Exhibit 2

EXHIBIT

2△3**17**4

SAMSUNG’S INVALIDITY CLAIM CHART FOR U.S. PATENT 7,372,455 (“PERSKI △[7]’[8]455”) Summary of Invalidity Opinions and Materials Relied Upon:

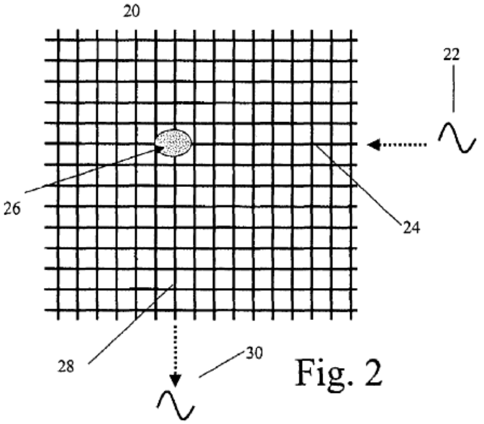
- U.S. Patent 7,372,455 (“Perski △[9]’[10]455”), entitled “Touch Detection for a Digitizer,” to Haim Perski and Meir Morag, was filed on January 15, 2004, issued on May 13, 2008, and is assigned to N-Trig Ltd. Perski ‘455 claims the benefit of U.S. Provisional Pat, App. Nos. 60/446,808, filed on February 10, 2003, and 60/501,484, filed September 5, 2003. As such, Perski △[11]’[12]455 qualifies as prior art to the ’607 patent under 35 U.S.C. § 102(e). In addition, the patent incorporates by reference U.S. Provisional Pat. App. No. 60/406,662, filed Aug 27, 2002, (“Perski △[13]’[14]662”) and U.S. Pat. App. No. 10/649,708, filed Aug 28, 2003 (“Perski△[15] ’[16]708.”), both of which are also assigned to N-Trig Ltd.

- Perski △[17]’[18]455 anticipates △[19]and/or renders obvious Claim 8[20] of the △[21]’[22]607 patent. To the extent any limitation of △[23]Claim 8[24] is not expressly or inherently disclosed in Perski △[25]’[26]455, any such limitation would have been obvious to one of ordinary skill in the art at the time of the invention of the △[27]’[28]607 patent.

- Perski ’455 is directed to “a combined touch and stylus digitizer, and more particularly, but not exclusively to adaptations for the detection of finger touch.” (*Id.* at 1:14-16). Using Perski’s digitizer, “multiple conductive objects can be detected” and the digitizer is configured “to detect more than one finger touch at the same time.” (*Id.* at 4:1-3; 14:15-19). In my opinion, Perski’s digitizer is almost identical in construction and operation to the transparent capacitive sensing medium described in the ’607 Patent. As described △[29]in my Declaration[30], ALJ Essex, the Commission Investigative Staff, and the full Commission also agreed with this opinion. △[31]*See* △[32]750 ID[33].

- I also understand that during the ITC investigation initiated against Motorola, Apple did not contest that Perski △[34]’[35]455 did in fact disclose *almost all* of the limitations of △[36]Claim 8.[37] I understand that the only contested △[38]limitation was[39] the multitouch limitation △[40]of claim 1.[41] (*Id.*).

U.S. Patent No. 7,663,607	Perski '455[1]

[1A] A touch panel comprising a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches,	Perski ’455 discloses a touch panel (e.g., two-dimensional sensor matrix 20 in Figure 2) comprising a transparent capacitive sensing medium configured to detect multiple touches or near touches (e.g., with finger 26 in Figure 2) that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals (e.g., output signal 30 in Figure 2) representative of a location of the touches on the plane of the touch panel for each of the multiple touches.  Fig. 2 Perski ’455 states: “A two-dimensional sensor matrix 20 lies in a transparent layer over an electronic display device. An electric signal 22 is applied to a first conductor line 24 in the two-dimensional sensor matrix 20. At each junction between two conductors a certain minimal amount of capacitance exists. A finger 26 touches the sensor 20 at a certain position and increases the capacitance between the first conductor line 24 and the orthogonal conductor line 28 which happens to be at or closest to the touch position. As the signal is AC, the signal crosses by virtue of the capacitance of the finger 26 from the first conductor line 24 to the orthogonal conductor 28, and an output signal 30 may be detected.” Perski

	’455 at 13:32-43. Perski ’455 also states: “Preferably, the sensor is substantially transparent and suitable for location over a display screen. Preferably, the detection region is the surface of a display screen and wherein the sensor including the at least one conductive element is substantially transparent.” Id. at 3:39-3:43. The sensing medium disclosed in Perski ’455 is configured to detect multiple touches or near touches that occur at a same time. Perski ’455 states: “The goal of the finger detection algorithm, in this method, is to recognize all the sensor matrix junctions that transfer signals due to external finger touch. It should be noted that this algorithm is preferably able to detect more than one finger touch at the same time.” Id. at 14:15-19.1 Perski also is capable of detecting *near touches*: “[i]n the preferred embodiments of the present invention, the same detector can detect and process signals from an Electro Magnetic Stylus whether it is placed in contact with, *or at a short distance from*, the surface of a flat panel display.” (Perski ’455 at 8:56-65).[43]
[1B] wherein the transparent capacitive sensing medium comprises: a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another; and	Perski ’455 teaches a transparent capacitive sensing medium (e.g., two-dimensional sensor matrix 20 in Figure 2) comprising a first layer having a plurality of transparent first conductive lines (e.g., vertical pattern/conductors 3 in Figure 3 of the ’662 App.) that are electrically isolated from one another.

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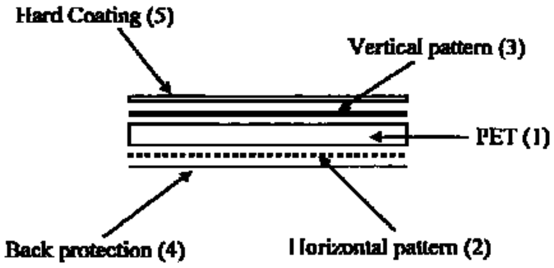
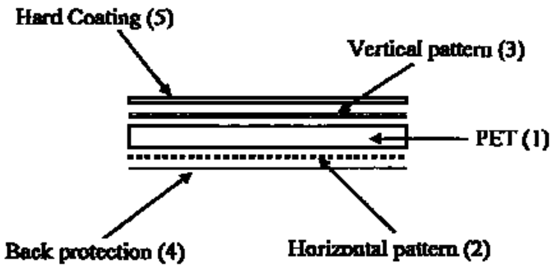
1 Perski ’455 expressly incorporates by reference U.S. Prov. Pat. App. No. 60/406,662 (“the ’662 App.”). Because the disclosure of the ’662 App. was expressly incorporated by reference in Perski ’455, both the ’662 App. and Perski ’455 will be treated as a single invalidating reference for purposes of this analysis. *See Advanced Display Sys. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000).

	 The ’662 App. states: “the sensor is a grid of conductive lines made of conductive polymers patterned on a PET foil. The grid is made of two layers, which are electrically separated from each other. One of the layers contains a set of parallel conductors. The other layer contains a set of parallel conductors orthogonal to the set of the first layer.” ’662 App. at 4.[45] “It is a general object of the present invention to enable as higher transparency as possible, and therefore in a preferred embodiment only one foil is used. Figure number 3 described a one-foil configuration in which a Polyester foil (1) patterned on its lower size with horizontal conductors (2) and on its upper side with vertical conductors (3). The upper side is covered by protection layer (5) to avoid integration or shipping damage. It should be noted that the present invention could be implemented in additional combinations, such as using two foils.” ’662 App. at 6. “In a preferred embodiment, the conductors are straight lines having 1 mm width, equally spaced in 4 mm intervals. In different embodiments different patterns could be used. Larger interval between the lines could be selected in order to reduce the total number of conductors and therefore to reduce the electronic and the price of the system. Smaller intervals could be selected to get higher resolution. Wider line width could be selected in order to reduce the resistance of a conductive line.” Id. at 5.

[1C] a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another,	Perski ’455 teaches a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines (e.g., horizontal pattern/conductors 2 in Figure 3 of the ’662 App.) that are electrically isolated from one another.  See **[1A]** and **[1B]**. Strickon Dep. Tr. 230:13-△[48]28, attached as Exhibit 18 to my Declaration.[49]
[1D] the second conductive lines being positioned transverse to the first conductive lines,	Perski ’455 teaches the second conductive lines (e.g., horizontal pattern/conductors 2 in Figure 3 of the ’662 App.) being positioned transverse to the first conductive lines (e.g., vertical conductors 3 in Figure 3 of the ’662 App.). See **[1A]** and **[1B]**. Huppi Dep. Tr., Exhibit 9 to my Declaration, at[50] 168:23 - 169:3; 171:1-
[1E] the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry;	Perski ’455 teaches the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry (e.g., “detection circuitry”). See **[1A]** and **[1B]**. Perski ’455 states: “The detector may comprise a plurality of conductive elements and the detection circuitry may comprise a differential detector arrangement associated with the sensing conductors for detecting differences between outputs of the conductors.” Id. at△[51]

3:44-49.[54]

The ’622 App. states: “the sensor is surrounded with a non-transparent frame build of a PCB or flexible circuit. The frame hose the front-end analog components, the conductors from the grid to the front-end, the conductors from the front-end to the digital sections and the excitation coil. In additional embodiments, however, the front-end components could [be] mounted directly on the transparent foil. In this case conductors to/from the front-end could be implemented either by patterning the transparent conductive material or by printing of different material, such as silver on the foil.” Id. at 6.[55]

Perski ’455 states: “In FIG. 1A a sensor 2 comprises at least one electrical conductor 4. In the typical case there is more than one conductor, and the conductors are set in an arrangement or pattern over the sensor, most often as a grid which extends over a surface such as an electronic screen for which touch sensing is required. A detector 6 picks up the [56]output from the conductors. An oscillator 8 provides oscillations or [AC] energy to the system comprising the sensor and detector. In one embodiment, the system is not initially [AC] coupled. However a conductive object, including body parts such as fingers are capacitive and therefore touch by a finger or the like completes the [AC] coupling within the system and allows the touch to be sensed. Alternatively a touch by the finger may provide an [AC] short circuit to ground for a given conductor, again allowing the touch to be sensed.” Id. at 9:19-33.

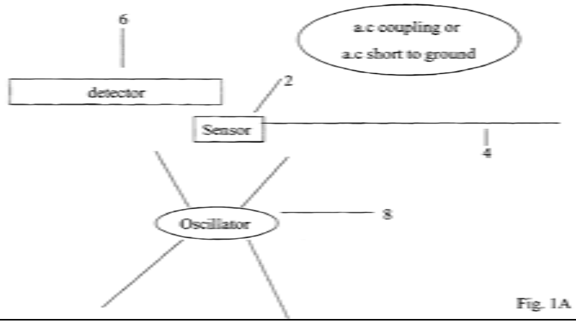


Fig. 1A

[1F] wherein the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines.	Perski ’455 teaches that the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines. See **[1A]** and **[1E]**. “A faster approach is to apply the signal to a group of conductors on one axis. A group can comprise any subset including all of the conductors in that axis, and look for a signal at each one of the conductors on the other axis. Subsequently, an input signal is applied to a group of lines on the second axis, and outputs are sought at each one of the conductors on the first axis.” Id. at 14:20-59.[57]
△[58]	△[59] △[60] △[61]
△[62] △[63]	△[64] △[65] △[66] △[67]

△[68] △[69]	△[70] △[71] △[72] △[73]
[7] The touch panel as recited in claim 1, wherein the capacitive sensing medium is a mutual capacitance sensing medium.	Perski ’455 teaches the touch panel as recited in claim 1, wherein the capacitive sensing medium lines (e.g., of two-dimensional sensor matrix 20 in Figure 2) is a mutual capacitance sensing medium. See **[1A]**. Perski ’455 states: “A number of procedures for detection are possible. The most simple and direct approach is to provide a signal to each one of the matrix lines in one of the matrix axes, one line at a time, and to read the signal in turn at each one of the matrix lines on the orthogonal axis. The signal, in such a case, can be a simple cosine pattern at any frequency within the range of the sampling hardware and detection algorithms. If a significant output signal is detected, it means that there is a finger touching a junction. The junction that is being touched is the one connecting the conductor that is currently being energized with an input signal and the conductor at which the output signal is detected. The disadvantage of such a direct detection method is that it requires an order of n*m steps, where n stands for the number of vertical lines and m for the number of horizontal lines. In fact, because it is typically necessary to repeat the procedure for the second axis so the number of steps is more typically 2*n*m steps. However, this method enables the detection of multiple finger touches. When an output signal is detected on more then one conductor that means more than one finger touch is present. The junctions that are being touched are the ones connecting the conductor that is currently being energized and the conductors which exhibit an output signal.”[74]

	△[75] △[76] "A faster approach is to apply the signal to a group of conductors on one axis. A group can comprise any subset including all of the conductors in that axis, and look for a signal at each one of the conductors on the other axis. Subsequently, an input signal is applied to a group of lines on the second axis, and outputs are sought at each one of the conductors on the first axis. The method requires a maximum of n+m steps, and in the case in which the groups are the entire axis then the number of steps is two. However, this method may lead to ambiguity on those rare occasions when multiple touches occur simultaneously at specific combinations of locations, and the larger the groups the greater is the scope for ambiguity." "An optimal approach is to combine the above methods, starting with the faster method and switching to the direct approach upon detection of a possible ambiguity." Id. at 14:20-59. Strickon Dep. Tr. 54:7-18; 183:16-20; 204:25 – 205:6.; 258:24-259:1, attached as Exhibit 18 to my Declaration.[77] Huppi Dep. Tr., Exhibit 9 to my Declaration, at 155:23 – 156:14.[78] Day Dep. Tr. 25:8-13; 108:19 – 109:△[79]11, attached as Exhibit 19 to my
[8] The touch panel as recited in claim 7, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel.	Perski '455 teaches the touch panel as recited in claim 7, further comprising a virtual ground charge amplifier (e.g., differential amplifier 74) coupled to the touch panel for detecting the touches on the touch panel.

	Perski ’455 states: “In FIG. 5, oscillator 64 is connected between ground 62 and detector 60. The oscillator 64 oscillates the detector 60 and the detector front end, which includes two sensor conductors 70 and 72. The two conductors are connected to the two differential inputs respectively of differential amplifier 74. As explained above, all oscillations are in reference to the common ground 62. The touch by the user’s finger of a sensor conductor, say 70 creates capacitance 76. As there is a potential between conductor 70 and the user, current passes from conductor 70 through the finger to ground. Impedance 78 indicates the impedance of the finger. Consequently a potential difference is created between conductors 70 and 72. Preferably, the separation between the two conductors 70 and 72 which are connected to the same differential amplifier 74 is greater than the width of a finger so that the necessary potential difference can be formed. The differential amplifier 74 amplifies the potential difference, and the detector 60 processes the amplified signal and thereby determines the location of the user’s finger. It should be noted that in alternative embodiments the sensor may be connected to a standard amplifier rather than to a differential amplifier.” Id. at 15:44-65. The digitizer described in Perski ‘455 employs such operational amplifiers. (*See, e,g,. id.* at Figures 5, 8, 10B, 14, 15, 16A, and 17). As discussed previously, these operational amplifiers were known to carry Miller capacitance. Perski ‘455 uses the operational amplifiers without other feedback. Thus, the Miller capacitance of the operational amplifier provides the charge feedback in the structure, producing the charge amplifier circuit shown in Figure 13 of the ‘607 patent. Furthermore, the Miller theorem states that this Miller[83]

△84	△85
	△86

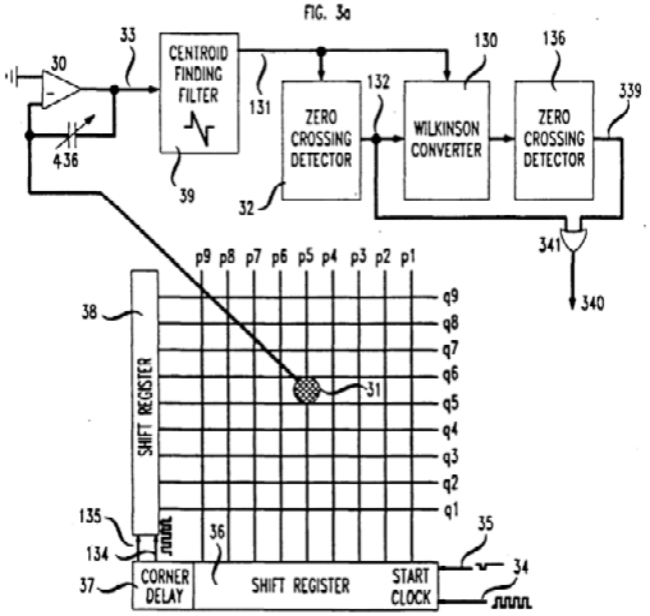
△87	△88 △89 △90

△91	△92 △93
△94 △95	△96
	△97 △98

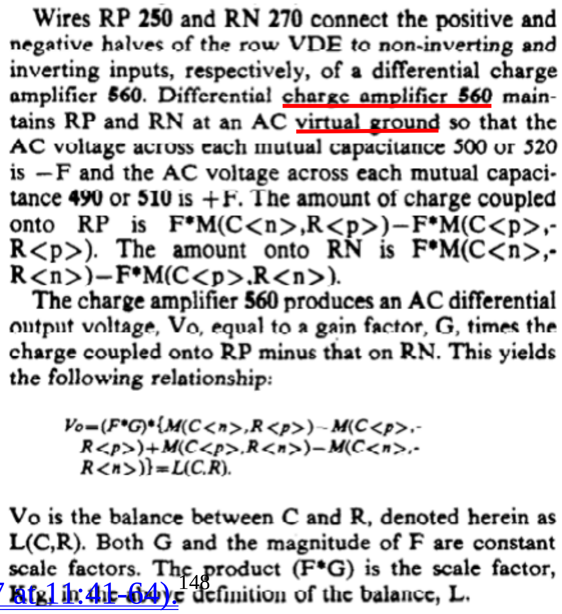
△99	△100 △101 △102
△103	△104 △105 △106 △107 △108

△109	△110 △111
△112 △113	△114 △115 △116
△117 △118 △119	△120 △121 △122 △123

△[124] △[125]	△[126]capacitance is mathematically identical to a pair of capacitors to ground, providing a virtual ground to the charge amplifier.[127] △[128] △[129] Thus, the operational amplifier 7 shown in Figure 5 of Perski ’455 is a virtual ground charge amplifier. One of ordinary skill in the art knows that operational amplifier 7 has Miller capacitance, which provides virtual ground charge feedback. Additional virtual grounding is provided by the capacitive coupling of the finger or touch, through the natural resistance of the body to the ground.[130] △[131]Even if Perski ‘455 did not expressly or inherently disclose a virtual ground charge amplifier, it would have been obvious to one of ordinary skill in the art to use a virtual ground charge amplifier as one of the several ways that detection of touches on the touch panel could have been performed. Indeed, Perski ‘455 acknowledges that “the prior art teaches connection of a separate charge sensor or the like to each electrode.” (Perski ‘455 at 8:26-28). One such example of such a separate charge sensor is that of Blonder et al., U.S. Patent No. 5,113,041 issued May 12, 1992 (“Blonder”). As shown in Figure [132]3△[133]a of Blonder, reproduced below, element 30 is a virtual ground charge amplifier coupled to the touch panel

△[135] △[136]	 △[137] △[138]Another example of the claimed "virtual ground charge amplifier" is shown in U.S. Patent No. 5,565,658 to Gerpheide et al. (hereinafter "Gerpheide '658"). Gerpheide '658 issued in 1996—8 years before the '607 Patent was filed. I understand that Gerpheide '658 was even included and charted in Samsung's preliminary invalidity contentions in an obviousness combination with U.S. Patent No. 5,305,017 also to Gerpheide et al. (hereinafter "Gerpheide '017"). Gerpheide '658, like Blonder, is directed to a capacitive touch sensor. Gerpheide '658, in FIG. 6B, shows a "virtual ground charge amplifier" as its "capacitive measuring element" connected to the touch panel[139].

△[140] △[141]	△ Once again, this amplifier is in precisely the same configuration as shown in FIG. 13 of the ’607 Patent. The non-inverting (positive) terminal of the amplifier is tied to ground, and the inverting (negative) terminal is connected to a feedback loop with a capacitor. As such, the amplifier includes the exact same “capacitor designed into a negative feedback loop” that Apple’s own expert alleged was required for an operational amplifier to be considered a “virtual ground charge amplifier.” There can be no doubt that Gerpheide ’658 clearly shows a “virtual ground charge amplifier” coupled to the touch panel for detecting touches.[143] Gerpheide ’658 provides the motivation to incorporate the virtual ground charge amplifier of FIG. 6b shown above into any capacitive touch sensor. For example, Gerpheide ’658 teaches that FIG. 6b represents a “preferred alternative” for the capacitive measurement element shown in the prior figures. (Gerpheide ’658 at 7:46-54). Gerpheide ’658 also expressly mentions that these configurations “represent different implementations known in the art for low pass filter elements, such as switched capacitor integrators and filters, high-order analog filters, and digital filters.” (*Id.* at 8:15-19). As such, it would be readily apparent to one of ordinary skill in the art to incorporate the virtual ground charge amplifier of FIG. 6b into any capacitive touch sensing application, including the touch sensors described in Perski and Smartskin, in order to filter unwanted charge coupling and detect only charge coupling due to the presence of a finger touch.[144] △[145]As yet another example, Gerpheide ’017, which I understand was also included and charted in Samsung’s preliminary invalidity contentions, again shows the claimed “virtual ground charge amplifier.” Gerpheide ’017 issued in 1994—a *decade* before the ’607 Patent was filed. Gerpheide ’017 was also identified and referenced in my opening expert report with respect to claim 7, from which claim 8 depends. I cited Gerpheide ’017 for its description of a mutual capacitive touch sensor (*see* ¶¶ 111 and 112 of my Corrected Opening Report, attached as Exhibit 16 to my Declaration). In particular, I cited column 9, line 62 through column 12, line 13 in my opening report. (*Id.* at ¶ 112). These columns describe the exact same “virtual ground charge amplifier” shown in FIG. 13 of the ’607

	For example, Gerpheide ’017 describes a “differential charge amplifier” which maintains its inputs to “virtual ground” in order to detect mutual capacitance. This is yet another clear example of the claimed “virtual ground charge amplifier” recited in claim 8 of the ’607 patent. As shown in the excerpt below, differential charge amplifier 560 is a virtual ground charge amplifier because it is a charge amplifier whose inputs are maintained at virtual ground, the precise definition provided by Brian Huppi, an inventor of the ’607 Patent.[147]  Wires RP 250 and RN 270 connect the positive and negative halves of the row VDE to non-inverting and inverting inputs, respectively, of a differential charge amplifier 560. Differential charge amplifier 560 maintains RP and RN at an AC virtual ground so that the AC voltage across each mutual capacitance 500 or 520 is −F and the AC voltage across each mutual capacitance 490 or 510 is +F. The amount of charge coupled onto RP is F*M(C<n>,R<p>)−F*M(C<p>,R<p>). The amount onto RN is F*M(C<n>,R<n>)−F*M(C<p>,R<n>). The charge amplifier 560 produces an AC differential output voltage, Vo, equal to a gain factor, G, times the charge coupled onto RP minus that on RN. This yields the following relationship: $$V_o = (F{*}G){*}\{M(C<n>,R<p>) - M(C<p>,R<p>) + M(C<p>,R<n>) - M(C<n>,R<n>)\} = L(C,R).$$ Vo is the balance between C and R, denoted herein as L(C,R). Both G and the magnitude of F are constant scale factors. The product (F*G) is the scale factor, K, e.g. in the above definition of the balance, L. (Gerpheide ’017 at 11:41-64).[148] It is therefore my opinion that [149]Perski △[150]‘455 discloses this limitation. Huppi Dep. Tr. 96:19-98:5, attached as Exhibit 9[151] to

△[154] △[155]	△[156] △[157] △[158] △[159]*See also* the analysis in my Declaration of several textbooks references, a university physics experiment, and an IEEE reference, each of which confirms my opinion that the use of a “virtual ground charge amplifier” in a capacitive touch sensor would be an obvious and trivial addition to the digitizer of Perski ’455. The inclusion of such a charge

SAMSUNG'S INVALIDITY CLAIM CHART FOR "SMARTSKIN: AN INFRASTRUCTURE FOR FREEHAND MOVEMENT OF INTERACTIVE SURFACES" ("SMARTSKIN")

Summary of Invalidity Opinions and Materials Relied Upon:

- "Smartskin: An Infrastructure for Freehand Manipulation on Interactive Surfaces," Conference on Human Interaction 2002, by Jun Rekimoto, ("Smartskin") was published between April 20-25, 2002. Smartskin appears to refer to the same input device described in Smartskin and is by the same author. Smartskin qualifies as prior art to the '607 patent under 35 U.S.C. § 102(b).

- Smartskin anticipates △△△[78]and/or[79] renders △△△△△△△△△[80]obvious Claim 8 of the '607 Patent[81]. To the extent any limitation of the △△△△△△△△△△△△△△△[82]Claim 8[83] is not expressly or inherently disclosed in Smartskin, any such limitation would have been obvious to one of ordinary skill in the art at the time of the invention of the △[84]'[85]607 patent.

- Smartskin is "a new sensor architecture for making interactive surfaces that are sensitive to human hand and finger gestures." (Smartskin at 1). Similar to the other prior art references I analyzed above, "[t]his sensor recognizes multiple hand positions and shapes and calculates the distance between the hand and the surface by using capacitive sensing and a mesh-shaped antenna." (*Id.*). The mesh or grid-like arrangement includes both transmitter and receiver electrodes and describes a mutual capacitance sensing system. (*Id.* at 2).

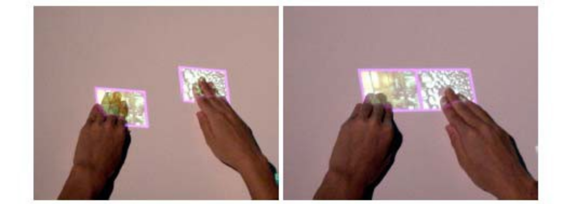
- As described in my △△△△△△[86]Declaration[87], ALJ Essex △△△△△△△[88]and the full Commission held[89] that Smartskin rendered all the asserted claims of the △[90]'[91]607 patent obvious, by itself or in combination with △△△△△△△△△[92]Rekimoto[93]. △[94]*See* △△△△△△△△△△△△△△△△△△△△△△△△[95]750 ID[96].

- I also understand that during the ITC investigation initiated against Motorola, Apple only contested the "[97]transparent△△[98]" sensing medium limitation of Claim 1. (*Id.*[99] at 147).

U.S. Patent No. 7,663,607	Smartskin△[1]

△△△△

[1A] A touch panel comprising a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches,	Smartskin teaches a touch panel comprising a transparent capacitive sensing medium (e.g., the SmartSkin sensor of Figure 2) configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches. Smartskin states: “The sensor consists of grid-shaped transmitter and receiver electrodes (copper wires). The vertical wires are transmitter electrodes, and the horizontal wires are[105]

	receiver electrodes. When one of the transmitter lines is excited by a wave signal (of typically several hundred kilohertz), the receiver receives this wave signal because each crossing point (transmitter/receiver pairs) acts as a (very weak) capacitor. The magnitude of the received signal is proportional to the frequency and voltage of the transmitted signal, as well as to the capacitance between the two electrodes. When a conductive and grounded object approaches a crossing point, it capacitively couples to the electrodes, and drains the wave signal. As a result, the received signal amplitude becomes weak. By measuring this effect, it is possible to detect the proximity of a conductive object, such as a human hand."[106] Id. at 2.[107]  **Figure 7: Two-handed operation is used to concatenate two objects.** "A notable advantage of SmartSkin over traditional mouse-based systems is its natural support for multiple-hand, multiple-user operations. Two or more users can simultaneously interact with the surface at the same time…. He or she can also 'concatenate' two objects by using both hands, as shown in Figure 7, or can take objects apart in the same manner." Id. at 4.[108] "The system time-dividing transmitting signal is sent to each of the vertical electrodes and the system independently measures values from each of the receiver electrodes. These values are integrated to form two-dimensional sensor values, which we called "proximity pixels." Once these values are obtained, algorithms similar to those used in image processing, such as peak detection, connected region analysis, and template matching, can be applied to recognize gestures. As a result, the system can recognize multiple objects (e.g., hands). If the granularity of the mesh is dense, the system can recognize the shape of objects." Id. at 2[109] [111].

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2 The Sony Smartskin system is also a prior art reference in its own right. The analysis for Sony Smartskin system is believed to be identical (or substantially similar) to the analysis shown here.[110]

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U.S. Patent No. 7,663,607	Smartskin[redacted][1]
	[redacted][118] [redacted][119] [redacted][120]

	ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ[121] “A transparent SmartSkin sensor can be obtained by using indium tin oxide (ITO). This sensor can be mounted in front of a flat panel display or on a rear-projection screen.” Id. at 7. Strickon Dep. Tr. ΔΔΔΔΔΔΔΔΔΔ[122]214:6-13, attached as Exhibit 18 to my Declaration.[123] Huppi Dep. Tr., Exhibit 9 to my Declaration, at[124] 157:5 – 158:5; 158:20 – 159:11. Smartskin also is capable of detecting *near touches*: “[w]hen a user’s hand is placed within 5-10 cm from the table, the system recognizes the effect of capacitance change.” (Smartskin at p. 3). Smartskin goes on to explain how “distance estimation” is implemented to determine the relative distance of a hand to the table and even shows (in Figure 5 reproduced below) different visual indications corresponding to varying distances of a finger being away from the table. Smartskin, therefore, clearly detects near touches as well as actual touches.[125]
[1B] wherein the transparent capacitive sensing medium comprises: a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another; and	Smartskin teaches a transparent capacitive sensing medium comprising a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another. See **[1A]**. A person of ordinary skill in the art would understand that it is inherent that

	transmitter lines and indiviudal receiver lines of the SmartSkin sensor are electrically isolated from one another and each layer is electrically isolated from the other layer, otherwise the lines could not be individually driven and sensed, nor would each crossing point between the transmitter and receiver lines act as a capacitor—as expressly disclosed in Smartskin. Id. at 2.[127] Strickon Dep. Tr. 230:13-28, attached as Exhibit 18 to my Declaration.[128]
[1C] a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another,	Smartskin teaches a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another. See **[1A]** and **[1B]**. Huppi Dep. Tr., Exhibit 9 to my Declaration, at[129] 155:6-21. Strickon Dep. Tr. 183:21 – 184:△△[130]6, attached as Exhibit 18 to my Declaration.[131]
[1D] the second conductive lines being positioned transverse to the first conductive lines,	Smartskin teaches the second conductive lines being positioned transverse to the first conductive lines. See **[1A]**. Huppi Dep. Tr., Exhibit 9 to my Declaration, at 168:23 - 169:3; 171:1-8.[132]
[1E] the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry;	Smartskin teaches the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry (e.g., receiver circuitry, A/D converter, and/or host PC of Figure 2)△△[133]

	See **[1A].**[135]
[1F] wherein the △△△△△△△△△△△△△△△△△△△△[136]capacitive monitoring[137] circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines.	Smartskin teaches the claimed touch panel wherein capacitive monitoring circuitry △△△△△△△△△△△△[138]is configured[139] to detect changes in charge coupling between the first conductive lines and the second conductive lines. △△△△[140]To the extent this limition requires driving more than one electrode at the same time while sensing on more than one sense line, Smartskin discloses this feature.[141] For example, Smartskin teaches that "[142][[143]△△△△[144]t]he system time-dividing transmitting singal [is] sent to *each of a vertical electrodes* and the system independently measures values from *each of receiver electrodes*." (Smartskin at p. 2). The fact that the transmitted signal is time-divided would indicate that the signal is transmitted to a subset of all the electrodes in

[redacted][146] [redacted][147]	[redacted][148]
[redacted][149] [redacted][150]	[redacted][151]
[redacted][152] [redacted][153]	[redacted][154]all the electrodes on the other axis are sensed. It is therefore my opinion that Smartskin discloses driving more than one line while sensing one more than one line at the same time. To the extent Smartskin's sensor applies the drive signal only to one electrode at a time, it would have been obvious to use the "faster approach" described in Perski '455 in the Smartskin sensor in order to reduce the number of steps or operations required in order to scan the entire panel.[155]
[7] The touch panel as recited in claim 1, wherein the capacitive sensing medium is a mutual capacitance sensing medium.	Smartskin teaches the touch panel as recited in claim 1, wherein the capacitive sensing medium is a mutual capacitance sensing medium. See **[1A]**. Strickon Dep. Tr. 54:7-18; 183:16-20; 204:25 – 205:6.; 258:24-259:[redacted][160]1, attached as Exhibit 18 to my Declaration.[161] Huppi Dep. Tr., Exhibit 9 to my Declaration, at[162] 155:23 – 156:14. Hotelling Dep. Tr. 78:24 – 79:[redacted][163]2, attached as Exhibit 20 to my Declaration.[164] Day Dep. Tr. 25:8-13; 108:19 – 109:[redacted][165]11, attached as Exhibit 19 to my Declaration.[166]

[8] The touch panel as recited in claim 7, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel.	Smartskin teaches the touch panel as recited in claim 7, further comprising a virtual ground charge amplifier (e.g., “lock-in amplifier” of Figure 2) coupled to the touch panel for detecting the touches on the touch panel. See **[1A]**.
[illegible][169] [illegible][170]	[illegible][171] [illegible][172]
[illegible] 174	[illegible][175] [illegible][176]
[illegible][177]	[illegible][178] [illegible][179]

[illegible][180]	[illegible][181] [illegible][182]
	[illegible][183]
[illegible][184]	[illegible][185] [illegible][186]
[illegible][187]	[illegible][188]
[illegible][189]	[illegible][190] [illegible][191] [illegible][192]

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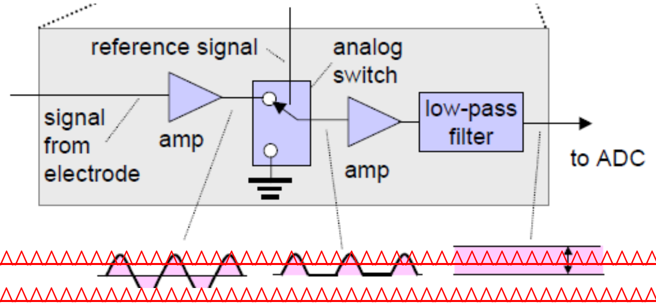
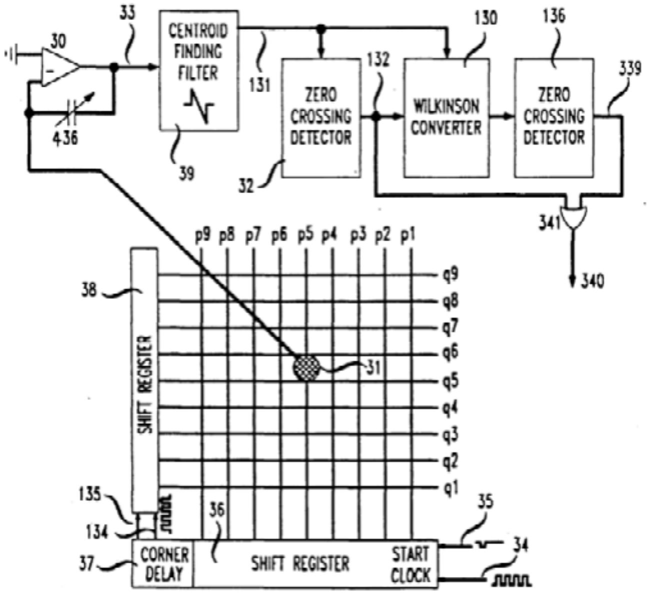
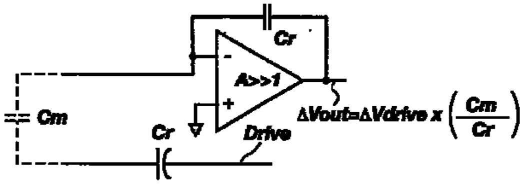
ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ[198]	 Smartskin ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ[199] states: "To accurately measure signals only from the transmitter electrode, a technique called "lock-in amplifier" is used. This technique uses an analogue switch as a phase-sensitive detector. The transmitter signal is used as a reference signal for switching this analog switch, to enable the system to select signals that have the synchronized frequency and the phase of the transmitted signal." Id. at 2.[200] The sensor of Smartskin employs such operational amplifiers. As discussed previously, these operational amplifiers were known to carry Miller capacitance. Smartskin uses the operational amplifiers without other feedback. Thus, the Miller capacitance of the operational amplifier provides the charge feedback in the structure, producing the charge amplifier circuit shown in Figure 13 of the '607 patent. Furthermore, the Miller theorem states that this Miller capacitance is mathematically identical to a pair of capacitors to ground, providing a virtual ground to the charge amplifier.[201] Thus, the "lock-in" amplifier of Smartskin is a virtual ground charge amplifier. One of ordinary skill in the art knows that the operational amplifier has Miller capacitance, which provides virtual ground charge feedback. Additional virtual grounding is provided by the capacitive coupling of the finger or touch, through the natural resistance of the body to the ground.[202] Even if Smartskin did not expressly or inherently disclose a virtual ground charge amplifier, it would have been obvious to one of ordinary skill in the art to use a virtual ground charge

ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ[204]	ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ ΔΔΔΔΔΔΔΔΔΔΔΔΔ[205]Blonder, reproduced below, element 30 is a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel. It would have been obvious to one of ordinary skill in the art to include the virtual ground charge amplifier of Blonder in the sensor of Smartskin as a predictable variant and a matter of simple design implementation in order, for example, to reduce noise from stray capacitance[206].  FIG. 3a It is therefore my opinion that Smartskin discloses this limitation.[207] ΔΔΔΔΔΔΔΔ[208]Another example of the claimed "virtual ground charge amplifier" is shown in U[209].S. Patent No. 5,565,658 to Gerpheide et al. (hereinafter "Gerpheide '658"). Gerpheide '658 issued in 1996—8 years before the '607 Patent was filed. I understand that Gerpheide '658 was even included and charted in Samsung's preliminary invalidity contentions in an

[redacted][211]'017").

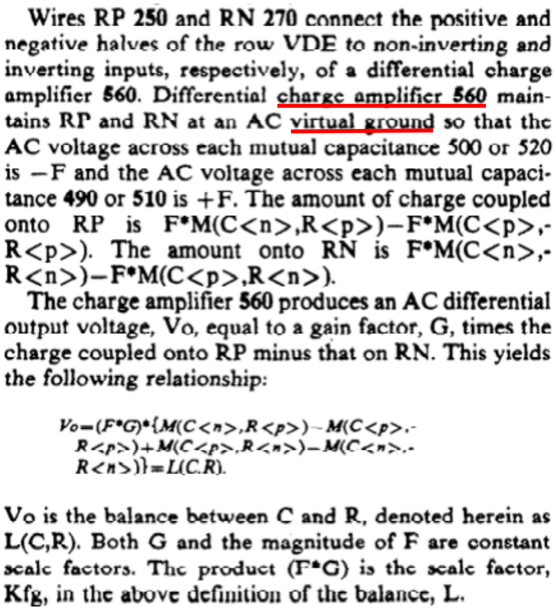
Gerpheide '658, like Blonder, is directed to a capacitive touch sensor. Gerpheide '658, in FIG. 6B, shows a "virtual ground charge amplifier" as its "capacitive measuring element" connected to the touch panel.[212]

Fig. 6b



Once again, this amplifier is in precisely the same configuration as shown in FIG. 13 of the '607 Patent. The non-inverting (positive) terminal of the amplifier is tied to ground, and the inverting (negative) terminal is connected to a feedback loop with a capacitor. As such, the amplifier includes the exact same "capacitor designed into a negative feedback loop" that Apple's own expert alleged was required for an operational amplifier to be considered a "virtual ground charge amplifier." There can be no doubt that Gerpheide '658 clearly shows a "virtual ground charge amplifier" coupled to the touch panel for detecting touches.[213]

Gerpheide '658 provides the motivation to incorporate the virtual ground charge amplifier of FIG. 6b shown above into any capacitive touch sensor. For example, Gerpheide '658 teaches that FIG. 6b represents a "preferred alternative" for the capacitive measurement element shown in the prior figures. (Gerpheide '658 at 7:46-54). Gerpheide '658 also expressly mentions that these configurations "represent different implementations known in the art for

[redacted][217]	[redacted][218]in Samsung's preliminary invalidity contentions, again shows the claimed "virtual ground charge amplifier." Gerpheide '017 issued in 1994—a *decade* before the '607 Patent was filed. Gerpheide '017 was also identified and referenced in my opening expert report with respect to claim 7, from which claim 8 depends. I cited Gerpheide '017 for its description of a mutual capacitive touch sensor (*see* ¶¶ 111 and 112 of my Corrected Opening Report, attached as Exhibit 16 to my Declaration). In particular, I cited column 9, line 62 through column 12, line 13 in my opening report. (*Id.* at ¶ 112). These columns describe the exact same "virtual ground charge amplifier" shown in FIG. 13 of the '607 Patent[219]. [redacted][220]For example, Gerpheide '017 describes a "differential charge amplifier" which maintains its inputs to "virtual ground" in order to detect mutual capacitance. This is yet another clear example of the claimed "virtual ground charge amplifier" recited in claim 8 of the '607 patent. As shown in the excerpt below, differential charge amplifier 560 is a virtual ground charge amplifier because it is a charge amplifier whose inputs are maintained at virtual ground, the precise definition provided by Brian Huppi, an inventor of the '607 Patent[221].  Wires RP 250 and RN 270 connect the positive and negative halves of the row VDE to non-inverting and inverting inputs, respectively, of a differential charge amplifier 560. Differential charge amplifier 560 maintains RP and RN at an AC virtual ground so that the AC voltage across each mutual capacitance 500 or 520 is −F and the AC voltage across each mutual capacitance 490 or 510 is +F. The amount of charge coupled onto RP is F•M(C<n>,R<p>)−F•M(C<p>,R<p>). The amount onto RN is F•M(C<n>,R<n>)−F•M(C<p>,R<n>). The charge amplifier 560 produces an AC differential output voltage, Vo, equal to a gain factor, G, times the charge coupled onto RP minus that on RN. This yields the following relationship: $Vo=(F^{*}G)^{*}\{M(C<n>,R<p>)-M(C<p>,R<p>)+M(C<p>,R<n>)-M(C<n>,R<n>)\}=L(C,R).$ Vo is the balance between C and R, denoted herein as L(C,R). Both G and the magnitude of F are constant scale factors. The product (F*G) is the scale factor, Kfg, in the above definition of the balance, L.

[redacted][222]	[redacted][223] (Gerpheide ’017 at 11:41-64).[224] Huppi Dep. Tr. 96:19-98:5, attached as Exhibit 9 to my Declaration.[225] [redacted][226] [redacted][227]*See also* the analysis in my Declaration of several textbooks references, a university physics experiment, and an IEEE reference, each of which confirms my opinion that the use of a “virtual ground charge amplifier” in a capacitive touch sensor[228] would [redacted]