UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC., FOSSIL GROUP, INC., FOSSIL STORES I, INC., FOSSIL PARTNERS, L.P., OURA HEALTH OY, AND ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.,

Petitioners,

v.

OMNI MEDSCI, INC.,
Patent Owner.

U.S. Patent Nos. 9,651,533; 10,874,304; 11,160,455; 12,268,475

Case Nos.
IPR2025-01250 ('533 Patent); IPR2025-01251 ('304 Patent); IPR2025-01252 ('455 Patent); IPR2025-01254 ('475 Patent)

DECLARATION OF MOHAMMED N. ISLAM, Sc.D.

I, Dr. Mohammed N. Islam, hereby declare as follows:

I. Introduction

1. I am over the age of eighteen (18) and otherwise competent to make this Declaration.

2. I received my B.S. (1981), M.S. (1983), and Sc.D. (1985) degrees in electrical engineering from the Massachusetts Institute of Technology, where I was a Fannie and John Hertz Fellow from 1981 to 1985. From 1985 to 1992, I was a member of the Technical Staff in the Advanced Photonics Department at AT&T Bell Laboratories. In 1992, I joined the Electrical Engineering and Computer Science Department at the University of Michigan, where I am currently a Full Tenured Professor, as well as a joint Full Professor appointment in the Department of Biomedical Engineering. I was also previously with the University of Michigan Medical School, Department of Internal Medicine. I am the Founder and Chief Technology Officer of Omni MedSci, Inc. ("Omni MedSci"), the Patent Owner in this proceeding.

3. The bases for my testimony are my personal participation in the events described, my review of the documents identified herein, and my review of the Challenged Patents. I am not being compensated for my time spent preparing this Declaration beyond reimbursement of expenses, and my compensation does not depend on the outcome of this proceeding or on the substance of my testimony.

4. I understand that Omni MedSci is the owner of the following five U.S. patents (collectively, the "Challenged Patents") which are the subject of *inter partes* review proceedings pending before the Patent Trial and Appeal Board: (1) U.S. Patent No. 9,651,533 ("the '533 Patent"); (2) U.S. Patent No. 10,874,304 ("the '304 Patent"); (3) U.S. Patent No. 11,160,455 ("the '455 Patent"); (4) U.S. Patent No. 12,268,475 ("the '475 Patent"). I understand that the Petitioners in each of the proceedings are: Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., Fossil Group, Inc., Fossil Stores I, Inc., Fossil Partners, L.P., Oura Health Oy, and OnePlus Technology (Shenzhen) Co., Ltd.

5. I am the same Mohammed N. Islam identified on the cover of each of the Challenged Patents as the sole inventor.

6. This Declaration addresses three subjects: (i) my 2017 disclosures to senior Samsung executives and engineers of the techniques claimed in the Challenged Patents; (ii) the long-recognized industry problem those techniques solved; and (iii) the failure of Samsung and other major wearable-device makers to solve the signal-to-noise ratio ("SNR") and motion-artifact problem despite substantial industry resources brought to bear on it.

II. Omni MedSci's Disclosures to Samsung

7. The documents identified below establish a chronological record of my 2017 outreach to Samsung, [redacted]

[redacted] I have personal knowledge of each of the documents identified below. Each is a true and correct copy of an email I sent or received, or of a presentation, slide deck, or other attachment that I prepared and transmitted to (or received from) the Samsung personnel identified, in the ordinary course of my work as the founder and Chief Technology Officer of Omni MedSci.

8. The following exhibits are true and correct copies of an email I sent or received or of a presentation, slide deck, or attachment that I prepared and transmitted to (or received from) the Samsung personnel identified:

- **Ex. 2101** (OMS_SAM0031768): [redacted];
- **Ex. 2102** (OMS_SAM0031776): [redacted];
- **Ex. 2103** (OMS_SAM0031782): [redacted]

[redacted]

- **Ex. 2104** (OMS_SAM0031797): [redacted];
- **Ex. 2105** (OMS_SAM0031867): [redacted]
- **Ex. 2106** (OMS_SAM0031851): T[redacted]
- **Ex. 2107** (OMS_SAM0031961): [redacted].

9. From March through November 2017, I made repeated efforts on behalf of Omni MedSci to disclose to senior Samsung executives and engineers the techniques claimed in the Challenged Patents, to identify the Omni MedSci patents and applications that covered those techniques, and to propose a collaboration with

Samsung. The paragraphs below summarize the substance of those disclosures and Samsung's response.

10. [redacted].

11. [redacted]

12. [redacted].

13. [redacted]

14.

15.

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16.

17. Samsung never collaborated with Omni

MedSci in the 2017 time frame, and there were no collaborative agreements between the parties at any time.

18. Across my 2017 outreach as a whole, I made every effort I could, talking to Samsung personnel at the president, senior vice president, director, and engineering levels, to convey that Omni MedSci had patents that would be of value to Samsung and to propose a collaboration under which Omni MedSci and Samsung would work together on those techniques. At Samsung's request, I provided claim charts comparing certain Omni MedSci patents to products parallel to those Samsung was selling. Samsung never entered into any collaboration or agreement with Omni MedSci.

19. After several years without communications from Samsung, communications picked up again in mid-2021. [redacted]

20. [redacted]

D[redacted]

21. [redacted]

III. Long-Felt Need

22. I have reviewed, in connection with this Declaration, patents and academic literature that recognized the motion-artifact problem but failed to solve it. For example, U.S. Patent No. 5,632,272 to Diab et al., assigned to Masimo Corporation (Ex. 2108, "the '272 Patent"), states that when the patient moves, "the measured signal becomes erratic" and that "[e]rratic motion induced noise typically cannot be predetermined and/or subtracted from the measured signal via traditional filtering techniques." '272 Patent at 34:1-7.

23. U.S. Patent No. 7,738,935 to Turcott, assigned to Pacesetter, Inc. (Ex. 2109, "the '935 Patent"), similarly acknowledges that pulse oximetry methods were "acutely sensitive to sensor and/or tissue motion" and that "[e]ven rather subtle

motion can (and often do) swamp the detected optical signals and render the oxygen saturation measurements unusable." '935 Patent at 3:25-28.

24. Prior to the techniques disclosed in the Challenged Patents, the industry's response to the motion-artifact problem fell into three general categories, each of which was widely recognized as inadequate for the kind of continuous, real-world health monitoring that consumers expect from modern wearable devices: (i) requiring the user to remain still during measurement; (ii) confining measurements to clinical or other controlled environments; and (iii) reliance on filtering and software algorithms.

25. The first category—requiring the user to remain still—is exemplified by U.S. Patent No. 6,126,595 to Amano et al., assigned to Seiko Epson Corporation (Ex. 2110, "the '595 Patent"), which instructs that "when, for example, the test subject is waving his arm, the blood pulse wave cannot be measured" and that "measurements obviously cannot be made during sports activity," and which requires the user to be in a "state of repose" before measurement can proceed. '595 Patent at 61:38-40, 68:39-49.

26. The second category—confining measurements to controlled environments—is illustrated by the protocol in the '595 Patent, which required subjects to perform measurements in a temperature- and humidity-controlled facility while breathing in time with a 0.25 Hz metronome. '595 Patent at 16:1-23. Non-

invasive consumer wearable devices providing continuous, 24/7 physiological measurements were simply not available before the claimed inventions.

27. The third category—software-based motion compensation, including adaptive filters and Kalman filters—was widely recognized as insufficient. The Fitbit ’854 Publication (Ex. 2111, U.S. Pat. Pub. No. 2014/0275854) acknowledges that its motion-compensation algorithms were designed only for cases where “the user’s motion is periodic” and required multiple passes of adaptive filtering even then. ’854 Publication at [0136], [0147]. The Masimo ’272 Patent confirms that “erratic motion induced noise typically cannot be predetermined and/or subtracted from the measured signal via traditional filtering techniques.” ’272 Patent at 34:1-7.

28. The GE Dash 2000 Patient Monitor operating manual (Ex. 2112, DEFS-PA_0007488) likewise instructs that motion artifact “can be reduced, if not eliminated, by selecting a ‘quieter’ site on the patient”—a mechanical workaround, not a technological solution. Ex. 2112 at DEFS-PA_0007696.

29. Ambient light interference posed an additional and compounding obstacle to accurate PPG measurements, particularly during the daytime and outdoor settings in which wearable health monitoring is most needed. The Fitbit ’854 application acknowledges that “[a]mbient light and skin color may make it difficult to extract a user’s heart rate from a PPG signal” and describes a technique for reducing the effect of ambient light by “subtracting a value of the received detected

light signal when the PPG light source is off from the value of the received detected light signal when the PPG light source is on." Ex. 2111 at ¶ [0194]. The combined challenge of ambient light and motion is precisely what the Challenged Patents were designed to address. Earlier wearable devices could reliably capture physiological measurements only under ideal conditions, such as during motionless sleep at night, when low-power light sources and modest sampling rates were sufficient.

30. The Challenged Patents addressed this long-felt need by disclosing and claiming an integrated suite of hardware and signal-processing techniques that enabled accurate physiological measurements during the daytime and during exercise—conditions under which prior devices had consistently failed. The Challenged Patents claim, in their respective issued claims, the SNR-improvement features described in Section II above—the increased-light-intensity, change-detection, spatially-separated-detectors, synchronization, increased-pulse-rate, and wavelength-comparison features—although the particular combination of those features recited in any given challenged claim varies from patent to patent. Every challenged claim of every Challenged Patent recites at least the increased-light-intensity and synchronization features; the change-detection feature is recited in the challenged claims of the '455, '304, and '475 Patents; the spatially-separated-detectors feature is recited in the challenged claims of the '455 and '475 Patents; the increased-pulse-rate feature is recited in the challenged claims of the '455, '533,

and ’304 Patents; and the wavelength-comparison feature is recited in the challenged claims of the ’455 and ’533 Patents. The change-detection feature directly addresses the ambient-light interference problem identified in the prior art discussed above; the increased-light-intensity, increased-pulse-rate, and synchronization features address the motion-artifact and signal-strength problems likewise identified above; and the wavelength-comparison feature addresses interference from overlapping spectra of other physiological constituents.

IV. Industry Recognition of the Unsolved Problem

31. By 2016 and 2017, the industry’s failure to solve the SNR and motion-artifact problem was visible not only in academic and prior-art literature, but also in the actual accuracy of the leading wearable devices then on the market. In the slide decks I prepared and shared with [redacted] in 2017, I documented my contemporaneous understanding, based on then-current published research, that heart-rate measurement accuracy on the leading wrist-worn wearable devices ranged widely and that the Samsung Gear S and Samsung Gear S2 in particular exhibited some of the highest reported heart-rate errors among the devices then on the market. Ex. 2103 at OMS_SAM0031786. The heart-rate error rates I reproduced on those slides—including that “[t]he Apple Watch achieved the lowest error in Heart Rate, 2 [1.2-2.8]%, while the Samsung Gear S2 had the highest Heart Rate error, 6.8 [4.6-9.0]%”—were taken from the then-recently published peer-reviewed study by (Ex.

2113) Anna Shcherbina et al., Accuracy in Wrist-Worn, Sensor-Based Measurements of Heart Rate and Energy Expenditure in a Diverse Cohort (Stanford, Dec. 17, 2016). Ex. 2106 at OMS_SAM0031851; *see also* Ex. 2114. The error rates I documented in those decks reflected my contemporaneous understanding of the unresolved nature of the SNR problem at the time my disclosures to Samsung were made.

32. Apple is one of the major wearable-device makers that had access to my group's patented techniques during this period. [redacted] Apple did not enter into any agreement with Omni MedSci regarding the patented techniques.

33. Other major industry participants, including Samsung, Fitbit, and Microsoft, were similarly active in the wearable PPG space during the same period and likewise had not solved the SNR and motion-artifact problem with conventional approaches. The 2016 Stanford study compared seven wrist-worn devices then on the market—Apple Watch, Basis Peak, Fitbit Surge, Microsoft Band, MIO Alpha 2, PulseOn, and Samsung Gear S2—and none achieved consistent, low-error performance across sitting, walking, running, and cycling activities. Ex. 2103 at OMS_SAM0031786.

34. I declare under penalty of perjury under the laws of the United States of America that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: May 7, 2026

By: _____
Mohammed N. Islam, Sc.D.