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3 MR. MUELLER: Your Honor, for our next witness we
4 call Dr. Steve Waydo, and Ms. Garcia will do the
5 examination, Nina Garcia.

6 MS. GARCIA: Good morning, Your Honor. Nina
7 Garcia for Respondent Apple.

8 JUDGE BHATTACHARYYA: Good morning, Dr. Waydo. I
9 believe you're on mute.

10 THE WITNESS: Good morning.

11 JUDGE BHATTACHARYYA: Welcome. Do you understand
12 that you are under an obligation to tell the truth here
13 today?

14 THE WITNESS: I do.

15 STEPHEN WAYDO,
16 having been first duly sworn and/or affirmed
17 on his oath, was thereafter examined and testified as
18 follows:

19 JUDGE BHATTACHARYYA: You may proceed, counsel.

20 DIRECT EXAMINATION

21 BY MS. GARCIA:

22 Q. Good morning, sir. Would you please introduce
23 yourself? Where do you live? Where do you work?

24 A. My name is Stephen Waydo. I live in Saratoga,
25 California, and I work for Apple.

1 Q. What is your current role at Apple?

2 A. I'm director of a group called HID Health.

3 Q. What is HID Health?

4 A. HID stands for human interface devices. The
5 larger organization builds algorithms for sensors on a
6 variety of Apple products. My team, in particular, is
7 responsible for health algorithms primarily on the Apple
8 Watch.

9 Q. Dr. Waydo, could you briefly describe your
10 educational history?

11 A. Yes. I have a Bachelor's degree in aeronautics
12 and astronautics from the University of Washington that I
13 obtained in 2001, and a Ph.D. in control and dynamical
14 systems from Caltech that I obtained in 2007.

15 Q. What did you do after you received your Ph.D.
16 from Caltech?

17 A. Before and during graduate school I worked at
18 NASA Jet Propulsion Laboratory in Pasadena, and I continued
19 on there as a full-time employee for about six or eight
20 months after I finished my Ph.D.

21 Q. Can you give an example of a project that you
22 worked on at NASA Jet Propulsion Lab?

23 A. Yes. I worked on a variety of robotic heat space
24 exploration missions. The biggest one was a mission called
25 Deep Impact that flew out and took pictures of a comet in

1 2005.

2 (Clarification by reporter.)

3 Q. Did you work anywhere else before joining Apple?

4 A. Yes. After JPL I worked at a startup called C8
5 Medisensors for about four and a half years. At C8 we were
6 trying to build a noninvasive glucose measuring device.

7 Q. When did you join Apple?

8 A. I joined Apple in March of 2013.

9 Q. What motivated you to join Apple, Dr. Waydo?

10 A. Well, the startup I worked at was ultimately
11 unsuccessful, but I got very excited about the prospect of
12 the building consumer products, and I thought Apple offered
13 a tremendous learning opportunity to learn from the best
14 about how to build products, and to have the opportunity to
15 ship something at very large scale.

16 Q. And when you joined Apple in 2013, were you hired
17 for a specific product?

18 A. I was, although I didn't know it at the time. So
19 the interview process is very secretive. But I knew I would
20 be working on products, and I was informed on my first day
21 that the -- that I would be working on the first generation
22 Apple Watch.

23 Q. What features did you work on for the first
24 generation Apple Watch?

25 A. I worked on the algorithm supporting heart rate

1 sensing as well as wrist detection on the first Apple Watch.

2 Q. And what specifically was your role in developing
3 the heart rate sensor for that first watch?

4 A. The biggest part of my role was working together
5 with the hardware team to make sure that the hardware
6 sensors they were building were a good fit for the
7 algorithms we were building for particular end user
8 applications. And by the time we shipped that first watch,
9 I was responsible overall for the heart rate algorithm
10 development.

11 Q. Can you tell us briefly about the hardware and
12 software used for the heart rate sensing?

13 MS. GARCIA: Your Honor, at this point we would
14 like to move onto the Apple confidential record.

15 JUDGE BHATTACHARYYA: We're moving onto the Apple
16 confidential record.

17 (Whereupon, the hearing proceeded in confidential
18 session.)

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█ [REDACTED]

2 (Whereupon, the hearing resumed in open session.)

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3 JUDGE BHATTACHARYYA: We're moving to the public
4 record.

5 THE WITNESS: Okay.

6 BY MS. SWAROOP:

7 Q. Dr. Waydo, I believe in your direct testimony you
8 said that you wanted to join Apple because you wanted to
9 learn from the best, correct?

10 A. Yes.

11 Q. Okay. And, Dr. Waydo, are you aware that Apple
12 has hired individuals from Masimo?

13 A. Yes.

14 Q. You know Mike O'Reilly, correct?

15 A. I do.

16 Q. You worked with Mike O'Reilly, correct?

17 A. Yes.

18 Q. And you filed a patent application with Mike
19 O'Reilly; isn't that correct?

20 A. It's possible. I don't know for sure.

21 Q. Okay. Let's bring up CX-1684. It's in your
22 binder. And we'll put it up on the screen.

23 Dr. Waydo, this is a published patent application
24 filed by Apple naming you and Michael O'Reilly among the
25 inventors; isn't that right?

1 A. Yes.

2 Q. Dr. Waydo, in your direct testimony you discussed
3 the heart rate sensing feature of the Series 0 watch; isn't
4 that right?

5 A. Yes.

6 Q. Okay. And that watch involved a heart rate
7 measurement, correct?

8 A. Yes.

9 Q. Okay. And the measurement of oxygen saturation
10 is a more difficult measurement than the heart rate
11 measurement, correct?

12 A. It's different for sure.

13 Q. It's more difficult, isn't it, Dr. Waydo?

14 A. It's very different. It solves a different set
15 of problems. I don't know that I would characterize it as
16 more difficult.

17 Q. Okay. Let's go to your deposition, which is in
18 your binder, and we'll take a look at pages -- page 163,
19 line 15, to 164, line 3.

20 A. Can you tell me where in my binder I can find
21 that?

22 Q. It should be in your binder, if there's a tab
23 there, I believe it's CX-298C.

24 A. Okay. And then what pages?

25 Q. Page 164 -- sorry -- page 163, line 15, to 164,

1 line 3, and I have it up on the screen as well.

2 A. Okay.

3 Q. And the question was from your own counsel:

4 What was your reaction to receiving the
5 assignment of helping develop the blood oxygen feature for
6 the Apple Watch?

7 And your answer:

8 I was both excited and, I'd say, intimidated.
9 It's a more difficult measurement than the heart rate
10 measurement, and, however, embarking on a new sensing
11 development project is always exciting and quite a ride. So
12 I was looking forward to it.

13 Were you asked that question and did you give
14 that answer at your deposition, Dr. Waydo?

15 A. Yes.

16 Q. Okay. So you would agree, then, that oxygen
17 saturation is a more difficult measurement than heart rate
18 measurement, correct?

19 A. It depends very much on the context, but in some
20 contexts, yes.

21 Q. Okay. And, in fact, it was extremely challenging
22 to develop the blood oxygen feature in the Apple Watch,
23 correct?

24 A. Yes.

25 Q. Now you've been involved in assessing the

1 accuracy of the blood oxygen feature of the Apple Watch,
2 correct?

3 A. Not in a hands-on way, but I reviewed the data.

4 Q. You understand when talking about accuracy that
5 there's a difference between sensitivity on the one hand and
6 specificity on the other hand, correct?

7 A. Yes.

8 Q. And let's talk first about sensitivity.

9 An Apple Watch that detects everyone who has a
10 particular medical condition would be an example of a highly
11 sensitive device, correct?

12 A. Yes.

13 Q. Okay. And that's different from specificity,
14 correct?

15 A. That's correct.

16 Q. Okay. An Apple Watch that detects medical
17 conditions in people who do not actually have that medical
18 condition would be an example of a device with low
19 specificity, correct?

20 A. Yes.

21 Q. Okay. And in your direct today you didn't
22 present any information on false alarms, that is, people who
23 went to seek out medical care or thought something was wrong
24 with them based on something from the Apple Watch but had no
25 reason to do so, correct?

1 A. Presented nothing to that effect, that's correct.

2 Q. Okay. Did you ever work with Chin San Han in
3 2013?

4 A. Yes.

5 Q. Are you aware that Mr. Han tore apart a Masimo
6 reflectance sensor during that time period?

7 MS. GARCIA: Objection, Your Honor. This lacks
8 foundation.

9 JUDGE BHATTACHARYYA: Ms. Swaroop?

10 MS. SWAROOP: I'm simply asking if he is aware,
11 Your Honor.

12 JUDGE BHATTACHARYYA: The objection is overruled.

13 A. Not that I can recall.

14 Q. Dr. Waydo, there has been feedback in the press
15 about the unreliability of the blood oxygen feature of the
16 Apple Watch Series 6, correct?

17 A. There's been a wide variety of feedback in the
18 press about the product, both positive and negative.

19 Q. Okay. Well, let's talk about some of that
20 feedback. Let's go to CX-1606 in your book, and I'm also
21 going to put it on the screen. It's an article from Input
22 Mag titled, quote, The Apple Watch's blood oxygen sensor is
23 less accurate than you think.

24 Do you see that?

25 A. I see that.

1 Q. Okay. And let's turn to page 2. Let's go to the
2 "Check with your doctor" paragraph. In this article it
3 says, quote, some day Apple's blood oxygen monitoring could
4 be accurate enough to actually detect medical conditions,
5 but right now it's more of a gimmick than anything else.

6 Is that correct, Dr. Waydo?

7 A. That's what this article says.

8 Q. Right. Let's go to CX-1608 in your book. This
9 is an article from the Verge entitled Apple Watch Series 6
10 review, minute improvements.

11 Do you see that?

12 A. What page are we looking at here?

13 Q. Sure. We're at CX-1608, page 1.

14 A. Okay.

15 Q. Okay. And if we go to page 2, there's a heading,
16 "bad stuff."

17 Do you see that?

18 A. I see that.

19 Q. And the third bullet point, "blood oxygen
20 monitoring is unreliable."

21 Do you see that?

22 A. I see that. I think here they are referring to
23 difficulties getting successful measurements, because we
24 tried very hard not to produce inaccurate measurements.

25 MS. SWAROOP: Okay. We need to go to the Apple

1 CBI record at this point.

2 (Whereupon, the hearing proceeded in confidential
3 session.)

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3 BY MS. SWAROOP:

4 Q. Dr. Waydo, you've been aware of Masimo since
5 2010, correct?

6 A. I think so.

7 Q. Okay. And you're aware of Masimo's products,
8 correct?

9 A. Not by model number, but generally speaking, yes.

10 Q. Okay. And in the specific area of clinical and
11 in-hospital monitoring, you consider Masimo to be an
12 important player and a leader; isn't that right, Dr. Waydo?

13 A. I believe they are an important player.

14 Q. And a leader, correct?

15 A. I don't know. I'm not deeply familiar with the
16 clinical market.

17 Q. Okay. Well, let's go to your deposition. It's
18 in your binder, CX-298C, page 127, line 25, to 128, line 6.

19 A. Can you repeat the page number again, please?

20 Q. Sure. Page 127, line 25 to 128, line 6.

21 A. Okay.

22 Q. And you were asked:

23 And do you consider Masimo to be a leader in that
24 field as well?

25 And you answered:

1 I consider Masimo to be an important player and a
2 leader just specifically in the area of clinical and
3 in-hospital monitoring.

4 Do you see that?

5 A. Yes. Masimo is certainly a market leader. I
6 don't know the extent to which they are a technology leader.

7 Q. So you were asked that question and you gave that
8 answer at your deposition, right, Dr. Waydo?

9 A. Yes.

10 Q. Thank you.

11 MS. SWAROOP: I have no further questions.

12 MS. GARCIA: Brief redirect, Your Honor.

13 REDIRECT EXAMINATION

14 JUDGE BHATTACHARYYA: Yes, go ahead. We're on
15 the public record. Do you want to stay on the public
16 record?

17 MS. GARCIA: No, Your Honor. We'll briefly go on
18 the confidential record please.

19 (Whereupon, the hearing proceeded in confidential
20 session.)

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[REDACTED]
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6 (Whereupon, the hearing resumed in open session.)

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3 JUDGE BHATTACHARYYA: We're moving to the public
4 record.

5 BY MS. GARCIA:

6 Q. Dr. Waydo, you were also shown some articles that
7 purported to describe the accuracy of Apple Watch.

8 Do you recall that?

9 A. Yes.

10 Q. Now as a factual matter, based on your work
11 developing the blood oxygen feature, how accurate are the
12 measurements that are presented to users?

13 A. We've tested the watch to the same standards that
14 are used to assess clinical grade devices, and we meet the
15 general accepted standards for accuracy of blood oxygen
16 devices.

17 Q. Dr. Waydo, you were asked some questions about
18 Dr. O'Reilly.

19 Do you recall that?

20 A. Yes.

21 Q. Did Dr. O'Reilly contribute any ideas to the
22 software or hardware of the Apple Watch blood oxygen
23 sensors?

24 MS. SWAROOP: Objection, foundation.

25 MS. GARCIA: I can restate it.

1 Q. Dr. Waydo, what role, if any, did Dr. O'Reilly
2 have on your health sensing algorithm team with respect to
3 the development of the blood oxygen feature?

4 A. Dr. O'Reilly is an anesthesiologist. He has
5 extensive knowledge around the physiological, that's in
6 general, and physiological of PPG signals in particular, but
7 he has no engineering expertise and had no contributions to
8 the hardware or software.

9 Q. Who did come up with the ideas for the software
10 and hardware of Apple Watch and the blood oxygen feature?

11 A. The majority of the work happened between the
12 health sensing hardware team, I believe we have heard from a
13 few of them in this hearing, as well as my team.

14 Q. Did any of those ideas come from Masimo?

15 A. No.

16 Q. Thank you, Dr. Waydo.

17 MS. GARCIA: I have no further questions at this
18 time.

19 RE CROSS-EXAMINATION

20 BY MS. SWAROOP:

21 Q. Ms. Garcia asked you about your familiarity of
22 accuracy with the Apple Watch health sensing features.

23 Do you recall that?

24 A. Yes.

25 Q. Okay. Are you aware of a published study from

1 the Mayo Clinic indicating that the Apple Watch triggers a
2 number of false alarms causing people to go to the hospital
3 and resulting in unnecessary utilization of hospital
4 resources?

5 A. We have a number of problems with that particular
6 study and the methodology there in general, but I'm aware of
7 the paper you're talking about.

8 Q. Thank you.

9 MS. SWAROOP: No further questions.

10 MS. GARCIA: Nothing further, Your Honor.

11 Thank you, Dr. Waydo.

12 JUDGE BHATTACHARYYA: Thank you for your time,
13 Dr. Waydo.

14 THE WITNESS: Thank you.

15 MR. MUELLER: We certainly defer to Your Honor,
16 but this might be a good time for the morning break before
17 our next witness.

18 JUDGE BHATTACHARYYA: It sounds like a good idea.
19 Let's take a morning break now. We're in recess for 15
20 minutes.

21 (Whereupon the proceedings recessed at 11:07
22 a.m.)s.

23 (In session at 11:23 a.m.)

24 JUDGE BHATTACHARYYA: We're back on the record.

25 MR. MUELLER: Thank you, Your Honor. Apple calls