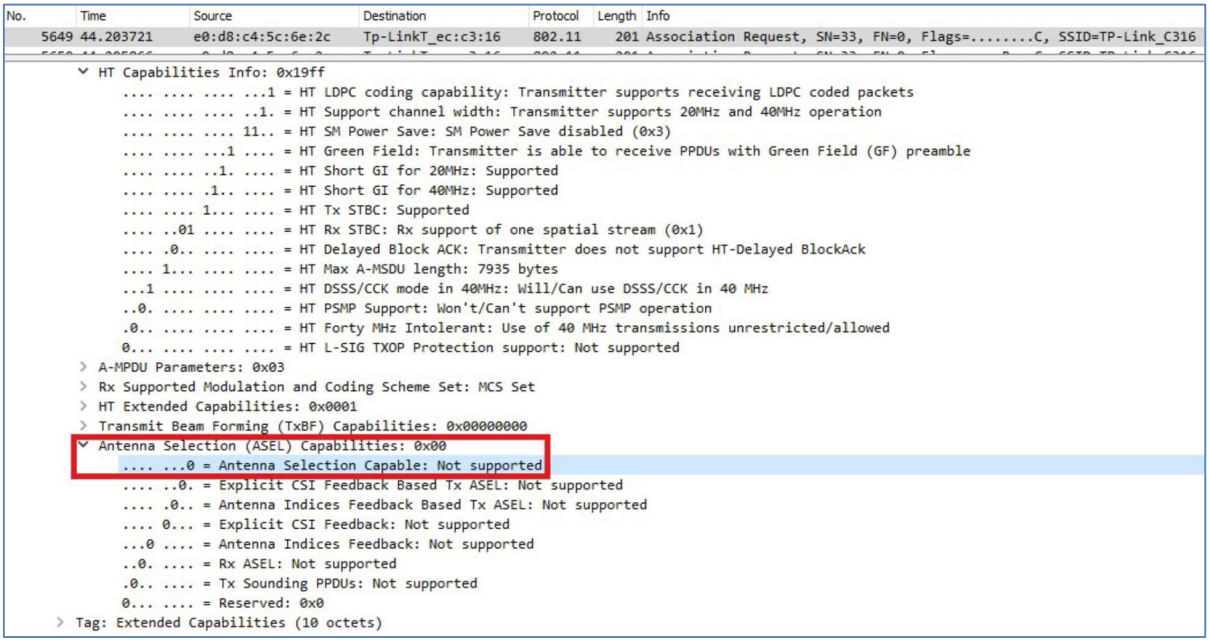
62. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '815 patent, and that this patent is valid.

63. Counterclaimants have not infringed and are not infringing the '815 patent, either directly, indirectly, literally, or under the doctrine of equivalents.

64. The antenna selection feature of the IEEE 802.11n standard that Freedom Patents accuses in paragraphs 84-104 of its Complaint is an optional feature.

65. The accused Hisense products do not support the accused antenna selection feature of the IEEE 802.11n standard.

66. The accused Hisense products indicate their lack of support for the accused antenna selection feature of the IEEE 802.11n standard via the Antenna Selection (ASEL) Capabilities field of the HT Capabilities field in certain frames such as an association request frame.



67. In a letter sent to counsel for Freedom Patents on July 5, 2023, Hisense explained that the accused products do not support the accused antenna selection feature and provided the image above as evidence.

68. Freedom Patents attempted to test the accused Hisense products to verify that the products do not support the accused antenna selection feature.

69. Freedom Patents has no evidence or factual basis to dispute that the accused Hisense products support the accused antenna selection feature in the IEEE 802.11n standard.

70. There accordingly is an actual, immediate, and justiciable controversy between the parties with respect to the alleged infringement of the '815 patent.

71. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

SIXTH COUNTERCLAIM
Declaratory Judgment of Invalidity of the '815 Patent

72. Counterclaimants incorporate by reference the allegations in paragraphs 1 through 71 of their Counterclaims, paragraphs 1 through 132 of Defendants' Answer, and Defendants' first through seventh defenses, set forth above.

73. Freedom Patents has alleged in this action that Hisense has been and currently is infringing the '815 patent, and that this patent is valid.

74. However, some or all of the claims of the '815 patent are invalid under the Patent Act, 35 U.S.C. §§ 1, *et seq.*, including, but not limited to, 35 U.S.C. §§ 101, 102, 103, and/or 112.

75. There accordingly is an actual, immediate, and justiciable controversy between the parties.

76. A judicial declaration concerning these matters is necessary and appropriate at this time so that the Counterclaimants can ascertain their rights and duties with regard to the parties and with regard to designing, developing, manufacturing, marketing, and selling their products.

JURY DEMAND

Counterclaimants request a trial by jury on all claims and defenses properly decided by a jury.

PRAYER FOR RELIEF

WHEREFORE, Counterclaimants pray that the Court enter judgment in their favor and against Freedom Patents as follows:

A. Declare that the Counterclaimants have not infringed and do not infringe any claims of the '686, '096, and '815 Patents;

B. Declare that the claims of the '686, '096, and '815 Patents are invalid;

C. Deny all relief that Freedom seeks in its Complaint;

D. Award the Counterclaimants their expenses and costs in accordance with Rule 54(d) of the Federal Rules of Civil Procedure;

E. Find this case to be exceptional under 35 U.S.C. § 285 and award the Counterclaimants costs and attorneys' fees; and

F. Award the Counterclaimants any other relief that the Court deems just and proper.

Dated: September 27, 2023

Respectfully submitted,

/s/ *Matthew C. Bernstein*

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that counsel of record who are deemed to have consented to electronic services are being served with a copy of this document via the Court's CM/ECF system per Local Rule CV-5(a)(3) on this 27th day of September 2023.

/s/ Matthew C. Bernstein
Matthew C. Bernstein

EXHIBIT F

(915) 792 6704

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Chinese electronics manufacturer doubling Mexico investment

The world's largest TV maker, Chinese electronics manufacturer Hisense, Co., has announced they will double investment and capacity at their Mexico production facility, underscoring the global draw to manufacture for export in Mexico.

China Moving to Mexico?

Once known as the offshore partner of choice, China has experienced dramatic increases in price, most notably in the price of labor. As the trend shifts, many companies are choosing to nearshore production to Mexico for export to the US and other consumer markets. And some of those companies moving production to Mexico are from China, of all places.

Shrinking margins have forced some companies out of the market, put others are more willing to cut profits and relocate operations in order to strategically enhance market share. For Chinese electronics manufacturer, Hisense Co., this involves investing in a Mexican manufacturing facility to target the US consumer market as well as developing Latin American markets.

Hisense Mexico

Hisense bought their facility from Sharp Corp. for $24 million USD over a year ago. It is in Rosarita, Mexico, and currently ships 1.5 million units to North America. The facility currently sits on 49 acres. The Chinese electronics manufacturer employs 500 people, and houses a warehouse with a supply-chain platform, a free healthcare clinic, a childcare facility, and a recreational sports facility.

The Qingdao-based company has recently announced it is more than doubling its investment there with an infusion of another $30 million USD to enhance automation and increase production capacity to 4 million units. While Hisense is currently the 3rd largest television manufacturer in the world – recently surpassing Sony – its share of the North American market is relatively small. Partnering with Mexico is the cornerstone of their strategy for increasing market share in the US. They aim to become the 3rd largest television provider to the US in just three years.

"In addition to enhancing our logistics and fulfillment capabilities through its strategic location, this world-class facility will be producing a total of 47 television models that will be available to consumers across North and South America this year," states Hisense North America CEO Jerry Liu



TECMA

Toby Spoon

Executive Vice President of Human Resources

Mexico shelter company executive vice president, Toby Spoon, benefitted from early international experience.

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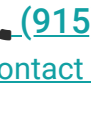
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EXHIBIT G

Hisense Targets American TV Market With Mexican Factory

Hisense is the latest Chinese manufacturer to invest in overseas production to fuel global expansion



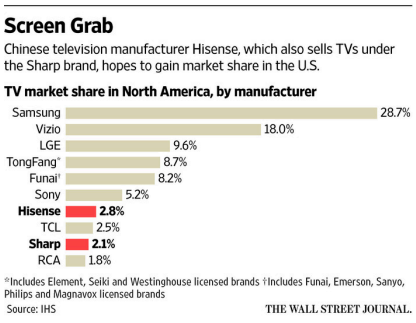
Chinese electronics manufacturer Hisense Co. is doubling down on an investment in a Mexican factory as it grabs for a bigger slice of North America's television market.

The Qingdao-based company, which also has operations in Africa and Central Europe, is part of a wave of Chinese companies—from electronics and auto makers to shoemakers and textile producers—that are increasingly looking to manufacture abroad. Rising costs in China have made factories in other markets more competitive. Chinese brands expanding globally are also opening regional manufacturing hubs to cut the time it takes to get goods onto store shelves.

Hisense will put an additional $30 million toward a plant in Rosarito, Mexico it bought from Sharp Corp. last year, said Jerry Liu, the company's Americas CEO, who also led its effort to set manufacturing up in Africa. The company plans to enhance automation and increase production capacity, with a goal of shipping as many as four million televisions throughout North America a year, up from 1.5 million today. Hisense sells televisions including under the Sharp brand, through Wal-Mart Stores Inc., Best Buy Co., Amazon.com Inc. and others.

The expansion comes as manufacturing in China is getting more expensive, and slower economic growth is reducing domestic demand. That is pushing manufacturers from China to look to other emerging markets, as well as to the U.S. and Europe, for growth. Chinese companies completed a record $61 billion in acquisitions abroad in 2015, according to research firm Rhodium Group.

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"Labor costs are rising, and other factors are becoming more expensive, too—the cost of land, environmental compliance. They are facing a new reality and they need to adjust to stay in business," said Thilo Hanemann, an economist with Rhodium. Chinese manufacturers "are being pushed out by a changing economic reality in the Chinese marketplace."

Chinese television makers are expanding overseas at a time when shrinking margins have forced established brands to exit the market. Companies like Hisense have proven willing to accept lower profits to gain market share, saidPaul Gagnon, director of TV sets research at IHS Inc.

"Their strategic goal overseas is to grow market share so there is a willingness at the corporate level to accept lower returns," he said.

Hisense surpassed Sony Corp. to become the world's third-largest TV maker by unit shipments last year, but sold just 2.8% of televisions purchased in North America, according to IHS. This is set to grow in 2016, as the company has been licensing Sharp's brand name since January, analysts say. Sharp sold 2.1% of TV sets in the region in 2015. Samsung Electronics Co. is the market leader in the region, with a 28.7% share.

Hisense has said in the past that one of the challenges of expanding abroad is finding enough workers with the right skill set. But Mr. Liu said wages for line workers in China have risen to roughly equal to those in Mexico. And with advances in automation, the company, which has 13 factories world-wide, including nine in China, employs around 500 workers in Mexico who produce 200,000 units a month. Previously, it took 800 workers to produce less than half that amount, Mr. Liu said.

Shipping a finished television from Mexico to the U.S. cuts up to a month of travel time compared with moving that same unit from a Chinese factory, Mr. Liu said. Speedy delivery is becoming more important as major U.S. retailers hold less inventory, requiring more frequent orders with manufacturers.

Companies with the capability to deliver products quickly will have a "real advantage," Mr. Liu said. And "in the U.S. market for the long-term, retailers cannot continue doing business with too much inventory; it's too risky."

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EXHIBIT H

In 3 years to replace China, Mexico occupies 60% of the US color TV market, and the core components still come from China

2022-07-20 11:51:00

Three years ago, China's exports of color TVs still accounted for 60% of the US imported color TV market, and now it is a different picture. Today, Mexico exports color TVs that account for the largest share of the U.S. market, accounting for 60% of its market.

In the years of Sino-US trade frictions, Mexico has attracted investment from many color TV companies with its advantage of zero tariffs on trade with the United States. Color TV is an industry with mature technology and small profits. Chinese companies are also using Mexico as a manufacturing base, hoping to seize the US market.

Several business people interviewed by the first financial reporter said that China, Mexico and the United States have formed a color TV industry chain. The core components of color TVs still come from China, while the Supporting Industries in Mexico, as a manufacturing base, are becoming more and more mature, and the final products are marketed in the United States while taking into account the Central and South American markets.

Rush to Mexico

Yu Tao has been sent to Mexico for four years. As the general manager of Hisense's Mexican color TV factory, he is based in the Mexican border city of Rosarito, which is also home to Hisense's Mexican factory in the United States.

In the past few years, he has witnessed the great changes of Chinese companies in Mexico.

Hisense's factory originally belonged to the Japanese company Sharp. Japanese companies are losing ground in the color TV industry, and Hisense took over Sharp's Mexican factory in 2016 and intelligently upgraded the factory.

In the past few years, Hisense has continuously expanded its color TV production capacity in Mexico through continuous investment. According to Yu Tao's introduction to the first financial reporter, aft er Hisense completed the acquisition, the factory with an annual output of 600,000 color TVs was inc reased to an annual production capacity of 2.5 million units. By 2021, the plant's annual production will further increase to 8.5 million units, about four times in five years.

Chinese color TV companies set up factories in Mexico, which can be traced back to seven or eight y ears ago. TCL went deeper into Mexico earlier than Hisense. With the decline of some Japanese colo r TV brands, in 2014 TCL acquired the Mexican factory of Japanese company Sanyo.

These two leading Chinese color TV companies have established their own North American producti on bases in Mexico through the acquisition of japanese factories, and rely on this base to radiate the entire American market.

Zero tariffs are the biggest advantage of Mexican products entering the U.S. market. According to th e "U.S.-Mexico-Canada Free Trade Agreement", Mexican color TVs exported to the United States are 0 tariffs, while China's exports of color TVs to the United States are subject to 11.4% tariffs.

The city of Monterrey in central Mexico has also been a hotspot for investment by Chinese home ap pliance companies in recent years. Hu Hai, chairman of the North American Huafushan Industrial Par k in Monterrey, told the first financial reporter on July 6 that mexico's hydropower costs are similar t o China's, and labor costs are a little cheaper than China's. The average Mexican worker earns about $300 a month without working overtime, plus social security, about $400, but Chinese workers are m ore efficient.

"Manpower, water and electricity costs are not the most important reason, behind the Construction of Factories in Mexico by Chinese home appliance companies, it is mainly because of Sino-US trade f rictions." Hu Hai said that the original manufacturing industry was the optimal combination of global ization factors, and now it is regionalized, and the new manufacturing is concentrated in North Amer ica, the European Union and ASEAN. The US market wants products to shorten the supply chain, whi ch has become more and more significant in the past few years and has become irreversible.

The color TVs that Hisense exports to the U.S. market are basically exported from Mexican factories. The lcd panel, the core component of the color TV, is mainly imported from Chinese mainland and T aiwan.

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In order to further reduce costs and respond more quickly to market demand, enterprises have also driven supporting enterprises in the industrial chain to land in Mexico. Hisense has increased its loca lization investment and expansion, introduced the localization of raw materials such as injection mol ding, sheet metal, diaphragm and packaging materials, and the localization rate of the main compon ents of its color TV products has reached more than 20%.

For those parts that Cannot be produced in Mexico, Hisense cooperated with China's Ocean Shippin g Group (COSCO) to open a route from Qingdao to Ensenada Port in 2017, which can reach Mexico f rom Qingdao in 14 days, greatly shortening the supply chain cycle and saving 7 to 10 days compare d with the original route through the Port of Long Beach in the United States. Moreover, COSCO's ro utes now run once a week and respond faster.

Customs data show that from January to May 2022, the amount of LIQUID crystal flat panel display modules exported by China to Mexico fell by 35.7% year-on-year. The industry estimates that this m ay be because the price of panels continues to decline this year and the US color TV market is not u p to expectations, and the color TV brand factories have reduced the purchase of panels.

Manufacturing costs in China have also increased in recent years, with increases in labor, land, water and electricity, rents, and taxes offsetting the original cost advantages, and the epidemic has increas ed the cost of ocean logistics. Hu Hai believes that Japanese and Korean brands that compete with C hinese brands in the U.S. market have achieved localization of production. China's large-scale home appliances are increasingly unsustainable through ocean shipping to the United States.

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In 3 years to replace China, Mexico occupies 60% of the US color TV market, and the core components still come from China

Replace Chinese exports

"Mexico's color TV production capacity is mainly to meet the needs of North America, especially the US market." Zhang Bing, research director of Omdia China, told the first financial reporter.

Citing data from the ITC (U.S. International Trade Commission), he said that in January 2019, China's exports of color TVs accounted for more than 60% of the market share of color TVs imported from t he United States, and Mexico's exports of color TVs accounted for about 30% of the market share of color TVs imported from the United States; By February 2022, Mexico's export of color TVs accounte d for 60% of the market share of color TVs imported from the United States, and China's exports of c olor TVs accounted for less than 20% of the market share of imported color TVs from the United Stat es.

The data provided by the China Chamber of Commerce for Import and Export of Machinery and Elec tronics to the first financial reporter shows that in the past five years, affected by trade frictions, the share of China's export color TV in the US imported color TV market has decreased year by year, 5 5% in 2018, 42% in 2019, 31% in 2020, 20% in 2021, and a total of 19% in January-April this year; Th e share of mexico, Vietnam and Thailand's export of color TVs in the US imported color TV market h

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as risen steadily, 76%, 5% and 2% last year, and 76%, 7% and 4% from January to April this year, whil e the corresponding share of China's exports of color TVs to the United States has dropped from 1 2% to 10%.

"In the past 2-3 years, mexico's color TV production capacity layout has grown rapidly, the most imp ortant thing is that the first-line brand manufacturers have caused higher import tariffs to avoid Sino -US trade frictions, and the epidemic has led to a surge in us market demand." Zhang Bing thinks.

In the past two or three years, not only Hisense, TCL has expanded color TV production capacity in Mexico, and China's panel manufacturer BOE (BOE) has also set up a color TV processing plant in Me xico in 2021 to increase the panel "sea outlet", which has 4 production lines in Mexico. In addition, G uanjie, Foxconn and others have also set up color TV foundries in Mexico.

Lu Yong, secretary general of the Audiovisual Branch of the China Chamber of Commerce for Import and Export of Machinery and Electronics, told the first financial reporter that TCL supplied nearly 6.9 million color TVs to the US market in 2021, and 7.3 million units in 2020 (after the outbreak of the ep idemic that year, the government's consumption stimulus policy amplified demand). TCL has several sources of production, one is the Huizhou base, after the United States imposed tariffs, it is basically unable to ship to the US market; The second is the Mexican base, TCL has two plants, MASA and MO KA, with an annual output of nearly 1.8 million units; The third is the Vietnam base, with an annual o utput of more than 3.5 million units; The fourth is the Indian base, which was put into operation last year and can be integrated into the production of modules and complete machines.

TCL related sources told the first financial reporter that the color TV products of TCL's Mexico factory are mainly 32-65 inches, and the panels are purchased from Chinese mainland or Taiwan, mainly for the North American market.

TCL Mexico color TV factory was the first to produce large-size LCD TVs to reduce international logis tics costs, and in recent years, with the increase in US tariffs and soaring shipping costs, locally prod uced TVs have covered full size.

China is the world's largest producer of color TV and LCD TV panels, with the contraction of the dom estic color TV market, expanding overseas markets is the only way. The US color TV market is huge a nd should not be abandoned. According to the U.S. Census Bureau, the U.S. color TV market imports 54.9 million units in 2020, 49.2 million units in 2021, and 10.48 million units from January to April 20 22.

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Li Dongsheng, founder and chairman of TCL, once said that under the new international trade situation, the internationalization of Chinese enterprises will change from exporting products to exporting industrial capabilities.

"Supply nearby is the direction of the future." Lu Yong said.

A arena for Chinese and Korean companies

The United States is the world's largest color TV market, and the competition is also very fierce. Before TCL and Hisense, Japanese and Korean companies laid out Mexican color TV production capacity earlier.

With the decline of some Japanese brands, Sanyo and Sharp's Mexican color TV factories have been transferred to TCL and Hisense, while the color TVs sold by Sony in the United States are mainly handed over to Foxconn's Mexican factory.

At present, South Korea's Samsung has its world's largest color TV factory in Mexico, with a production of 15 million units a year, covering the entire American market, and it has a deeper supply chain in the local supply chain, and many suppliers have brought it from South Korea.

In today's U.S. market, the main competitors are color TV companies in China and South Korea. South Korea's Samsung and LG are still in the leading position in the North American color TV market, and Chinese companies are closely following.

At the 2021 annual performance briefing in May this year, TCL revealed that its TCL smart screen (color TV) sales ranked second in the United States in 2021, third in Canada, fourth in Mexico, and fourth in Brazil and Argentina.

Does Mexico have the ability to become a completely self-circulating industrial ecology?

Yu Tao believes that it is "difficult" because Mexico does not have a complete industrial system like China, small parts are basically imported from China, and China still has advantages in supply chain and manufacturing.

Talking about the challenges and difficulties of the development of Chinese enterprises in Mexico, Yu Tao believes that enterprises must adapt to local culture and laws, and second, they must integrate with local employees, which generally takes one or two years. After the company integrates the local culture, it can start to develop at a high speed.

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According to Yu Tao, Hisense is currently building its white goods industrial park in Mexico at Monterrey, covering refrigerators, washing machines, kitchen appliances, etc., and is expected to be put into production this year.

Zhou Nanxiang, secretary general of the Home Appliance Branch of the China Chamber of Commerce for Import and Export of Machinery and Electronics, analyzed to the first financial reporter that trade barriers and the impact of the epidemic are causing global industries to shrink near the local market. Originally considering production in a low-cost place, it is now considering producing in a safe and reliable place. Mexico has become an important home appliance production base for the U.S. market after China. China's home appliance companies adhere to globalization, one is to follow the national policy, the other is to follow the market, and the global layout of the supply chain should have a long-term vision.

Mexico China United States

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Mexico China

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Interesting! Ruiz reveals the secret to becoming a boxing champion: mainly through nachos and Mexic...

Mexico corn

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Is Mexico ready for its first female president?

Mexico

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08-03

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Mexico United States

08-03

Casa CC – Casa CC, a Mexico cube-stacking building that showcases the poetry and luxury of modernist...

Mexico nowadays building

08-04

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Change the Dodge logo! GAC Trumpchi Shadow Leopard debuted in Mexico: the current price starts a...

Mexico Logos

08-04

Half-time - Inter Miami 0-1 Mexico Tigers Brunetta volleys over Campana and misses half a single shot

Mexico tiger

08-04

Vancouver Chinese "God Challenge": Travel to Mexico by public transportation only, in 9 days!

Mexico traffic

08-04

Strong! Chinese in Vancouver had a big bus ride from Canada to Mexico for 9 days $200 across 3 countries

Mexico Canada

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Tropical Storm Debbie formed in the Gulf of Mexico and will reach hurricane strength before making...

Mexico hurricane

08-05

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Why is there a claim that Mexico is Brazil's nemesis? In fact, it was the two finals

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Australia United States

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James + Curry Savior! United States public opinion collapsed: Kolb is rigid, Tatum is lonely?

United States

08-09

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BYD's first pickup truck is about to be released in China, the name of this car is shark, the price in Mexi...

Renminbi Mexico shark

08-10

The Olympics almost caused a big upset! The United States men's basketball team fought fiercely against...

Serbia United States

08-10

Shocking reversal! United States men's basketball desperate awakening, Zhan Duku three giants join...

United States

08-10

The United States men's basketball team was lucky to advance, Kuhn broke out against Jokic, and Tatum sat...

United States

08-10

The latest Olympic gold medal list: China won 4 gold medals in a single day, 33 gold ranked second, and...

China United States

08-10

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After watching the semifinals, I understood how strong the defense of the Serbia men's basketball team is. Ju…

Serbia Germany United States basketball

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The Chinese diving team returned to China with honor, Quan Hongchan and Chen Yuxi were surrounded by…

Chen Yuxi Quan Hongchan China A fan of someone

08-12

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Philip: The three most important reform measures are the most important and will provide support for...

China nowadays

08-12

An enterprise, especially if it has developed into an international large enterprise, public opinion and...

China culture occupation standard TV image

08-12

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Big data analytics Big data ChatGPT China medicine

08-12

China's gold medal at the Paris Olympics is still inspiring many people, because the gold content is...

China

08-12

The Ukrainian army has captured Russian territory, how should Russia fight back? Whether to encircle the poi...

United States

08-12

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The Paris Olympics ended perfectly, the Chinese team had two major accidents, and after 4 years, there wer…

China

08-12

I watched the Paris Olympics (eighteen) (seven unique) Paris Olympics shocked the world, China's gold medal…

China

08-12

China's CN Olympic history, how much do you know #Share Olympic memories#

China history

08-12

Enlightenment Edition - Telling Chinese Stories in English (28 pages) Forward Collection!

China English collection enlightenment

08-13

Lasts 6 years! FrieslandCampina's Milk for Orphans programme in China has benefited 14,000 children in…

China

08-12

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 134 of 186

United States men's basketball team defeats France to win the championship! Curry convinces the world! La...

France United States world

08-12

The gap between China, Japan and Russia in foreign exchange reserves is off a cliff: Russia 606.7 billion US...

China Japan

08-12

Single-season rankings updated! Four Chinese people are in the top 16, and O'Sullivan and Ding Junhui are...

Ding China

08-12

China's 40 gold turns into 41 gold to overtake United States? The International Boxing Federation has been...

China United States willow

08-12

Statistical analysis of China's battery export data from January to June 2024: export volume increased slightly

accumulator China battery

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 135 of 186

Case 2:23-cv-00477-RWS-RSP Document 36-8 Filed 08/19/24 Page 17 of 29 PageID #: 482

The full ranking of the Olympic gold medal table: China 40 gold, from 2nd to 1st, United States did not reach...

China United States

08-13

The Chinese team is expected to make up the gold medal to surpass United States! The Olympic...

China United States

08-13

United States won the first place in the 2024 International Mathematical Olympiad, which is more...

United States

08-13

Last update

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 136 of 186

Case 2:23-cv-00477-RWS-RSP Document 36-8 Filed 08/19/24 Page 18 of 29 PageID #: 483



The poster of "Another Day Full of Hope" is full of emotions and arouses empathy

08-13

Chen Handian shared photos of having dinner with Xiao S Cai Kangyong, is this to restart "Kangxi is Coming"?[fig]

Chen Handian shared photos of having dinner with Xiao S Cai Kangyong, is this to restart "Kangxi is Coming"?

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 137 of 186

Case 2:23-cv-00477-RWS-RSP Document 36-8 Filed 08/19/24 Page 19 of 29 PageID #: 484



Xiao S's second daughter Lily attended a charity event, and Taiwanese media praised it: Super b eautiful nine-headed beauty!

08-13

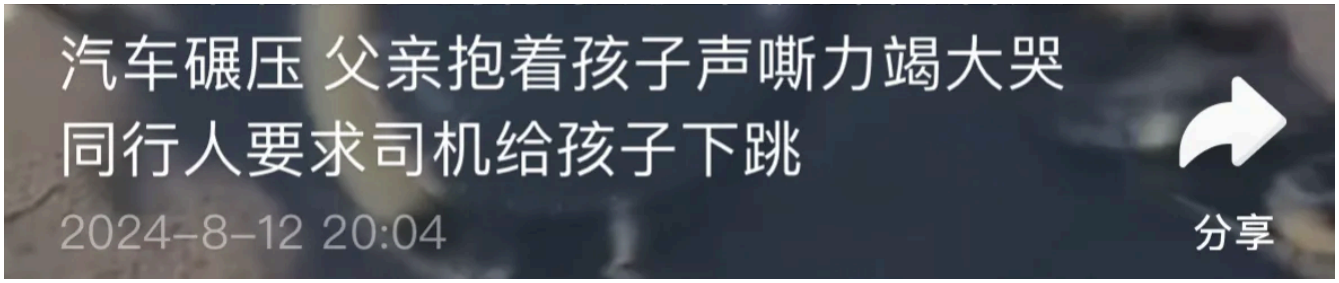
All members of the CBA are tested, but they are not allowed to play, and only Zhang Ning and other 4 people can be exempted from the test[fig]

All members of the CBA are tested, but they are not allowed to play, and only Zhang Ning and other 4 people can be exempted from the test

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 138 of 186


大人带着孩子骑行
孩子不慎摔倒后遭汽车碾压
父亲抱着孩子声嘶力竭大哭
同行人要求司机给孩子下跪
8月12日（发布）
河北保定
法治进行时
+关注
8053
7231
849
报警去报警去
@法治进行时
大人带着孩子骑行 孩子不慎摔倒后遭



An adult takes a child to ride and walk on a motorway, and the child falls into the opposite lane and is run over by a normal vehicle and dies. The child's father blamed the other party for dri...

08-13

Lonely Boat: The Great Reversal! Hu Zhiping and Zhou Zhifei are connected, he is the No. 8 cell, a double agent[fig]

Lonely Boat: The Great Reversal! Hu Zhiping and Zhou Zhifei are connected, he is the No. 8 cell, a double agent

08-13



The Chinese team is expected to make up the gold medal to surpass United States! The Olympi c Committee responded: This is indeed the case!

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 142 of 186



How to choose the right renovation and maintenance method for the basketball hall? Discuss s anding refurbishment and topcoat recoating

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 143 of 186



The human body is made up of atoms, why can it produce consciousness?

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 144 of 186

United States won the first place in the 2024 International Mathematical Olympiad, which is mo re important than hard work or talent

08-13

Petitioner Hisense USA Corporation
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The man turned around at the door of the restaurant and was blackmailed for 50, and the coup le took turns to fight with red and white faces, and the result was very happy

08-13

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 146 of 186

Case 2:23-cv-00477-RWS-RSP Document 36-8 Filed 08/19/24 Page 28 of 29 PageID #: 493

#夏日随手拍#夏日的陶然亭, it is indeed a good place to cool off and enjoy the scenery. Walking in the garden, you can feel the influence of history and culture, appreciate the grace of weepi…

08-13

看 laitimes

english

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 147 of 186

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EXHIBIT I

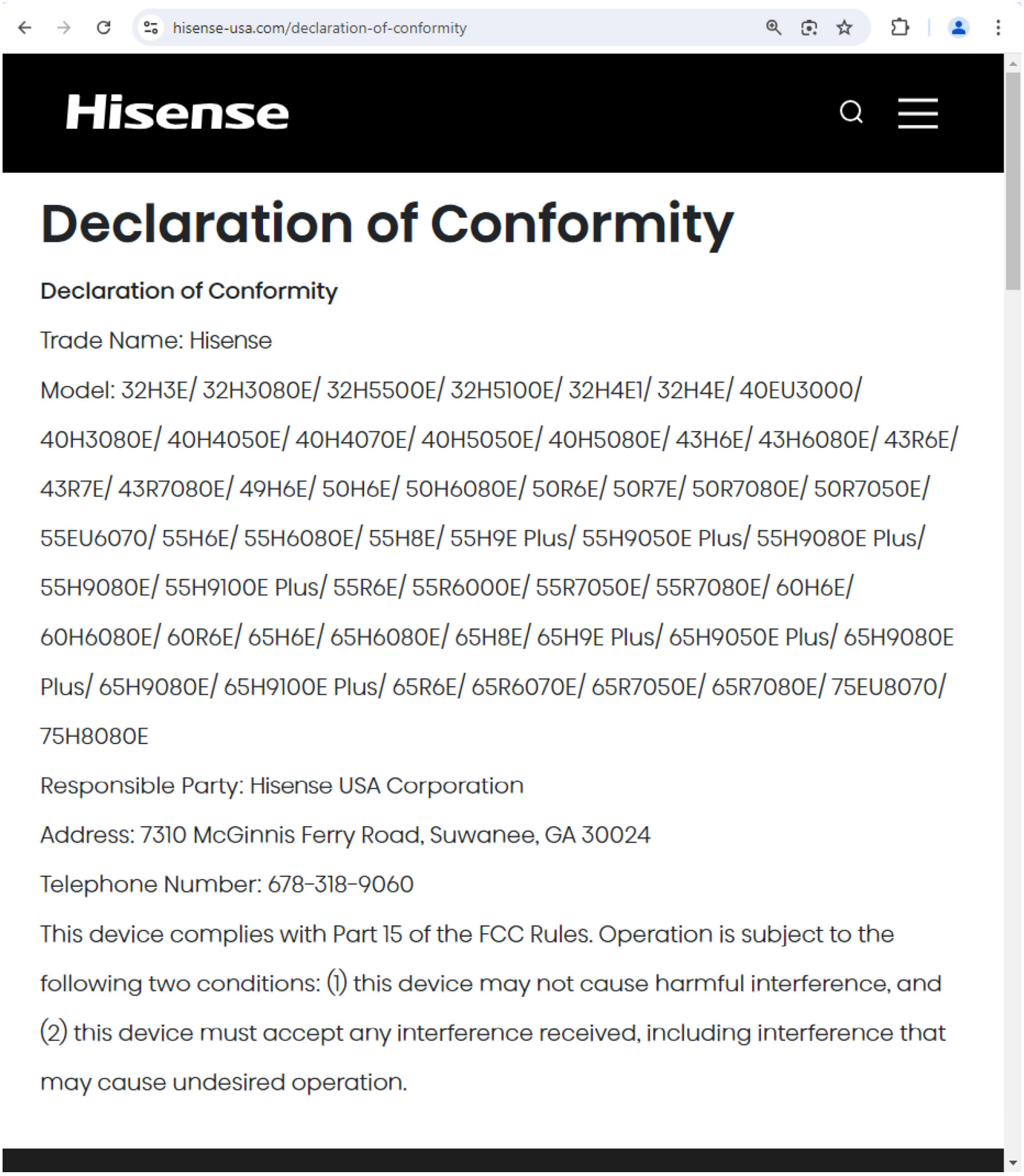

hisense-usa.com/declaration-of-conformity
Hisense
Declaration of Conformity
Declaration of Conformity
Trade Name: Hisense
Model: 32H3E/ 32H3080E/ 32H5500E/ 32H5100E/ 32H4E1/ 32H4E/ 40EU3000/ 40H3080E/ 40H4050E/ 40H4070E/ 40H5050E/ 40H5080E/ 43H6E/ 43H6080E/ 43R6E/ 43R7E/ 43R7080E/ 49H6E/ 50H6E/ 50H6080E/ 50R6E/ 50R7E/ 50R7080E/ 50R7050E/ 55EU6070/ 55H6E/ 55H6080E/ 55H8E/ 55H9E Plus/ 55H9050E Plus/ 55H9080E Plus/ 55H9080E/ 55H9100E Plus/ 55R6E/ 55R6000E/ 55R7050E/ 55R7080E/ 60H6E/ 60H6080E/ 60R6E/ 65H6E/ 65H6080E/ 65H8E/ 65H9E Plus/ 65H9050E Plus/ 65H9080E Plus/ 65H9080E/ 65H9100E Plus/ 65R6E/ 65R6070E/ 65R7050E/ 65R7080E/ 75EU8070/ 75H8080E
Responsible Party: Hisense USA Corporation
Address: 7310 McGinnis Ferry Road, Suwanee, GA 30024
Telephone Number: 678-318-9060
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

EXHIBIT J

Contact info

Type	Name	Address	Follow company
IMPORTER	ALMACENES LADY LEE, S.A. DE C.V.	RTN 05019995106150 OFICINAS CORPORATIVAS/CENTRO DE DISTRIBUCION CEDI KM. 3 CARRETERA A LA LIMA, SURESTE	Follow
NOTIFY PARTY	ALMACENES LADY LEE, S.A. DE C.V.	RTN 05019995106150 OFICINAS CORPORATIVAS/CENTRO DE DISTRIBUCION CEDI KM. 3 CARRETERA A LA LIMA, SURESTE	Follow
SHIPPER	HISENSE MEXICO S DE RL DE CV	RFC HME110512IY3 BLVD. MIGUEL DE CERVANTES SAAVEDRA NO. 301 TORRE NORTE, PISO 2, COL. AMPLIACIN GRANADA DEL. MIGUEL HIDALGO, CIUDAD	Follow

Product details

Container no.	Description area
BSIU9168456	TELEVISION TELEVISION PANTALLA DE CRISTAL LIQUIDO HS CODE 852872

Transit details

Transit name	Transit value
Carrier	**HLCU - HAPAG LLOYD A G** **ADDRESS** 399 HOES LN HAMBURG GERMANY CONTACT NO.: 8002234443
Ship Registered In	LIBERIA
Vessel	JPO SCORPIUS
Voyage	1834N
US Port	San Juan, Puerto Rico
Foreign Port	Caucedo
Country of Origin	Dominican Republic
Place of Receipt	ENSENADA, BCN, MX
Bill of Lading	HLCUME3IH02334AA
Arrival Date	2018-09-09
Quantity	850 PCS
Container Count	1
Weight (LB / KG)	13420.00 / 6100.00
CBM	0
House vs Master	H
Master Bill of Lading	HLCUME3180802334

Other info

Container no.	Description area
BSIU9168456	NM . . .

Related B/L

Type (House/Master)	B/L
H	HLCUME3IH02334AA

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 152 of 186

EXHIBIT K

Declaration Number: **1087780**

Export Date: 12/17/2021

Consignee *(Buyer/Consignee)*

Unavailable

, Estados Unidos De America

Shipper *(Seller)*

Sharp Electronica Mexico Sa De Cv

Blvd Sharp/3510//Parque Industrial Rosarito//Arroyo Seco Cerro, Mexico

Cargo details

Product Description	Televisor Color Pantalla Plana Lcd
Incoterm	N/A
Weight	249,903.65 kg
Quantity	7,472 PIEZA
H.S. Code	852872 - Other, color
H.S. Code Description	Other, color
H.T.S. Code	85287206 - Televisor A Color De Pantalla Plana Lcd
Value in USD	$3,907,630.68

Ports & Carriers

Departure Port	Tijuana, Tijuana, Ba
Transport Type	Truck
Custom Regimes	N/A
Custom Regime Code	N/A
Custom Broker Code	N/A

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 155 of 186

Declaration Number: **2089574**

Export Date: 12/09/2022

Consignee *(Buyer/Consignee)*

Unavailable

, Estados Unidos De America

Shipper *(Seller)*

Sharp Electronica Mexico Sa De Cv

Blvd Sharp/3510//Parque Industrial Rosarito//Arroyo Seco Cerro, Mexico

Cargo details

Product Description	Televisor Color Pantalla Plana
Incoterm	N/A
Weight	525,564 kg
Quantity	6,203 PIEZA
H.S. Code	852872 - Other, color
H.S. Code Description	Other, color
H.T.S. Code	85287206 - Televisor A Color De Pantalla Plana
Value in USD	$8,054,045.26

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 156 of 186

Ports & Carriers

Departure Port	Tijuana, Tijuana, Ba
Transport Type	Truck
Custom Regimes	N/A
Custom Regime Code	N/A
Custom Broker Code	N/A

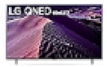
Petitioner Hisense USA Corporation
Exhibit 1014 - Page 157 of 186

EXHIBIT L

amazon Deliver to Texarkana 75501 | Electronics | Search Amazon | EN | Hello, sign in Account & Lists | Returns & Orders | 0 Cart

All | Medical Care | Best Sellers | Amazon Basics | Prime | Today's Deals | New Releases | Music | Customer Service | Amazon Home | Registry | Books | Pharmacy | Gift Cards | Fashion | Smart Home | Toys & Games

All Electronics | Deals | Best Sellers | TV & Video | Audio & Home Theater | Computers | Camera & Photo | Wearable Technology | Car Electronics & GPS | Portable Audio | Cell Phones | Office Electronics | Musical Instruments | New Arrivals



QNED85 Series 65-Inch Smart TV, Black, LG, Alexa Built-in... 4.4 ★★★★½ 212 $1,096.99 prime

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Electronics › Television & Video › Televisions › LED & LCD TVs



Hisense 50R7E 50-Inch 4K Ultra HD Roku Smart LED TV HDR (2019)

Visit the Hisense Store

4.3 ★★★★½ 894 ratings | Search this page

$397.14

Get $50 off instantly: Pay $347.14 upon approval for Amazon Visa.

Delivery & Support

Select to learn more

Ships from Fast&Shipping | 30-day easy returns | Customer Support

Size: **50-inch**

$397.14

FREE delivery **August 16 - 21.** Details

Deliver to Texarkana 75501

In Stock

Quantity: 1

Add to Cart

Buy Now

Ships from Fast&Shipping
Sold by Fast&Shipping
Returns 30-day refund/replacement
Payment Secure transaction

EXHIBIT M





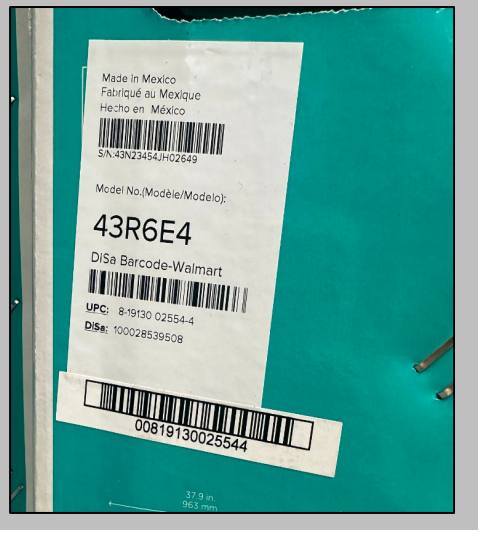
Walmart Supercenter
6801 S Broadway Ave
Tyler, TX 75703

43-inch Hisense TV

Made in Mexico







58-inch Hisense TV

Made in Mexico







EXHIBIT N

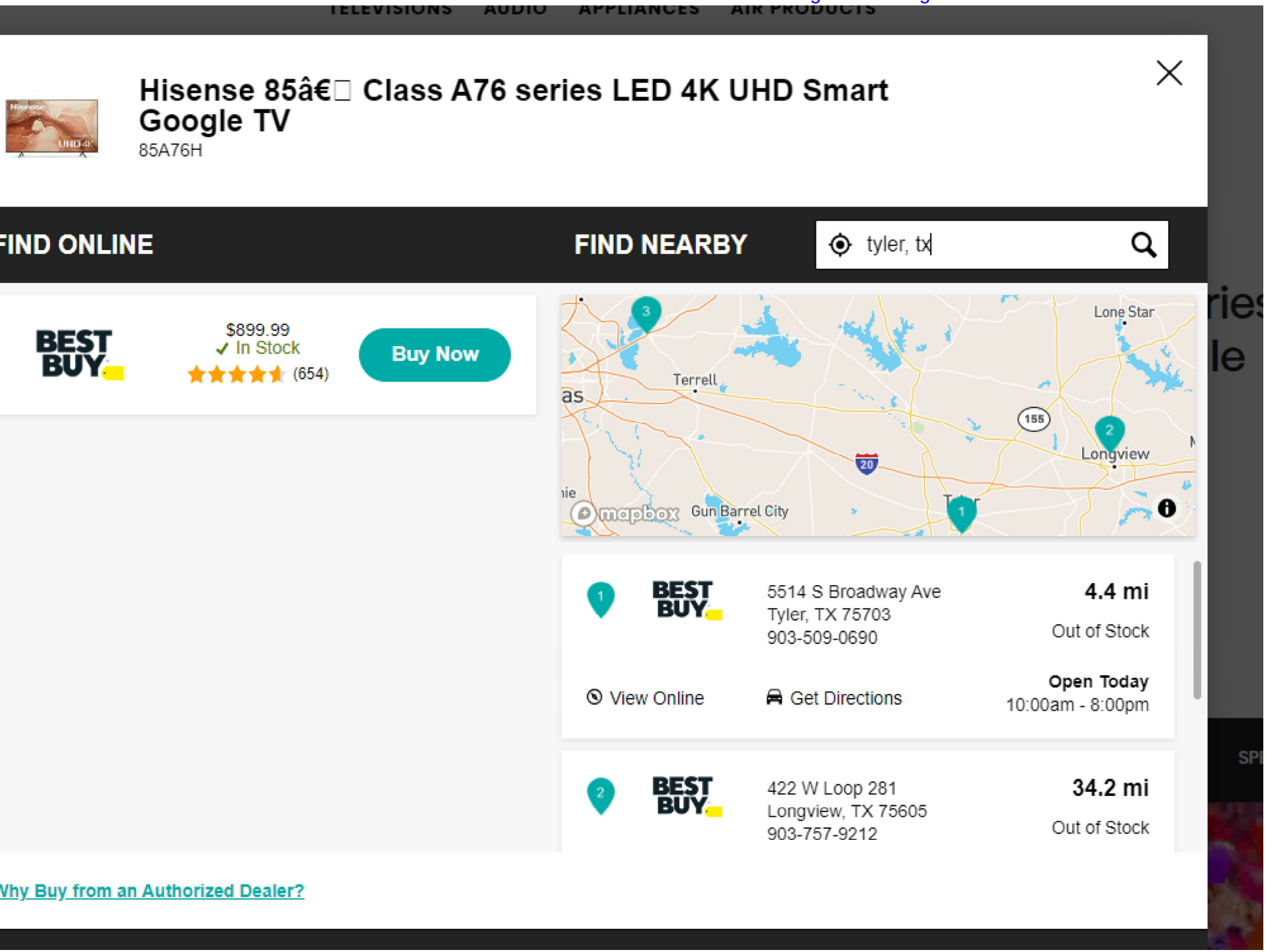

TELEVISIONS AUDIO APPLIANCES AIR PRODUCTS
Hisense 85â€□ Class A76 series LED 4K UHD Smart Google TV
85A76H
FIND ONLINE
FIND NEARBY
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BEST BUY
$899.99
In Stock
(654)
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EXHIBIT O

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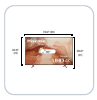
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Yardbird Best Buy Outlet Best Buy Business Shop with an Expert

Back to School Top Deals Deal of the Day Yes, Best Buy Sells That Account Recently Viewed Order Status Saved Items

Best Buy ▸ TV & Home Theater ▸ TVs ▸ All Flat-Screen TVs












@ Best Buy

Hisense

Hisense - 85" Class A7 Series LED 4K UHD Smart Google TV - (2022)

Model: 85A76H SKU: 6521460

4.6 (654 Reviews)

$899.99 or **$50.00/mo.*** suggested payments with **18-Month Financing**

Show me how >

3 free months of Apple TV+ & 1 more

Series: **LED 4K - A7**

LED 4K - A7 | ULED 4K - U7

Key Accessories:

SANUS Elite - Advanced Tilt 4D TV Wall Mount...
$149.99
Add to Cart

Sanus - In-Concealer
$99.99
Add to

Protect your TV (26,969)

Standard Geek Squad Protection | What's Included | Terms & Conditions

No Plan	2-Year $99.99 About $4.17/mo.	5-Year $189.99 About $3.17/mo.

Availability

Pickup	Delivery
Ready on **Sat, Aug 17**	Unavailable to 30301

Order now for pickup on Sat, Aug 17 at Tyler

See all pickup locations

Highlights

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 165 of 186

Add to Cart Save

Cart

4K (2160p)
Resolution

HD | Full HD | **4K UHD** | 8K UHD

- 4X the pixels of Full HD
- Found on most modern TVs
- Lifelike images and graphics

What's the difference in TV resolution?

85 inches
Screen Size Class

Small | Mid | Large

- Theater-like, immersive experience
- Perfect for family rooms home theaters

Which TV size is best?

More Buying Options

Open Box from
$650.99

Show Full Specs

Features

Questions & Answers (81)

From the Manufacturer

Package deals that include this item



Package - Hisense - 85" Class A7 Series LED 4K UHD Smart Google TV - (2022) and 3.1.2 Dolby ATMOS Soundbar with Wireless Subwoofer - Black

$1,129.98
$1,149.98

Our experts recommend



(654)

$899.99
Currently viewing

Offer disclaimer



(7,866)

$149.99
Description



(3,097)

$99.99
Description

Package Total: **$1,149.97**

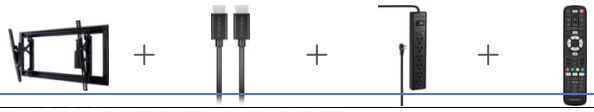
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Build your own package

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 166 of 186

Have everything you need?

See other items that work well with this one.



Complete Your Solution

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This Product
Hisense - 85" Class A7 Series LED 4K UHD Smart Google TV - (2022)
Hisense - 85" Class A7 Series LED 4K UHD Smart Google TV - (2022)

(654)

$899.99



Hisense - 85" Class A6 Series LED 4K UHD Smart Google TV (2024)

(13)

$999.99



Hisense - 85" Class QD7 Series QLED 4K Smart Google TV (2024)

(1)

$899.99



TCL - 85" Class S4 S-Class 4K UHD HDR LED Smart TV with Google TV (2023)

(315)

$799.99

Display Type			
LED	LED	LED	LED
Resolution			
4K (2160p)	4K (2160p)	4K (2160p)	4K (2160p)
Screen Size Class			
85 inches	85 inches	85 inches	85 inches

Show More Specs

Reviews

4.6
654 reviews

5	537
4	59
3	17
2	7
1	34

4.7 Picture Quality

4.6 Sound Quality

4.7 Brightness

92% would recommend to a friend

Customers are saying

Customers express satisfaction with the picture quality, price, large screen, easy setup, and Google TV features of the 85" Class A7 Series LED 4K UHD Smart Google TV. They appreciate the vibrant colors and good sound, and find the TV to be a great value for the price. The easy setup process is also praised, with customers noting that the TV was simple to set up and get started.

This summary was generated by AI based on customer reviews.

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 167 of 186

Top Mentions

Picture quality (167) | Price (68) | Large screen (35) | Customer service (3) | Freezing (2) | Heavy (2)

Cart

The vast majority of our reviews come from verified purchases. Reviews from customers may include My Best Buy members, employees, and Tech Insider Network members (as tagged). Select reviewers may receive discounted products, promotional considerations or entries into drawings for honest, helpful reviews.

Good Price. Decent Functions. Inconsistent Color.

Incentivized | Verified Purchaser | Owned for 1 month | My Best Buy® Member

Large and impressive out of the box. TV was easy to physically set up and generally ready to use out of the box. It is relatively light, but since it is large, will require at least two (2) people to maneuver. The TV includes strategically placed and solid handles factory-installed near the top back of the TV for improved handling. The only physical setup is 1) pow...
Read More




Posted 11 months ago by **NewUser**

Very Satisfied with Purchase

Incentivized | Verified Purchaser | Owned for less than 1 week | My Best Buy® Member

This is my first time using this brand. I thought I would give it a try due to the great price. The set-up was extremely easy from unboxing to powering up and signing in to all accounts. It easily connect to our NAS (network drive). I did adjust the picture based on another customer review regarding the "soap opera" view. I like that you can disable the ...
Read More



Posted 1 year ago by **GeorgeA**

Need to be seen in person to fully appreciate.

Incentivized | Verified Purchaser | Owned for 1 month | My Best Buy® Member

I recently purchased this 85-inch 4K LED TV and have been incredibly impressed with its performance and features.
...
Read More





Posted 10 months ago by **KangC**

See All Customer Reviews

Write a Review

Petitioner Hisense USA Corporation
Exhibit 1014 - Page 168 of 186

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$109.99
(469)
Govee



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$1,899.00
Sylvox TV



LG 65" Class 4K UHD Smart LE...
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Aloeverakadeh



VIZIO 65" Class M6 Series 4K...
$96.50
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75"
$399.99
Dreamedia



Pul Fir
$24
(3)
Mou

High-End TVS On Clearance - Browse TVs in Stock

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Upgrade Your Viewing Experience With Our In-Stock Range Of Premium **TVs**. Get The Latest **TVs** In Stock Now - Stunning Visuals & Features Await. Fast & Accurate. Safe Search. Easy Lookup. Types: LED **TVs**, 4K Ultra HD, Gaming **TVs**, Voice Controlled.

Current TV Inventory · QLED Stock Update
In-Stock HDTV Units · LED TVs On Shelf

Our 10 Best Big Screen Tv In The US - 08/2024 | Buyereviews.com

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Discover the perfect products to fit your budget ensuring you find exactly what you need. Reviews and ratings for 2024's top picks, ensuring you find the perfect match and prices. Save Big! 24/7 Customer Support. Free Delivery. 30-day Returns. Types: Top-Rated, Best Choise, Best Affordable, Best Value.

rating for buyereviews.com

Deal: Up to 70% off Top products

Our Top Picks · Best Deals · Top Rated · Customer Choice

Listen Before you Purchase - best home cinema TV

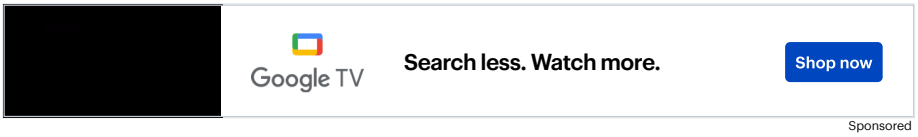
Sponsored · https://www.custom**home**hifi.com/**home**/**theatre**
Listening Showroom allows you to compare and purchase the best for your needs and budget. Custom **Home** HiFi can assemble a terrific sound system for any **home theater** budget. Speakers & Woofers. Amps & Pre-Amps. Turntables & Receivers. Wi-Fi & Connect Expertise.

Receivers & Amplifiers · Phono Cartridges
Stereo Listening Showroom · Theater - Home/Office

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Exhibit 1014 - Page 169 of 186

Order & Purchases

Check Order Status
Shipping, Delivery & Pickup
Returns & Exchanges
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Trade-In Program
Gift Cards

Payment Options

My Best Buy® Credit Card
Pay Your Bill at Citibank
Lease to Own

Support & Services

Visit our Support Center
Shop with an Expert
Schedule a Service
Manage an Appointment
Protection & Support Plans
Haul Away & Recycling
Contact Us

Rewards & Membership

My Best Buy Memberships
View Points & Certificates
Member Offers

Partnerships

Affiliate Program
Advertise with Us
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Careers
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Get the latest deals and more.

Enter email address

Sign Up

Best Buy app
Learn more ›

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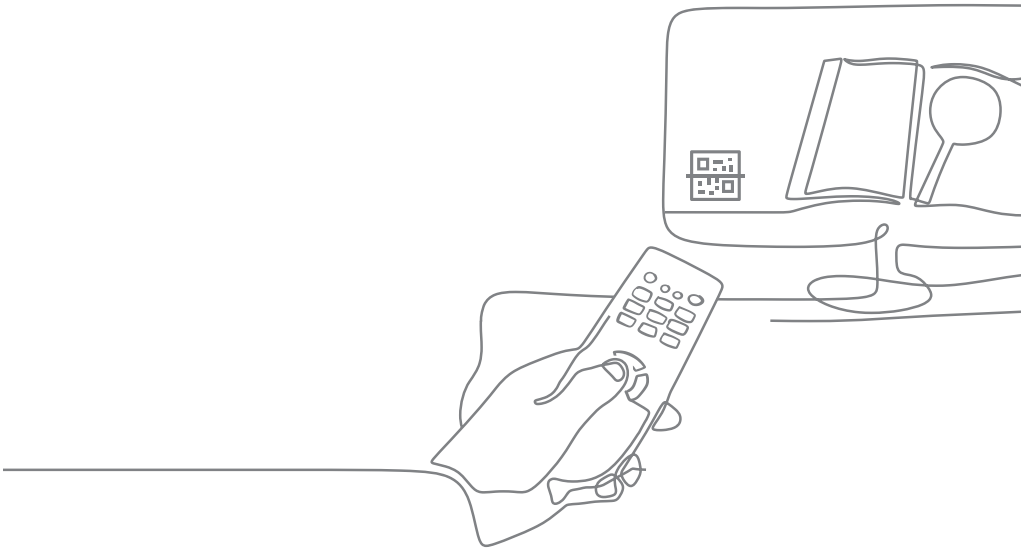
In-store pricing may vary. Prices and offers are subject to change. © 2024 Best Buy. All rights reserved. BEST BUY, the BEST BUY logo, the tag design, and MY BEST BUY are trademarks of Best Buy and its affiliated companies.

EXHIBIT P

Hisense

QUICK
SETUP GUIDE

Before using the TV, please read this guide thoroughly and retain it for future reference.



ES-A223617-1

English

Congratulations on the purchase of your Hisense TV! If you would like to know 'all things Hisense', contact us using the support info:

The model and serial number of the TV is located on the back and/or on one side of the TV. We recommend that you record this if you ever need service.

Country	U.S.A	CANADA	MEXICO
Customer Care Center	• **Phone:** 1-888-935-8880 • **Hours of Operation:** Monday - Friday: 9 AM to 9 PM EST Saturday - Sunday: 9 AM to 6 PM EST • **Service Email:** Service@hisense-usa.com **USA:** Hisense USA Corporation 105 Satellite BLVD Suite I, Suwanee, GA 30024	• **Phone:** 1-855-344-7367 • **Hours of Operation:** Monday - Friday: 8 AM to 8 PM EST Saturday - Sunday: 9 AM to 6 PM EST, Federal holidays excluded • **Service Email:** canadasupport@hisense.com **CANADA:** Hisense Canada Co., Ltd 2283 Argentia Road, Unit 16 Mississauga, ON, Canada L5N 5Z2	• **Phone:** 800-008-8880 • **Hours of Operation:** Monday - Friday: 9:00-21:00 hrs Saturday: 9:00-15:00 hrs • **Service Email:** servicio@hisense.com.mx **MEXICO IMPORTER:** Hisense Mexico S. de R.L. de C.V. Blvd. Miguel de Cervantes Saavedra No 301 Torre Norte Piso 2, Col. Ampliación Granada Miguel Hidalgo, Ciudad de México, C.P. 11520
Hisense Support Page	http://www.hisense-usa.com/support/	http://www.hisense-canada.com/support/	https://hisense.com.mx/support/ *Scan to download user manual
Register your TV	http://www.hisense-usa.com/support/register	http://www.hisense-canada.com/support/productReg.asp	https://hisense.com.mx/support/register

Disclaimer

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Find what you want

This TV is equipped with this quick setup guide and embedded E-Manual (⚙ > **Settings > System > Advanced System > E-Manual**).

On the website (www.hisense.com), you can get the User Manual.

E-Manual support functions

	QR Code	Scan to open the E-Manual on your mobile device.
	Search	Find the help you are looking for.

This Quick Setup Guide supports the following models:

85A7H / 85A68H / 85A76H

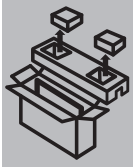
What's in the box

Your Hisense TV comes with the following items:

- TV
- 1 set of AAA(1.5Vcc) batteries
- remote control
- power cord
- Quick Setup Guide (this document)
- 2 base stands
- Important Safety Information and Warranty Card
- 6 screws (M5×16)

IMPORTANT:

To prevent accidentally discarding items that came with your TV, be sure to **check ALL of the foam** in the carton box.



· Please check foam for accessories before discarding.
· Veuillez vérifier la mousse pour qu'il n'y ait pas d'accessoires avant de la jeter.
· Antes de desechar la espuma, asegúrese de retirar todos los accesorios.

Disclaimer: *This Quick Setup Guide is intended as a general guideline to help you set up your TV. Images throughout this document are for illustrative purposes only and may differ from the actual product.*

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Getting started

Step 1. Attach stand or mount

Before you start using your TV, attach your TV stand or mount it on the wall.

CAUTION:

- Disconnect the AC power cord before installing a stand or a wall mount bracket.
- The LED display on your TV is fragile. Make sure the TV screen is not scratched or damaged by hard objects or from pressure.
- After the installation is complete, make sure the TV is steady on a table or firmly attached to a wall mount, before removing all protective film, if any.

Attach the TV stand

To attach the TV stand legs to your TV:

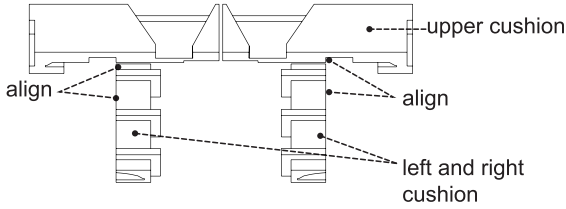
1. Carefully place your TV on a clean, soft and flat surface.
2. Insert the TV base stands into the bottom slots on your TV.
3. Use the screws provided to secure each leg tightly.

ATTENTION

- Follow the illustrations and textual instructions below to complete the stand installation steps.
- Two people and above are required.

1. Open the box, take out the base stands and then take out the upper cushion, left cushion and right cushion.

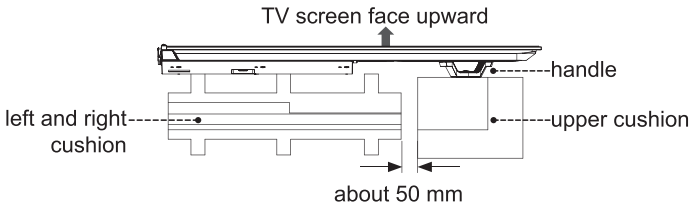
   Make sure the side of left and right cushion is aligned with the gap of upper cushion, just as the picture shows below. This step can help avoid the interference between cushions and the base stand when installing stands.



Top view of cushions or overlooking cushions

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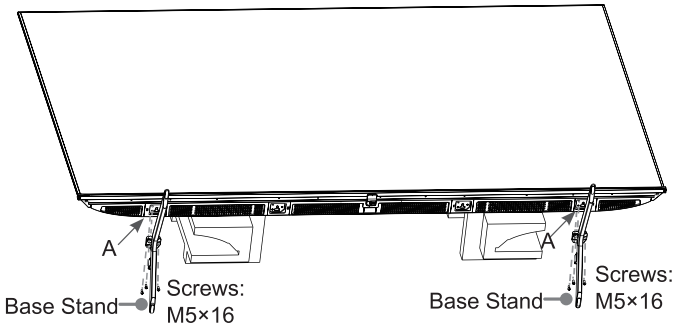
2. Two people stand on each side of the TV. Hold the back side of TV with one hand and grasp the buckle on lower box with the other hand. Place the TV on the cushions with the screen facing upward. Make the handle touch upper cushion, back cover touch the left and right cushions. When finished, take off the lower box.

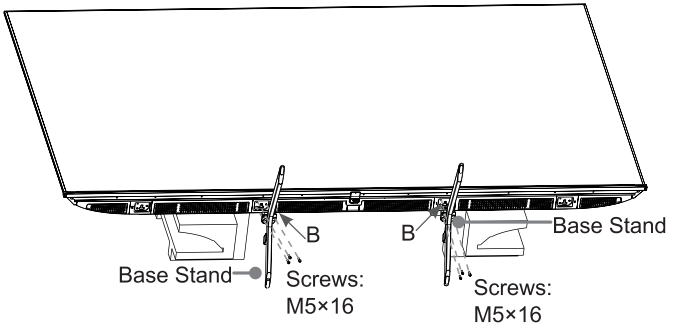


Side view of cushions and TV

3. Secure the Base Stand to the TV with the 6 screws in the accessory bag tightly. Then stand the TV up.

Note: If your table is long enough to place the TV on top of, then insert the base stands into the screw holes 'A' that are shown in the illustration. If your table is NOT long enough, then insert the base stand into the screw holes 'B' that are shown in the illustration. Note that these two installation methods types cannot be mixed.



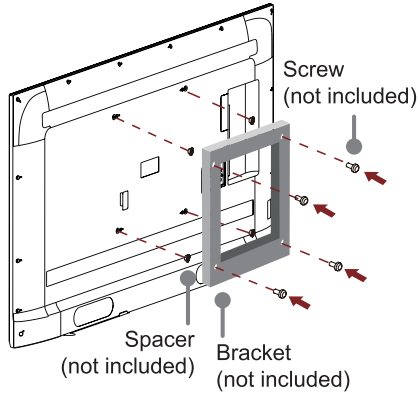


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Attach the wall mount bracket (not included)

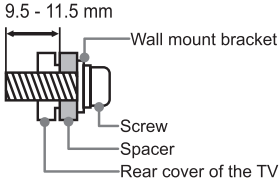
Before you begin the third-party manufacturer instructions, be sure to do the following things:

1. Place the TV on a clean, safe and cushioned surface.
2. Remove the TV stand if you have already attached it.
3. Place spacers (not included) in the corresponding bracket holes.



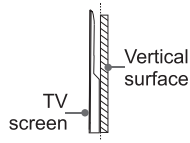
CAUTION:

- Follow instructions provided with the wall mount bracket. If it is not correctly mounted, the TV may fall and cause property damage or personal injury.
- When you attach the mount, be sure to use spacers (provided by the third-party manufacturer) between the TV and the bracket.
- To prevent internal damage to the TV and to ensure it is mounted securely, be sure to use fixing screws (not included) that are 9.5 - 11.5 mm in length when measured from the attaching surface of the rear cover.



Wall mount hole pattern(mm)	600 × 400
Wall mount screw size	M8

- We do not recommend hanging the TV on a slanted wall, and when wall mounting make sure your television remains parallel to the wall and does not lean forward.



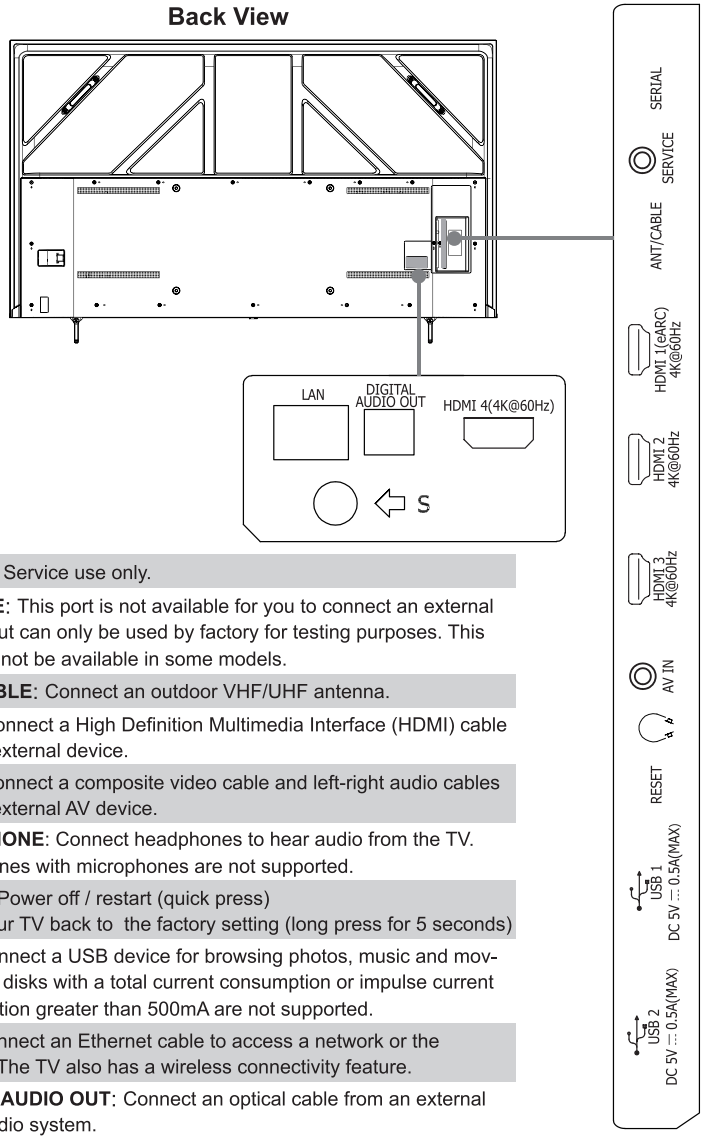
NOTE:

- If installed on a ceiling or slanted wall, or the television installed is not parallel to the wall, the television may fall and result in property damage or severe personal injury.
- If you have additional questions, please contact the wall mount manufacturer or the retailer from which you purchased the TV.
- The diameter and length of the screws differ depending on the wall mount bracket model.

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Step 2. Connect devices to your TV

Check to ensure that you have connected right cables for right ports securely. Loose connections can affect the quality of the picture image and color.



- **SERIAL**: Service use only.
- **SERVICE**: This port is not available for you to connect an external device, but can only be used by factory for testing purposes. This port may not be available in some models.
- **ANT/CABLE**: Connect an outdoor VHF/UHF antenna.
- **HDMI**: Connect a High Definition Multimedia Interface (HDMI) cable from an external device.
- **AV IN**: Connect a composite video cable and left-right audio cables from an external AV device.
- **HEADPHONE**: Connect headphones to hear audio from the TV. Headphones with microphones are not supported.
- **RESET**: Power off / restart (quick press)
  Reset your TV back to the factory setting (long press for 5 seconds)
- **USB**: Connect a USB device for browsing photos, music and movies. Hard disks with a total current consumption or impulse current consumption greater than 500mA are not supported.
- **LAN**: Connect an Ethernet cable to access a network or the Internet. The TV also has a wireless connectivity feature.
- **DIGITAL AUDIO OUT**: Connect an optical cable from an external digital audio system.

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Step 3. Get your remote ready

The following table shows the buttons on your remote control and describes what they are for.

BUTTON	*DESCRIPTION*
⏻	Power on/off
•	Microphone / Indicator
INPUT	Change TV input source
	Google Assistant of TV
	Accounts & Sign In or switch profile
	Access the settings (direct or through the dashboard in GTV) from any place in the system
^ / v / < / >	D-pad (up/down/left/right navigation buttons)
OK	Confirmation button
	Return to the previous place in the menu or app
	Press to display the Home screen
	Return to Live TV/Enter to Live tab in launcher/Display the Electronic Program Guide(if support) *
^ VOL v	Volume (up/down)
^ CH v	Channel (up/down)
	Mute and restore sound Press and hold to display Accessibility menu
	Press to enter Menu
	Media content control function buttons
123	Enter Channels/input numbers and special function buttons
App	Quick access buttons to apps

NOTE:

- Buttons listed here are for reference only. Actual remote control may vary depending on model, country/region.
- * Pressing the button in different scenarios will have different responses.

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Insert the batteries

1. Take off the back cover to open the battery compartment of the remote control.
2. Insert two AAA(1.5Vcc) size batteries. Make sure to match the (+) and (-) ends of the batteries with the (+) and (-) ends indicated in the battery compartment.
3. Restore the battery compartment cover.

Important information about the remote and batteries

- Discard batteries in a designated disposal area. Do not throw them into a fire.
- Remove old batteries immediately to prevent them from leaking into the battery compartment.
- If you do not intend to use the remote control for a long time, then remove the batteries.
- Battery chemicals can cause a rash. If the batteries leak, clean the battery compartment with a cloth. If chemicals touch your skin then wash it immediately.
- Do not mix old and new batteries.
- Do not mix alkaline, standard (carbon-zinc) or rechargeable (NiCd, NiMH, etc.) batteries.
- Do not continue using the remote if it gets warm or hot.
- Call our Support Center immediately on the support website.

Remote control range information

- The remote control can work at a distance of up to 26 feet (792.5 cm) in front of the TV set.
- It can work at a 30 degree horizontal or vertical angle.

Pairing the remote control

1. Pair the remote to the TV after you power it on for the first time, there will be instructions on how to pair the remote.
2. If your remote fails to pair with TV, keep the remote within 10 feet (304.8 cm) from the TV, press and hold the [←] button and [⌂] button at the same time at least 3 seconds to start pairing.
3. If the remote pairs successfully, a confirmation will display on the screen. If it does not pair successfully, an unsuccessful message will display. Repeat step 2, or you can check the Bluetooth is set On by pressing [⚙] button to select Settings > Remotes & Accessories > Bluetooth to On.

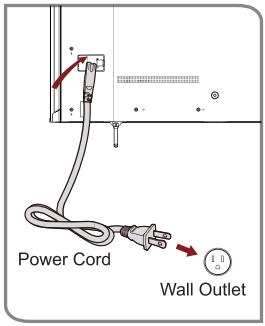
NOTE:

- If an unknown error occurs with the remote, it could have been caused by interference. Try to remove what's causing the interference and pair the remote again.
- If an unknown error occurs with the remote control while the battery power is normal, you can take out the batteries and press any key for 1~2 seconds, and insert them back. The remote control can work normally.
- The remote cannot be paired to the TV while the TV is in the standby mode.

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Step 4. Power on the TV

Connect your power cord to the TV and plug it into a power outlet. Your TV will display a launch screen showing the Hisense logo.



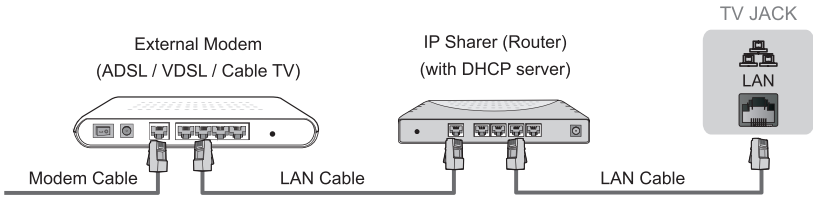
Step 5. Complete the first-time setup

The first time you turn on your TV, there is a guided setup to make it easy to connect your TV to the Internet and complete the setup of your TV.

Step 6. Establish a network connection

1. Press the **Home** button on the remote control, and select the ⚙ icon to select **Settings** to enter the Settings menu.
2. Select **Network & Internet.**

Establish a wired network connection



Establish a wireless network connection



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And setup is done, congratulations!

Now that you've completed the first-time setup, enjoy your TV!

Text-to-Speech (TTS) and Video Description functionalities on TV

Text-to-Speech (TTS) and Video Description can help you to navigate the menus on the screen and hear an audio description of relevant programs. Text-to-Speech can convert written text into voice to help visually impaired people listen to the information they are unable to read. In addition, the Video Description has an audio narration added to certain programs that will describe the main visual elements which visually impaired users may not be able to see.

Follow the steps below to enable the functions:

1. Press the [⚙] button on your remote to select **Settings.**
2. Next, select **System** to enter the **Accessibility** menu.
3. Select **TalkBack** to turn the Menu Audio on or off by selecting the appropriate choice that is presented.

or you can:

1. Press the [**INPUT**] button on your remote**,** select **TV.**
2. Next, press the menu button to select **Video Description** to turn Video Description on or off by selecting the appropriate choice that is presented.

Text-to-Speech(TTS) and Audio Description functionalities on Google TV - Hisense USA (hisense-usa.com)



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Troubleshooting

If you are having trouble with your TV, first try turning it off and on again. If this does not fix the problem, check the tips in the following table. If your problem is not listed in the following table, then contact us at one of the phone numbers on Page before.

Issues	Possible solutions
No sound or picture	• Check if the power cord is plugged into a powered AC outlet. • Press the Power button on the remote control to activate the unit from 'Standby' mode. • Check to see if the LED light is on or not. If it is, then the TV is receiving power.
I have connected an external source to my TV and I get no picture and/or sound.	• Check for the correct output connection on the external source and for the correct input connection on the TV. • Make sure you have made the correct selection for the input mode for the incoming signal.
When I turn on my TV, there is a delay for a few seconds before the picture appears. Is this normal?	• Yes, this is normal. The TV is initializing and searching for previous setting information.
The picture is normal but there is no sound	• Check the volume settings. • Check if 'Mute' mode is set to On.
Sound but no picture or black and white picture	• If the picture is black and white, unplug the TV from the AC outlet and replug it after 60 seconds. • Check that the Color is set to 50 or higher. • Try different TV channels.
The sound and/or picture is distorted or appears wavy	• An electric appliance may be affecting the TV. Turn off any appliances that are nearby and move it farther away from the TV. • Insert the power plug of the TV set into another power outlet.
The sound and picture is blurry or cuts out	• If using an external antenna, check the direction, position and connection of the antenna. • Adjust the direction of your antenna or reset or fine tune the channel.
A horizontal or vertical stripe appears on the picture and/or the picture is shaking	• Check if there is an appliance or electric tool nearby that is causing interference.
The plastic cabinet makes a "clicking" type of sound	• The 'click' sound can occur when the temperature of the television changes. This change causes the television cabinet to expand or contract, which makes the sound. This is normal and the TV is OK.
The remote control does not work	• Confirm that TV still has power and is operational. • Change the batteries in the remote control. • Check if the batteries are correctly installed.

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Product Specifications

Model Name		85A7H / 85A68H / 85A76H
Dimension (W × H × D)	Without Stand	74.9 × 42.8 × 3.7 inches (1 903 × 1 088 × 94 mm)
	With Stand	74.9 × 46.6 × 18.7 inches (1 903 × 1 183 × 474 mm)
Weight	Without Stand	90.4 lbs (41.0 kg)
	With Stand	95.7 lbs (43.4 kg)
TV Stand Width (W × D)		55.0 × 18.7 inches/24.3 × 18.7 inches (1 396 × 474 mm)/(616 × 474 mm)
Active Screen Size (Diagonal)		84.5 inches (214.7 cm)
Screen Resolution		3840 × 2160
Audio Power		15 W + 15 W
Power consumption		Please refer to the rating babel.
Power Supply		Please refer to the rating babel.
Connectivity		Built-in Wireless feature (2x2 dual band)
Receiving Channels		VHF: 2 - 13, UHF: 14 - 69, CATV: 1 - 125 Digital Terrestrial Broadcast (8VSB): 2 - 69 Digital cable (64/256 QAM): 1 - 135
Tuner Type		Frequency synthesized
Receiving System		Analog: NTSC Digital: ATSC/QAM
Operating Temperature		41°F - 95°F(5°C - 35°C)
Operating Humidity		20% to 80% non-condensing
Storage Temperature		5°F to 113°F(-15°C to 45°C)
Storage Humidity		10% to 70%, non-condensing

Disclaimer: *All products, product specifications, and data are subject to change without notice to improve reliability, function, design or otherwise.*

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Certification and Compliance

FCC Notice

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the device and receiver.
- Connect the device into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

The Wi-Fi Module complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

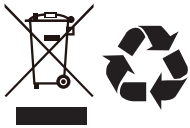
Declaration of Conformity

Trade Name: Hisense
Model: 85A7H / 85A68H / 85A76H
Responsible Party: Hisense USA Corporation
Service Address: 105 Satellite BLVD Suite I, Suwanee, GA 30024
Service Phone Number: 1-888-935-8880
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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