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8 **UNITED STATES DISTRICT COURT**
9 **NORTHERN DISTRICT OF CALIFORNIA**

11 YANBIN YU and ZHONGXUAN ZHANG,
12 Plaintiffs,
13 v.
14 SAMSUNG ELECTRONICS CO., LTD.,
15 a Korean corporation, and SAMSUNG
16 ELECTRONICS AMERICA, INC.,
17 a New York corporation,
Defendants.

Case No.
COMPLAINT FOR PATENT
INFRINGEMENT
DEMAND FOR JURY TRIAL

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1 **COMPLAINT FOR PATENT INFRINGEMENT**

2 Plaintiffs Yanbin Yu (“Yu”) and Zhongxuan Zhang (“Zhang”) (collectively “Plaintiffs”)
3 hereby file this Original Complaint against Defendants Samsung Electronics Co., Ltd. (“SEC”)
4 and Samsung Electronics America, Inc. (“SEA”) (collectively, “Defendants” or “Samsung”)
5 seeking damages for Samsung’s direct and indirect willful infringement of U.S. Patent No.
6 6,611,289 (the “’289 Patent”), and allege as follows:

7 **THE PARTIES**

8 1. Yu is an individual and a resident of the State of California who resides in
9 Fremont, California.

10 2. Zhang is an individual and a resident of the State of California who resides in San
11 Diego, California.

12 3. SEC is a multinational corporation incorporated under the laws of the Republic of
13 Korea and having its headquarters located at 129 Samsung-ro, Yeongtong-gu, Suwon-si,
14 Gyeonggi-do, Korea. On information and belief, SEC has approximately 263 subsidiaries,
15 including Defendant SEA, which collectively with SEC operate four business divisions:
16 Consumer Electronics (“CE”), which designs, manufactures, and sells products such as digital
17 televisions and computer monitors; Information Technology & Mobile Communications (“IM”),
18 which designs, manufactures, and sells products such as mobile phones, communication systems,
19 and computers; Device Solutions (“DC”), which designs, manufactures, and sells products and
20 services within its Semiconductor Business including memory products, LSI products such as
21 system-on-chip (“SoC”) semiconductor devices and image sensors, and foundry services, as well
22 as products within its Display Business such as LCD and OLED panels; and Harman, which
23 designs, manufactures, and sells connected car systems, audio and visual products, enterprise
24 automation solutions, and connected services.

25 4. SEA is a New York corporation having its principal place of business at 85
26 Challenger Road, Ridgefield Park, New Jersey, 07660. On information and belief, SEA is a
27 wholly-owned subsidiary of SEC that markets and sells products and services within the United
28 States that are designed, manufactured, and/or provided by SEC and/or one or more of SEC’s

1 approximately 263 subsidiaries and that fall within at least one of SEC's CE, IM, and DC
2 business divisions, including Samsung smartphones that infringe the '289 Patent. On
3 information and belief, SEA maintains an office at 665 Clyde Avenue, Mountain View,
4 California, 94043, that is involved in the marketing and selling of Samsung smartphones that
5 infringe the '289 Patent.

6 5. On information and belief, SEC and SEA work collectively with one another, and
7 with SEC's other subsidiaries, in the design, manufacture, importation, distribution, marketing,
8 and selling of Samsung smartphones that infringe the '289 Patent.

9 **JURISDICTION AND VENUE**

10 6. This Court has original subject matter jurisdiction over this action pursuant to 28
11 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States,
12 35 U.S.C. §§ 1 et seq.

13 7. This Court can exercise personal jurisdiction over Samsung because Samsung
14 maintains substantial operations located in this District, and therefore Samsung's affiliations with
15 this District are so substantial as to render it essentially at home in this District. Additionally,
16 this Court can exercise personal jurisdiction over Samsung in this action because Samsung has
17 committed acts of infringement and/or inducement of infringement in this District, because
18 Plaintiffs' claims arise out of and relate to Samsung's acts of infringement and/or inducement of
19 infringement in this District, and because the exercise of jurisdiction by this Court over Samsung
20 in this action would be reasonable. Accordingly, Samsung has minimum contacts with this
21 District such that the maintenance of this action within this District would not offend traditional
22 notions of fair play and substantial justice.

23 8. Venue is proper in this Court pursuant to 28 U.S.C. §§ 1391(b) and (c) and/or
24 1400(b) because Samsung resides in this District and because a substantial part of Samsung's
25 acts of infringement and/or inducement of infringement occurred in this District.

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INTRADISTRICT ASSIGNMENT

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2 9. This action involves Intellectual Property Rights and, therefore, is subject to
3 assignment on a district-wide basis pursuant to Local Rule 3-2(c).

4 **THE '289 PATENT**

5 10. The '289 Patent, entitled "Digital Cameras Using Multiple Sensors With Multiple
6 Lenses," was filed on January 15, 1999 and was issued to Yu and Zhang by the United States
7 Patent and Trademark Office ("USPTO") on August 26, 2003. A copy of the '289 Patent is
8 attached hereto as Exhibit A.

9 11. Plaintiffs are the sole owners of the '289 Patent.

10 12. A fundamental problem of digital cameras at the time Plaintiffs filed the '289
11 Patent was poor quality of digital images compared to traditional film images. For example,
12 limitations in photosensitive chips such as charged-coupled devices ("CCDs") or complementary
13 metal-oxide semiconductors ("CMOSs") used as sensors in digital cameras produced images
14 with significantly lower resolution compared with images created using traditional film cameras.
15 Additionally, CCDs and CMOS sensors produced images having significantly less dynamic
16 range than those produced by film cameras, a consequence of the limited pixel depth and
17 photocell sensitivity of the digital sensors. The Plaintiffs solved these and other problems
18 associated with digital imaging by developing a novel approach of using multiple lenses and
19 digital sensors to capture two digital images of a scene, and using one of the digital images to
20 enhance the other, thereby resulting in an enhanced digital image having a quality rivaling that of
21 one taken with a traditional film camera.

22 13. One improved digital camera claimed in the '289 Patent includes first and second
23 image sensors that are positioned with respect to a common plane, and that are provided for
24 producing first and second images (*i.e.* first and second "intensity images"), respectively. At
25 least one of the two image sensors is sensitive to a full region of visible color spectrum, although
26 some claimed embodiments require that both image sensors must be sensitive to a full region of
27 visible color spectrum. Two lenses are provided, each lens being mounted in front of one of the
28 image sensors. Analog-to-digital converting circuitry, coupled to the first and second image

1 sensors, is provided for digitizing the first and second intensity images to create first and second
2 digital images. An image memory, coupled to the analog-to-digital circuitry, is provided for
3 storing the first and second digital images. A digital image processor, coupled to the image
4 memory, is provided for receiving the first and second digital images, and for producing a
5 resultant digital image from the first digital image enhanced with the second digital image. The
6 improved digital camera is not limited to performing any particular type of image enhancement,
7 but some dependent claims specify that the image enhancement involves increasing the dynamic
8 range of the first digital image by incorporating a portion of the second digital image into the
9 first digital image. With respect to this claimed embodiment, the patent specification states that
10 “[o]ne simple approach to expand the dynamic range of the color sensor is to append those
11 signals missed by the threshold 704 of the color sensor to signals from the color sensor.”

12 14. Plaintiffs are informed and believe, and on this basis allege, that virtually all dual-
13 lens cameras on the market today use the techniques claimed in the '289 Patent to improve
14 digital image quality and allow for the use of additional features that consumers desire, in order
15 to be competitive in the consumer marketplace.

16 **SAMSUNG’S DUAL-LENS CAMERA PRODUCTS**

17 15. Samsung makes, uses, sells, offers for sale, and/or imports into the United States
18 and this District products that incorporate the multi-lens camera technology claimed in the '289
19 Patent. These products include Samsung’s the Galaxy Note 8, Galaxy S9+, and the Galaxy Note
20 9 (collectively “Samsung Accused Products”).

21 16. On information and belief, Samsung released its first smartphone, the Galaxy S,
22 on June 2, 2010.¹ The Galaxy S included a single-lens fixed-focus 5.0 megapixel rear-facing
23 camera for taking digital photos.² The camera in the original Galaxy S suffered from limitations
24 arising from design constraints that are common to virtually all smartphone cameras, particularly
25 their small lens and image sensor size, as well as the proximity of the lens to the sensor. These
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27 ¹ See https://www.phonearena.com/phones/Samsung-Galaxy-S_id4522.

28 ² See https://www.phonearena.com/phones/Samsung-Galaxy-S_id4522.

1 limitations resulted in inferior image quality and less creative control over the appearance of a
2 captured image compared to what could be achieved using larger-format digital cameras of the
3 time such as digital single-lens reflex (DSLR) cameras. On information and belief, Samsung has
4 invested significant resources in addressing the limitations in its smartphone cameras ever since
5 the release of the Galaxy S.³

6 17. One shortcoming of the original Galaxy S camera design that Samsung took
7 considerable steps to address was the inability to create a bokeh effect in a captured image due to
8 the large depth-of-field (“DOF”) of the camera.⁴ DOF refers to the region in front of, and
9 behind, the plane of focus (“POF”) of a lens that looks sufficiently sharp to appear in-focus,
10 despite technically being out-of-focus. Being able to control the depth of field provides
11 photographers with a great deal of creative control over their compositions because it allows
12 them to control which portions of the photograph are in-focus, and which portions are out-of-
13 focus. In some instances, such as landscape photography, it can be desirable for an entire
14 captured image to appear in-focus. However, in other instances, such as portrait photography, it
15 might instead be desirable for only the subject to appear in-focus while the background is out-of-
16 focus, thereby emphasizing the sharply-focused subject against a blurred background. Bokeh
17 refers to the blurring of the out-of-focus portions of a photographic image that lie outside of the
18 DOF.

19 18. Bokeh is achieved in traditional larger-format cameras such as DLSR cameras by
20 using a lens having a large focal length (“ f ”). The f of a lens is the distance between the lens and
21 its point of focus, which in the case of a digital camera is an image sensor, and it is both directly
22 proportional to magnification and inversely proportional to field-of-view (“FOV”). A larger f
23 will result in greater magnification and a narrower FOV; conversely, a smaller f will result in
24 lower magnification and a wider FOV. The f of typical DLSR camera can be adjusted by either
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26 ³ See <https://news.samsung.com/global/in-depth-look-1-how-the-galaxy-s9-reimagines-the-smartphone-camera>.

27 ⁴ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

1 adjusting the magnification of an attached zoom lens or using a fixed prime lens having a f that
2 will produce the desired DOF. The f of a typical smartphone camera, however, cannot be
3 adjusted, but rather is fixed at a value that is too small to produce the shallow DOF required
4 under most circumstances to create a bokeh effect. The small f of virtually all smartphone
5 cameras, and consequently their large DOF, is a natural consequence of their geometry,
6 particularly the small size of the lenses and sensors, and their proximity to one another. This is a
7 problem that Samsung and other smartphone manufacturers have been attempting to address for
8 years.⁵

9 19. One approach Samsung adopted to provide a bokeh effect in its smartphone
10 cameras is a feature it calls Selective Focus.⁶ This feature first appeared in the Samsung Galaxy
11 S5,⁷ which was introduced on February 24, 2014⁸ and became generally available on April 11,
12 2014.⁹ Selective Focus is a mode that takes a burst of shots with a single camera but at different
13 focus points and allows users the ability to change the focus area in a post-processing action that
14 stitches the images together.¹⁰ This approach, however, requires the user to turn on Selective
15 Focus mode, capture the image, view the image in the picture gallery, select the image to which
16 the effect is to be applied, choose the type of focus desired (with the available options being Near
17 Focus, Far Focus, and Pan Focus), and hit “Done” to save the modified image to the picture
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20 ⁵ See [https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-](https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup)
21 [handset-with-a-dual-camera-setup](https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup).

22 ⁶ See [https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-](https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-galaxy-s5-0154589/)
23 [galaxy-s5-0154589/](https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-galaxy-s5-0154589/).

24 ⁷ See [https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-](https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-galaxy-s5-0154589/)
25 [galaxy-s5-0154589/](https://gs5.gadgethacks.com/how-to/take-selective-focus-pics-shoot-4k-videos-your-galaxy-s5-0154589/).

26 ⁸ See https://www.phonearena.com/phones/Samsung-Galaxy-S5_id8202.

27 ⁹ See [https://www.engadget.com/2014/02/24/samsung-galaxy-s5-launching-on-april-11-in-](https://www.engadget.com/2014/02/24/samsung-galaxy-s5-launching-on-april-11-in-150-countries/)
28 [150-countries/](https://www.engadget.com/2014/02/24/samsung-galaxy-s5-launching-on-april-11-in-150-countries/).

¹⁰ See [https://www.androidheadlines.com/2018/03/samsung-galaxy-s9-plus-has-live-focus-](https://www.androidheadlines.com/2018/03/samsung-galaxy-s9-plus-has-live-focus-mode-unlike-galaxy-s9.html)
[mode-unlike-galaxy-s9.html](https://www.androidheadlines.com/2018/03/samsung-galaxy-s9-plus-has-live-focus-mode-unlike-galaxy-s9.html).

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1 gallery.¹¹ This introduced a significant number of steps, requires additional time, and cannot be
2 done in the camera app itself.

3 20. Samsung also attempted to provide a bokeh feature in its smartphones by utilizing
4 its Dual Pixel Sensor,¹² first used in the Galaxy S7,¹³ which was introduced on February 21,
5 2016 and became generally available on March 11, 2016.¹⁴ The Dual Pixel Sensor in the Galaxy
6 S7 is used with a single-camera arrangement.¹⁵ According to Samsung, “Dual Pixel technology
7 employs two photodiodes in each and every pixel of the sensor instead of only one.”¹⁶ Samsung
8 has stated that “[d]ual Pixel technology especially allows depth-of-field effect for taking *bokeh*,
9 or aesthetically out-of-focused photographs, through a traditional single lens camera.”¹⁷ One
10 online publication explained how Samsung’s Dual Pixel Sensor can estimate depth-of-field,
11 stating that “Dual-lens cameras can compare the view from their slightly different positions to
12 determine what’s the subject and what’s in the background, allowing the software to simulate the
13 background blur or bokeh traditionally associated with cameras that pack larger sensors. A Dual
14 Pixel sensor, on the other hand, instead measures the difference from one side of the pixel and
15 the other rather than two lenses. The feature allows dual-camera effects like the portrait mode for
16 background blur to work in single lens cameras.”¹⁸ Despite Samsung’s hope that their Dual
17 Pixel Sensor camera could enable a single-camera smartphone to provide the same bokeh effect
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19 ¹¹ See <https://www.tomsguide.com/us/samsung-galaxy-s5-guide,review-2821-13.html>.

20 ¹² See [https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-
21 mobile-iot-applications/](https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-mobile-iot-applications/).

22 ¹³ See <https://www.samsung.com/global/galaxy/galaxy-s7/camera/>.

23 ¹⁴ See https://www.phonearena.com/phones/Samsung-Galaxy-S7_id9817.

24 ¹⁵ See <https://www.samsung.com/global/galaxy/galaxy-s7/camera/>.

25 ¹⁶ See [https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-
26 mobile-iot-applications/](https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-mobile-iot-applications/).

27 ¹⁷ See [https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-
28 mobile-iot-applications/](https://news.samsung.com/us/samsungs-new-image-sensors-bring-fast-slim-attributes-mobile-iot-applications/).

¹⁸ See <https://www.digitaltrends.com/photography/samsung-launches-dual-pixel-sensor/>.

(continued...)

1 as its competitors' dual-camera smartphones, the Dual Pixel Sensor was too "noisy" to provide
2 consistent results.¹⁹ Moreover, Samsung has stated with respect to single-lens arrangement using
3 the Dual Pixel Sensor that "these techniques only provide partial information of what we need
4 and are more noisy than the dual-camera technology. They do not provide enough information to
5 create the bokeh effect."²⁰ Moreover, "even in the future, it will be difficult to create the bokeh
6 effect using a single lens dual pixel technology."²¹ Therefore, according to Samsung, "[t]he
7 purpose of the dual pixel camera that we've had since the S7 is not to create the bokeh effect, but
8 to accelerate the autofocus."²²

9 21. While Samsung's attempts to provide a bokeh effect with a single-camera
10 configuration through its Selective Focus mode and its Dual Pixel Sensor fell short of the dual-
11 camera approaches being employed by competitors such as Apple, Samsung had also begun
12 researching dual-sensor and lens cameras sometime around 2012 or 2013.²³ According to
13 Samsung, "[we] started to research the dual camera because we believed it had the potential to
14 offer features that were difficult or impossible to provide through single lens cameras."²⁴ In
15 particular, Samsung explained how a dual-camera can be used to create a bokeh effect by stating
16 that "[i]n order to create the bokeh effect, you need to measure the distance between the camera
17 and the object that you are shooting. Using the dual cameras you get two perspectives and, based
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20 ¹⁹ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

21 ²⁰ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

22 ²¹ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

23 ²² See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

24 ²³ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

25 ²⁴ See <https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup>.

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28 (continued...)

1 on the differences between the two images, you can extract the depth information and create the
2 bokeh effect.”²⁵

3 22. On August 23, 2017, Samsung introduced the Galaxy Note 8, its first smartphone
4 incorporating a dual-lens camera.²⁶ The Galaxy Note 8 became generally available in the United
5 States on September 15, 2017.²⁷ According to Samsung’s website, the Galaxy Note 8 includes a
6 rear-facing “Dual camera” that includes a “Wide-angle camera” having a f/1.7 aperture, and a
7 “Telephoto camera” having a f/2.4 aperture.²⁸ The rear-facing dual camera of the Galaxy Note
8 8 supports a feature called Live Focus.²⁹ According to Samsung, “Thanks to the dual rear
9 cameras on Galaxy S9+ and Galaxy Note 8, you can use Live focus, a feature that allows you to
10 adjust the level of background blur so you can create a variety of moods within one shot. Even
11 after taking the photo, you can readjust the blur until you find the ideal setting.”³⁰ In order to
12 enable the Galaxy Note 8 to perform the complex computations necessary to take advantage of
13 the dual-lens camera introduced on the Galaxy Note 8, Samsung uses a powerful 64-bit ARM-
14 based system on a chip (SoC) from Qualcomm Inc. called the Snapdragon 835.³¹ The
15 Snapdragon 835 includes an advanced image signal processor (“ISP”) from Qualcomm called the
16 Spectra 180 ISP, which Qualcomm describes as an ISP that “supports capture of up to 32
17 megapixels with zero shutter lag, and offers smooth zoom, fast autofocus and true-to-life colors
18 for improved image quality.”³² On information and belief, the Spectra ISP in the Qualcomm
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20 ²⁵ See [https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-](https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup)
21 [handset-with-a-dual-camera-setup](https://www.techradar.com/news/heres-why-the-galaxy-note-8-is-samsungs-first-handset-with-a-dual-camera-setup).

22 ²⁶ See https://www.phonearena.com/phones/Samsung-Galaxy-Note-8_id10478.

23 ²⁷ See https://www.phonearena.com/phones/Samsung-Galaxy-Note-8_id10478.

24 ²⁸ See <https://www.samsung.com/global/galaxy/galaxy-note8/specs/>.

25 ²⁹ See <https://www.samsung.com/global/galaxy/galaxy-note8/specs/>.

26 ³⁰ See <https://www.samsung.com/global/galaxy/what-is/live-focus/>.

27 ³¹ See https://www.phonearena.com/phones/Samsung-Galaxy-Note-8_id10478.

28 ³² See <https://www.qualcomm.com/products/snapdragon/processors/835>.

(continued...)

1 Snapdragon 835 SoC used in the Galaxy Note 8 performs the processing for implementing the
2 new Live Focus mode that was introduced with the Galaxy Note 8.

3 23. On February 25, 2018, Samsung introduced another smartphone, the Galaxy S9+,
4 which became generally available in the United States on March 16, 2018.³³ The Galaxy S9+
5 retains the rear-facing dual-lens camera of the Galaxy Note 8, with the modification that it
6 incorporates Samsung's improved Dual Aperture wide-angle camera instead of the Galaxy Note
7 8's standard f/1.7 wide angle camera,³⁴ and the Galaxy S9+ is capable of performing the Live
8 Focus feature introduced with the Galaxy Note 8, but it also improves upon that feature by
9 providing bokeh filters that allow the user "to then go into the Gallery and select from a range of
10 background blur shapes to add characters and shapes to the photo."³⁵ To implement the
11 improved Live Focus feature, the Galaxy S9+ incorporates an even more powerful 64-bit ARM-
12 based SoC from Qualcomm than the one found in the Galaxy Note 8.³⁶ This more powerful
13 SoC, called the Snapdragon 845, incorporates a more powerful ISP, called the Spectra 280 ISP,
14 that "features a completely new architecture" and "is engineered to support immersive, cutting-
15 edge mobile photography and video capture, even in challenging lighting conditions with lots of
16 movement."³⁷ Furthermore, "Snapdragon 845 was also designed to capture the depth of three-
17 dimensional images for new XR experiences. Additionally, it supports emerging consumer use
18 cases that require cameras to accurately capture faces for unlocking devices and security-rich e-
19 commerce transactions."³⁸

21 _____
22 ³³ See https://www.phonearena.com/phones/Samsung-Galaxy-S9_id10717.

23 ³⁴ See <https://www.samsung.com/global/galaxy/galaxy-s9/specs/>.

24 ³⁵ See <https://www.samsung.com/global/galaxy/what-is/live-focus/>.

25 ³⁶ See https://www.phonearena.com/phones/Samsung-Galaxy-S9_id10717.

26 ³⁷ See <https://www.qualcomm.com/news/onq/2018/02/15/how-does-snapdragon-845-capture-more-lifelike-experiences>.

27 ³⁸ See <https://www.qualcomm.com/news/onq/2018/02/15/how-does-snapdragon-845-capture-more-lifelike-experiences>.

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1 24. On August 9, 2018, Samsung introduced the successor to the Galaxy Note 8, the
2 Galaxy Note 9, which became generally available in the United States on August 24, 2018.³⁹
3 The Galaxy Note 9 utilizes the rear-facing dual-lens camera of the Galaxy S9+, with the
4 improved Dual Aperture wide-angle camera, and it is capable of performing the improved Live
5 Focus feature of the S9+ that provides bokeh filters.⁴⁰ The Galaxy Note 9 also uses the same
6 Qualcomm Snapdragon 845, with the Spectra 280 ISP, that is used in the Galaxy S9+.⁴¹

7 25. On information and belief, in response to the popularity and success of its dual-
8 camera systems in its Galaxy Note 8, Galaxy S9+, and Galaxy Note 9 smartphones, Samsung has
9 developed turnkey dual-camera solutions intended for use in mid- to entry-level smartphones
10 developed by other manufacturers.⁴² According to Samsung:

11 Dual camera smartphones have two image sensors that capture different light
12 information, enabling new features like refocusing and LLS. With these
13 benefits, dual cameras are a growing trend in premium mobile devices.
14 However, integrating dual cameras can be a difficult process for original
15 equipment manufacturers (OEM), as it requires time-consuming optimization
16 between the OEMs and different vendors developing the sensors and
17 algorithm software. Samsung's total dual camera solution will simplify that
18 process and enable mid- to entry-level mobile devices to take advantage of
19 certain camera features mainly available in premium devices equipped with an
20 extra image signal processor.

21 To accelerate development and reduce optimization difficulties with dual
22 camera smartphones, Samsung now offers the industry's first total dual
23 camera solution, with both ISOCELL Dual sensor hardware and sensor-
24 optimized algorithm software. This enables even mid- to entry-level mobile
25 devices to utilize popular dual camera features like refocusing and LLS.
26 Samsung is coupling its refocusing algorithm with a 13 megapixel (Mp) and
27 5Mp set of image sensors, and its LLS algorithm with a set of two 8Mp
28 sensors, to simplify implementation by OEMs.⁴³

22 ³⁹ See https://www.phonearena.com/phones/Samsung-Galaxy-Note-9_id10857.

23 ⁴⁰ See <https://www.samsung.com/us/mobile/galaxy-note9/specs/>.

24 ⁴¹ See https://www.phonearena.com/phones/Samsung-Galaxy-Note-9_id10857.

25 ⁴² See <https://news.samsung.com/global/samsungs-isocell-dual-software-solution-enables-dual-camera-features-in-a-wider-range-of-smartphones>.

26 ⁴³ See <https://news.samsung.com/global/samsungs-isocell-dual-software-solution-enables-dual-camera-features-in-a-wider-range-of-smartphones>.

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1 These dual-camera kits, called ISOCELL Dual, include dual Samsung ISOCELL sensors that
 2 “can be mixed and matched in various combinations on consumer devices to bring about features
 3 demanded in the latest dual camera trend.”⁴⁴ Samsung describes its “mix and match dual
 4 camera” by stating that “ISOCELL Dual provides unique versatility for dual cameras, including
 5 optical zoom, low-light shooting (LLS) and depth sensing for out-focusing effects. ISOCELL
 6 Dual enables DSLR-like photo experiences such as greater light sensitivity, depth effects and
 7 sharper brightness in all conditions.”⁴⁵ Samsung further states that its ISOCELL Dual solution
 8 includes “[d]ual image sensors and proprietary software for two popular features – refocusing
 9 (bokeh) and low-light shooting (LLS). While such dual camera features had generally been
 10 exclusive to premium smartphones, Samsung’s ISOCELL Dual sensors and its library of
 11 proprietary software algorithms enable these features in lower price mobile devices.”⁴⁶

12 26. As detailed above, the Samsung Galaxy Note 8, Galaxy S9+, and Galaxy Note 9,
 13 as well as mobile devices that incorporate Samsung’s ISOCELL Dual image sensors and
 14 proprietary software, all infringe at least Claims 1, 2, and 4 of the ’289 Patent:

Claim Element	Samsung Accused Products
1. An improved digital camera comprising:	The Samsung Accused Products are all digital cameras.
1[a] a first and a second image sensor closely positioned with respect to a common plane, said second image sensor sensitive to a full region of visible color spectrum;	The Samsung Galaxy Note 8 includes first and second image sensors closely positioned with respect to a common plane, the first sensor being located behind a wide-angle f/1.7 aperture lens, and the second sensor being located behind a telephoto f/2.4 aperture lens, both lenses being on the rear-side of the device. Both of the first and second image sensors behind the lenses on the rear-side of the device are sensitive to a full region of visible color spectrum. The Samsung Galaxy S9+ and the Galaxy Note 9 include first and second image

25 ⁴⁴ See <https://news.samsung.com/global/samsung-introduces-image-sensor-brand-isocell-at-2017-mwc-shanghai>.

26 ⁴⁵ See <https://www.samsung.com/semiconductor/image-sensor/mobile-image-sensor/>.

27 ⁴⁶ See <https://news.samsung.com/us/samsungs-isocell-dual-software-solution-dual-camera-smartphones/>.

Claim Element	Samsung Accused Products
	sensors closely positioned with respect to a common plane, the first sensor being located behind a wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode, and the second sensor being located behind a telephoto f/2.4 aperture lens, both lenses being on the rear-side of the device. Both of the first and second image sensors behind the lenses on the rear-side of the device are sensitive to a full region of visible color spectrum.
1[b] two lenses, each being mounted in front of one of said two image sensors;	<p>The Samsung Galaxy Note 8 includes a wide-angle f/1.7 aperture lens and a telephoto f/2.4 aperture lens on the rear-side of the device, each lens being mounted in front of an image sensor.</p> <p>The Samsung Galaxy S9+ and Galaxy Note 9 include a wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode and a telephoto f/2.4 aperture lens on the rear-side of the device, each lens being mounted in front of an image sensor.</p>
1[c] said first image sensor producing a first image and said second image sensor producing a second image;	<p>The first and second image sensors located behind the wide-angle f/1.7 aperture lens and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy Note 8 create first and second images, respectively.</p> <p>The first and second image sensors located behind the wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy S9+ and the Galaxy Note 9 create first and second images, respectively.</p>
1[d] an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image;	<p>The first and second image sensors located behind the wide-angle f/1.7 aperture lens and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy Note 8 each are coupled to analog-to-digital converting circuitry that digitizes the first and second images to produce first and second digital images, respectively.</p> <p>The first and second image sensors located behind the wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy S9+ and the</p>

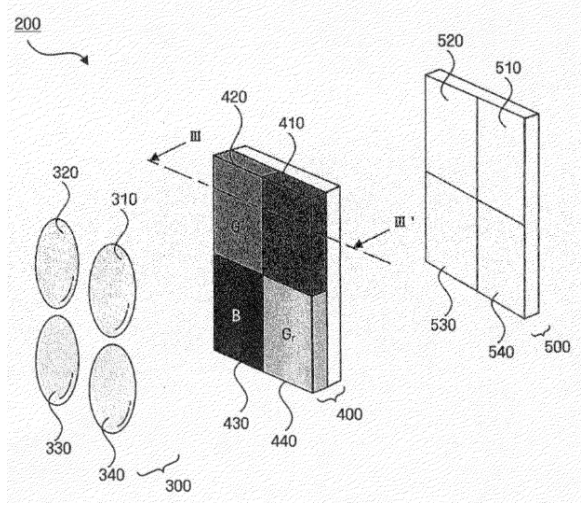
Claim Element	Samsung Accused Products
	Galaxy Note 9 each are coupled to analog-to-digital converting circuitry that digitizes the first and second images to produce first and second digital images, respectively.
1[e] an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image; and	An image memory coupled to the analog-to-digital converting circuitry in the Samsung Accused Products stores the digital images.
1[f] a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image.	<p>A digital image processor coupled to the image memory in the Samsung Accused Products receives the first and second digital images, produces a resultant digital image from the first and second digital images, and produced a resultant digital image from the first digital image enhanced with the second digital image.</p> <p>In the Samsung Galaxy Note 8, the digital image processor is a Spectra 180 ISP located in a Qualcomm Snapdragon 835 SoC, and a resultant image is produced from the first digital image enhanced with the second digital image when using the Live Focus feature.</p> <p>In the Samsung Galaxy S9+ and the Galaxy Note 9, the digital image processor is a Spectra 280 ISP located in a Qualcomm Snapdragon 845 SoC, and a resultant image is produced from the first digital image enhanced with the second digital image when using the Live Focus feature, either with or without bokeh filters.</p>
2. The improved digital camera as recited in claim 1, wherein said first image sensor sensitive to said full region of visible color spectrum.	<p>Both of the first and second image sensors behind the wide-angle f/1.7 aperture lens and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy Note 8 are sensitive to a full region of visible color spectrum.</p> <p>Both of the first and second image sensors behind the wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode and the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy S9+ and the Galaxy Note 9 are sensitive to a full region of visible color spectrum.</p>
4. The improved digital camera as recited in claim 1, wherein said analog-to-digital converting circuitry comprises two individual	The analog-to-digital circuitry coupled to the first image sensor located behind the wide-angle f/1.7 aperture lens on the rear-side of

Claim Element	Samsung Accused Products
analog-to-digital converters, each integrated with one of said first and second image sensors so that said first and second digital images are digitized independently and in parallel to increase signal throughput rate.	<p>the Samsung Galaxy Note 8 comprises an individual analog-to-digital converter, and the analog-to-digital circuitry coupled to the second image sensor located behind the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy Note 8 comprises another individual analog-to-digital converter. The individual analog-to-digital converters digitize the first and second digital images independently and in parallel to increase signal throughput rate.</p> <p>The analog-to-digital circuitry coupled to the first image sensor located behind the wide-angle Dual Aperture lens having an f/1.5 mode and an f/2.4 mode on the rear-side of the Samsung Galaxy S9+ and Galaxy Note 9 comprises an individual analog-to-digital converter, and the analog-to-digital circuitry coupled to the second image sensor located behind the telephoto f/2.4 aperture lens on the rear-side of the Samsung Galaxy S9+ and Galaxy Note 9 comprise another individual analog-to-digital converter. The individual analog-to-digital converters digitize the first and second digital images independently and in parallel to increase signal throughput rate.</p>

SAMSUNG’S KNOWLEDGE OF THE ’289 PATENT

27. On May 24, 2007, Samsung Electro-Mechanics Co., Ltd. (“SEM”), an affiliate of SEC, filed U.S. Patent Application No. 11/802,752 (the “Samsung ’752 Application”), entitled “Camera Module.” The Samsung ’752 Application disclosed and sought to claim many of the features claimed in the ’289 Patent. In particular, the Samsung ’752 Application taught “an improved digital camera uses four image sensors, each having its own lens, of which three image sensors are made responsive to the three primary colors and the fourth one made responsive to all intensity information.” According to the inventors, by “[u]sing a set of digital image processes embedded in a digital signal processing chip, images from the three color image sensors are processed with reference to the image from the black-and-white image sensor and subsequently produce high quality and film-like true color digital images.” This disclosed arrangement of lenses and sensors is depicted in Figure 2 of the Samsung ’752 Application:

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This disclosure in the Samsung '752 Application is nearly identical to some of the embodiments disclosed and claimed in the '289 Patent. Moreover, the Samsung '752 Application explicitly contemplates that the invention relates to “[d]igital devices including high-resolution camera modules, such as digital cameras and camera phones”

28. On November 30, 2009, during prosecution of the Samsung '752 Application, SEM filed an Information Disclosure Statement (“IDS”) citing the '289 Patent to the United States Patent and Trademark Office (“USPTO”) as prior art. Thus, Samsung was aware of the claims of the '289 Patent, and Samsung was aware of the significance of the '289 Patent to Samsung’s products incorporating dual-lens cameras and their uses, no later than November 30, 2009. Despite this awareness, Samsung made no attempt to contact Plaintiffs or obtain a license for the '289 technology up to and including the filing of this lawsuit.

29. Samsung’s conduct was deliberate and willful and subjects it to exemplary damages under the patent laws. *Halo Electronics, Inc. v. Pulse Electronics, Inc., et al.*, 136 S. Ct. 1923, 1935-36 (2016).

COUNT I

(Direct Infringement of the '289 Patent pursuant to 35 U.S.C. § 271(a))

30. Plaintiffs incorporate Paragraphs 1 through 29 herein as set forth in full.

31. Samsung has infringed and continues to infringe at least Claims 1, 2, and 4 of the '289 Patent in violation of 35 U.S.C. § 271(a).

32. Samsung's infringement is based upon literal infringement or infringement under the doctrine of equivalents, or both.

33. Samsung's acts of making, using, importing, selling, and/or offering for sale infringing products and services have been without the permission, consent, authorization, or license of Plaintiffs.

34. Samsung's infringement includes the manufacture, use, sale, importation and/or offer for sale of Samsung's products, including Samsung's Galaxy Note 8, Galaxy S9+, and Galaxy Note 9. The Samsung Accused Products embody the patented invention of the '289 Patent.

35. Samsung's infringement of the '289 Patent has injured and continues to injure Plaintiffs in an amount to be proven at trial.

36. Samsung has been well aware of Plaintiffs' patents, including the '289 Patent, and has continued its infringing activity despite this knowledge.

37. Samsung knew of the '289 Patent at least as early as November 30, 2009, when Samsung cited the '289 Patent to the USPTO in an IDS during prosecution of the Samsung '752 Application.

38. Despite the foregoing knowledge of the '289 Patent and the technology covered by this patent, and despite a high likelihood that its actions constituted infringement of this patent, Samsung proceeded to and continued to infringe the '289 Patent. Samsung made the deliberate decision to acquire and to continue to sell products and services that it knew infringed the '289 Patent.

39. Samsung's infringement of the '289 Patent is egregious.

1 40. On information and belief, Samsung has undertaken no efforts to design these
2 products or services around the '289 Patent to avoid infringement despite Samsung's knowledge
3 and understanding that its products and services infringe the '289 Patent. Thus, Samsung's
4 infringement of the '289 Patent is willful and egregious, warranting enhancement of damages
5 under 35 U.S.C. § 284, and attorneys' fees and costs incurred under 35 U.S.C. § 285.

6 **COUNT II**

7 **(Indirect Infringement of the '289 Patent pursuant to 35 U.S.C. § 271(b))**

8 41. Plaintiffs incorporate Paragraphs 1 through 29 herein as set forth in full.

9 42. Samsung has induced and continues to induce infringement of at least Claims 1,
10 2, and 4 of the '289 Patent under 35 U.S.C. § 271(b) by instructing, directing and/or requiring
11 others, including its customers, purchasers, users, and developers, to perform one or more of the
12 limitations of the claims, either literally or under the doctrine of equivalents, of the '289 Patent,
13 where all the limitations of the claims are performed by either Samsung, its customers,
14 purchasers, users or developers, or some combination thereof. Samsung knew or was willfully
15 blind to the fact that it was inducing others, including customers, purchasers, users or developers,
16 to infringe by practicing, either themselves or in conjunction with Samsung, one or more claims
17 of the '289 Patent, including at least Claims 1, 2, and 4.

18 43. Samsung knowingly and actively aided and abetted the direct infringement of the
19 '289 Patent by instructing and encouraging its customers, purchasers, users and developers to use
20 the Samsung Accused Products. Such instructions and encouragement include, but are not
21 limited to, advising third parties to use the Samsung Accused Products in an infringing manner,
22 providing a mechanism through which third parties may infringe the '289 Patent, specifically
23 through the use of multiple lens cameras and multiple image sensors, and by advertising and
24 promoting the use of the Samsung Accused Products in an infringing manner, and distributing
25 guidelines and instructions to third parties on how to use the Samsung Accused Products in an
26 infringing manner.

27 44. On information and belief, Samsung has had knowledge and notice of the '289
28 Patent as early as November 30, 2009, when Samsung cited the '289 Patent to the USPTO in an

1 IDS during prosecution of the Samsung '752 Application. Samsung's infringement is willful,
2 egregious, deliberate and done in bad faith entitling Plaintiffs to exemplary damages.

3 45. Plaintiffs have suffered damages because of Samsung's indirect infringement of
4 the '289 Patent.

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PRAYER FOR RELIEF

WHEREFORE, Plaintiffs pray for judgment and relief as follows:

A. An entry of judgment holding that Samsung has infringed and is infringing the '289 Patent, and has induced infringement and is inducing infringement of the '289 Patent;

B. An award to Plaintiffs of such damages as it shall prove at trial against Samsung that is adequate to fully compensate Plaintiffs for Samsung’s infringement of the '289 Patent, said damages to be no less than a reasonable royalty;

C. A determination that Samsung’s infringement has been willful, wanton, deliberate and egregious and that the damages against it be increased up to treble on this basis or for any other basis within the Court’s discretion;

D. A finding that this case is “exceptional” and an award to Plaintiffs of their costs and reasonable attorneys’ fees, as provided by 35 U.S.C. § 285;

E. An accounting of all infringing sales and revenues, together with post-judgment interest and prejudgment interest from the first date of infringement of the '289 Patent; and

F. Such further and other relief as the Court may deem proper and just.

Respectfully submitted,

DATED: October 16, 2018

By /s/ Daniel Johnson, Jr.

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DEMAND FOR JURY TRIAL

Plaintiffs demand a jury trial on all issues so triable.

Respectfully submitted,

DATED: October 16, 2018

By /s/ Daniel Johnson, Jr.

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