

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,

PETITIONER

V.

THL HOLDING COMPANY, LLC,

PATENT OWNER

Case No. IPR2024-00399

U.S. Patent No. 11,350,246

SUPPLEMENTAL DECLARATION OF DR. R. MICHAEL BUEHRER

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I, Dr. R. Michael Buehrer, declare the following:

I. INTRODUCTION

1. I have been asked to respond to certain issues raised by Patent Owner and Patent Owner's expert, Dr. Feuerstein. All of my opinions expressed in my original declaration dated January 19, 2024 (Ex. 1003) remain the same. I have reviewed the following additional materials in connection with preparing this supplemental declaration:

- Paper 14 – Patent Owner's Response to Petition ("Response");
- Ex. 2002 – Declaration of Dr. Martin J. Feuerstein ("Feuerstein Declaration");
- Ex. 1046 – Deposition Transcript of Dr. Martin J. Feuerstein dated December 11, 2024 ("Feuerstein Deposition Transcript");
- Paper 8 – Decision Granting Institution of *Inter Partes* Review ("Institution Decision");
- Ex. 1048 – Tony Atkins & Marcel Escudier, Oxford Dictionary of Mechanical Engineering (2013) ("Atkins");
- Ex. 1049 – Chun-Wang Tsou & Chun-Hsiung Liao, *Investigating the Antecedents of Intentions to Purchase a Netbook as a Second Laptop*, in 2010 International Conference on Education and Management Technology 285 (2010) ("Tsou");

- Ex. 1050 – Dan Ackerman, *Asus Eee PC 1005HA Review: Asus Eee PC 1005HA*, CNET, <https://www.cnet.com/reviews/asus-eee-pc-1005ha-review/> (June 22, 2009; retrieved Jan 7, 2025) (“Ackerman”); and
- Ex. 1051 – José L. Pons, Wearable Robots: Biomechatronic Exoskeletons (2008) (“Pons”);
- Ex. 1052 – Harry Newton, Newton’s Telecom Dictionary (20th updated and expanded edition ed. 2004) (“Newton”);
- Ex. 1053 – *The History of Gyroscopes – From Humble Beginnings to Hyper Technology*, Advanced Navigation (2023), <https://www.advancednavigation.com/tech-articles/the-history-of-gyroscopes-from-humble-beginnings-to-hyper-technology/> (last visited Jan 22, 2025) (“History of Gyroscopes”).

II. CLAIM CONSTRUCTION

2. I have been asked to respond to opinions offered by Dr. Feuerstein regarding the construction of the term “rotation of the mobile communication device” recited in claim limitations 11(d) and 11(e)(vii). *Feuerstein Declaration* at ¶¶ 49-57. Dr. Feuerstein alleges “that a person of ordinary skill in the art at the time of the invention would have interpreted the claim term ‘rotation of the mobile communication device’ to refer to the rotation of the mobile communication device

as a whole, as distinct from the rotation of one component of the mobile communication device relative to a different component of the same device.” *Id.* at ¶ 50. I disagree.

3. I have been informed that the words of a claim are generally given their plain and ordinary meaning as understood by a POSITA when read in the context of the specification and prosecution history. I also understand that the plain and ordinary meaning of the claim applies unless the term is (1) ambiguous or (2) the patentee has acted as its own lexicographer. I have also been informed that general descriptive claim terms will ordinarily be given their full meaning and that modifiers will not be added to broad terms standing alone.

A. **THL’s Construction Including the Phrase “as a Whole” Is Ambiguous and Not Supported by the Plain Language of the Claim**

4. Claim limitation 11(d) requires *an orientation sensor to detect rotation of the mobile communication device*, and limitation 11(e)(vii) requires a processor to *determine a direction to the at least one remote device based on signal delay of ultra-wideband communications between the two or more antennas and the at least one remote device and on rotation of the mobile communication device detected by the orientation sensor*.¹ Dr. Feuerstein opines, “[t]hese claim limitations, and the

¹ I have emphasized the claim language throughout with italics and underline for clarity.

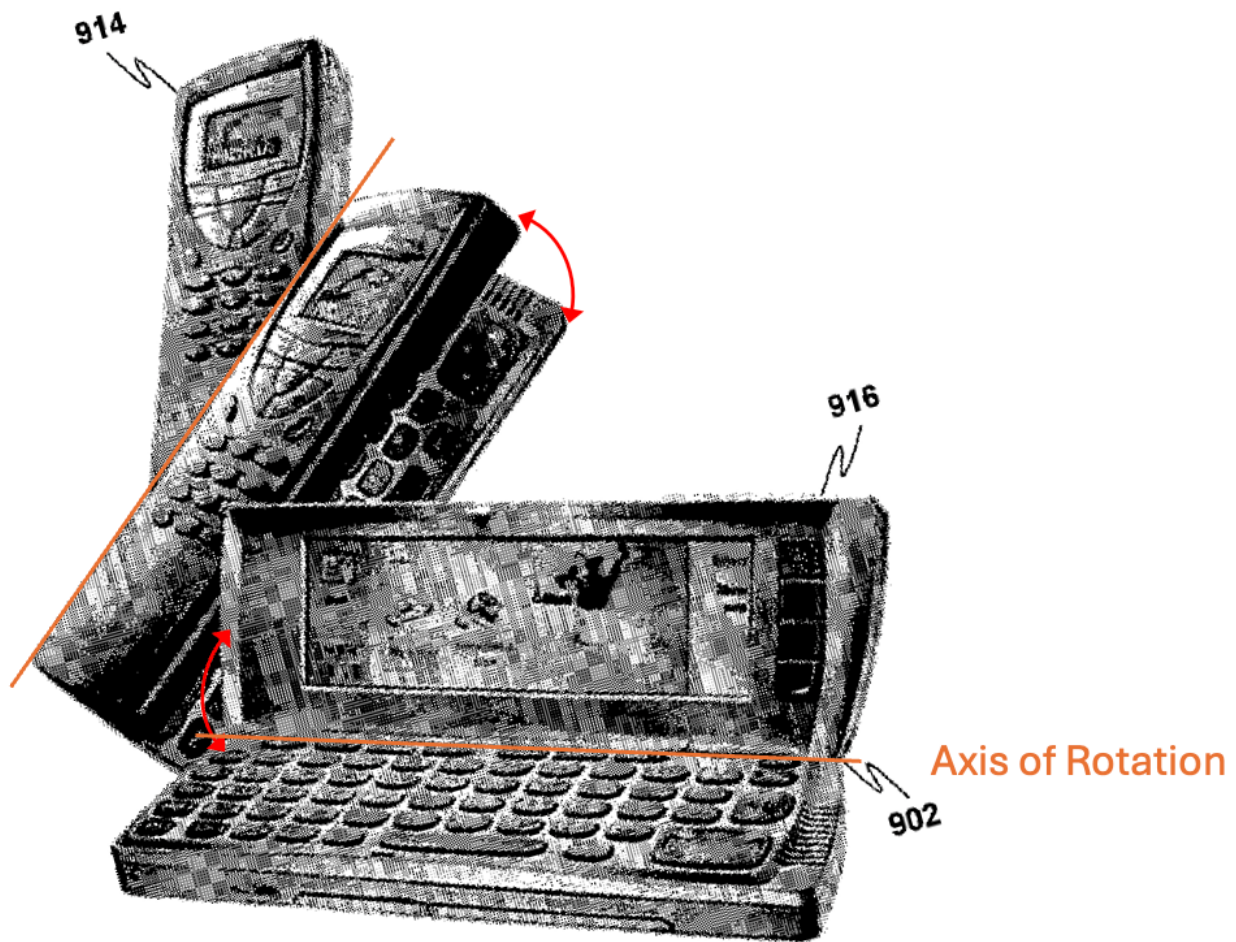
remaining language of claim 11, make clear to a POSITA that the ‘rotation’ being ‘detected’ by the ‘orientation sensor’ is of ‘the’ mobile communication ‘device,’ i.e., the device as a whole.” *Feuerstein Declaration* at ¶ 51. I disagree with Dr. Feuerstein’s opinion. Specifically, a POSITA would have found nothing in the plain language of Claim 11 supporting this interpretation because nothing in the plain language of the claim itself puts any caveats on the rotation of the mobile communication device detected by the orientation sensor. Indeed, a POSITA would understand that given the breadth of the plain language of the claim, the plain and ordinary meaning of the rotation of the mobile communication device would encompass any rotation of the mobile communication device relative to any object, including itself.

5. In my opinion, detecting rotation of the mobile communication device includes detecting rotation of components of the device. First, nothing in the claim excludes detecting rotation of components of the device because the claim does not include any limitations regarding the device’s housing or structural configuration, which means that any type of mobile communication device, including those with components that rotate relative to one another, is included. Second, I note Claim 11 does not recite determining any rotation or orientation *information* about the device, for example a direction or orientation to which the device is pointing. The claim

merely recites determining direction based on the rotation of the mobile device detected by the orientation sensor, as compared to determining direction based on rotation or orientation *information* detected by the device. I note this as an example of how the claim broadly determines direction based on a detected rotation. That is, the claim does not recite or require a particular type of rotation, does not use rotation or orientation information produced by the rotation of the device, and does not identify how rotation is detected. There is simply nothing in the claim language that would exclude detecting rotation of the components of the mobile communication device relative to one another.

6. A POSITA would never read the phrase “as a whole” into claim 11 because a POSITA would not give an unambiguous claim term (i.e., rotation of the mobile communication device) an ambiguous construction. To illustrate this ambiguity, I have described multiple reasonable interpretations of the phrase “as a whole” below. Because the phrase “as a whole” is imprecise and has multiple possible meanings, a POSITA would not have interpreted the plain language of Claim 11 as requiring the rotation of the of a fixed (i.e., one without hinges, swivels or other rotating joints) mobile communication device as a whole, as distinct from the rotation of one component of the mobile communication device relative to a different component of the same device as alleged by Dr. Feuerstein.

7. Regarding the first possible interpretation of “as a whole,” Dr. Feuerstein states that “to a person skilled in the art, the plain meaning of an object rotating involves the object as a whole spinning about its own axis.” *Feuerstein Declaration* at ¶ 51. Dr. Feuerstein also suggests that rotation of the device as a whole is “relative to other objects” and not just “one mobile communication component relative to another device component.” *Id.* at ¶ 52 (emphasis added). Dr. Feuerstein seems to suggest that the rotation of the mobile communication device must be relative to an inertial reference frame, such as the Earth, and not just relative to itself. As shown below, Figure 9A of Kalliola depicts two halves of the mobile communication device rotating between a closed position and open position “about its own axis:”



Kalliola at Fig. 9A (excerpted, annotated).

8. Because neither of the two sides of the mobile communication device is fixed, a POSITA would have understood that both halves of the mobile communication device are rotating freely via hinge 902, both relative to the device's axis of rotation and relative to an inertial frame of reference, such as the Earth. *See e.g., Atkins* at 169 (defining “hinge” as “Pin Joint”); 256 (defining a “pin joint,”

“hinge,” “hinge joint,” and “revolute joint” as “A joint in a mechanism...where the connection is a pin about the axis of which both parts can turn without restriction.”).

9. In spite of the mobile device in Kalliola illustrating two freely rotating halves, Dr. Feuerstein opines that this disclosure of Kalliola does not qualify as rotation “as a whole.” *Feuerstein Declaration* at ¶¶ 61-62. I disagree with Dr. Feuerstein’s conclusion. Both halves of the mobile communication device rotate relative to each other **and** “relative to other objects,” including the Earth. This qualifies as rotation of the device “as a whole” per Dr. Feuerstein’s testimony cited above because the whole device (i.e., both halves) is “spinning about its own axis” and rotating “relative to other objects.”

10. Regarding a second possible interpretation, a POSITA could also reasonably interpret “as a whole” to mean requiring a “whole” 360° rotation of the device about an axis. I note that this interpretation is consistent with the primary embodiment in the specification relied on by Dr. Feuerstein, which requires the user to “‘turn around’ to gather 360 degrees of directional data” so that “[t]he signal strength data can be analyzed in conjunction with one or more orientation sensors of the handheld wireless communication device 110, to determine a direction to the wireless device 120.” *’246 Patent* at 11:43-48; *Feuerstein Declaration* at ¶¶ 52-54. However, Dr. Feuerstein disagreed with this interpretation in his deposition and

testified that he did not “provide any opinion that rotating 360 degrees would be required.” *Feuerstein Deposition Transcript* at 107:14-16; *see also, id.* at 107:22-108:1 (“There’s nothing that a POSITA, at the time of the invention, would read into that to require the detected rotation to be any particular value, such as 360 degrees or greater.”). In fact, Dr. Feuerstein testified that even 0.5° of rotation would qualify “as sort of the lowest permissible amount of rotation that would meet the claim limitation.” *Id.* at 108:9-12.

11. A third possible interpretation of “as a whole” is requiring the entirety of the mobile communication device’s housing to be rotated. However, when asked about this interpretation in his deposition, Dr. Feuerstein testified that he “didn’t give an opinion...about housing or the entirety of the housing.” *Feuerstein Deposition Transcript* at 98:14-20. Also, as shown in Figure 9A above, the entirety of Kalliola’s mobile communication device’s housing (i.e., both halves) is rotating about the same axis along hinge 902. *Kalliola* at Fig. 9A. Figure 9A also depicts the hinge axis 902 itself rotating from a vertical to a horizontal position. *Id.* But, per Dr. Feuerstein, this does not qualify as rotation of the device “as a whole.”

12. As a fourth possible interpretation, a POSITA may also read “as a whole” to mean only rotating the mobile device in the azimuthal plane. However, such an interpretation does not agree with the examples that Dr. Feuerstein points to

in the specification. Specifically, Dr. Feuerstein points to the specification's mention of detecting rotation "about roll, pitch or yaw axes," which clearly does not limit the rotation to the azimuthal plane. *Feuerstein Declaration* at ¶¶ 55. Further, this interpretation is contradictory to when Dr. Feuerstein states at his deposition, "It's possible that multiple axis rotation could meet the claim." *Feuerstein Deposition Transcript* at 100:9-10.

13. Thus, the phrase "as a whole" can be interpreted in several different ways, and the fact that Dr. Feuerstein offers contradictory testimony regarding which of these interpretations he is applying further emphasizes that the meaning of "as a whole" is ambiguous to a POSITA.

14. The plain language of Claim 11 is not ambiguous. It simply requires an orientation sensor to detect rotation of the mobile communication device and determin[ing] a direction to the at least one remote device based ... on rotation of the mobile communication device detected by the orientation sensor. A POSITA would understand that the claimed rotation of the mobile communication device can be **any** rotation of the mobile communication device relative to itself and other objects because there are no claim limitations requiring any specific type of rotation. A POSITA would understand that just as there are multiple types of rotation, there are many ways to use the detected rotation of a wireless device and thus would not

expect that this “rotation” would be limited to a specific type of rotation. Specifically, the orientation of the device is clearly related to the orientation of the antennas associated with DOA estimation. This would be true regardless of whether the device had moving parts, hinges, a slider, or none of the above. Further, rotation sensors have also long been used to change the mode of the device (e.g., rotating the screen, turning on/off the screen, etc.).

B. The '246 Patent Specification Does Not Support Dr. Feuerstein's Construction

15. Dr. Feuerstein also opines that his “interpretation is consistent with the '246 specification, which describes determining the rotation of the mobile communication device as a whole relative to other objects and does not describe determining the movement of one mobile communication component relative to another device component.” *Feuerstein Declaration* at ¶ 52. I disagree. Indeed, there is no embodiment described in the '246 Patent that describes determin[ing] a direction to the at least one remote device based on signal delay of ultra-wideband communications between the two or more antennas and the at least one remote device and on rotation of the mobile communication device detected by the orientation sensor at all. Specifically, there is no embodiment that determines direction based on signal delay and rotation of the mobile communication device. There are described embodiments that determine direction based on signal *strength*

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(not signal *delay*, as I discuss below in ¶¶ 35-38), but there is no embodiment that determine direction based on signal *delay*.

16. As support for his construction, Dr. Feuerstein cites the '246 Patent at 11:43-52. *Feuerstein Declaration* at ¶ 52. However, this portion of the '246 Patent does not relate to Claim 11. This portion of the '246 Patent relates to an embodiment where a short-range wireless transceiver 140 and antenna 148 in a separate adjunct device 100 “generates signal strength in response to the location signal 114 from wireless device 120.” '246 Patent at 11:21-23, *see also, id.* at Fig. 5 (depicting adjunct device 100 including wireless transceiver 140 and antenna 148). The signal *strength* (not signal *delay*) information is “communicated to the location application of handheld wireless communication device 110 via the communication port of the handheld wireless communication device.” *Id.* at 11:23-27.

17. There are three separate implementations of the signal strength embodiment described in the '246 Patent, including (1) an implementation where “the user can change the orientation of the handheld wireless communication device to determine the direction to the wireless device 120” and “[t]he location application can detect when the orientation of the handheld wireless communication device corresponds to the direction of the wireless device, based on the signal strength data;” (2) an alternative implementation where “the user is instructed to ‘turn

around’ to gather 360 degrees of directional data” and “[t]he signal strength data can be analyzed in conjunction with one or more orientation sensors of the handheld wireless communication device 110, to determine a direction to the wireless device 120;” and (3) another alternative implementation where “the antenna 148 includes a steerable pattern 150 that includes a steerable null” and the location application “instruct[s] the user to stand still while the short-range wireless transceiver completes a directional sweep.” *Id.* at 11:21-67.

18. When the antenna 148 of adjunct device 100 (which is coupled to handheld device 110) is aligned with wireless device 120, the antenna is in a “null direction” relative to the wireless device, such that “a null signal strength reading will occur.” *Id.* at 11:37-39. This null signal strength indicates a “match” of the alignment of the handheld device 110 to the direction of the wireless device 120. *Id.* at 11:39-42. This match indicates a direction to the wireless device 120.

19. A POSITA would have understood that determining direction based on signal strength to detect the null of the antenna pattern is a different technique than determining direction based on signal delay at two or more antennas. Signal strength e.g., RSSI (received signal strength indicator), is “the measured power of a received signal.” *Newton* (Ex. 1052) at 689. In contrast, I understand that signal delay has been construed as “the **difference in time** between when a signal is received at two

or more antennas.” *Declaration* (Ex. 1003) at ¶ 34 (emphasis added). Thus, a POSITA would have understood that the embodiment that Dr. Feuerstein points to in 11:43-52 does not apply to Claim 11’s requirement to determine direction based on signal delay. I discuss the ’246 Patent’s use of the phrase signal delay at ¶¶ 35-38 below.

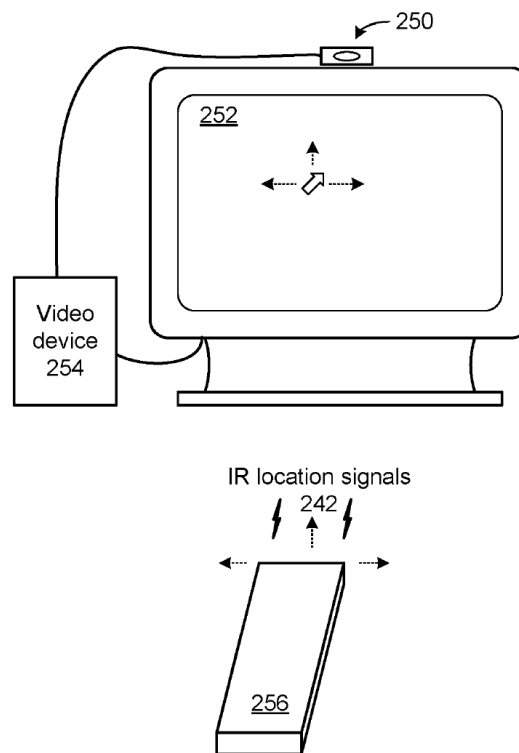
20. Dr. Feuerstein relies on the implementation where “the user is instructed to ‘turn around’ to gather 360 degrees of directional data” and “[t]he signal strength data can be analyzed in conjunction with one or more orientation sensors of the handheld wireless communication device 110, to determine a direction to the wireless device 120.” *Feuerstein Declaration* at ¶ 53 (citing ’246 Patent at 11:43-52). Dr. Feuerstein opines that “[i]n this example, the orientation sensor is implemented to help locate the remote device 120 relative to the handheld wireless communication device 110 *as a whole*.” *Id.* at ¶ 54 (emphasis in original). However, this implementation requires the user “to ‘turn around’ to gather **360 degrees** of directional data.” ’246 Patent at 11:43-52. In other words, this embodiment requires a full 360° rotation of the mobile communication device to have a complete signal strength data set to “determine the particular orientation of the device corresponding to the point where the null of the antenna pattern 160 is aligned with the direction to the wireless device 120.” *Id.* at 11:49-51.

21. In his deposition when describing “rotation” as used in Claim 11, Dr. Feuerstein testified that “[t]here’s nothing that a POSITA, at the time of the invention, would read into that to require the detected rotation to be any particular value, such as 360 degrees or greater.” *Feuerstein Deposition Transcript* at 107:22-108:1. This discrepancy further emphasizes the ambiguity of Dr. Feuerstein’s construction.

22. Dr. Feuerstein also relies on the embodiment of Figure 30, which he alleges shows “that ‘changes of orientation, **such as the rotation of the handheld device 256** about roll, pitch or yaw axes can be detected and used to adjust the orientation of the screen pointer.’” *Feuerstein Declaration* at ¶ 55 (citing ’246 Patent at 25:34-37, emphasis in original). Based on this, Dr. Feuerstein concludes that “the orientation sensor is implemented to help locate the orientation of the handheld device *as a whole relative* to the remote display screen 252.” *Id.* (emphasis in original). I find this statement highly misleading because this embodiment does not include an orientation sensor in the handheld device 256, as required by Claim 11.

23. As shown in the figure below, the embodiment of Figure 30 relates to a “screen pointing system” including “a handheld device 256, such as handheld wireless communication device 110 equipped with adjunct device 100 [that] emits

IR location signals 242, that are viewed by video camera 250.” ’246 Patent at 25:7-12.



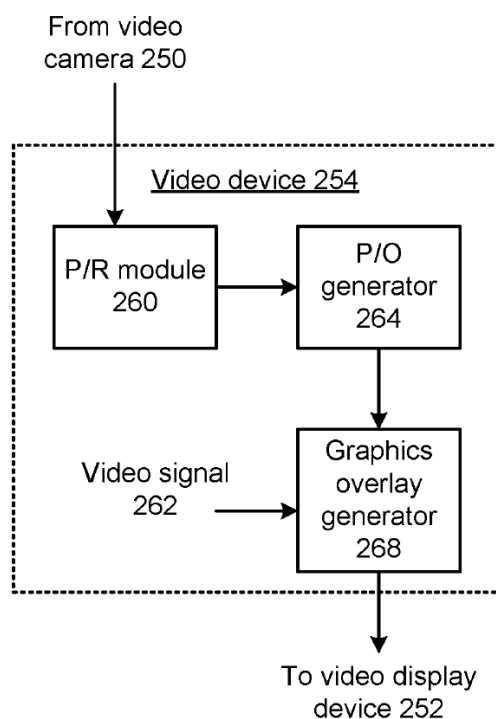
Id. at Fig. 30.

24. The video camera 250 serves as an infrared sensor that “generates a video signal that includes bright spots corresponding to each of the IR emitters 240.”

Id. at 25:15-17. “Video device 254 receives the video signal from the video camera 250 and **analyzes the video signal to determine the position and/or orientation of the IR emitters 240** in the video image.” *Id.* at 25:25-28 (emphasis added). In other words, video device 254, which may be a “video game console, computer, set-

top box,” etc., analyzes the video signal from the video camera to determine the orientation of handheld device 256. *Id.* at 25:38-41. There is **no** orientation sensor in handheld device 256.

25. This is further emphasized in Figure 31, which is a “block diagram of video device 254” (e.g., a video game console or computer) that includes “pattern recognition module 260, position/orientation generator 264, and graphics overlay generator 268.” *Id.* at 26:13-17.



Id. at Fig. 31.

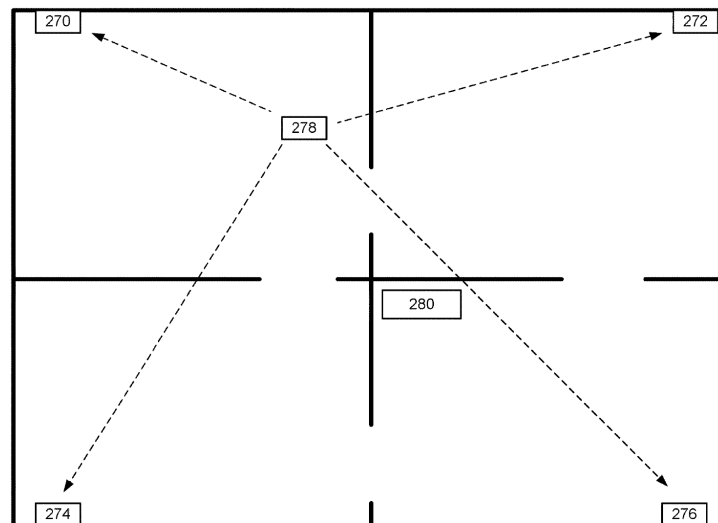
26. “After the bright spots produced by IR location signals 242 are located, position/orientations sensor 264 generates position and/or orientation signals

corresponding to, for instance, x, y, and z-axis translations and roll, pitch, and yaw axis orientations of the handheld device 256.” *Id.* at 26:23-27. Thus, the only “orientation sensor” in this embodiment is a module in a stationary video game console/computer that analyzes a video signal to detect rotations of the handheld device 256.

27. The screen-pointing embodiment of Figures 30 and 31 is entirely distinct from what is described in Claim 11. Indeed, the “orientation sensor” in this embodiment is not even located in the mobile communication device as required by the claim, and there is no disclosure of determin[ing] a direction to the at least one remote device based on signal delay of ultra-wideband communications between the two or more antennas and the at least one remote device and on rotation of the mobile communication device detected by the orientation sensor. As such, this embodiment provides no support for Dr. Feuerstein’s construction because it has no relevance to Claim 11.

28. In the final example cited by Dr. Feuerstein, he cites an embodiment where “an ‘internal compass’ of the wireless communication device 110 assists to provide ‘absolute directional information.’” *Feuerstein Declaration* at ¶ 56 (citing ‘246 Patent at 28:32-38). Again, this embodiment bears little relevance to Claim 11. Specifically, this embodiment relates to a location system in a building depicted in

Figure 32 that includes stationary paging devices 270, 272, 274, and 276, each of which “is positioned in a fixed location such as being attached to a wall or ceiling, or placed in another location that is stationary.” ’246 *Patent* at 27:11-19. “The paging device 278 is a mobile paging device to be located” and can be implemented via “adjunct device 100 and handheld wireless communication device 110. *Id.* at 27:22-26.



Id. at Fig. 32.

29. Each fixed paging device 270, 272, 274, and 276 includes a processing device 131 that “generates control signals 163 to scan a null or lobe of the programmable antenna 148’ over different orientations, determines signal strengths corresponding to the different orientations and determines a direction θ_1 , between the particular fixed paging device and the mobile paging device 278, based on a

lowest or highest signal strength M, lowest or highest differential signal strength $D(\theta_1)$, etc.” *Id.* at 28:4-12.

30. Thus, this embodiment relates to using **fixed** paging devices to triangulate the location of the mobile device using signal strength measurements. The mobile device’s “internal compass” is not used in conjunction with determining the direction to a remote device. Rather, this use case is the opposite of what is claimed in that the fixed paging devices are determining their relative directions to the mobile device. Thus, this embodiment also provides no support for Dr. Feuerstein’s construction because it has no relevance to Claim 11.

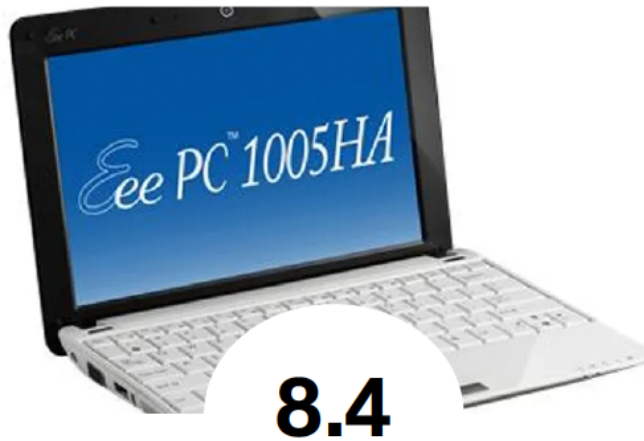
31. Not only do none of the examples cited by Dr. Feuerstein use both signal delay and rotation of the mobile communication device detected by the orientation sensor to determine direction as required by Claim 11, but I have searched the ’246 Patent specification extensively, and I cannot find a single instance where this is described.

32. Dr. Feuerstein also opines that “no example of the mobile communication device shown in the figures of the ’246 Patent illustrate a device having a multi-section body with hinges, folds, slides, and/or twist joints that rotate relative to one another.” *Feuerstein Declaration* at ¶ 57. I have been informed that the claims of a patent are not limited to what is depicted in the figures. Claim 11

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does not include any limitations regarding the structural configuration of the mobile communication device's housing. Also, the '246 Patent specification discloses that the handheld wireless communication device may be "a smart phone, digital book, **netbook**, personal computer with wireless data communication, or other wireless communication device..." '246 *Patent* at 4:55-58 (emphasis added). A netbook was well known to POSITAs as a small laptop computer. *See e.g., Tsou* at 285 ("Following the successful coverage of high-speed wireless networks, netbooks have become very popular as more portable versions of laptops, particularly as they offer the basic functionality of laptop computing and the portability that allows users to carry the netbook anywhere."). As noted by Tsou, one of the first commercially available netbooks was the Asus Eee PC, which was launched in October 2007. *Id.*

33. Just like the mobile communication device depicted in Figure 9A of Kalliola, netbooks, such as the Asus Eee PC, typically include two halves (one half with the display and the other half with the keyboard/input elements and processing components) connected via a hinge joint that allows the two halves to be rotated into open and closed positions:



Asus Eee PC 1005HA

See e.g., Ackerman at 1.

34. This means that a POSITA would understand that mobile communication devices “having a multi-section body with hinges, folds, slides, and/or twist joints that rotate relative to one another” are expressly contemplated by the ’246 Patent specification even if they are not depicted in the figures.

C. ’246 Patent’s Discussion of Signal Delay

35. I also analyzed the ’246 Patent specification to ascertain how the rotation of the mobile communication device is used when determining the direction to a remote device based on signal delay per Claim 11. I found that nothing in the ’246 Patent specification corresponds to Claim 11. The phrase “signal delay” is mentioned twice in the ’246 specification. In the first instance, the ’246 Patent discloses:

In addition or alternative to providing three dimensional direction finding, multiple antennas can be employed in a diversity receiver that, for example includes two or more receivers. Such configurations can be employed to mitigate the effects of fading, multipath interference and other path losses to provide more stable reception of signals, and more stable measurement of signal strength, **round trip signal delay**, etc.

'246 Patent at 15:45-52 (emphasis added).

36. In addition to not mentioning orientation sensors, round trip signal delay is used to measure distance – not direction. *See e.g., '246 Patent* at 34:38-40 (“This time delay (round trip flight time) can indicate the distance to the remote device.”); *Declaration* (Ex. 1003) at ¶ 52 (“U.S. Patent No. 5,379,447 to Bonta et al. was found to teach ‘determining distance between devices by using round-trip signal delays[.]’”).

37. The second instance also relates to determining distance and does not involve orientation sensors:

As previously discussed, distance can be determined based on a time of flight methodology that looks to **round trip signal delay to determine a measure of distance** to a remote device.

'246 Patent at 36:45-48 (emphasis added).

38. Therefore, a POSITA would not have had any reason to adopt Dr. Feuerstein's construction in light of the '246 Patent specification, given that nothing in the '246 Patent specification corresponds to the claimed invention of Claim 11.

39. I have also analyzed the '246 Patent file history and found nothing relevant to this limitation. I understand that Dr. Feuerstein agreed with this in his deposition:

Q. Is there anything in the file history that informs your construction of rotation of the device?

A. For this particular patent, the '246 Patent, I don't recall anything specific in the file history related to that. I don't have the file history up right in front of me, but I – my declaration didn't refer to, quote, particular things from the file history that I recall.

Feuerstein Deposition Transcript at 102:8-15.

III. THE PRIOR ART TEACHES THE CHALLENGED CLAIMS

A. The Combination Teaches Limitation 11(d)

40. As I opined in my original declaration, Claim 11(d) is taught by Kalliola in two ways – each of which alone is sufficient to satisfy the limitation. *Declaration* (Ex. 1003) at ¶¶ 259-262. First, Kalliola teaches “sensors ‘that provide information on the relative orientation of two sections of WCD 100’ where the orientation information is ‘provided to a controller in WCD 100.’” *Id.* at ¶259 (citing *Kalliola*

at [0078]). Second, Kalliola teaches using “a semiconductor gyroscope chip’ to detect when WCD 100 is being moved.” *Id.* at ¶ 262 (citing *Kalliola* at [0084]).

41. Dr. Feuerstein disagrees. *Feuerstein Declaration* at ¶¶59-69. I have addressed Dr. Feuerstein’s criticisms of each of Kalliola’s teachings below.

1. Kalliola’s Orientation Sensor Detects Rotation of the Mobile Communication Device

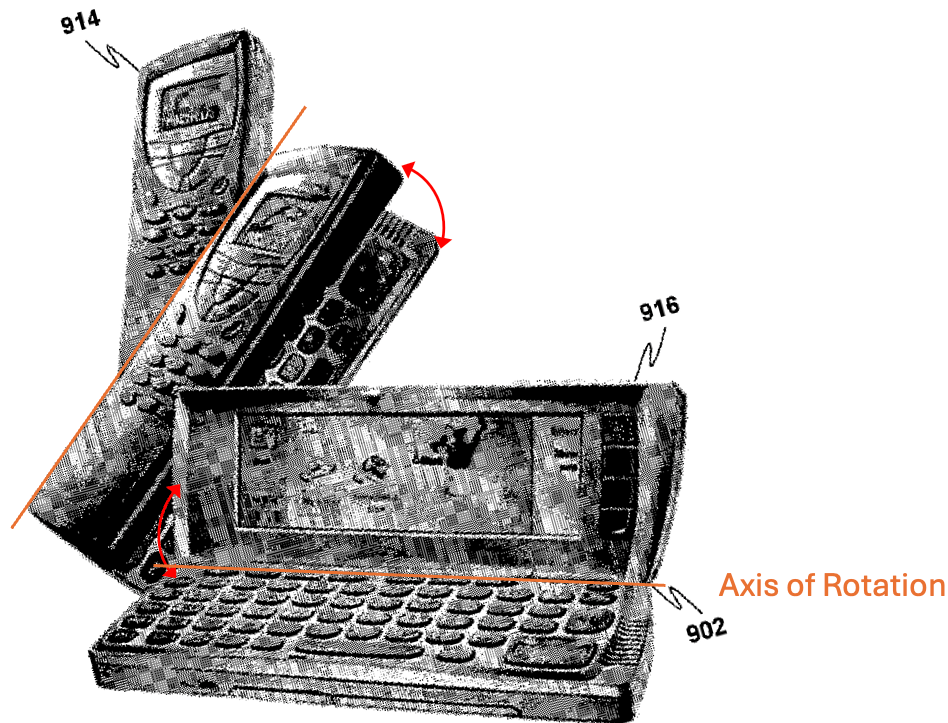
42. Citing Figure 9A, Dr. Feuerstein opines that Kalliola discloses a cellular telephone “‘implemented at 914 when a **hinge sensor 902 ... provides that the device is in a closed orientation.**’” *Feuerstein Declaration* at ¶ 64 (citing *Kalliola* at [0079] (emphasis in original)); *see also, id.* at ¶ 63 (citing *Kalliola* at Fig. 9A). Based on this Dr. Feuerstein concludes that Kalliola fails to teach “an orientation sensor to detect rotation of ‘the’ mobile communication ‘device,’ i.e., as a whole” because “Kalliola discloses only rotation of one section of the WCD body relative to another section (e.g., a folding or twisting action to open or close) for assessing open or closed states.” *Id.* at ¶ 65. I disagree.

43. As I discussed above, Kalliola’s Figure 9A depicts both halves of the mobile communication device rotating freely about hinge 902, both relative to each other and relative to an inertial reference frame, such as the Earth. *See* ¶¶ 6-8. In viewing the mobile communication device of Fig. 9A, it is my opinion that neither of the two sides of the mobile device is fixed. That is, the side having the screen can

rotate freely, and the side having the keyboard can rotate freely. My opinion is based on several reasons. One can understand this simply by seeing the various positions illustrated in the above Fig. 9A showing the opening of the device. In the far-left figure, the device halves are in a closed position. The device halves then rotate to open to a fully open position on the far-right figure. Kalliola also teaches that a hinge connects the two sides. As I discussed above, a POSITA would have known a hinge allows both parts to rotate, including rotating relative to each other. *See e.g., Atkins* at 169 (defining “hinge” as “Pin Joint”); 256 (defining a “pin joint,” “hinge,” “hinge joint,” and “revolute joint” as “A joint in a mechanism...where the connection is a pin about the axis of which both parts can turn without restriction.”). I note that THL seemingly also agrees that both sides of the Kalliola device are rotating freely, stating in the Patent Owner Response that Kalliola’s orientation sensor is “monitoring the movement ‘of the cover relative to the body[.]’” *Response* at 23.

44. Dr. Feuerstein does not seem to dispute that hinge sensor 902 detects the relative rotation. *Feuerstein Declaration* at ¶ 64 (citing *Kalliola* at [0079]). Dr. Feuerstein’s issue seems to be that the hinge sensor is not detecting the “right” kind of rotation because it detects when the two halves of the WCD have rotated into “open or closed” states. *Id.* at ¶ 65.

45. To be clear, there is nothing in the plain language of 11(d) requiring detecting a specific type of rotation. All that is required is an orientation sensor to detect rotation of the mobile communication device. As I established above, the entirety of Kalliola's mobile communication device (i.e., both halves of the WCD) are rotating freely about hinge 902. It is undisputed that hinge sensor 902 is detecting this relative rotation. *Feuerstein Declaration* at ¶ 64 (citing *Kalliola* at [0079]). If Dr. Feuerstein's "as a whole" construction means detecting rotation of the entirety of the device spinning about its own axis relative to other objects, then it is disclosed by Kalliola. As shown in Figure 9A below, Kalliola's WCD rotates about hinge 902, and the entirety of the WCD is simultaneously rotating from a vertical to a horizontal position. *Kalliola* at Fig. 9A. The hinge sensor detects both the relative motion of the two halves of the WCD and the motion of the "entirety" of the WCD because when the two halves are rotated either away from each other or towards each other, the "whole" WCD is also rotating in free space relative to other objects:



Kalliola at Fig. 9A (excerpted, annotated).

2. *Kalliola's Gyroscope Detects Rotation of the Mobile Communication Device*

46. Regarding Kalliola's teaching of a gyroscope, Dr. Feuerstein does not dispute that a gyroscope measures rotation. *Feuerstein Declaration* at ¶ 66; *Feuerstein Deposition Transcript* at 49:18-20 (testifying that gyroscopes "can be used to detect angular velocity"). Rather, he alleges that the "disclosure pertains to managing or conserving 'battery life' by suspending tracking calculations if a sensor indicates the WCD (and the target) are not moving, and resuming tracking calculations if the sensor indicates the WCD/target have moved." *Feuerstein*

Declaration at ¶ 66 (citing *Kalliola* at [0084]). Based on this, Dr. Feuerstein concludes that “Kalliola’s proposed use of a gyroscope to detect moving versus stationary status of the WCD and/or target is not at all synonymous with detecting rotation.” *Id.* I disagree.

47. As noted in *Kalliola*, the gyroscope is “used to detect when WCD 100 is being moved.” *Kalliola* at [0084]. A POSITA would understand that gyroscopes are well-known inertial sensors that specifically detect *rotational* motion. *See e.g., Pons* at 170 (“Gyroscopes are rate sensors that commonly use vibrating mechanical elements (proof-mass) to sense **rotation.**”) (emphasis added). “MEMS gyroscopic sensors are commonly found in commercial, industrial, up to tactical grade inertial navigation systems. Even a typical smartphone will contain MEMS gyroscopes that are used for detecting phone orientation (portrait or landscape display) and in navigation applications, for example. A MEMS gyroscope is a component that is a combination of electrical and mechanical elements that **indicate acceleration about a single or multiple axes.** A typical INS is able to provide various navigational and orientation data for a vehicle. That is, roll, pitch, and heading of the device / vehicle. This data is provided by sensors that can detect changes in linear acceleration in each axis **and, of course, gyroscopes for detecting rotation around each axis.** (*emphasis added*) *See, e.g., History of Gyroscopes* at 9.

48. As I noted in my original declaration, I understand that Patent Owner has previously contended that a gyroscope meets this limitation. *Declaration* (Ex. 1003) at ¶ 262. Thus, neither Patent Owner nor Dr. Feuerstein disagree that a gyroscope detects rotation.

49. Dr. Feuerstein does not dispute that Kalliola's gyroscope is used to detect motion of the WCD. *Feuerstein Declaration* at ¶ 66. Despite this, Dr. Feuerstein alleges that Kalliola's gyroscope does not satisfy Claim 11(d) because it is "for an entirely different and unrelated purpose, which does not include determining rotation of the mobile communication device." *Feuerstein Declaration* at ¶ 69. This is nonsensical because the *only* purpose of a gyroscope sensor, such as described by Kalliola, is to detect motion by *sensing the rotation* of the device. *See e.g., Pons* at 170. Dr. Feuerstein may argue that in this example in Kalliola, the gyroscope may not be used to *measure the amount* of rotation but only detect the presence of rotation. However, such an argument is completely in contrast to his statement that during his deposition that even 0.5 degrees of rotation meets the claim language. *Feuerstein Deposition Transcript* at 108:9-12. Additionally, the claim language only requires "detect[ing]" rotation, not measuring it. Because the purpose of a gyroscope is to detect rotation, a POSITA would have understood that Kalliola's

gyroscope is an orientation sensor to detect rotation of the mobile communication device.

B. The Combination Teaches Limitation 11(e)(vii)

50. As I opined in my original declaration, Claim 11(e)(vii) is taught by Kalliola in two ways – each of which alone is sufficient to satisfy the limitation. *Declaration* (Ex. 1003) at ¶¶ 272-284. First, Kalliola teaches using the orientation sensor output to configure the DoA application. In other words, the WCD used sensor output to determine whether the WCD is open/closed in order to set antenna calibration vectors that determine “from which antennas to measure received beacon signals” and/or “how the measurements from the active antennas will be interpreted in order to determine direction.” *Id.* at ¶¶ 272-274 (citing *Kalliola* at [0080]-[0081]; Fig. 9B). Second, Kalliola teaches using the motion sensor/gyroscope to suspend, resume, or speed up DoA estimation based on the detected rotation of the WCD. *Id.* at ¶¶ 281-282 (citing *Kalliola* at [0084], [0086]).

51. Dr. Feuerstein disagrees. *Feuerstein Declaration* at ¶¶ 70-77. I have addressed Dr. Feuerstein’s criticisms of each of Kalliola’s teachings below.

I. Kalliola’s First Mapped Embodiment Teaches 11(e)(vii)

52. Regarding the first mapped embodiment, Dr. Feuerstein argues “that the alleged orientation sensor merely senses whether the ‘flip-phone’ is ‘open’ or

closed” and that “it does *not* sense the ‘rotation’ of the WCD as a whole, and is *not* used to ‘determine’ the ‘direction from the mobile communication device to the remote device’ as claimed.” *Feuerstein Declaration* at ¶ 71 (emphasis in original). I addressed Dr. Feuerstein’s argument regarding Kalliola’s orientation sensor detecting the rotation of the WCD “as a whole” above. *See* ¶¶ 42-45. Regarding Dr. Feuerstein’s contention that the direction to the remote device is not determined based on rotation of the mobile communication device detected by the orientation sensor, he failed to address Kalliola’s express teachings to the contrary.

53. Kalliola teaches that the collected sensor data is provided to “a three-dimensional (3-D) antenna calibration matrices module 934” that “use[s] the collected sensor information **to determine the appropriate antenna calibration vectors to provide to DoA Estimation module 926.**” *Kalliola* at [0081] (emphasis added), Fig. 9B. “These calibration vectors allow DoA Estimation module 926 to configure the antenna array.” *Id.* “The antenna configuration may include, for example, from which antennas to measure received beacon signals, and **how the measurements from the active antennas will be interpreted in order to determine direction.**” *Id.* (emphasis added). Thus, Kalliola’s first embodiment teaches determining the direction to the remote device based in part on the antenna configuration, which is selected based on the rotation of the WCD detected by the

orientation sensor. That rotation includes both rotation of one part of the phone relative to another as well as the rotation of the entire WCD as discussed above. *See* ¶¶ 42-45.

2. *Kalliola's Second Mapped Embodiment Teaches 11(e)(vii)*

54. Regarding the second mapped embodiment, Dr. Feuerstein alleges that “the ‘motion’ in the context of Kalliola is in no way equivalent to, nor even related to the uses of ‘rotation’ in the ’246 Patent” because the motion sensor/gyroscope is “‘used to detect when WCD is being moved’ or when it ‘is stationary’ ... for purposes of ‘power management’ to ‘conserve battery life.’” *Feuerstein Declaration* at ¶ 72 (citing *Kalliola* at [0014], [0084]). I disagree.

55. First, as I established above, nothing in the ’246 Patent specification corresponds describes determining directed based on both signal delay and the rotation of the mobile communication device detected by the orientation sensor as required by Claim 11. *See* ¶¶ 15-38. Second, Kalliola’s disclosure of starting/stopping the DoA estimation based on whether the WCD has moved is highly relevant to Claim 11. As I explained in my original declaration, based on the motion sensor/gyroscope data, the DoA subsystem determines if rotation has occurred since the last DoA measurement. *Declaration* (Ex. 1003) at ¶ 281. If rotation of the WCD has been detected, the orientation of the WCD with respect to

the remote device has changed, and the previous DoA estimation is no longer accurate. As such, the DoA must be updated. In other words, the gyroscope detects rotation of the WCD with respect to the remote device to trigger a DoA measurement. Thus, determining the direction to the remote device is directly based on rotation of the mobile communication device detected by the orientation sensor because Kalliola's DoA subsystem will not perform the direction determination unless rotation of the WCD relative to the remote device has been detected by the gyroscope.

56. As I described in my original declaration, Kalliola also teaches “employing a ‘correction or compensation mode...when user 110 moves WCD too quickly for an accurate DoA estimation,” which causes an adjustment to “the speed at which the DoA estimation is performed.” *Declaration* (Ex. 1003) at ¶ 282 (citing Kalliola, [0086]). Dr. Feuerstein claims that the “sensor described in this embodiment . . . does not determine ‘rotation’ of the mobile communication device, let alone for the claimed purpose of ‘determine[ing] [sic] a direction to the at least one remote device as recited in limitation [11(e)(vii)].” *Feuerstein Declaration* at ¶ 73. To the contrary and just like in the suspending/resuming embodiment described above, the gyroscope measures the rotation of the WCD to determine how often the direction determination process must be performed. Additionally, Kalliola teaches

that via the gyroscope the WCD “senses when the current orientation of WCD 100 interferes with accurate direction determination, and as a result, may compensate for the sensed orientation by enabling, for example, a different antenna calibration vector.” *Kalliola* at [0086]. This is directly using the detected rotation to determine the direction to the at least one remote device.

IV. CONCLUSION

I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and 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.

Date: Jan. 23, 2025

By: 
R. Michael Buehner