

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
Patent No. 11,350,246

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,350,246, CLAIMS 1-19**

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I. INTRODUCTION

Apple Inc. (“Petitioner”) requests *inter partes* review (“IPR”) of Claims 1-19 (the “Challenged Claims”) of U.S. Patent No. 11,350,246 (“the ’246 Patent”). The Challenged Claims encompass a hotchpotch of features from prior mobile communication devices and using ultra-wideband (UWB) transceivers to estimate the distance and direction to a target—a well-known and even standardized technique prior to the ’246 Patent. *Dec.*, ¶59.¹

Because the Challenged Claims recite numerous known features, Petitioner’s proposed Grounds rely on combinations of multiple references. “The criterion [for obviousness], however, is not the number of references, but what they would have meant to a person of ordinary skill[.]” *In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991). The Challenged Claims are plainly obvious and should be canceled.

II. SUMMARY OF THE ’246 PATENT

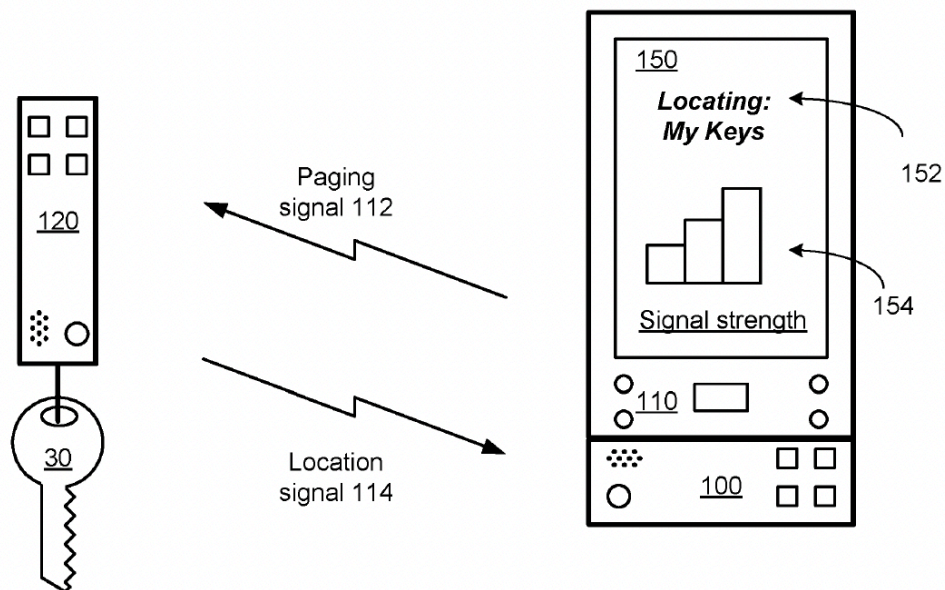
A. Description of the ’246 Patent

The ’246 Patent claims the benefit of a filing date before March 16, 2013; consequently, Petitioner applies the pre-AIA versions of §§102 and 103. Petitioner also adopts February 26, 2010, as the priority date for the Challenged Claims for purposes of this proceeding.

¹ All references to “*Dec.*” are to Exhibit 1003, Declaration of Dr. R. Michael Buehrer.

The '246 Patent describes “a location system for use with a handheld wireless communication device 110,” such as a smart phone, and including long and short-range wireless transceivers. '246 Patent (Ex. 1001), 4:52-64, 5:4-10, 5:31-40.

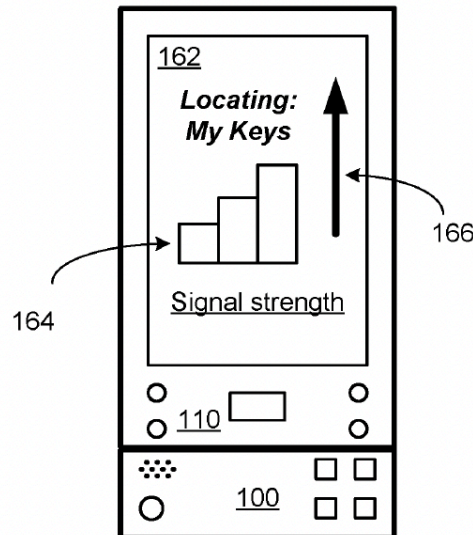
The wireless communication device 110 communicates with a wireless device 120 attachable to an object (e.g., keys). *Id.*, 7:40-44. Wireless device includes a short-range wireless receiver that receives a paging signal and emits a detectable alert signal and location signal that helps the user locate the personal object coupled to the wireless device. *Id.*, 7:47-52.



Id., Fig. 6.

A direction and/or distance from wireless communication device 110 to wireless device 120 can be determined via several known methods, such as (1) a signal strength of a signal sent between the devices (*id.*, 10:53-56, 11:23-27); (2) time of flight of a signal (*id.*, 11:4-7); and/or (3) a directional antenna (*id.*, 11:27-30).

The signal strength 164 and a direction indication 166 are shown on the screen of the wireless communication device 110:



Id., Fig. 8.

B. Field of Endeavor and Problem Solved by the Inventors

The claimed invention of the '246 Patent relates to wireless/mobile communication devices. '246 Patent, 2:8-9 (defining the Technical Field of Invention as "relat[ing] to wireless communication devices"), 37:54, 39:4. These wireless/mobile communication devices perform functions relating to transmitting signals in response to user interactions with the device and receiving signals from other wireless devices. *Id.*, Abstract, 5:54-59, 7:52-67, 10:37-59, 15:53-67, 31:18-28, Figs. 1, 4, 6, 16. The wireless communication device performs these functions using wireless transceivers. *Id.*, 4:52-5:4, 8:2-28, Figs. 1, 5. Thus, the field of

endeavor of the '246 Patent includes wireless communication devices that send and/or receive wireless signals. *Dec.*, ¶¶47-49.

The '246 Patent is reasonably pertinent to the problem of employing a first wireless device, such as a mobile communication device, to locate a second wireless device. For example, the Detailed Description of the alleged invention begins with reference to FIG. 1 and a “location system for use with a handheld wireless communication device,” indicating to a POSITA that at least one problem faced is location determination of a wireless communication device. *'246 Patent*, 4:52-55; *Dec.*, ¶51.

C. Level of Skill of a POSITA

A person of ordinary skill in the art (POSITA) at the time of the '246 Patent would have been a person having a bachelor's degree in computer science, computer engineering, electrical engineering, or a similar technical field and 2-4 years of experience with wireless ranging and positioning systems, wireless communication devices, and associated computer programming. *Dec.*, ¶35. Additional industry experience or technical training may offset less formal education, while advanced degrees or additional formal education may offset lesser levels of industry experience. *Id.*

III. REQUIREMENTS UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner certifies the '246 Patent is eligible for IPR.

B. Identification of Challenge Under 37 C.F.R. § 42.104(b)

Petitioner requests the Challenged Claims be found unpatentable on the following grounds.

Ground	Claim(s)	35 U.S.C. §	References
1	1, 11-14	103	Kalliola (Ex. 1004), Turunen (Ex. 1005), Oswald (Ex. 1006), Vauclair (Ex. 1007), and Kalayjian (Ex. 1008)
2	2-5, 15-18	103	Kalliola, Turunen, Oswald, Vauclair, Kalayjian, and Thorn (Ex. 1009)
3	6-10, 19	103	Kalliola, Turunen, Oswald, Vauclair, Kalayjian, Thorn, and Sharp (Ex. 1010)

C. Claim Construction Under 37 C.F.R. § 42.104(b)(3)

In this proceeding, claims are interpreted under the same standard applied by Article III courts (the *Phillips* standard). 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (*en banc*). For all terms not included

below, Petitioner applies the ordinary and customary meaning of the claim terms as understood by a POSITA.²

For purposes of this proceeding only, Petitioner applies THL’s construction in the parallel litigation for the following claim terms:

Claim Terms	PO’s Constructions
Time of flight calculations (1, 11)	“Determining the amount of time between when a signal is transmitted and when a reply signal is received”
Signal delay (1, 11)	“Difference in time between when a signal is received at two or more antennas”

THL’s Proposed Constructions (Ex. 1011), 6-11; *Western Digital Corporation v. Spex Technologies, Inc.*, IPR2018-00084, Paper 14, at 11 (PTAB Apr. 25, 2018) (finding Petition based on claim constructions urged by Patent Owner satisfies the claim construction requirements and that Petitioner is not required to express its subjective agreement regarding correctness of the proffered claim construction or take ownership of the construction); *10X Genomics, Inc. v. Bio-Rad Laboratories, Inc.*, IPR2020-00086, Paper 8, at 19-20.

² Petitioner’s application of prior art to the Challenged Claims is not a waiver of any argument in litigation that any claim term in the ’246 Patent is indefinite or invalid.

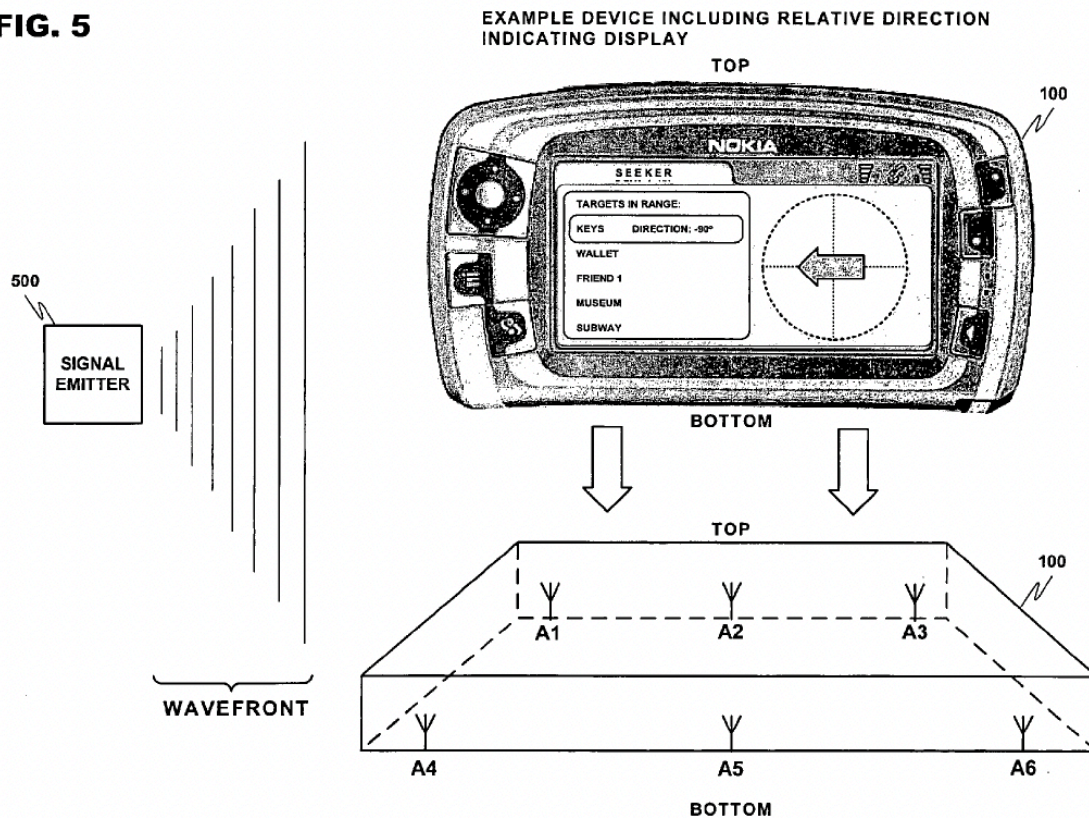
IV. SHOWING OF ANALOGOUS, PRIOR ART

A. Kalliola

Kalliola published on March 20, 2008, qualifying as prior art under §102(b). Kalliola was not cited or considered during the prosecution of the '246 Patent. Kalliola describes a need for “a directional and/or location finding method and system that allows a user to track or locate a signal beacon[.]” *Id.*, [0011]. Kalliola seeks to provide an application that “work[s] in conjunction with various resources within the wireless communication device in order to provide a visual representation of the relative direction towards, or location of, an object, place, etc. maintaining a broadcast beacon.” *Id.*

The system includes a wireless communication device (WCD) that may be a cellular telephone. *Id.*, [0034], [0037]. The WCD communicates via short-range (e.g., Bluetooth, UWB) and long-range (e.g., cellular) wireless networks and protocols. *Id.*, Fig. 1, [0034]-[0036], [0046], [0048], [0049]. The system also includes remotely-activated signal emitters “such as battery-operated transmitters in a keychain, in a wallet, embedded in an ID badge...may be activated remotely by a user as needed.” *Id.*, [0075]. The signal emitters “operate in a lower power or power conservation mode until a message is received instructing a device to activate the position-indicating transmission signal.” *Id.* The position-indicating signal

transmitted is received by an antenna array on the WCD, and the WCD determines the direction to the signal emitter, which is displayed for the user as an arrow:

FIG. 5

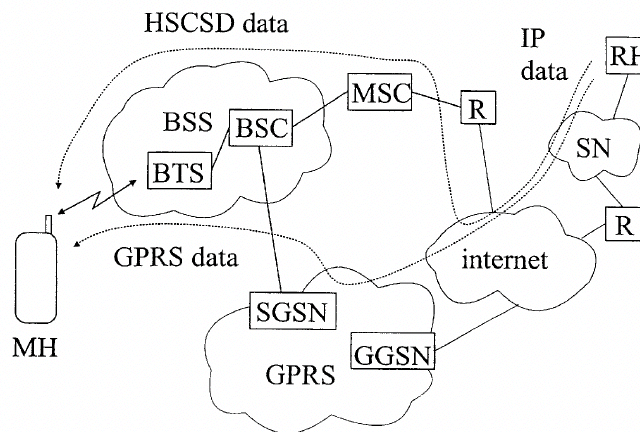
Id., Fig. 5, [0067].

Kalliola is analogous to the claimed invention of the '246 Patent because it is from the same field of endeavor. Kalliola is directed to a mobile communication device that sends/receives wireless signals. *Dec.*, ¶94.

Kalliola is also reasonably pertinent to the particular problem with which the inventor of the '246 Patent was involved because it is directed to solving the same problem. Kalliola proposes using the WCD to help the user locate wireless devices (i.e., signal emitters). *Dec.*, ¶95.

B. Turunen

Turunen issued on November 26, 2002, qualifying as prior art under § 102(b). Turunen was not cited or considered during the prosecution of the '246 Patent. Turunen describes “[a] method of transmitting Internet data between a mobile host and a remote host coupled via the Internet and a GSM/GPRS cellular telephone network.” *Turunen*, Abstract. The mobile host (MH) “communicates with a Base Transceiver Station (BTS) of a Base Station Subsystem (BSS) of the GSM network.” *Id.*, 5:39-41. As shown in Figure 2, the MH (depicted as a cellular telephone) sends and receives wireless signals via the GSM/GPRS cellular network:

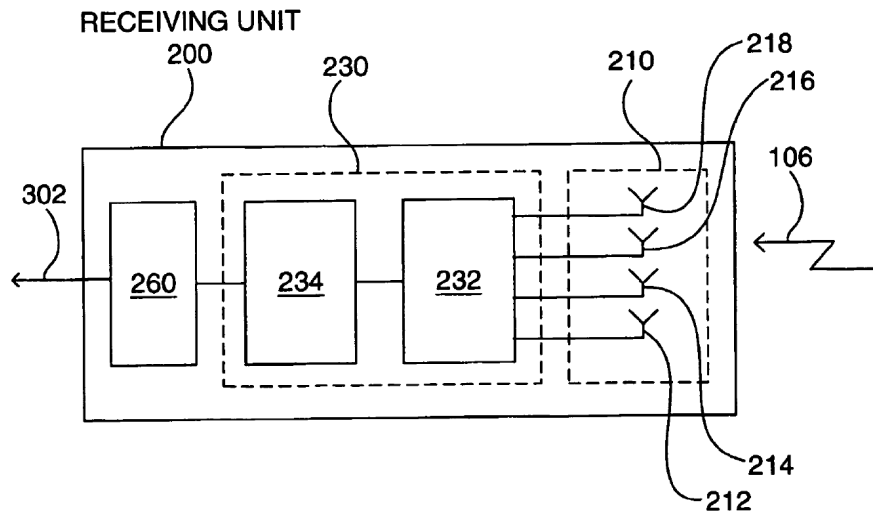


Id., Fig. 2; *see also, id.*, 5:13-14 (“FIG. 2 illustrates schematically a mobile host coupled to the Internet via a GSM/GPRS cellular telephone network”).

Turunen is analogous to the claimed invention of the '246 Patent because it is from the same field of endeavor. Turunen is directed to a mobile host that sends/receives wireless signals. *Dec.*, ¶100.

C. Oswald

Oswald published on August 28, 2008, qualifying as prior art under § 102(b). Oswald was not cited or considered during the prosecution of the '246 Patent. Oswald describes “an apparatus for determining positional information relating to an object incorporating a transmitter, the apparatus comprising means for receiving a signal transmitted by the transmitter at the object” where “the signals transmitted by the transmitter associated with the object are Ultra Wide Band (UWB) signals.” *Oswald*, [0005], [0099]. “In FIG. 9, the receiver component 210 in the receiving unit 200 comprises four antennas 212, 214, 216, 218 for receiving the transmitted signal 106 at carefully chosen spaced apart locations and the detector component 230 in turn comprises a transceiver unit 232 coupled to the antennas 212, 214, 216, 218[.]” *Id.*, [0260]. “[D]ifferential timing techniques are used to compute the angular position of transmitting objects whose signals are received at the receiving unit, which requires the analysis of a plurality of received signals.” *Id.*, [0261].



Id., Fig. 9.

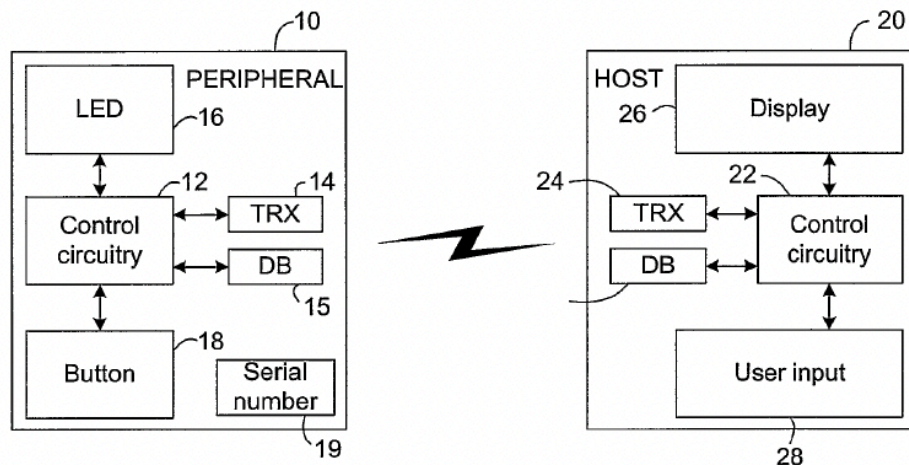
Oswald is analogous art because it is from the same field of endeavor. Like the '246 Patent, Oswald is also directed to a communication device that receives wireless signals, including UWB. *Dec.*, ¶110.

Oswald is also reasonably pertinent to the particular problem with which the inventor of the '246 Patent was involved because it is directed to solving the same problem. As discussed above, Oswald similarly uses UWB signals to determine positional information relating to an object associated with a UWB transmitter. *Dec.*, ¶111.

D. Vauclair

Vauclair published on December 25, 2008, qualifying as prior art under §102(b). Vauclair was not cited or considered during the prosecution of the '246 Patent. Vauclair describes a pairing process between a first electronic device 10,

which “is regarded as a peripheral device,” such as “a mobile telephone handsfree kit,” and a second electronic device 20, which “is regarded as a host device,” such as a “mobile telephone.” *Vauclair*, [0022]. The first and second devices “communicate according to any wireless or wired protocol” including “Bluetooth.” *Id.* The peripheral device 10 includes “control circuitry 12, in the form of a suitably programmed processor” that “is connected to transceiver (TRX) circuitry 14, which handles radio frequency communications with other electronic devices able to use the same wireless protocol.” *Id.*, [0024]. Likewise, “host second electronic device 20 has control circuitry 22, in the form of a suitably programmed processor” that “is connected to transceiver (TRX) circuitry 24, which handles radio frequency communications with other electronic devices able to use the same wireless protocol.” *Id.*, [0028].



Id., Fig. 1.

Vauclair describes a pairing process between the host device 20 and the

peripheral device 10 where the host device 20 sends and receives wireless signals from the peripheral device 10. *Id.*, Fig. 2, [0034] (“The process of pairing the first and second electronic devices 10, 20...will now be described with reference to FIG. 2, which shows the signals sent between the devices...”).

Vauclair is analogous to the claimed invention of the '246 Patent because it is from the same field of endeavor. Vauclair is directed to a host device 20 that sends/receives wireless signals. *Dec.*, ¶116.

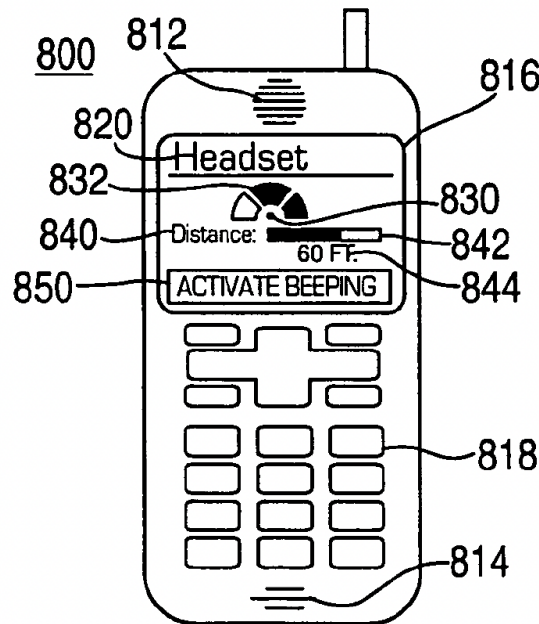
E. Kalayjian

Kalayjian published on May 29, 2008, qualifying as prior art under § 102(b). Kalayjian was not cited or considered during the prosecution of the '246 Patent. Kalayjian describes “[a] method and system for locating objects” using an RF (e.g., Bluetooth communications) protocol where a first device, such as a cellular phone, is paired with a second device, such as a wireless headset.³ *Kalayjian*, Abstract, [0033]-[0034]. “When a user wants to locate one of the slave devices 320, 400 and 500, the user can initiate the location discovery process through master device 310.” *Id.*, [0038]. “Master device 310 can transmit a signal to a slave device,” and “[u]pon

³ Kalayjian refers to the first device as the “master device” and the second device as the “slave device.” *Kalayjian*, Abstract. Unless quoted, Petitioner refers to the “master device” as the “first device” and the “slave device” as the “second device.”

receiving the signal, the slave device can guide a user to its location and/or notify a user of the distance from master device 310 to the slave device.” *Id.* The second devices “guide a user to their location by emitting auditory or visual signals,” which “allows a user to follow the sound or light to the misplaced object.” *Id.*, [0039].

The second devices also “transmit[] a return signal to master device 310,” which calculates the distance between the devices and determines “the direction towards the slave device from the master device.” *Id.*, [0040]-[0042]. The distance 840 and direction 830 information is presented on the display of the first device in addition to a graphical button 850 that “enable[s] the user to prompt the slave device to beep, flash or perform a combination of both”:



Id., Fig. 8, [0049].

Kalayjian is analogous to the claimed invention of the '246 Patent because it is from the same field of endeavor. Kalayjian is directed to a first device 310 that sends/receives wireless signals. *Dec.*, ¶126.

Kalayjian is also reasonably pertinent to the particular problem with which the inventor of the '246 Patent was involved because it is directed to solving the same problem of using the first device to help the user locate wireless devices, such as the user's Bluetooth headset. *Dec.*, ¶127.

F. Thorn

Thorn was filed on September 4, 2007, and published on March 5, 2009, qualifying as prior art under §§102(a), (e). Thorn was not cited or considered during the prosecution of the '246 Patent. Thorn describes “providing location information associated with moveable objects.” *Thorn*, [0004]. A first mobile terminal, such as a “cellular radiotelephone,” “periodically receives unique Identification (ID) Information from RFID tags coupled to moveable objects, such as a wallet, a briefcase, a set of keys, rental equipment, etc.” *Id.*, [0028], [0030]. Thorn also teaches using Bluetooth-enabled tags instead of RFID. *Id.*, [0032]. “The first terminal can then send the ID information to a database to determine if the moveable object is associated with the first terminal.” *Id.*, [0030]. “If the moveable object is not associated with the first terminal, the first terminal can determine location

information, using for example GPS and/or location information that is available through a network in which the first terminal communicates.” *Id.*

Thorn is analogous to the claimed invention of the ’246 Patent because it is from the same field of endeavor. Thorn is directed to a mobile terminal that sends/receives wireless signals. *Dec.*, ¶131.

Thorn is also reasonably pertinent to the particular problem with which the inventor of the ’246 Patent was involved because it is directed to solving the same problem of using the mobile terminal device to help locate Bluetooth tag attached to an object. *Dec.*, ¶132.

G. Sharp

Sharp was filed on May 1, 2009, qualifying as prior art under §102(e). Sharp was not cited or considered during the prosecution of the ’246 Patent. “Because mobile devices are sized for portability, they easily can be misplaced.” *Sharp*, [0004]. “Also, because mobile devices often are carried to many different locations, they can be forgotten or lost.” *Id.* To solve this problem, Sharp teaches a mobile device that “can be remotely contacted and commanded to perform one or more operations, such as through the transmission of a message to the device.” *Id.*, [0007]. For example, a mobile device owner can “remotely issue one or more commands to the mobile device, including commands used to present a message or sound on the mobile device...or locate the mobile device.” *Id.*, [0009].

Sharp is analogous art because it is from the same field of endeavor. Sharp is directed to a mobile communication device that sends/receives wireless signals. *Dec.*, ¶138.

Sharp is also reasonably pertinent to the particular problem with which the inventor of the '246 Patent was involved because it is directed to solving the same problem of sending signals to remotely contact and locate a lost mobile device. *Dec.*, ¶139.

V. GROUND 1: CLAIMS 1 AND 11-14 ARE OBVIOUS OVER KALLIOLA, TURUNEN, OSWALD, VAUCLAIR, AND KALAYJIAN

A. Claim 1

1. *Claim 1[P]*

Kalliola teaches a “wireless **communication device**” (WCD) 100 that “may be anything from a basic cellular handset to a more complex device such as a wirelessly enabled palmtop or laptop computer.” *Kalliola*, [0034], [0004].⁴ Because the WCD may be a “cellular telephone or other handheld wireless device[,]” Kalliola teaches a mobile communication device.⁵ *Kalliola*, [0037], Figs. 1, 9A, 10; *Dec.*, ¶¶146-147.

⁴ All emphasis and annotations added by Petitioner unless noted otherwise.

⁵ Claim language identified with *italics* and underline for clarity.

2. *Claim 1(a)*

(a) **Kalliola’s Disclosure of “a plurality of wireless transceivers” Including Bluetooth and UWB Transceivers**

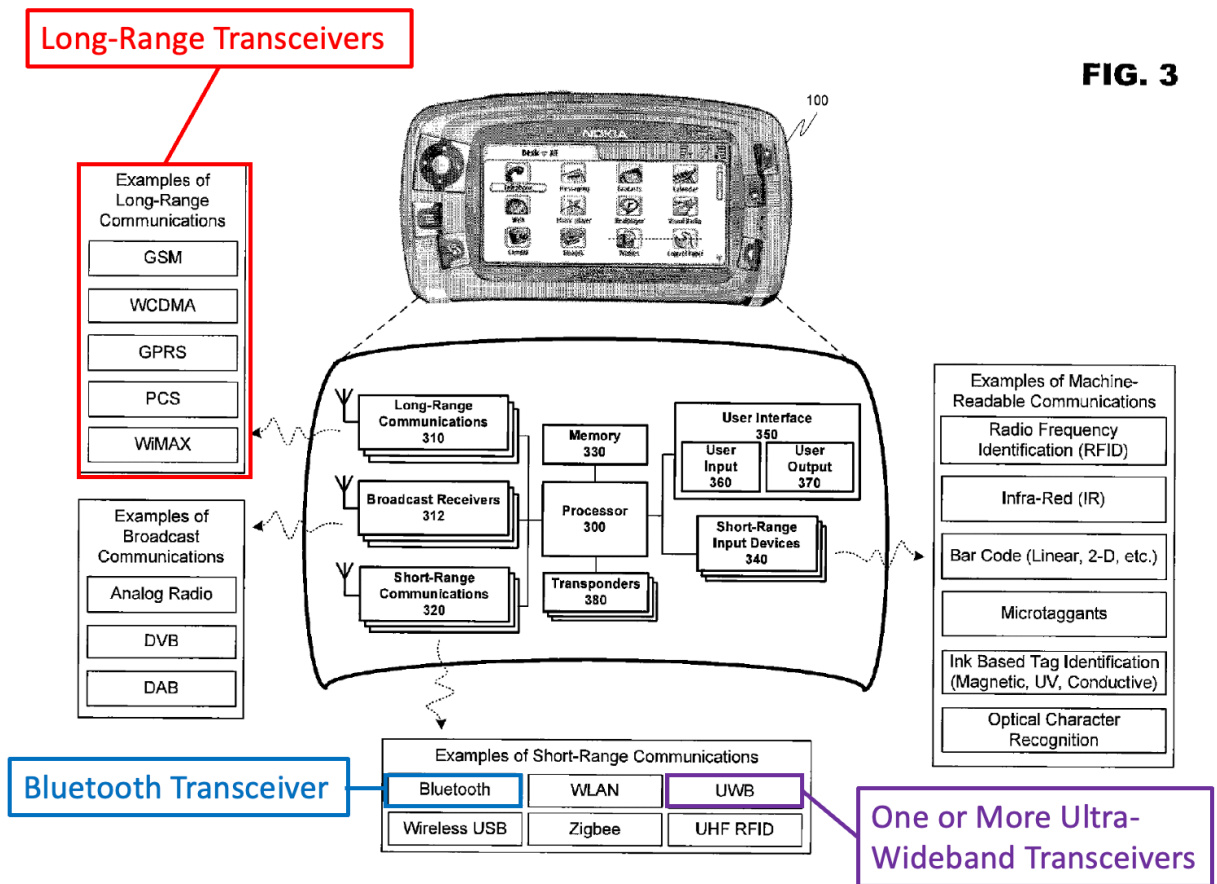
Kalliola’s WCD includes a communications module 230 having long-range communications module 232, 310 and short-range communications module 234, 320, which are a plurality of wireless transceivers used “to **receive** a multitude of different types of communication from both local and long distance sources, and to **transmit** data to recipient devices within the transmission range of WCD 100.” *Kalliola*, [0040], [0046], [0048], Fig. 2, [0052] (“Hardware corresponding to communications sections 310, 312, 320 and 340 provide for the **transmission and reception of signals.**”); *Dec.*, ¶149 (opining a transceiver transmits and receives signals).

Long-range communications 310 performs communication “over large geographic areas (such as cellular networks) via an antenna.” *Kalliola*, [0046]. Because the long-range communications transmits/receives information across a cellular network, it teaches a wireless transceiver, including a long-range transceiver. *Dec.*, ¶¶150-151, ¶156. Kalliola also at least inherently teaches the long-range communications is a long-range wireless transceiver because a POSITA would have known that to perform the disclosed wireless transmission/reception of voice/data across cellular networks, such as GSM, necessarily requires a long-range

wireless transceiver. *Id.*, ¶157. Finally, a POSITA would have found Kalliola renders obvious a long-range wireless transceiver at least because (1) Kalliola expressly suggests the long-range communications transmitting and receiving voice/data; (2) “the present invention may be implemented using a variety of wireless communication equipment”; and (3) wireless long-range transceivers were ubiquitous in mobile communication devices prior to the ’246 Patent’s effective filing date. *Kalliola*, [0004]-[0006], [0008], [0037]; *Dec.*, ¶158.

Short-range communications 320 performs short-range communications across “**wireless** networks,” including “processing related to the **transmission** and **reception** of information via such connections.” *Kalliola*, [0048]. Exemplary short-range communications 320 include “**Bluetooth™**, WLAN, **UWB** [ultra-wideband] and Wireless USB connections.” *Id.*, [0048], Fig. 3. Because the short-range communications module 320 transmits and receives information across Bluetooth and UWB wireless networks, it expressly or implicitly teaches a plurality of wireless transceivers including a Bluetooth transceiver...and one or more ultra-wideband transceivers. *Dec.*, ¶¶159-163. Kalliola also at least inherently teaches the short-range communications is a wireless transceiver because a POSITA would have known that to perform the disclosed wireless transceiver/reception of data across short-range networks necessarily requires a short-range transceiver. *Dec.*, ¶164. Finally, a POSITA would have found Kalliola renders obvious a short-range

transceiver at least because (1) Kalliola expressly teaches short-range communications transmits and receives wireless signals; (2) “the present invention may be implemented using a variety of wireless communication equipment”; and (3) short-range wireless transceivers were ubiquitous in mobile communication devices as of the 246 Patent’s effective filing date. *Kalliola*, [0006], [0008], [0037], [0048]; *Dec.*, ¶165.



Dec., ¶166 (citing *Kalliola*, Fig. 3).

A POSITA would have found it obvious and been motivated to include both a Bluetooth transceiver and a UWB transceiver in the WCD’s short-range

communications module 320, as expressly suggested by Kalliola. *Dec.*, ¶167. Per Kalliola, Bluetooth and UWB “avoid some of the problems seen in large cellular networks” and “have features and advantages that make them appropriate for various applications.” *Kalliola*, [0006].

Kalliola recognizes “Bluetooth™ is an example of a short-range wireless technology quickly gaining acceptance in the marketplace.” *Id.*; *Dec.*, ¶167 (opining cellular phones at the time of the ’246 Patent commonly included Bluetooth transceivers). Therefore, Kalliola expressly suggests including both Bluetooth and UWB transceivers in Kalliola’s WCD to take advantage of the “features and advantages” of the Bluetooth and UWB wireless networks. *Dec.*, ¶168. Given the predictability of standardized wireless communication protocols (e.g., Bluetooth and UWB), there would have been a reasonable expectation of success configuring Kalliola’s WCD to include Bluetooth and UWB transceivers. *Id.*

(b) Kalliola and Turunen teach “a long-range transceiver configured to send and receive telephone calls via a telephony network and to communicate Internet data”

Kalliola’s long-range communications module 310 is configured to send and receive telephone calls via a telephony network. Kalliola teaches module 310 is a cellular transceiver that sends/receives voice communications (telephone calls) via a cellular telephony network such as GSM. *Kalliola*, [0046], [0004]-[0005]; *Dec.*, ¶¶152-154.

Long-range communications module is also configured to enable data communication sessions via GPRS and/or UMTS. *Kalliola*, [0046], [0036] (disclosing wireless Internet access via long-range networks); *Dec.*, ¶169. In related art, Turunen teaches the specific type of data communicated using GPRS sessions. Turunen teaches a “method of transmitting **Internet data** between a mobile host and a remote host coupled via the Internet and a GSM/GPRS cellular telephone network.” *Turunen*, Abstract, 5:30-32 (discussing mobile host connected to the Internet via a cellular network). The network allows for communication of *Internet data*: “**Internet data** may be transmitted between the MH and the Internet via either of these links.” *Id.*, 5:33-38. Thus, Turunen teaches a mobile communication device that *communicates Internet data* via a GSM cellular network utilizing a GPRS link. *Dec.*, ¶170.

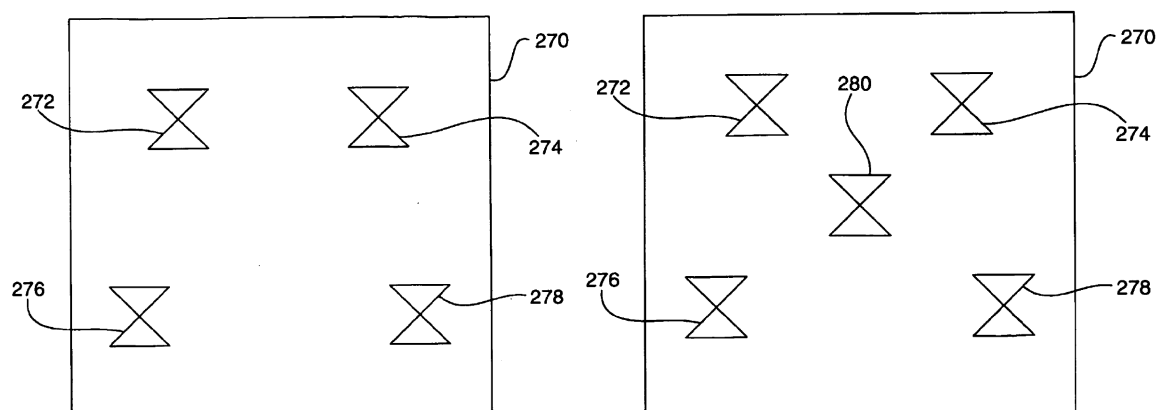
A POSITA would have found it obvious and been motivated to configure Kalliola’s cellular transceiver to communicate Turunen’s *Internet data* using a GPRS link. *Id.*, ¶171. Prior to the ’246 Patent, cellular devices that communicated internet data via 3G networks were common. *Id.* A POSITA would have been motivated to combine these prior art elements according to known methods to yield the predictable result of enabling Kalliola’s WCD to wirelessly communicate Internet data using GPRS data communication sessions on the GSM network. *Id.* GRPS was designed to handle Internet communications and was in use for a decade

prior to the '246 Patent; thus, there would have been a reasonable expectation of success configuring Kalliola's cellular transceiver to wirelessly communicate Internet data using GPRS data communication sessions. *Id.*

(c) Kalliola and Oswald teach “one or more ultra-wideband transceivers coupled to two or more antennas”

Kalliola teaches the Bluetooth transceiver is coupled to an array of six antennas. *Kalliola*, [0070], [0071], Fig. 6. Kalliola's WCD also includes a UWB transceiver, but Kalliola does not provide specificity regarding the UWB transceiver coupled to the antenna array. *Dec.*, ¶¶172-174.

Oswald teaches a similar positioning system to Kalliola, including an “object to be located 102, a transmitter 104 associated with or contained in the object 102 and outputting a signal 106, a pair of receiving apparatuses 200, 202, and a control unit 300.” *Oswald*, [0244], Fig. 1. Oswald teaches transmitting UWB signals. *Id.*, [0099], [0015], [0388]. Oswald's UWB receiver includes an array of four or five antennas 272-280 (*two or more antennas*):



Id., Figs. 16-17; [0345], [0346]; *Dec.*, ¶¶175-178.

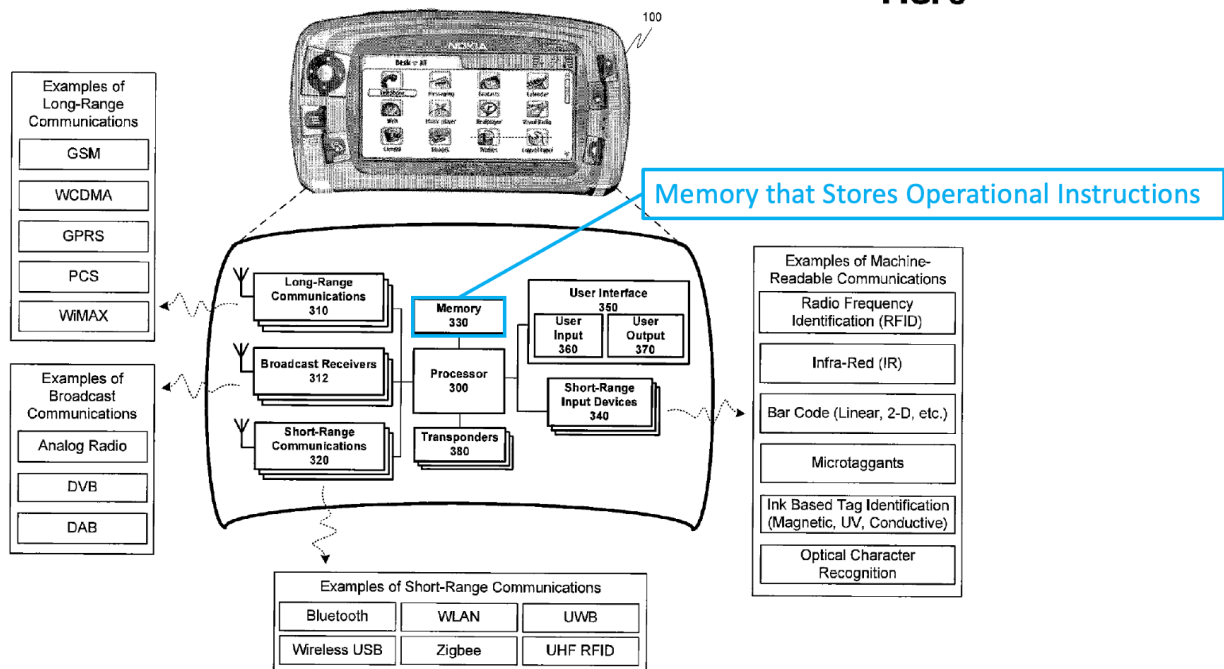
A POSITA would have found it obvious and been motivated to configure Kalliola's UWB transceiver to be coupled to a UWB antenna array, per Oswald. *Dec.*, ¶179. Oswald teaches "[t]he propagation characteristics of such [UWB] pulses can be relatively favourable in indoor applications" where "narrowband pulses can propagate poorly and/or highly unpredictably." *Oswald*, [0248]; *Dec.*, ¶¶181-182 (noting Bluetooth is narrowband and benefits of UWB indoors). A POSITA would have appreciated the user's personal items (keys/wallet) would often be indoors, such as in the user's house or office. *Id.*, ¶183. Utilizing UWB instead of Bluetooth would have advantageously provided high accuracy, even in harsh environments, due to its ability to resolve multipath and penetrate obstacles typical of indoor environments. *Id.* Thus, a POSITA would have been motivated to configure Kalliola's UWB transceiver to be coupled to an array of two or more antennas, per Oswald, to increase the accuracy of Kalliola's object-finding system and improve similar object-finding systems in the same way. *Id.*, ¶184. Additionally, a POSITA would have recognized that this modification to Kalliola's WCD would have represented a simple substitution of one known element (Kalliola's Bluetooth antenna array) for another (Oswald's UWB antenna array) to yield the predictable result of allowing Kalliola's WCD to perform Direction of Arrival (DoA) estimation (*see Kalliola*, [0060]) using UWB instead of Bluetooth. *Id.*, ¶185.

Given the well-known availability of technology to implement and generate UWB signals with relatively low complexity, there would have been a reasonable expectation of success configuring Kalliola's WCD to include one or more ultra-wideband transceivers coupled to two or more antennas, per Oswald. *Id.*, ¶186.

3. *Claim 1(b)*

Kalliola's WCD includes a memory 330, that stores operational instructions, namely "software components stored by memory 330 [that] include **instructions** that can be executed by processor 300." *Kalliola*, [0045]; *Dec.*, ¶¶187-189. Memory 330 "stores information in the form of data and software components (also referred to herein as modules)." *Id.*, [0044]. "[M]emory 330 may store software components that control the operation of communication sections 310, 320 and 340" and software components including "user interface manager." *Kalliola*, [0045]. One example of a software component is "a tracking application 922" that consists "of **an application in memory 330** executing on the main processor 300 of WCD 100[.]" *Id.*, [0080], Fig. 9B; *Dec.*, ¶188 (opining the tracking application is embodied as operational instructions). Therefore, memory 330 storing tracking application 922 teaches memory that stores operational instructions:

FIG. 3

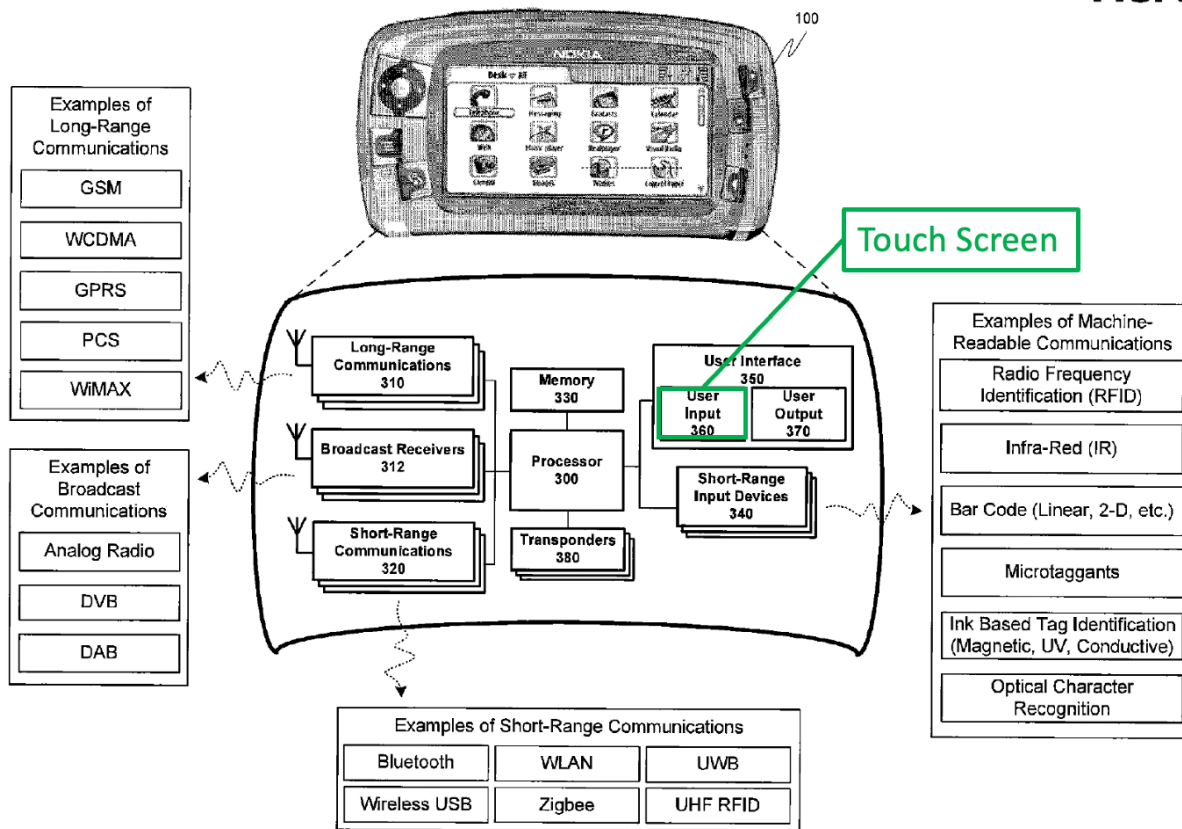


Dec., ¶189. (citing Kalliola, Fig. 3).

4. Claim 1(c)

Kalliola's WCD includes a user interface 350 that “includes a user input 360 and a user output 370.” *Kalliola*, [0050]. “User input 360 may include one or more components that allow a user to input information,” including “keypads, **touch screens**, and microphones.” *Id.* Therefore, user input 360 includes the claimed touch screen:

FIG. 3



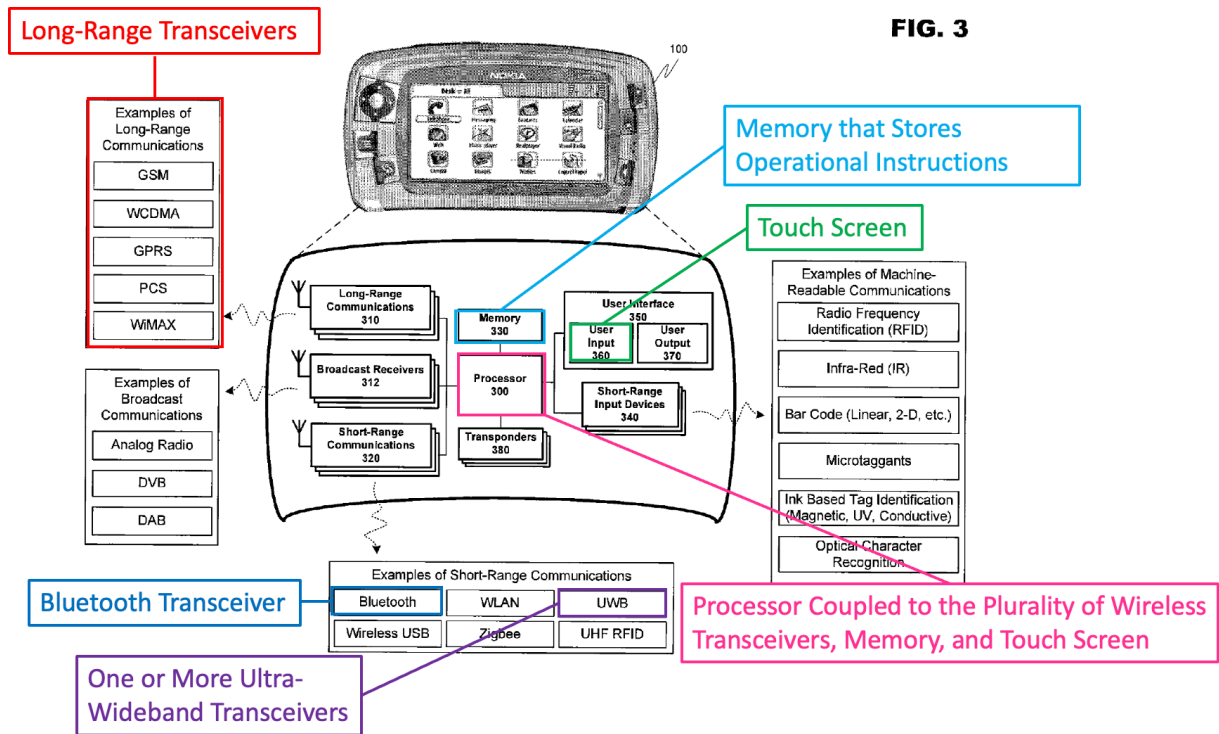
Dec., ¶190 (citing Kalliola, Fig. 3).

Although Kalliola's list of three input elements does not qualify as a large list of elements requiring an obviousness analysis, it would have been obvious to a POSITA to include a touchscreen as a user input 360 as expressly suggested by Kalliola. *Dec.*, ¶191. Mobile electronic devices, such as PDAs, included touchscreens for user input since at least the early 1990s. *Id.* Touchscreens were also ubiquitous in smartphones since Apple iPhone's release in 2007 (well before the 2010 priority date). *Id.* A POSITA would have been motivated to include a touchscreen, as Kalliola expressly suggests, thus representing a combination of prior

art elements according to known methods to yield predictable results. *Id.* Because touchscreens were well-known and conventional prior to the '246 Patent, there would have been a reasonable expectation of success incorporating a touchscreen as a user input element in Kalliola's WCD. *Id.*

5. Claim 1(d)(i)

Kalliola's WCD includes a processor 300 that "may be implemented with one or more microprocessors that are each capable of executing software instructions stored in memory 330." *Kalliola*, [0044]. Kalliola teaches "coupling separate hardware components corresponding to processor 300, communications sections 310, 312, and 320 [i.e., the plurality of wireless transceivers], memory 330, short-range input device 340, user interface 350, transponder 380, etc. through one or more bus interfaces." *Id.*, [0053]; *Dec.*, ¶¶192-194. User interface 350 includes user input 360, including a touch screen. *See* Claim 1(c). The WCD includes the claimed processor coupled to the plurality of wireless transceivers, the memory, and the touch screen:



Dec., ¶195 (citing Kalliola, Fig. 3).

6. Claim 1(d)(ii)

Kalliola expressly teaches a processor configured to execute operational instructions: “Processor 300 may be implemented with one or more microprocessors that are each capable of **executing software instructions** stored in memory 330.” Kalliola, [0043], [0045]. “Processor 300 **controls overall device operation**.” *Id.*, [0043]. Exemplary operational instructions include “a tracking application 922” that consists “of an application in memory 330 **executing on the main processor 300** of WCD 100[.]” *Id.*, [0080]; Claim 1(b).

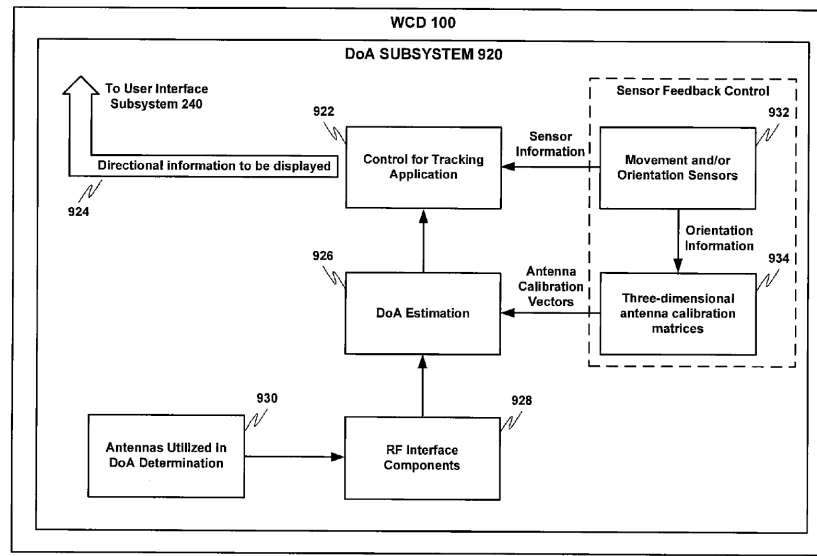
A POSITA would have understood or found obvious that for each Challenged Claim’s step, Kalliola’s processor alone or Kalliola’s processor as modified to

perform the claimed step would execute the operational instructions to cause the processor to perform the claimed step. *Dec.*, ¶141. Kalliola teaches “Processor 300 **controls overall device operation**” and WCD 100 (which includes processor 300) “implements the functionality” of the disclosed system. *Kalliola*, [0043]. The Kalliola processor executing software instructions, such as tracking application 922, causes the processor to perform the claimed step or such is obvious, at least because the processor “controls overall device operation.” *Id.*, [0043]; *Dec.*, ¶¶142-145. If the mapping requires modification of Kalliola’s system to perform the claimed step, a POSITA would have understood it would have been obvious for the Kalliola processor and stored software instructions to perform the claimed step per the motivations to combine provided in the mapping for the claimed step. *Dec.*, ¶145, ¶196.

7. *Claim 1(d)(iii)*

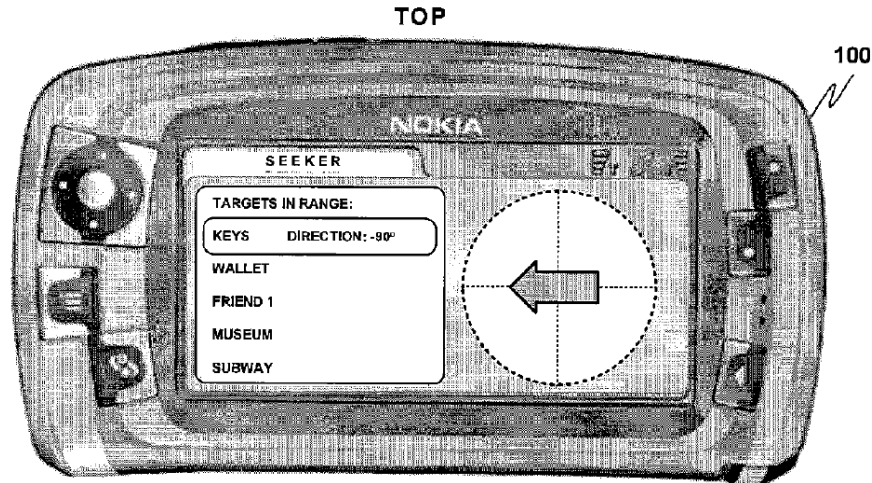
Kalliola’s tracking application 922 causes the processor to present a graphical user interface via the touch screen. The tracking application outputs “Directional Information to be displayed” to the “User Interface Subsystem 240.”

FIG. 9B



Kalliola, Fig. 9B; [0080] (disclosing displaying direction), [0041] (disclosing UI module 240 including “visual, audible and tactile elements” allowing user to enter and receive data), [0043]. The user interface functions are implemented by user interface 350, which includes a touchscreen as part of user input 360. *Id.*, [0050], Fig. 3; Claim 1(c). Thus, tracking application outputs the directional information to user interface module, which is implemented via a touchscreen. *Dec.*, ¶¶197-200.

Figure 5 depicts an exemplary graphical user interface (GUI) depicting the directional information:

EXAMPLE DEVICE INCLUDING RELATIVE DIRECTION INDICATING DISPLAY

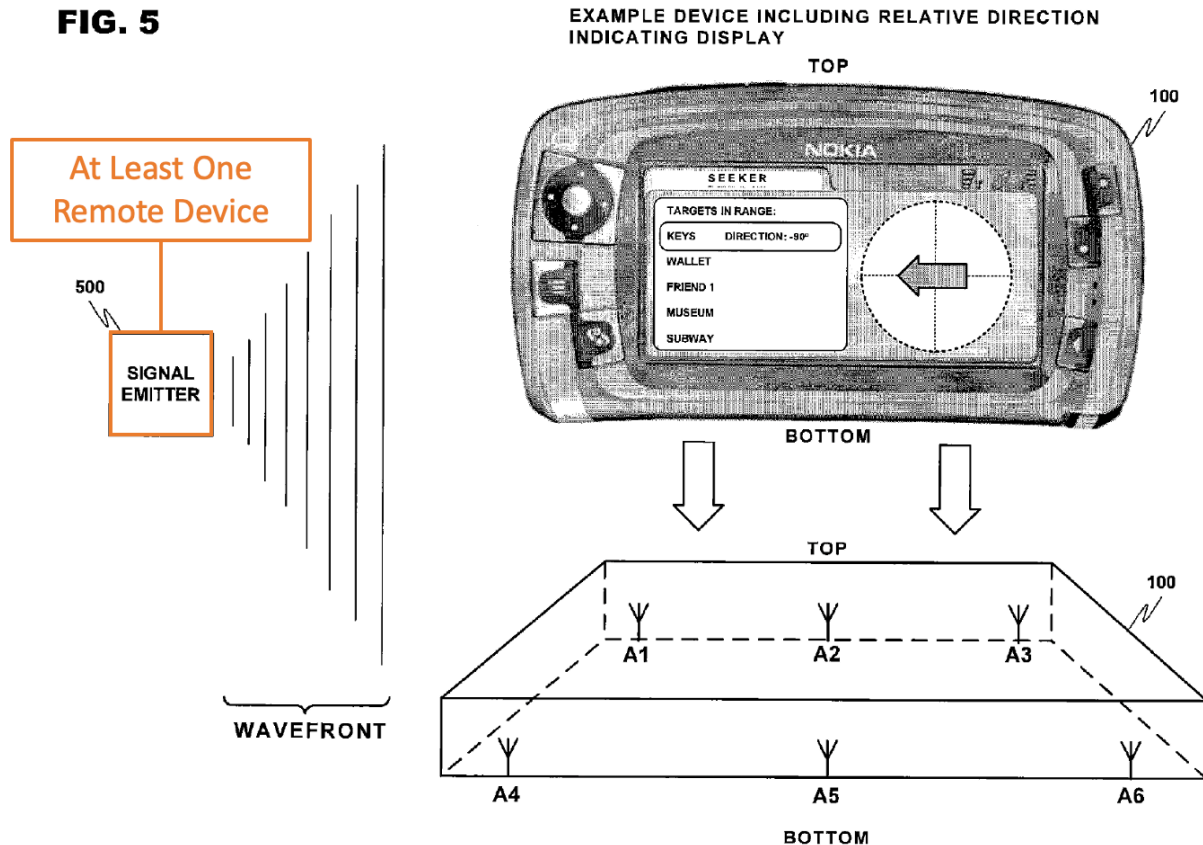
Kalliola, Fig. 5 (excerpt).

8. Claim 1(d)(iv)

(a) Kalliola's Disclosure of "at least one remote device"

Kalliola teaches signal emitters 500 attached to a plurality of "possible target objects," such as a user's keys, wallet, ID badge, etc. *Kalliola*, [0069], Fig. 8 (RN 802). The signal emitters, which include Bluetooth-enabled emitters, include "battery-operated transmitters in a keychain, in a wallet...." *Id.*, [0075], [0071] (disclosing incorporating a signal emitter 500 as a Bluetooth chipset in a keychain). A target object is remote from the WCD, and its associated signal emitter 500 is "activated remotely by a user as needed." *Id.*, [0075]. "[T]he device may operate in a lower power or power conservation mode until a message is received instructing a device to activate the position-indicating transmission signal." *Id.* The remote activation message may be "a Bluetooth™ message." *Id.* In the Fig. 5 example, a

signal emitter 500 is attached to the user's keys, thus teaching the claimed at least one remote device:

FIG. 5

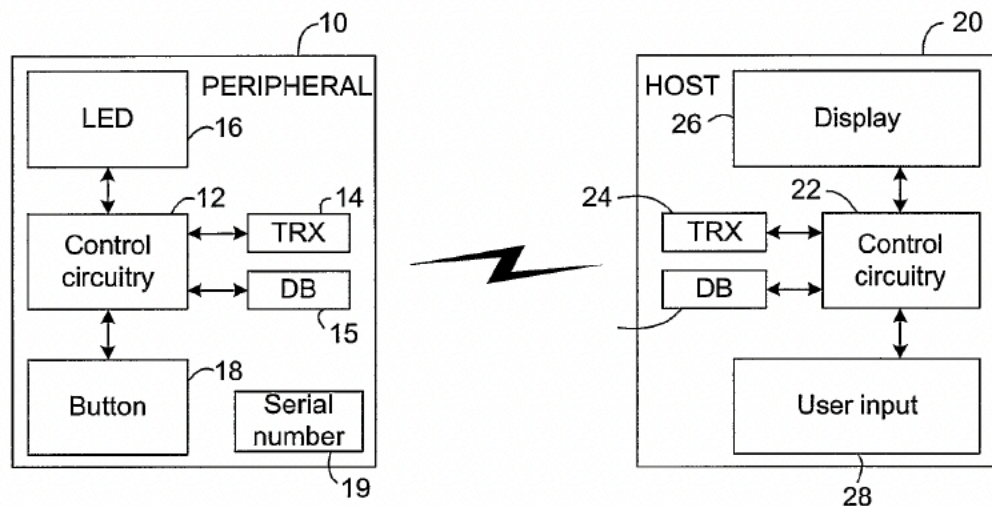
Dec., ¶201 (citing Kalliola, Fig. 5); Kalliola, Fig. 6.

Kalliola teaches the WCD communicates with the signal emitter via Bluetooth. *Kalliola*, [0074]-[0075]. In related art, Vaclair teaches the specifics of a Bluetooth pairing process.

(b) Vaclair's Disclosure Regarding Pairing

Vaclair teaches a pairing process between a first electronic device 10, which "is regarded as a peripheral device," and a second electronic device 20, which "is regarded as a host device," such as a "mobile telephone." *Vaclair*, [0022]. The first

and second devices “communicate according to any wireless or wired protocol” including “Bluetooth.” *Id.* Both the peripheral/first and host/second devices 10, 20 include suitably programmed processors connected to transceiver (TRX) circuitry 14, 24 for handling “radio frequency communications with other electronic devices able to use the same wireless protocol.” *Id.*, [0024], [0028].



Id., Fig. 1; *Dec.*, ¶¶203-204.

Vauclair teaches a pairing process where the user “establish[es] an ad hoc wireless network between the first and second electronic devices 10, 20” by “operat[ing] the host device 20[.]” *Id.*, [0036], [0034]-[0035]. “For example, **to initiate the process, the user may select a pairing option from a menu, using the user input 28.**” *Id.*, [0036], [0030] (disclosing user input 28). Thus, Vauclair teaches a pair request from a user received at the graphical user interface, where the user initiates the pairing process by **selecting a pairing option** from a menu. *Dec.*, ¶205.

After the user initiates the pairing process, “the host device 20 then seeks a nearby peripheral device...by sending a beacon signal...containing its identification.” *Vauclair*, [0037], Figs. 2-3. *Vauclair* teaches a series of steps are performed to complete the pairing process. *Id.*, [0039]-[0040], [0047]-[0049], [0051]-[0052], [0054], [0056], Fig. 2. Thus, *Vauclair* teaches that in response to a pair request from a user received at the graphical user interface (i.e., the user’s selection of the pairing option from the menu), the host device’s control circuitry causes the transceiver to pair the mobile communication device with at least one remote device. *Dec.*, ¶¶206-210.

(c) The Combination of Kalliola and Vauclair Teaches Claim 1(d)(iv)

In the mapped combination, Kalliola’s tracking application executing on processor 300 is modified to pair Kalliola’s WCD and signal emitter 500 in response to a pair request from a user received at the graphical user interface, per *Vauclair*. *Dec.*, ¶211. Kalliola’s WCD includes a touchscreen for receiving user inputs, and *Vauclair* teaches a user selecting a pairing option from a menu. Thus, Kalliola-*Vauclair* collectively teaches a mobile communication device with a touchscreen (Kalliola’s WCD) displaying a menu from which the user can select a pairing option (*Vauclair*). *Id.*

Vauclair also teaches the host device’s control circuitry responds to a pair request from a user received at the graphical user interface by causing the host

device's transceiver circuitry to communicate a series of pairing signals with the peripheral device, which pairs the host and peripheral devices. *Vauclair*, [0036], [0049]. In the modification, Kalliola's tracking application is configured to display a pairing menu on the GUI and cause the WCD's Bluetooth transceiver to pair the WCD with the signal emitter in response to a pair request from a user received at the graphical user interface, per *Vauclair*. *Dec.*, ¶211.

(d) Motivation to Combine

A POSITA would have found it obvious and been motivated to modify Kalliola's tracking application to include a Bluetooth pairing menu, per *Vauclair*. *Id.*, ¶212. Bluetooth pairing allows two Bluetooth devices to recognize each other on subsequent connections. *Id.* Kalliola's WCD would need to be paired with the signal emitters associated with the user's personal items to recognize the signal emitters during subsequent connections. *Id.*

The Kalliola-Vauclair modification would have been obvious at least for combining prior art elements according to known methods to yield predictable results. *Id.*, ¶213. The claim requires the well-known element of pairing two devices in response to a user's pairing request. *Id.* Kalliola describes WCD communicating with a remote signal emitter via a Bluetooth transceiver but does not include the specifics of the initial Bluetooth pairing process between the devices. *Id.* *Vauclair* describes allowing the user to select a pairing option from a menu on a host device,

causing the host device's transceiver to communicate a series of pairing signals to the peripheral device to complete a pairing process. *Id.* The only difference between the claim and the prior art is the combination of the known prior art elements into a single device by incorporating Vauclair's pairing process into Kalliola's WCD without a change to the respective functions of either Kalliola's WCD or Vauclair's pairing process. *Id.*

Bluetooth pairing and GUIs allowing users to initiate Bluetooth pairing/signaling were known at the '246 Patent, indicating a reasonable expectation of success in the combination. *Id.*, ¶214.

9. Claim 1(d)(v)

(a) Kalayjian's Teachings

Kalayjian teaches a wireless object location system including a first device 310 and a second device 320, which "can be any devices capable of communicating using a Bluetooth protocol but in this instance are cellular phone 310 and headset 320." *Kalayjian*, [0032], [0033]-[0034]. "Headset 320 can have speaker 324 to emit sounds operable to guide a user to its location." *Id.*, [0034].

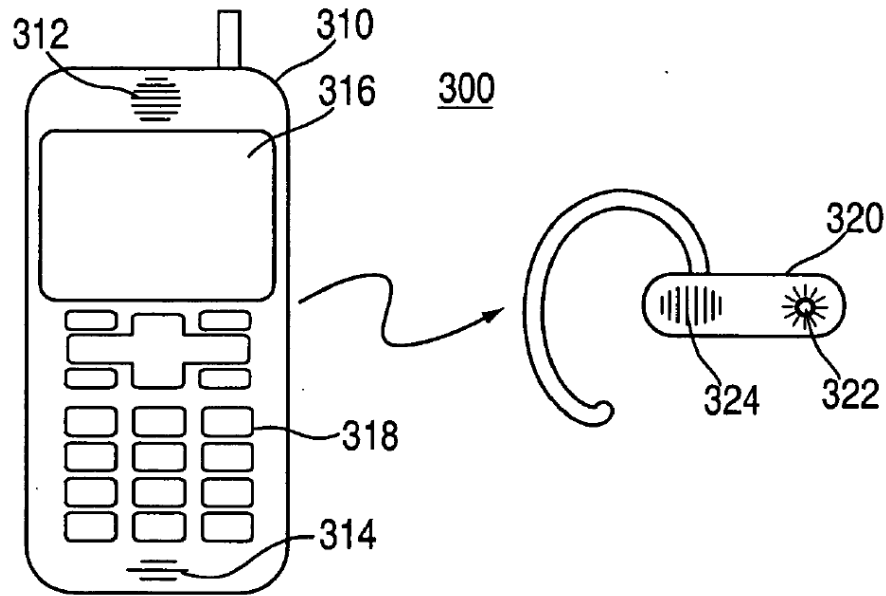
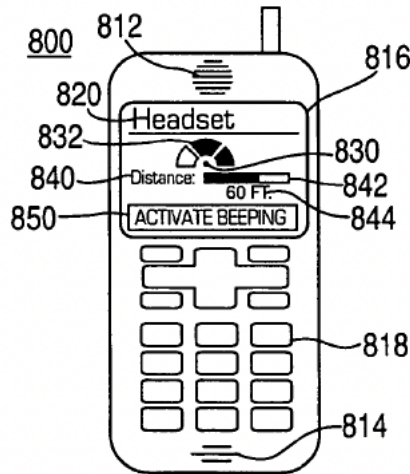


FIG. 3a

Id., Fig. 3a; *Dec.*, ¶215.

Kalayjian teaches the first device responds to an audio alert request from the user received at the graphical user interface by transmitting a Bluetooth message to the second device, causing the second device to generate an audio alert: “FIG. 8 includes a screenshot of the user interface of master device 800 when the master device is attempting to locate a slave device.” *Kalayjian*, [0049]. “Screen 816 can include **graphical button 850 to enable the user to prompt the slave device to beep[.]**” *Id.*



Id., Fig. 8. Then “the master device transmits a signal to a slave device using a Bluetooth communications protocol[,]” and “the slave device takes a predetermined action to guide a user to its location[,] such as **emitting a sound**[.]” *Id.*, [0054], Fig. 10, Abstract; *Dec.*, ¶216.

Because Kalayjian, [0049] and Fig. 8 teaches user selects graphical button 850 (“ACTIVATE BEEPING”) to prompt the second device to beep, Kalayjian teaches an audio alert request from the user received at the graphical user interface. *Dec.*, ¶217. Because Kalayjian teaches that in response to the user selecting button 850 ([0049]), the first device “transmits a signal to a slave device” via Bluetooth that causes the second device 320 to beep ([0054]), Kalayjian teaches transmit[ting] an audio alert request signal to the at least one remote device via the Bluetooth transceiver. *Dec.*, ¶218.

(b) Motivation to Combine

A POSITA would have found it obvious and been motivated to modify Kalliola's signal emitter to include a speaker, as taught by Kalayjian. *Dec.*, ¶219. Likewise, a POSITA would have found it obvious and been motivated to modify Kalliola's WCD to cause transmission of an audio alert request signal to signal emitter to cause it to generate an audio alert. *Id.* It would have been obvious to a POSITA to modify the tracking application's GUI to allow the user to input an audio alert request. *Id.* For example, it would have been obvious to include an "ACTIVATE BEEPING" graphical button, as taught by Kalayjian, on the GUI of the tracking application such that the user's interaction with the touchscreen causes the Bluetooth transceiver to transmit an audio alert request signal that causes the signal emitter to generate a sound. *Id.*

Per Kalayjian, causing the remote device to emit a sound "allows a user to follow the sound...to the misplaced object," thus improving Kalayjian's system. *Kalayjian*, [0039]. Therefore, Kalayjian expressly teaches a motivation for enabling signaling of an audio alert. *Dec.*, ¶220. A small object may be nearby but hidden from view by other objects. *Id.*, ¶¶221-223. Causing the signal emitter to emit an audio alert, per Kalayjian, would have allowed the user to follow the sound to the lost object. *Id.*

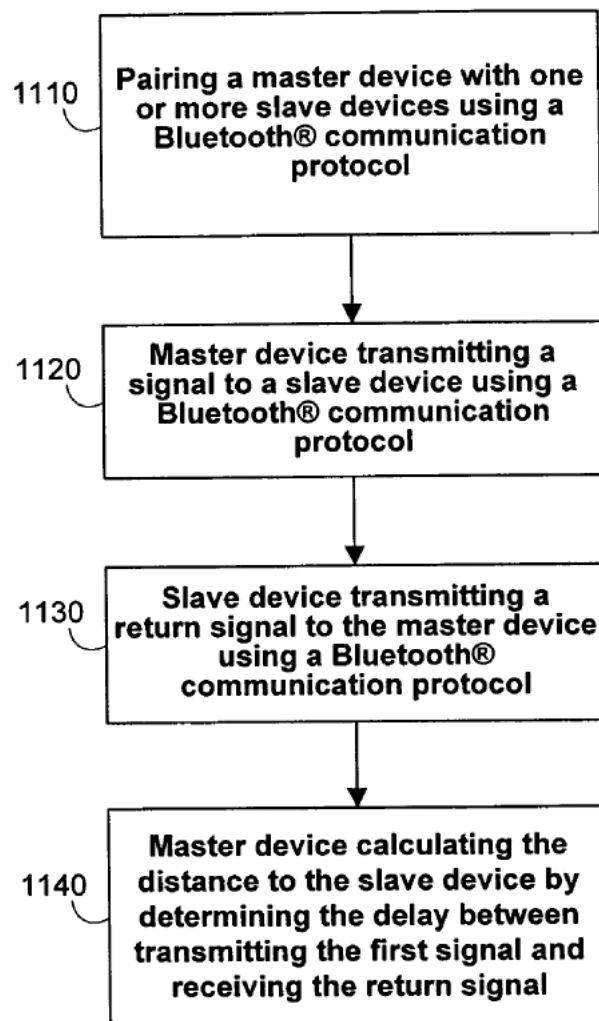
Object-finding systems using wireless signals to trigger auditory alerts were well-known prior to the '246 Patent. *Id.*, ¶¶224-225. Modifying Kalliola's tracking application to include a graphical button to initiate the audio alert would have only required minor software and hardware changes and not changed the principle of operation of Kalliola's tracking application. *Id.* Incorporating a speaker in a small device, such as Kalliola's keychain ([0069]), was known per Kalayjian, indicating the combination's reasonable expectation of success. *Id.*

10. Claim 1(d)(vi)

(a) Kalayjian's Teachings

Petitioner applies THL's construction of time of flight calculations as "determining the amount of time between when a signal is transmitted and when a reply signal is received." *See* Section III.C. Kalayjian's system estimates the distance between the first and second devices based on communications between the devices and by determining the elapsed time between a signal being transmitted by the first device and a reply signal being received from the second device. Specifically, "the master device transmits a signal to a slave device" and "the slave device transmits a return signal to the master device[.]" *Kalayjian*, [0055], Fig. 11 (steps 1120-1130). "At step 1140, the master device ***calculates the distance*** to the slave device ***by determining the amount of time delay*** between ***transmitting*** its signal to the slave device and when it ***receives*** a return signal from the slave device." *Id.*, [0040]. "The

master device can use the known speed of radio waves and the known response time of the slave device when calculating the distance.” *Id.*, [0055], [0041] (“The distance between the devices can be calculated by comparing the amount of time delay between the transmission of the signal sent from the master device to the slave device and the reception of the return signal from the slave device.”).



Id., Fig. 11.

Thus, Kalayjian teaches estimating a distance by determining the amount of time between a signal being transmitted by the first device and a reply signal being received from the second device (*time of flight calculations*). *Dec.*, ¶¶227-229.

(b) Motivation to Combine

It would have been obvious to a POSITA to configure Kalliola's WCD to include a UWB transceiver coupled to an antenna array, per Oswald's teachings. *See*, Claim 1(a). Oswald, like Kalayjian, teaches "the delay between transmission and reception of a pulse" is "proportional to the range [i.e., distance] between the transmitter and receiver[.]" *Oswald*, [0286], [0288] ("The...computed range delay 432 is multiplied by the speed of light to obtain a measure of the distance between the relevant receiving unit and the transmitter."); *Dec.*, ¶¶230-231. Per Kalayjian's teachings, it would have been obvious to a POSITA to configure the WCD modified in view of Oswald to estimate a distance between the WCD (the mobile communication device) and the signal emitter (the at least one remote device) based on ultra-wideband communication between the one or more ultra-wideband transceivers and the at least one remote device and time of flight calculations. *Dec.*, ¶230.

Kalliola provides "a *directional* and/or location finding method and system that allows a user to track or locate a signal beacon[.]" *Kalliola*, [0011]. Providing the user with the estimated *distance* from the WCD to the signal emitter, per

Kalayjian, would have enhanced the user's ability to locate the object associated with the signal emitter. *Dec.*, ¶232. For example, Kalliola's Fig. 5 shows the user's keys are located 90° to the left. *Kalliola*, Figs. 5. Providing both the estimated *distance* and *direction* to the signal emitter (e.g., 10 feet at 90° to the left) would provide the advantage of additional data to assist the user in locating the object. *Id.* A POSITA would have been motivated to configure Kalliola's WCD to estimate the distance to the signal emitter based on round trip time of flight calculations, per Kalayjian, to improve similar object-finding systems in the same way. *Id.*

Oswald recognizes that UWB transmissions are more favorable for indoor applications than narrowband transmissions (Bluetooth) because "narrowband pulses can propagate poorly and/or highly unpredictably." *Oswald*, [0278]; *Dec.*, ¶233. A POSITA would have appreciated the user's personal items would often be indoors, such as in the user's house. *Id.* Utilizing UWB instead of Bluetooth indoors would have been advantageous because UWB technology provides high accuracy, even in harsh environments, due to its ability to resolve multipath components and penetrate obstacles typical of indoor environments. *Id.* Therefore, a POSITA would have been motivated to implement Kalayjian's round-trip time of flight technique using UWB to predictably improve the accuracy of the distance estimate in indoor environments. *Id.*

Estimating distance using round-trip time of flight calculations of UWB transmissions was well-known and even incorporated into the IEEE 802.15.4a standard prior to the '246 Patent. *Id.*, ¶234. Thus, there would have been a reasonable expectation of success configuring Kalliola's WCD to perform Kalayjian's distance estimation technique using UWB communications. *Id.*

11. Claim 1(d)(vii)

Petitioner applies THL's construction of signal delay as the "difference in time between when a signal is received at two or more antennas." *See*, Section III.C. Both Kalliola and Oswald teach determining a direction based on signal delay. Oswald expressly teaches determining direction based on signal delay of UWB communications between two or more antennas and the at least one remote device.

(a) Kalliola's Teachings

Kalliola teaches determin[ing] a direction...based on signal delay. Kalliola teaches performing a Direction of Arrival (DoA) estimation to "determin[e] a relative direction towards a beacon device emitting a locator signal." *Kalliola*, [0013]. Kalliola's WCD "employs signals received on multiple antennas in a Direction of Arrival ("DoA") signal processing scheme in order to determine a relative direction to a target from WCD 100." *Id.*, [0060]. "[T]he direction of arrival of the incident signal (e.g., the position-indicating transmission) is resolved based

on the phase and possibly amplitude differences of signals received by the elements of an antenna array.” *Id.*

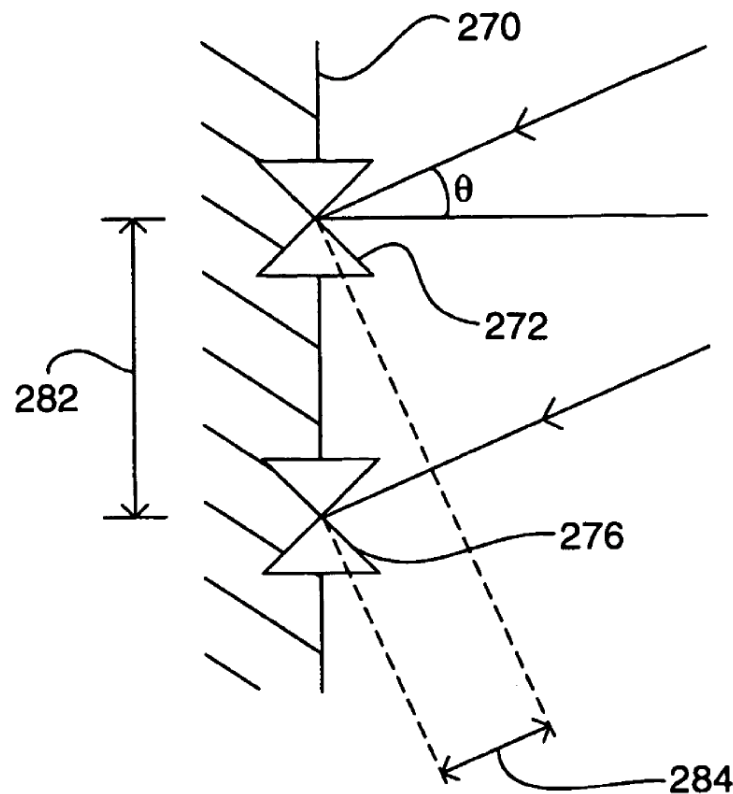
In the parallel litigation, THL’s Declarant opined that signal delay can be measured as a time delay or a phase delay of the signal. *THL’s Expert Report* (Ex. 1012), 4 (“Therefore signal delay...can be measured as phase delay or time delay.”). Per THL, the claimed signal delay is met by determining **phase delay** of a signal. Because Kalliola teaches determining a direction to a target based on a phase of signals received at the antenna array, Kalliola teaches determin[ing] a direction to the at least one remote device based on a signal delay...between the two or more antennas and the at least one remote device, applying THL’s interpretation of the limitation. *Dec.*, ¶¶236-237.

A POSITA would have looked to related art, such as Oswald, for the express teaching of the signal delay being based on UWB communications or the UWB transceiver coupled with the antenna array, discussed for Claim 1(a). *Id.*, ¶237.

(b) Oswald’s Teachings

Oswald teaches a method of determining a direction to a remote transmitter based on the time difference between when a UWB pulse is received at two or more antennas. Oswald teaches a UWB receiver that includes an antenna array having four antennas. *Oswald*, [0345] (“[T]he array substrate 270 contains four antennas 272, 274, 276, 278 formed on the substrate.”), Fig. 16. “FIG. 18 is a side-view of the

sensor array in operation” where “the antennas 272, 276 are again mounted on the substrate 270, and receive a signal from an object[.]” *Id.*, [0351]. “It can be seen that **the signal arrives at the antennas 272, 274, 276, 278 at different times** dependent upon the transmitting object’s three-dimensional location with respect to the receiving unit.” *Id.* “The elevation angle θ and the signal path length difference 284 (which is proportional to **the time delay between reception of the signal at both antennas 272, 276**) are shown.” *Id.*



Id., Fig. 18.

Oswald teaches using the times that the UWB signal is received at each antenna to determine the azimuth ϕ and elevation θ directions to the remote

transmitter: “More specifically, the times at which the reflected signals will be received by the receiving elements are times $Tr1$, $Tr2$, $Tr3$, $Tr4$, respectively[.]” *Id.*, [0350]. Based on the signal receipt times for each of the antenna elements $Tr1$, $Tr2$, $Tr3$, $Tr4$, the following set of equations are solved for the azimuth ϕ and elevation θ angles:

$$Tr1=(2R5+(-D14 \sin(\theta)+D12 \sin(\phi))/2)/c$$

$$Tr2=(2R5+(-D23 \sin(\theta)-D12 \sin(\phi))/2)/c$$

$$Tr3=(2R5+(D23 \sin(\theta)-D34 \sin(\phi))/2)/c$$

$$Tr4=(2R5+(D14 \sin(\theta)+D34 \sin(\phi))/2)/c$$

Id., [0350] (“The above equations can be solved...to obtain the angles θ and ϕ .”).

Thus, Oswald teaches Claim 1(d)(vii). *Dec.*, ¶¶238-240.

(c) Motivation to Combine

The proposed combination includes either (1) Kalliola’s teaching of determining signal delay (DoA) modified to include Oswald’s UWB signals; or (2) modifying Kalliola’s system to include Oswald’s signal delay teaching for UWB communications, to the extent that it is determined that phase delay does not meet the signal delay limitation. *Dec.*, ¶¶241-242.

Kalliola recognizes “[t]he DoA estimation accuracy decreases in the presence of multipath propagation or noise.” *Kalliola*, [0064]. “Multipath radio propagation

causes fading that can lead to rapid changes of the DoA estimates and temporary mispointings.” *Id.*, [0065]. To overcome this problem, Kalliola teaches a tracking algorithm that registers several DoA estimates and chooses the highest average power. *Id.* A POSITA would have understood a simpler system for addressing Kalliola’s discussed problems of multipath propagation or noise would be employing a UWB transceiver to send UWB communications in indoor environments, per Oswald. *Dec.*, ¶¶243-244.

Oswald notes that narrowband transmissions, such as Bluetooth, “can propagate poorly and/or highly unpredictably” in indoor environments. *Oswald*, [0278]; *Dec.*, ¶245. Per Oswald, the propagation characteristics of UWB transmissions are more favorable for indoor applications than narrowband transmissions. *Oswald*, [0278].

As mapped for Claim 1(a), Kalliola’s antenna array is substituted with Oswald’s UWB antenna array, such that Kalliola’s UWB transceiver is coupled to Oswald’s antenna array. *See* Claim 1(a). With this modification, Kalliola’s WCD is equipped to perform UWB communications using the antenna array to determine a direction to the at least one remote device based on signal delay of ultra-wideband communications utilizing either (1) Kalliola’s DoA estimation; or (2) Oswald’s direction-finding method based on the signal delay of UWB pulses received at the antenna elements. *Dec.*, ¶¶246-248. Considering the known weaknesses of both

narrowband transmissions indoors and Kalliola's DoA estimation in the presence of multipath propagation (e.g., from Bluetooth communications), the modification represents use of a known technique (signal delay estimation for direction determination, per either Kalliola or Oswald, using UWB communications, per Oswald) to a known device (Kalliola's UWB transceiver modified to be coupled to an antenna array) to improve similar devices (Kalliola's WCD) in the same way (Oswald's express advantages of performing UWB communications). *Id.*, ¶249.

A POSITA would have appreciated that the user's personal items would often be indoors. *Id.* A POSITA would have understood that utilizing either Kalliola's DoA method with UWB signals or Oswald's UWB signal delay method employing UWB pulses would have been advantageous because UWB technology provides high accuracy, even in harsh environments, due to its ability to resolve multipath and penetrate obstacles typical of indoor environments. *Id.*; *see also* Section VI.A.10.b. This modification would have predictably increased the accuracy of the WCD's directional measurements, thereby improving similar object-finding systems in the same way. *Dec.*, ¶249.

There would have been no change to Kalliola's principle of operation because the WCD would still provide the relative direction to the signal emitter to the user. *Id.* Moreover, determining the direction to a transmitting target based on the time difference between when a UWB pulse or signal is received at two or more antennas

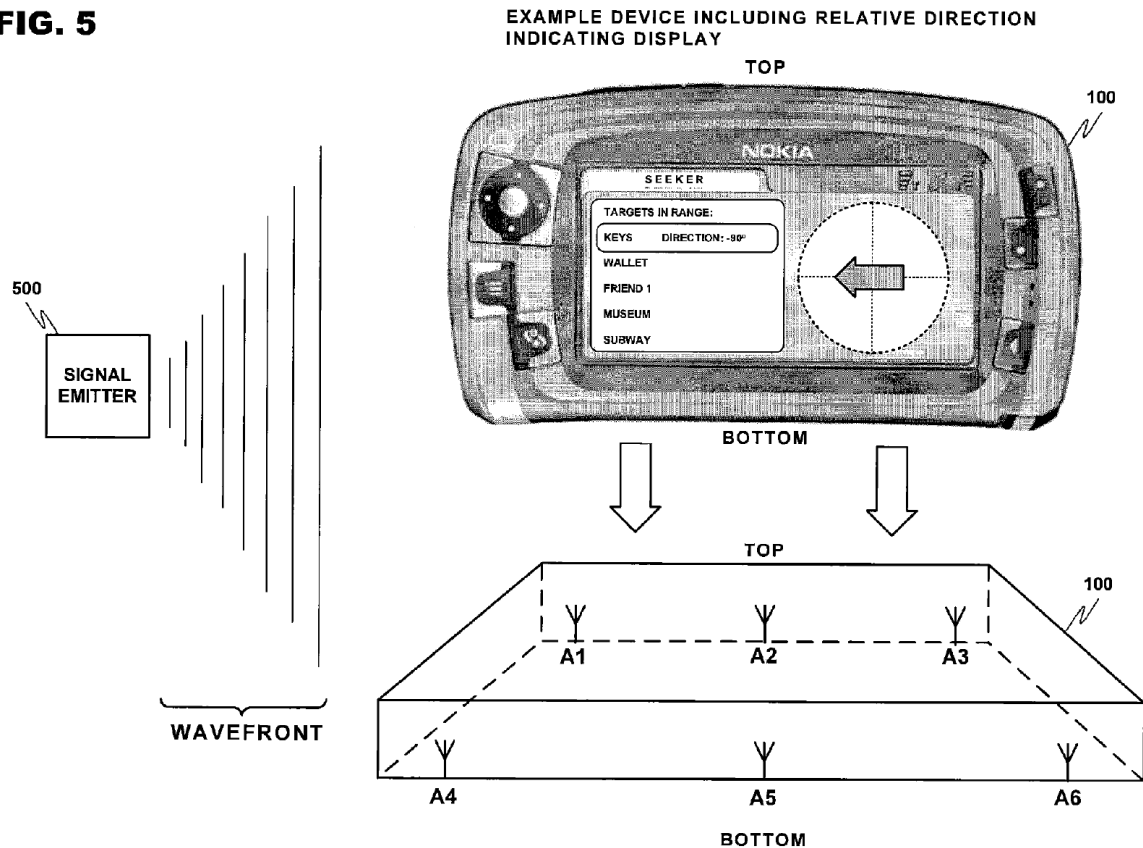
was well-known prior to the '246 Patent. *Id.* Thus, there would have been a reasonable expectation of success configuring Kalliola's WCD to determine the direction to the signal emitter based on the time difference between when the UWB signal or pulse is received at the antennas of the antenna array. *Id.*

12. Claim 1(d)(viii)

(a) Kalliola's Disclosure an Arrow

Kalliola's tracking application executing on the processor outputs to the graphical user interface...an arrow pointing in the direction of the at least one remote device. Figure 5 is a screenshot of an exemplary GUI including directional information output by the tracking application. *See* Claim 1(d)(iii). Here, "the display shows both a list of possible target objects and **an arrow pointer**" pointing in the direction of the selected KEYS signal emitter. *Kalliola*, [0069].

FIG. 5

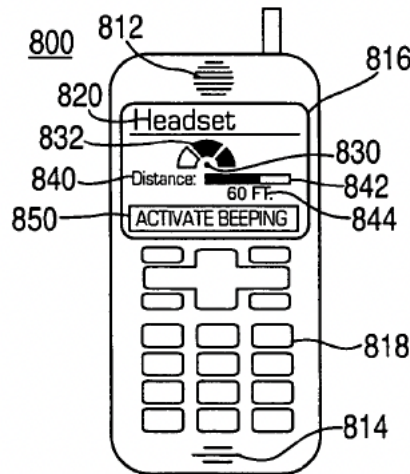


Id., Fig. 5, Fig. 6, [0069] (“The display shows the **directional arrow pointing in the direction of the keys**, and gives a relative direction measurement towards the keys of -90° .”); *Dec.*, ¶250.

(b) Kalayjian’s Teachings Regarding Distance

Kalayjian teaches output[ting] to the graphical user interface the estimated distance to the at least one remote device. “FIG. 8 includes a screenshot of the user interface of master device 800 when the master device is attempting to locate a slave device.” *Kalayjian*, [0049]. “Screen 816 can include **distance graphic 840** to identify the distance between the selected slave device and master device 800.

Distance graphic 840 can include a symbolic representation 842 of distance, for example, a horizontal bar graphic or a numeric representation of distance 844.” *Id.*



Id., Fig. 8; *Dec.*, ¶251.

(c) Motivation to Combine

A POSITA would have found it obvious and been motivated to configure Kalliola’s tracking application’s GUI to also display the estimated distance to the signal emitter, per Kalayjian. *Dec.*, ¶252. Kalliola’s WCD displays a screen assisting the user in determining the location of the signal emitter by displaying an arrow pointing in the emitter’s direction. *Kalliola*, Figs. 5-6. Displaying both the *distance* and *direction* to the signal emitter would have predictably enhanced the user’s ability to quickly locate the target object, thereby enhancing user satisfaction. *Dec.*, ¶252. Kalayjian expressly teaches such, repeatedly stating the desire for the system to “guide a user to [the second device’s] location.” *Kalayjian*, Abstract, [0038]; *Dec.*, ¶253. For these reasons, a POSITA would have been motivated to use Kalayjian’s

known technique of providing a GUI that includes an estimated distance to the remote device to improve similar object-finding systems in the same way. *Id.*

A POSITA would have understood that including a distance graphic on the GUI of Kalliola's tracking application would have only required minor software changes. *Id.*, ¶254. Thus, there would have been a reasonable expectation of success configuring Kalliola's WCD to output to the tracking application's GUI the estimated distance to the signal emitter as taught by Kalayjian. *Id.*

B. Claim 11

1. Claim 11[P]

See Claim 1[P].

2. Claim 11(a)

See Claim 1(a).

3. Claim 11(b)

See Claim 1(b).

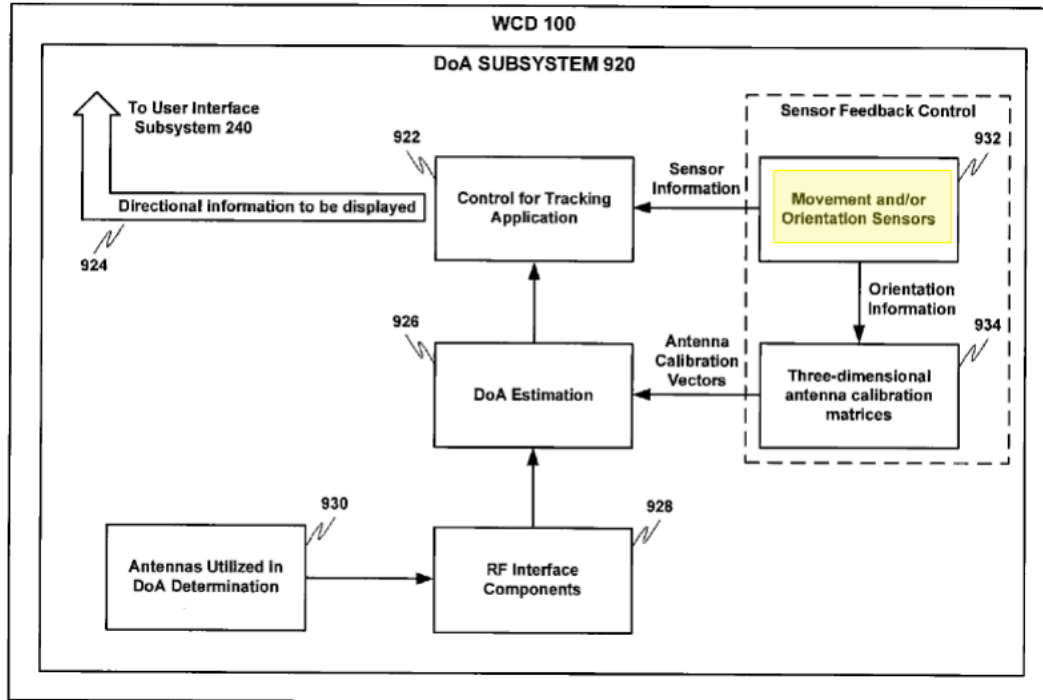
4. Claim 11(c)

See Claim 1(c).

5. Claim 11(d)

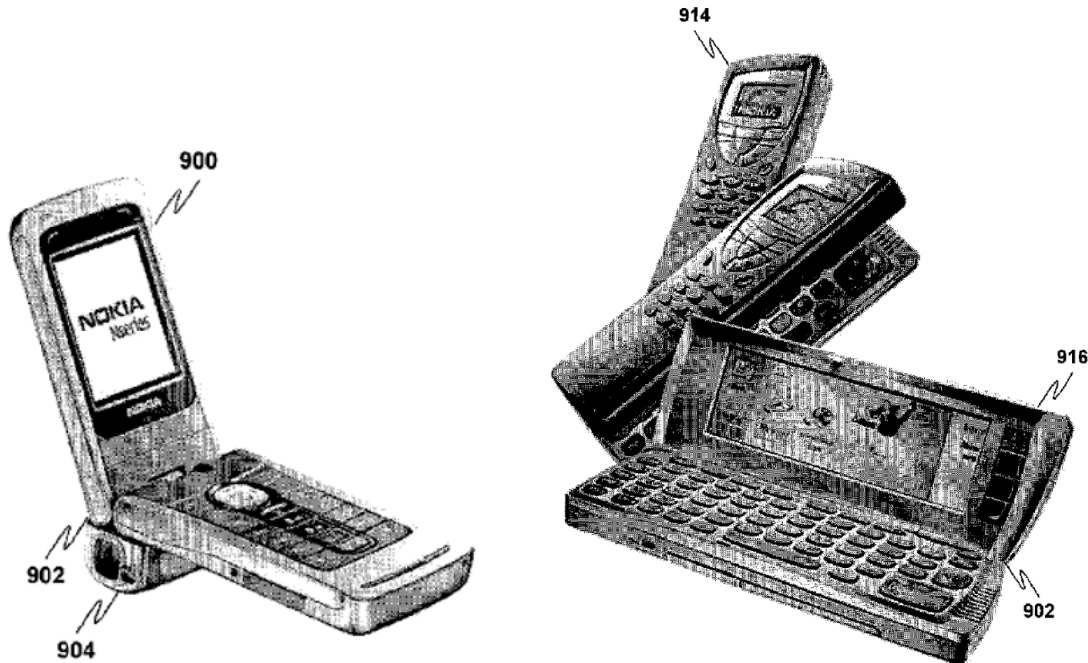
Kalliola's WCD includes orientation sensor, namely "movement and/or orientation sensors" 932 that "provide information on the relative **orientation** of two sections of WCD 100." *Kalliola*, [0078], [0081], Figs. 9A-9B; *Dec.*, ¶¶259-260.

FIG. 9B



Kalliola, Fig. 9B.

Kalliola teaches “[t]his **sensor** may provide information to a controller in WCD 100 regarding the **orientation** of the device, such as shown at 900, as to whether a flip cover of the device is open or closed.” *Id.*, [0078]. The orientation sensor detects when the cover of the WCD is rotated into an open/closed position:



Kalliola, Fig. 9A (excerpt). When determining whether the phone's flip cover is open/closed, the orientation sensor is detect[ing] rotation of the mobile communication device and specifically, the rotation of the cover relative to the body. *Dec.*, ¶261.

In addition to or alternative to the mapping of the orientation sensor disclosed in *Kalliola*, [0079] for detecting rotation of the flip phone cover, *Kalliola* describes an exemplary motion and/or orientation sensor is “a semiconductor gyroscope chip.” *Id.*, [0084]. In the parallel litigation, THL alleges a gyroscope qualifies as the claimed orientation sensor:

a **memory** that stores operational instructions;
a **touch screen**;
an **orientation sensor** to detect rotation of the mobile communication device; and
a **processor** coupled to the plurality of wireless transceivers, the memory, the touch screen and the orientation sensor, wherein the processor is configured to execute the operational instructions, which upon execution, cause the processor to:

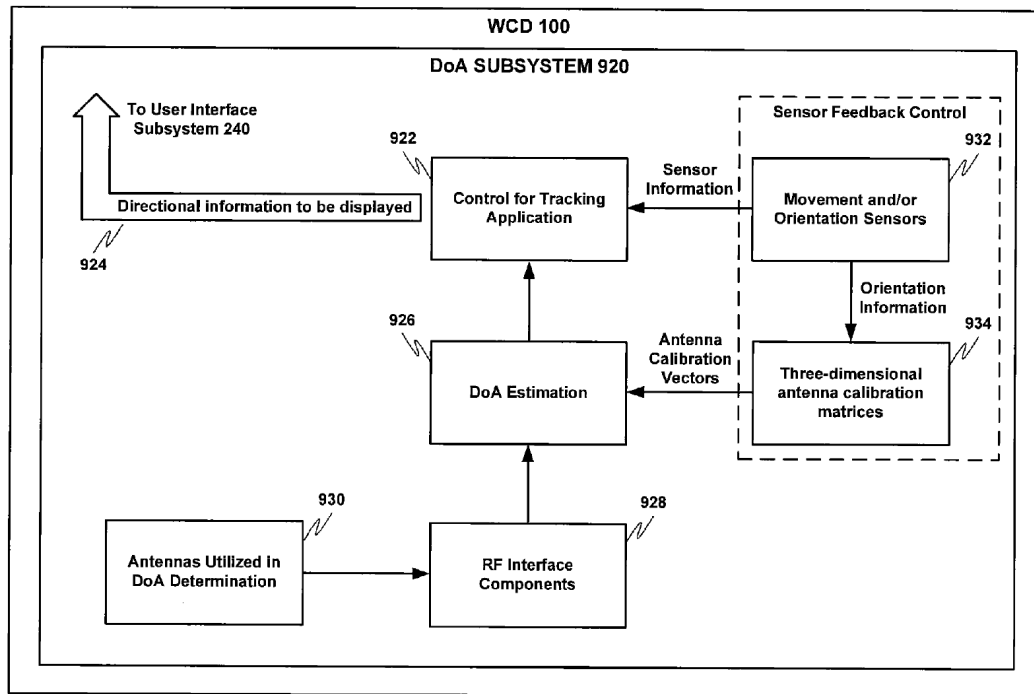
	iPhone 11	iPhone 12	iPhone 13	iPhone 14
touchscreen				
memory	▪ 64GB ▪ 128GB ▪ 256GB 4 GB RAM	64GB 128GB 256GB 4/6 GB RAM	128GB 256GB 512GB 4/6 GB RAM	128GB 256GB 512GB 6 GB RAM
orientation sensor	Three-axis gyro	Three-axis gyro	Three-axis gyro	Dynamic High Range Gyro

THL's Infringement Contentions (Ex. 1013), 38.

Thus, the gyroscope is an orientation sensor to detect rotation of the mobile communication device under THL's interpretation of the claim. *Dec.*, ¶262.

6. Claim 11(e)(i)

Kalliola teaches a processor coupled to the plurality of wireless transceivers, the memory, the touch screen, and the orientation sensor. See Claim 1(d)(i). “Movement and/or **orientation sensors module 932** may collect information from sensors integrated into WCD 100, and may convey this information to at least the control for the tracking application 922[.]” *Kalliola*, [0081]; *Dec.*, ¶¶263-264 (opining both the flip phone cover sensor and gyroscope are movement and/or orientation sensors part of orientation sensors module 932); *Kalliola*, [0081], [0078], [0084].



Id., Fig. 9B.

“Control for a tracking application 922 may...consist of an application in memory 330 executing on the main processor 300 of WCD 100[.]” *Id.*, [0080]. Because the orientation sensor module 932 provides input to the tracking application executing on the processor, the orientation sensor module 932 is coupled to the processor. *Dec.*, ¶265.

7. Claim 11(e)(ii)

See Claim 1(d)(ii).

8. Claim 11(e)(iii)

See Claim 1(d)(iii).

9. Claim 11(e)(iv)

See Claim 1(d)(iv).

10. Claim 11(e)(v)

See Claim 1(d)(v).

11. Claim 11(e)(vi)

See Claim 1(d)(vi).

12. Claim 11(e)(vii)

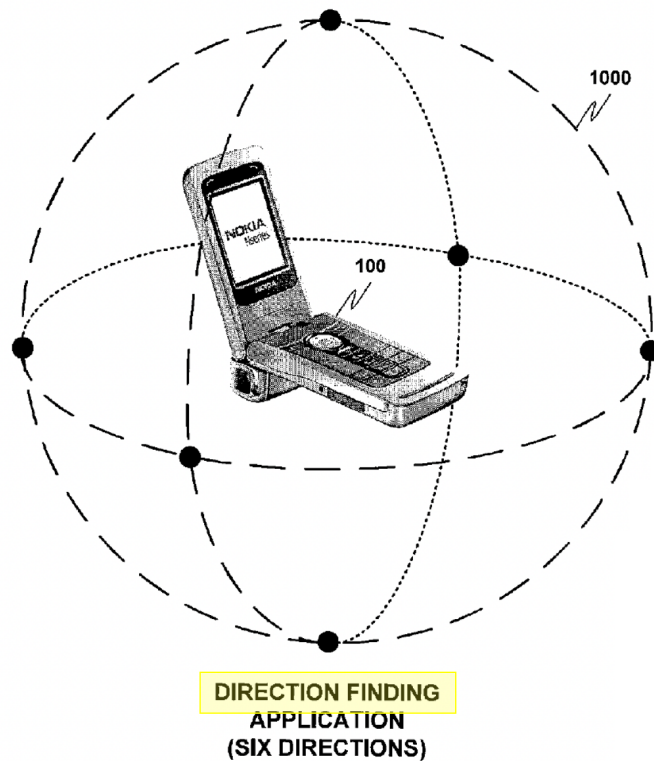
Kalliola and Oswald render obvious Claim 11(e)(vii). See Claim 1(d)(vi). Kalliola teaches at least two embodiments using the rotation of the WCD as detected by the orientation sensor to determine a direction of the WCD to the at least one remote device (target).

(a) Kalliola's First Embodiment

Kalliola's WCD includes DoA subsystem 920. *Kalliola*, [0080]. Modules of the DoA subsystem 920 “work together in order to **provide a relative direction towards a target beacon.**” *Id.*, [0080], [0013] (“The DoA estimation may operate in a multitude of modes **depending on the physical orientation of the device.**”). One of the modules is a “[m]ovement and/or orientation sensors module 932[, which] may collect information from sensors integrated into WCD 100 (e.g., the sensors described in FIG. 9A), and may convey this information to at least the control for the tracking application 922 and/or a three-dimensional (3-D) antenna calibration matrices module 934.” *Id.*, [0081], Fig. 9B (illustrating “Orientation Information” outputted from “Orientation Sensors”); *Dec.*, ¶¶272-273.

The 3-D antenna module 934 uses collected sensor information from module 932 to “determine the appropriate antenna calibration vectors to provide to DoA Estimation module 926.” *Kalliola*, [0081]. “These calibration vectors allow DoA Estimation module 926 to configure the [3-D] antenna array.” *Id.* “The antenna configuration may include...how the measurements from the active antennas will be interpreted **in order to determine direction.**” *Id.*, [0013] (“[A] DoA application...displays a directional pointer in a compass-like fashion in order **to indicate the direction towards a target**”); *Dec.*, ¶274.

Kalliola teaches one use of the orientation information disclosed in Fig. 10, RN 1000, is to determine the phone is in a flip-phone open mode, which triggers the 3-D antenna module to set an antenna configuration for use in “direction finding” performed by the DoA estimation:



Kalliola, Fig. 10, [0082].

Kalliola explains the Fig. 10, RN 1000 mode is a “compass directional mode,” where “orientation information” is received from sensors, and such orientation information is used to configure the operational mode, namely the compass directional mode. *Kalliola*, [0085], Fig. 12 (Steps 1208, 1210); *Dec.*, ¶¶275-278. Upon determining the operational mode based on the orientation sensor information (Step 1208) is the directional mode (Step 1210), the antenna calibration vectors and user interface mode are set (Step 1212), the DoA estimation is performed (Step 1222), and the “directional information” is displayed (Step 1224). *Kalliola*, Fig. 12, [0087], [0086]. *Kalliola* teaches the WCD’s controller configures the device “**based**

on the information sensed by the one or more sensors” and where the sensed conditions “affect the behavior of the wireless communication device while determining the direction of arrival estimate.” *Id.*, Claims 1, 14, [0081] (disclosing using sensor information to “configure and/or implement functionality to enhance the performance of WCD”).

Because Kalliola expressly teaches using orientation sensor information, e.g., the rotation of the flip phone cover is in an open position, to configure an antenna array that is used to determine a direction to a remote device, a POSITA would have understood the step of determin[ing] direction to the remote device is based on...rotation of the mobile communication device detected by the orientation sensor. *Dec.*, ¶279.

Modification of Kalliola’s DoA method using UWB signals or substitution with Oswald’s signal delay method using UWB pulses, per Claim 11(e)(vii), would be consistent with employing Kalliola’s method of determining direction based on rotation of the WCD detected by an orientation sensor. *Id.*, ¶280; Claim 1(d)(vii). Even with the modification to include UWB, per Oswald, Kalliola’s system would still be operable and desired to determine a preferred antenna array based on the WCD’s rotation. *Id.*

(b) Kalliola's Second Embodiment

Kalliola teaches “[t]he sensor information may initially be used to determine an appropriate configuration for the device” and “may also be used to affect the behavior of the device while performing the DoA estimation.” *Kalliola*, Abstract. “A DoA-based application tracking a stationary target may conserve power by pausing a DoA estimation until **the motion of the WCD is detected by the motion sensors**” and “[w]hen the WCD is moved, the updating of the DoA estimation **may be resumed.**” *Id.*, [0014]. “If WCD 100 is motionless, and the target is also not moving, then updated directional information would not be necessary until the position of WCD 100 changes.” *Id.*, [0084]. “[T]he tracker application halts the DoA estimation when motion sensors determine that WCD 100 is stationary” and “[a]t a time when motion resumes, the DoA application control 902 may resume the DoA estimation in order to provide updated directional information through a display on WCD 100.” *Id.* Thus, Kalliola teaches pausing the direction estimation when the WCD is stationary and resuming the estimation when the orientation sensor detects motion (rotation) of the WCD. *Dec.*, ¶281.

Because Kalliola teaches initiating and pausing the DoA estimation based on motion detected by the orientation sensor, Kalliola expressly teaches the direction estimation is partially based on the rotation of the WCD as detected by the orientation sensor. *Id.*, ¶283. The power savings gained by pausing the direction

estimation when the WCD is stationary and resuming the direction estimation when the orientation sensor detects motion would be equally applicable to the WCD when implementing Oswald's UWB direction-finding technique described in Claim 1(d)(vi). *Dec.*, ¶284.

Kalliola also teaches a “correction or compensation mode may be employed when user 110 moves WCD 100 too quickly for an accurate DoA estimation.” *Kalliola*, [0086]. “Increased activity detected by motion sensors in WCD 100 may trigger a configuration that increases the speed of the DoA estimation[.]” Thus, Kalliola teaches speeding up the direction estimation when the orientation sensor detects increased motion (rotation) of the WCD, which also teaches the direction estimation is partially based on the rotation of the WCD as detected by the orientation sensor. *Dec.*, ¶282. Determining the user is rotating the WCD too quickly and increasing the speed of the directional estimation would be equally applicable when performing the direction estimation using UWB, per Claim 1(d)(vii). *Id.*

13. Claim 11(e)(viii)

See Claim 1(d)(viii).

C. Claim 12

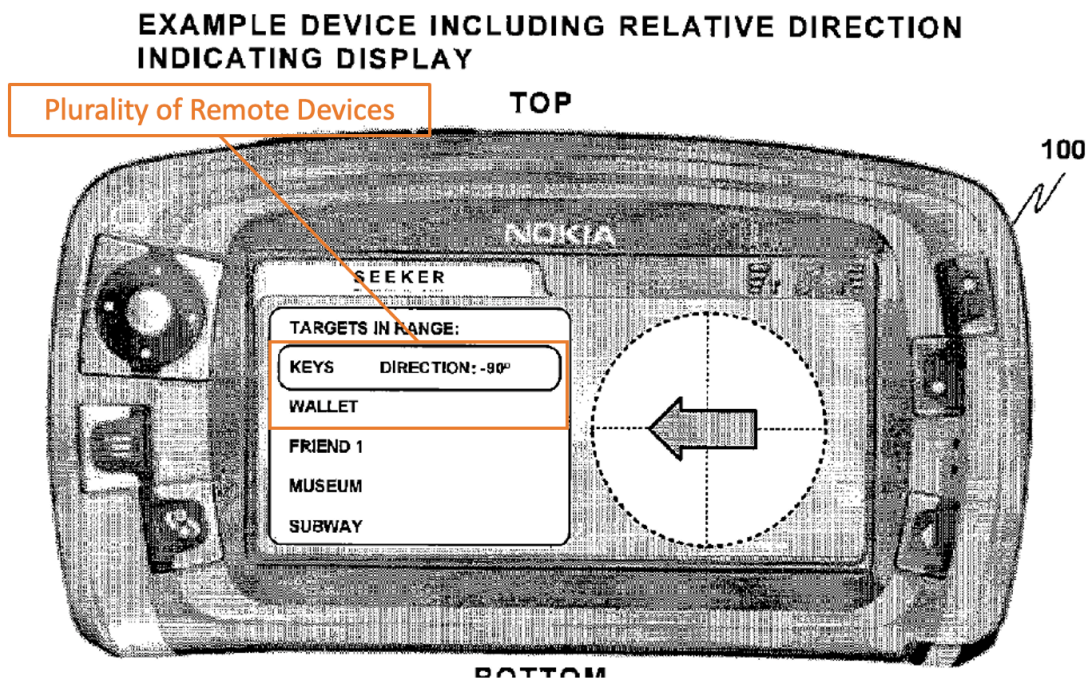
1. Claim 12(a)

Kalliola's signal emitter 500 is the at least one remote device. *See* Claims 1(d)(iv), 11(e)(iv). Kalliola teaches “[t]here can be one or **multiple active signal emitters 500** within one area at the same time.” *Kalliola*, [0069]. Signal emitters

500 may be included in the user's personal items. *Id.*, [0075], Figs. 5-6, 8. Thus, Kalliola teaches a plurality of remote devices. *Dec.*, ¶¶286-287.

2. Claim 12(b)

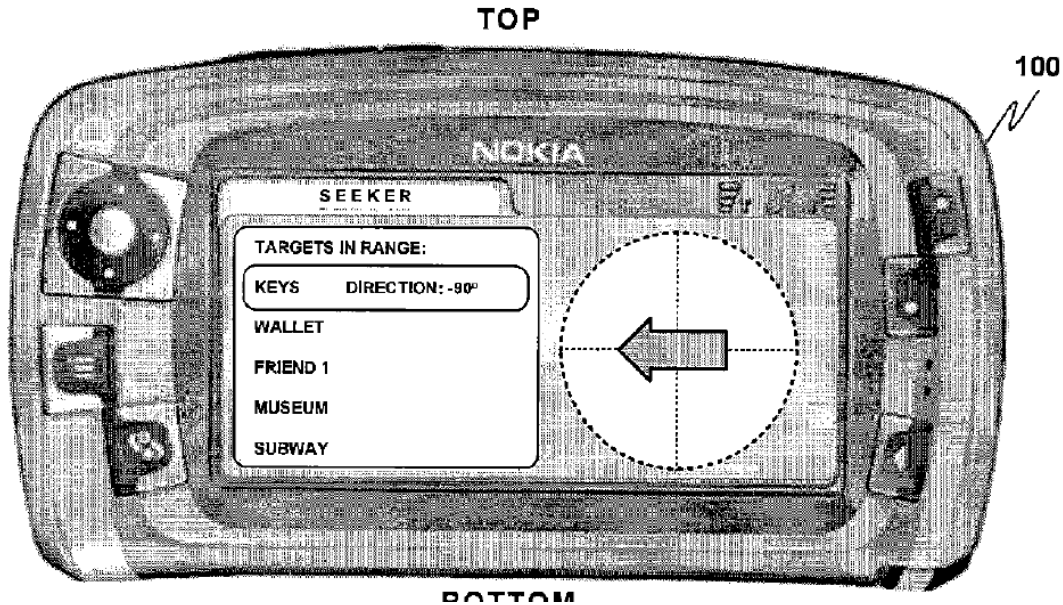
The tracking application outputs a representation of the signal emitters associated with the user's items to the display, which is a touchscreen:



Dec., ¶288 (citing Kalliola, Fig. 5); Kalliola, [0069] (“[T]he display shows both a **list of possible target objects** and an arrow pointer.”), Fig. 6; Claim 1(c).

3. Claim 12(c)

Figure 5 depicts a screenshot of the tracking application GUI displayed on the touchscreen where “[t]he “KEYS” target object is currently selected.” Kalliola, [0069].



Id., Fig. 5 (excerpt), Fig. 6.

Kalliola teaches user input 360 includes a touchscreen. *See* Claims 1(c), 11(c). Because the WCD's user input device is a touchscreen and the KEYS target is selected in Fig. 5 ([0069]), a POSITA would have understood or found obvious that Kalliola teaches the processor receives user input at the touchscreen via selection of the KEYS signal emitter. *Dec.*, ¶291.

4. *Claim 12(d)*

See Claims 1(d)(viii), 11(e)(viii).

D. **Claim 13**

Kalliola discloses each signal emitter (*remote device*) has a name, such as keys or wallet. *Dec.*, ¶¶293-294. A POSITA wanting specificity on defining names for the signal emitters would have looked to related art, such as Kalayjian, which teaches that after the first and second devices are paired, “[a] **user can be given the ability**

to create unique names or other identifiers for the slave devices through the master device's user interface.” *Kalayjian*, [0037]; *Dec.*, ¶295.

Based on Kalayjian's teachings, it would have been obvious to a POSITA to similarly configure Kalliola's tracking application (*the operational instructions*) executing on Kalliola's processor to *further cause the processor to receive input from the touch screen defining names for one or more of the plurality of remote devices*. *Dec.*, ¶296. Kalliola teaches user input 360 includes a touchscreen. *See* Claim 1(c). Because the WCD's user input device is a touchscreen, it would have been obvious to configure the tracking application to prompt the user to input, via the touchscreen, a name for each signal emitter after it is paired with the WCD per Kalayjian. *Id.* Because Kalliola already shows that each signal emitter is named (e.g., keys, wallet), a POSITA would have understood Kalliola provides for the user inputting a name for the signal emitter or that such is obvious. *Id.* Thus, a POSITA would have been motivated to configure the tracking application to receive user inputs to define the names of the signal emitters per Kalayjian to predictably improve the usability of Kalliola's tracking application and improve similar object-finding systems in the same way. *Id.*, ¶297.

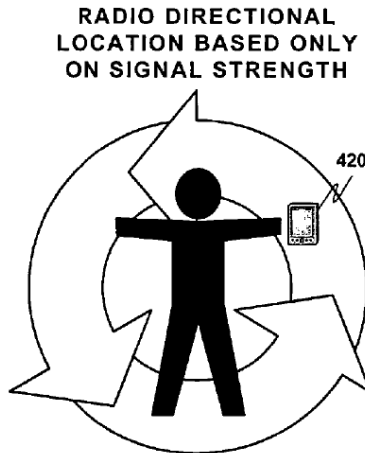
A POSITA would have understood that configuring the tracking application to receive user inputs from the touchscreen defining names for the signal emitters would have only required minor software changes. *Id.*, ¶¶298-299. Thus, there

would have been a reasonable expectation of success modifying Kalliola's tracking application as described above. *Id.*

E. Claim 14

Kalliola teaches prior art systems where “an omnidirectional antenna is used to find any targets in the vicinity by receiving their signals, in order to indicate their presence and possibly the location of the tracking device.” *Kalliola*, [0058]. “To improve the accuracy, a unidirectional antenna on tracking device 420 may be used to **measure the strength of each received signal**, wherein the reception strength is indicated using a visual or audio method.” *Id.* “The user physically moves the device in a sweeping pattern and monitors the signal strength indicator,” and “[t]he **direction of strongest signal reception is deemed to be the direction towards the target.**” *Id.*; *Dec.*, ¶300.

It would have been obvious, and a POSITA would have been motivated to configure Kalliola's tracking application to employ Kalliola's signal strength direction measurement along with the UWB direction measurement described above with regard to Claim 11(e)(vii). *Dec.*, ¶301. Kalliola describes the advantage and disadvantages of prior art systems that use *only* signal strength to determine directional information to a target:



**ADVANTAGE: ECONOMICAL WAY TO
PROVIDE DIRECTIONAL LOCATION OF
A TARGET.**

DISADVANTAGES:

1. SHORT RANGE ONLY
2. HAS TO BE PHYSICALLY MOVED TO
DETERMINE CORRECT DIRECTION
3. DOES NOT DETERMINE ABSOLUTE
POSITION OF SENSING DEVICE
4. NO IDENTIFICATION OF TARGET (NO
PROVISIONS FOR NEWLY
ENCOUNTERED TARGETS)
5. SUBJECT TO ENVIRONMENTAL
INTERFERENCE

Kalliola, Fig. 4, [0058]-[0059].

Kalliola's disclosure does not teach away from the claimed invention. Claim 14 does not require using *only* signal strength to determine direction. Petitioner's proposed combination employs Oswald's UWB technique in addition to Kalliola's signal strength method. *See* Claim 11(e)(vii); *Idemitsu Kosan Co., Ltd., v. SFC Co., Ltd.*, 870 F.3d 1376, 1381 (Fed. Cir. 2017) ("Evidence concerning whether the prior art teaches away from a given invention must relate to and be commensurate in scope with the ultimate claims at issue."). Moreover, nothing in Kalliola criticizes, discredits, or discourages using signal strength in addition to another method to determine the direction to the signal emitter. *Dec.*, ¶305.

The Federal Circuit has found that “a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (internal quotation omitted)). Here, Kalliola recognizes that signal strength is a “very economical” way to determine directional information. *Kalliola*, Fig. 4, [0059]. Based on this express teaching, a POSITA would have been motivated to use signal strength in addition to the UWB technique described above to economically obtain more data points to increase the accuracy of the tracking application’s direction measurement. *Dec.*, ¶301.

Kalliola recognizes the simplicity of using signal strength to determine direction to the target. *Kalliola*, [0058] (“In the simplest implementation...”); *Dec.*, ¶306. Thus, there would have been a reasonable expectation of success configuring Kalliola’s tracking application to determine the direction of the signal emitter based on a strength of a signal received from signal emitter at the Bluetooth transceiver. *Dec.*, ¶306.

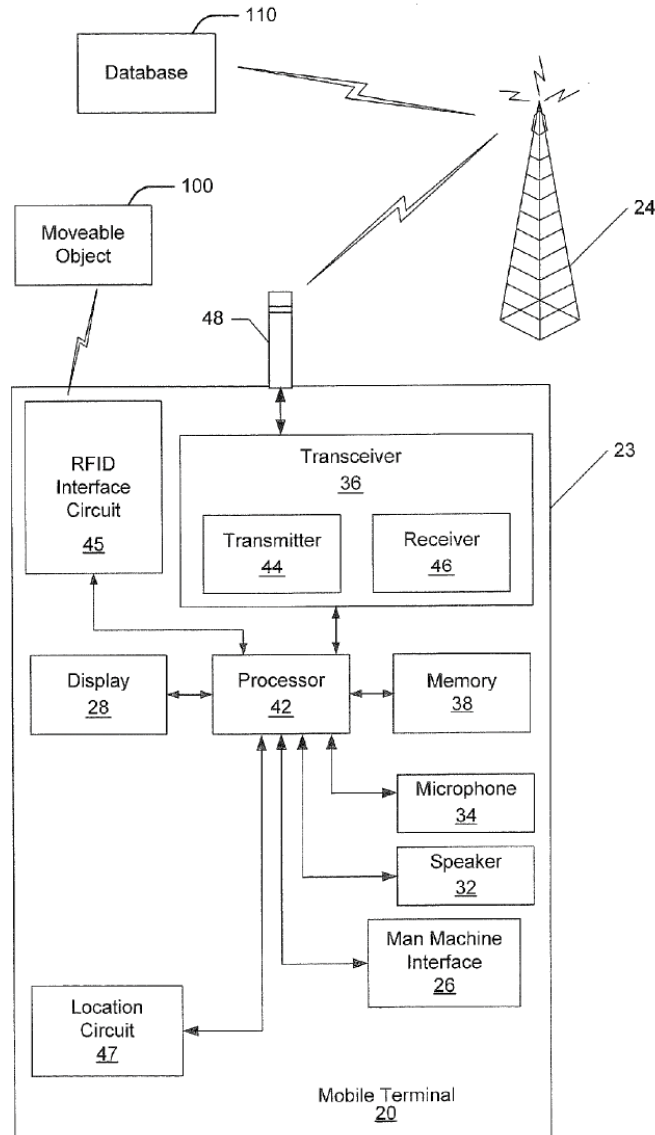
VI. GROUND 2: CLAIMS 2-5 AND 15-18 ARE OBVIOUS OVER KALLIOLA, TURUNEN, OSWALD, VAUCLAIR, KALAYJIAN, AND THORN

A. Claim 2

1. Thorn’s Teachings

Thorn describes methods and systems “for providing location information associated with movable objects.” *Thorn*, [0014], Abstract. The system includes

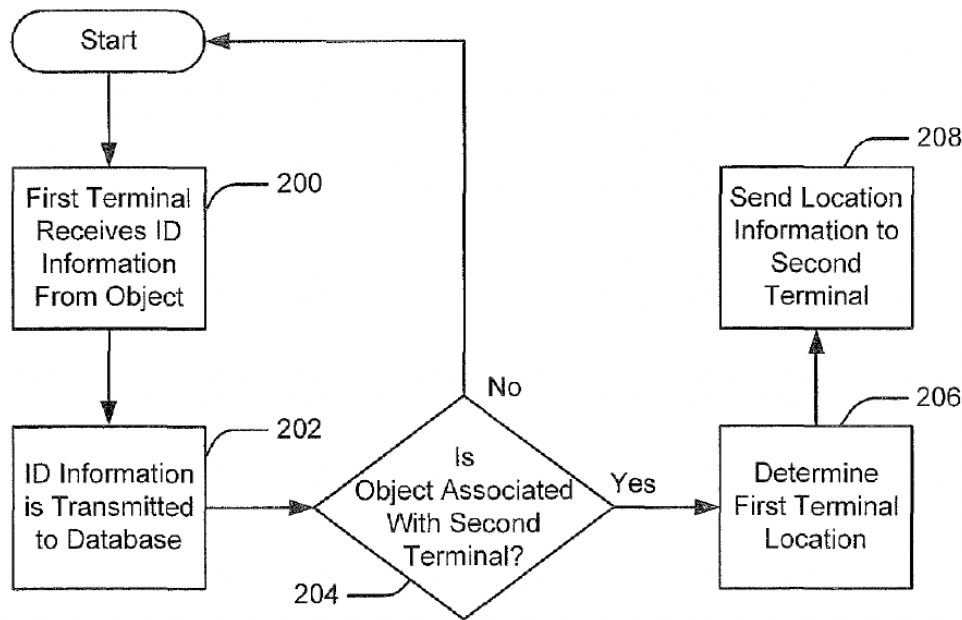
mobile terminals that communicate with a base station transceiver 24 in a wireless communication network. *Id.*, [0034], [0036]. Similar to Kalliola, each mobile terminal 20 includes a transceiver 36 for wireless communication. *Id.*, [0034]-[0035]. The wireless communication network may be “any type of wireless communications network,” including a cellular network. *Id.*, [0029], [0037]. Each mobile terminal 20 may wirelessly communicate via Bluetooth or RFID with a moveable object 100, which may be “a wallet, a briefcase, a set of keys, rental equipment, etc.” *Id.*, [0030], Fig. 1, [0041], [0032] (disclosing Bluetooth communication with the movable object).



Thorn, Fig. 2, Fig. 1; *Dec.*, ¶¶307-309.

Thorn teaches a first user of a first terminal happens upon a lost movable object, such that the first terminal is proximate the movable object. *Thorn*, [0053]. Because the first terminal is proximate the movable object, the location of the first terminal “correspond[s] to the location of the movable object.” *Id.* The first terminal sends location information corresponding to the movable object to a second terminal.

Id., [0053], [0064]-[0065], [0047]-[0048], [0011]-[0012]. The location information for the movable object is transmitted by the first terminal to the second terminal “via the communications network.” *Id.*, [0053]; *see also id.*, [0064]-[0065], Figs. 6A-6B; *Dec.*, ¶¶310-312.



Thorn, Fig. 4, [0055]-[0056], [0059]-[0060].

Thorn teaches the location information sent from the first terminal to the second terminal is displayed on the second terminal’s display on a map: “the location information message includes a map including the location information on a display of the associated terminal.” *Id.*, [0013], [0062]; *Dec.*, ¶313.

Regarding the claimed based on information received at one of the plurality of wireless transceivers via a wireless network, *Thorn* teaches each of the terminals includes transceiver 36 for performing wireless communication across a

communications network, such as a cellular network. *Id.*, [0034]-[0035], [0029].

Thorn also teaches the location information can be transmitted from the first terminal to the second terminal “via the communications network.” *Id.*, [0053]. A POSITA would have found obvious the transmission of the location information via the communications network is performed by receiving information at the second terminal’s transceiver. *Dec.*, ¶314.

Thorn therefore teaches output[ting] an estimated position of the at least one remote device (the location of the movable object proximate to the first terminal) based on information received (the location information) at one of the plurality of wireless transceivers via a wireless network (location information received by the second terminal’s transceiver). *Id.*, ¶315.

2. Motivation to Combine

A POSITA would have found it obvious and been motivated to configure Kalliola’s object-finding system to locate signal emitters outside the range of Kalliola’s WCD’s short-range transceivers using Thorn’s long-range location-finding method. *Dec.*, ¶316. A POSITA would have understood that the user may have left a personal item at a location far from their current location and out of range of the Kalliola WCD’s short-range wireless transceivers. *Id.* In this instance, it would have been advantageous to utilize Thorn’s long-range location-finding method to send the location of the signal emitter to the WCD via the cellular network and

display a map depicting the estimated position on the WCD's touch screen. *Id.* Thus, a POSITA would have been motivated to configure Kalliola's tracking application to display the estimated position of the signal emitter based on information received at the long-range transceiver and from another mobile device, as taught by Thorn. *Id.*

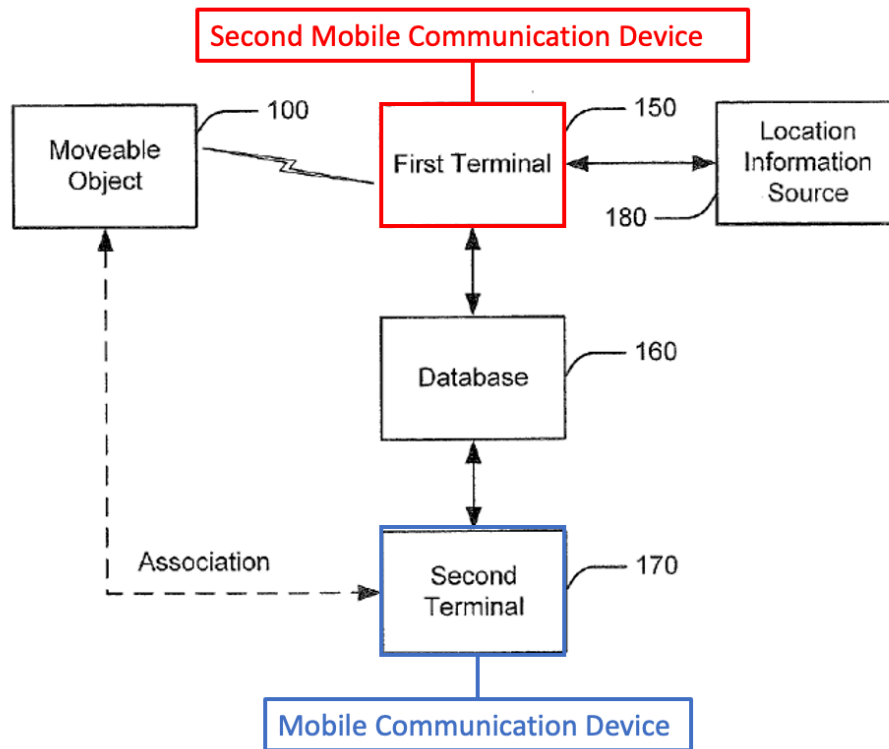
A POSITA would have recognized that Kalliola's object-finding system would only be able to find objects located within range of the WCD's short-range transceivers. *Id.*, ¶317. Configuring Kalliola's system to also utilize Thorn's long-range method would have predictably enabled Kalliola's system to locate the signal emitter over a wide geographical area. *Id.* This modification would have predictably improved the system's flexibility and robustness, thereby increasing user satisfaction. *Id.* For these reasons, a POSITA would have been motivated to configure Kalliola's tracking application to improve similar object-finding systems in the same way. *Id.*

Kalliola's WCD includes the long-range transceiver hardware required to configure Kalliola's WCD to implement Thorn's method. *See* Claim 1(a). Therefore, this modification would not have required any hardware changes to Kalliola's WCD or changed its principle of operation. *Dec.*, ¶318. Thus, there would have been a reasonable expectation of success configuring Kalliola's WCD to implement Thorn's long-range location-finding method. *Id.*

B. Claim 3

Thorn teaches the estimated position of the moveable object is based on information received from a second mobile communication device. As discussed for Claim 2, the location of the remote device is based on information received from the first mobile terminal, namely the location of the first terminal proximate to the movable object. *Thorn*, [0053]; *see also id.*, [0064]-[0065]; Claim 2; *Dec.*, ¶¶319-320.

To avoid any confusion about the first/second nomenclature for the mobile devices, Petitioner notes that in the scenario described in *Thorn*, [0053], the second terminal corresponds to the mobile communication device receiving the location information. If the mobile communication device of Claim 1 is designated the “first device,” this means that *Thorn*’s **second** terminal corresponds to Claim 1’s **first** device. *Dec.*, ¶319. Conversely, *Thorn*’s **first** terminal corresponds to Claim 3’s second mobile communication device, because the first terminal sends the location of the movable object to *Thorn*’s second terminal. *Id.*



Id. (citing *Thorn*, Fig. 3).

C. Claim 4

(a) Thorn's Teachings

Thorn teaches a scenario where “multiple traveling companions shar[e] a common resource, such as, for example a travel book.” *Thorn*, [0057]. “In the case when one of the travelers wishes to use the resource, the location may be determined relative to which of the travelers is in possession of the resource.” *Id.* In this scenario, it would have been obvious for each traveler’s terminal to be paired with the moveable object (the travel book) based on Kalayjian’s teachings. *Dec.*, ¶321.

(b) Kalayjian's Teachings

Kalayjian teaches “determining a slave device’s relative location...using

more than one master device and determining the distance of the slave device to each master device.” *Kalayjian*, [0046]. Thus, *Kalayjian* teaches more than one first device – i.e., a second mobile communication device. *Dec.*, ¶322. *Kalayjian* teaches that each first device must be paired with the second device to communicate with it. *Kalayjian*, [0054] (“[A] master device is paired with one or more slave devices using a Bluetooth communications protocol.”), [0055] (“[A] master device is paired with one or more slave devices using a Bluetooth communications protocol.”), Figs. 10-11.

(a) Motivation to Combine

It would have been obvious to a POSITA to configure Kalliola’s WCD (mobile communication device) to receive an estimated position of the signal emitter from a second WCD (second mobile communication device). *See* Claims 2-3. Based on Thorn’s and *Kalayjian*’s teachings, it would have been obvious to pair Kalliola’s signal emitter with more than one WCD to allow users of both WCDs to share access to and track the location of the object associated with the signal emitter. *Dec.*, ¶323. If the user of the second WCD possesses the shared resource when the first WCD user attempts to locate it, then the first WCD, as modified, would receive the estimated position of the shared signal emitter from the second WCD, which is paired with the signal emitter (per *Kalayjian*). *Id.* Thus, the Kalliola-*Kalayjian*-Thorn combination teaches wherein the second mobile communication device is

paired with the selected remote device. *Id.*

Based on Thorn's and Kalliola's teachings, it would have been obvious, and a POSITA would have been motivated to configure Kalliola-Thorn's second WCD to be paired with the signal emitter. *Id.*, ¶324. Per Thorn, multiple users share a common resource (e.g., multiple travelers sharing a travel book). *Id.* In this scenario, it would have been obvious for each user's WCD to be paired with the signal source associated with the shared resource to allow each user to track the resource's location. *Id.* Thus, a POSITA would have been motivated to combine the prior art elements of Kalliola's object locating system with Thorn's teaching of multiple users sharing a common resource and determining the location of the resource relative to which user possesses it and Kalayjian's teaching of pairing multiple mobile communication devices to the same remote device to yield the predictable result of an object finding system where multiple users track the location of a shared object. *Id.* A POSITA would have understood that this modification would have only required minor software changes. *Id.* Given the predictability of Bluetooth pairing at the time of the '246 Patent, there would have been a reasonable expectation of success configuring Kalliola-Thorn's second WCD to be paired with the signal emitter. *Id.*

D. Claim 5

Thorn teaches that for the scenario discussed at [0053] (and mapped for Claim 2), “the first terminal 150 does **not** have an association with the movable object 100.” *Thorn*, [0053], [0030] (disclosing a first terminal sends ID information for a movable object to a database to “determine if the moveable object is associated with the first terminal. **If the moveable object is not associated with the first terminal**, the first terminal can determine location information...”), [0039] (disclosing database including “terminal information associated with the movable object”). Thorn therefore expressly teaches the first mobile terminal (*the second mobile communication device*) is not associated with (*is not paired with*) the movable object (*the at least one remote device*). *Dec.*, ¶¶326-327. Therefore, the Kalliola-Thorn combination teaches Claim 5 for the reasons provided for Claims 2-3. *See* Claims 2-3.

E. Claim 15

See Claim 2.

F. Claim 16

See Claim 3.

G. Claim 17

See Claim 4.

H. Claim 18

See Claim 5.

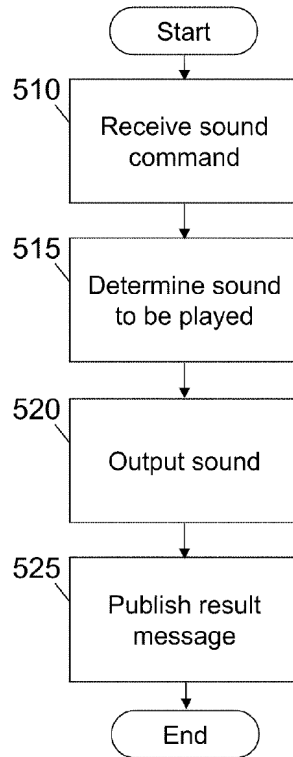
VII. GROUND 3: CLAIMS 6-10 AND 19 ARE OBVIOUS OVER KALLIOLA, TURUNEN, OSWALD, VAUCLAIR, KALAYJIAN, THORN, AND SHARP

A. Claim 6

1. *Sharp's Teachings*

Sharp teaches “[b]ecause mobile devices are sized for portability, they easily can be misplaced” and “are often carried to many different locations,” which means “they can be forgotten or lost.” *Sharp*, [0004]. Sharp recognizes the need for the misplaced mobile device to issue an audible alert for locating the device. *Id.*, [0009], [0057].

Sharp’s system includes a user station 110, such as a smartphone, that communicates over a wireless network. *Id.*, [0031]-[0033], Fig. 1. The system also includes “one or more mobile devices, such as...a digital media player 125” that can communicate over the network. *Id.*, [0039], [0059]. A user can “select a mobile device that has been misplaced” from a list of mobile devices linked with the user’s remote management account. *Id.*, [0053]-[0054], Fig. 3. “A remote command to be executed by the mobile device can be selected from the available remote commands (325).” *Id.*, [0055]. A notification message is sent to the misplaced mobile device. *Id.*, [0056]. Fig. 5 shows the misplaced mobile device receives “**a sound command** indicating that an **audible alert** is to be output (510)” and “[t]he one or more sounds representing the audible alert can then be output by the mobile device (520).” *Id.*, [0068], [0070].



Id., Fig. 5.

Thus, Sharp teaches Claim 6. *Dec.*, ¶¶332-336.

2. *Motivation to Combine*

A POSITA would have found it obvious and been motivated to configure Kalliola's tracking application executing on the processor to transmit an audio alert request signal to the signal emitter via the long-range cellular network. *Id.*, ¶337. It is common sense that users misplace personal items, and per Sharp, it would have been advantageous to allow the user to remotely activate the signal emitter's audio alert via the cellular network to increase the chances of the signal emitter being noticed. *Id.*, ¶338; *Sharp*, [0057]. For these reasons, a POSITA would have been motivated to improve similar object-finding systems in the same way by configuring

Kalliola's WCD to transmit an audio alert request signal to the signal emitter via the wireless cellular network when the signal emitter is out of range of the WCD's short-range transceivers. *Dec.*, ¶338. This is especially true given object-finding systems using wireless signals to trigger auditory alerts were well-known prior to the '246 Patent. *Id.*, ¶339.

Because Wi-Fi transceivers were conventional components of wireless devices well before the '246 Patent, a POSITA would have had a reasonable expectation of successfully modifying the signal emitter to include a Wi-Fi transceiver. *Id.* Per Sharp, a POSITA would have understood that periodically turning on the signal emitter's Wi-Fi transceiver when the signal emitter is outside the WCD's Bluetooth transceiver's range would have preserved the signal emitter's battery life. *Id.*, ¶340. Moreover, a POSITA would have understood that modifying Kalliola's seeker application such that it transmits an audio alert signal via the wireless cellular network would have only required minor software changes. *Id.* A POSITA would have further recognized that the addition of this feature would not have changed the principle of operation of Kalliola's tracking application. *Id.* For these reasons, there would have been a reasonable expectation of success modifying Kalliola's tracking application to transmit an audio alert signal via the wireless cellular network per Sharp. *Id.*

B. Claim 7

1. Claim 7(a)

See Claim 12(a).

2. Claim 7(b)

See Claim 12(b).

3. Claim 7(c)

See Claim 12(c).

4. Claim 7(d)

See Claim 12(d).

C. Claim 8

See Claim 13.

D. Claim 9

Kalliola teaches an orientation sensor coupled to the processor. See Claims 11(d)-11(e)(i). Kalliola also teaches the direction to the signal emitter is determined based on a manual rotation of the WCD. In Kalliola's first mapped embodiment regarding the flip phone cover, Kalliola teaches a sensor employed to determine the "orientation of the device," i.e., the rotation, as to whether the flip phone cover is open/closed. *Id.*; Claim 11(e)(vii). A user thus **manually** flips the cover between open/closed positions, thereby teaching or rendering obvious determining direction based on manual rotation of the device. *Dec.*, ¶347.

In Kalliola's second mapped embodiment regarding determining movement of the WCD, Kalliola teaches tracker application 922 halts/starts DoA estimation

based on the received sensor information. *Kalliola*, [0084]; Claim 11(e)(vii). A POSITA would have understood the sensor is detecting manual rotation of the WCD, at least because the sensor is detecting movement of the WCD, and the WCD is carried by a user. *Dec.*, ¶348. Thus, direction estimation is adjusted based on the speed of the user's manual rotations of the WCD. *Id.*

E. Claim 10

See Claim 14.

F. Claim 19

See Claim 6.

VIII. DISCRETION UNDER 35 U.S.C. § 314(A)

Petitioner stipulates that if the Petition is instituted, Petitioner will not seek resolution in the district court of any ground of invalidity raised in the Petition or that could have been raised in the Petition. *Sotera Wireless v. Masimo*, IPR2020-01019, Paper 12 at 18-19 (Dec. 1, 2020) (precedential). This stipulation “mitigates concerns of potentially conflicting decisions and duplicative efforts between the district court and the PTAB,” and the Director has instructed that the Board will not discretionarily deny institution under 35 U.S.C. § 314(a). *Interim Procedure for Discretionary Denials*, pp. 7-8 (June 21, 2022).

IX. CONCLUSION

Petitioner respectfully requests *inter partes* review of the Challenged Claims.

Respectfully submitted,

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Christina Canino, *pro hac vice*

COUNSEL FOR PETITIONER

X. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Parties-in-Interest Under 37 C.F.R. § 42.8(b)(1)

Petitioner is the real party in interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '246 Patent is presently the subject of a patent infringement lawsuit filed against Petitioner in the United States District Court for the Western District of Texas Waco Division. *THL Holding Company, LLC v. Apple, Inc.*, Case No. 6:23-cv-00077.

C. Lead and Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation and service information for lead and back-up counsel. 37 C.F.R. § 42.8(b)(3) and (b)(4).

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D. 37 C.F.R. § 42.8(b)(4) – Service Information

Please address all correspondence to the lead and back-up counsel as shown above. Petitioner consents to electronic service by e-mail at the e-mail addresses provided above.

CLAIM LISTING APPENDIX
U.S. Patent No. 11,350,246 for Claims 1-19

Claim Designation	Claim Language
Claim 1[P]	A mobile communication device comprising:
Claim 1(a)	a plurality of wireless transceivers including a Bluetooth transceiver, a long-range transceiver configured to send and receive telephone calls via a telephony network and to communicate Internet data, and one or more ultrawideband transceivers coupled to two or more antennas;
Claim 1(b)	a memory that stores operational instructions;
Claim 1(c)	a touch screen; and
Claim 1(d)(i)	a processor coupled to the plurality of wireless transceivers, the memory, and the touch screen,
Claim 1(d)(ii)	wherein the processor is configured to execute the operational instructions, which upon execution, cause the processor to:
Claim 1(d)(iii)	present a graphical user interface via the touch screen;
Claim 1(d)(iv)	in response to a pair request from a user received at the graphical user interface, pair the mobile communication device with at least one remote device;
Claim 1(d)(v)	in response to an audio alert request from the user received at the graphical user interface, transmit an audio alert request signal to the at least one remote device via the Bluetooth transceiver;
Claim 1(d)(vi)	estimate a distance between the mobile communication device and the at least one remote device based on ultra-wideband communication between the one or more ultra-wideband transceivers and the at least one remote device and time of flight calculations;
Claim 1(d)(vii)	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
Claim 1(d)(viii)	output to the graphical user interface the estimated distance to the at least one remote device and an arrow pointing in the direction of the at least one remote device.

Claim Designation	Claim Language
Claim 2	The mobile communication device of claim 1, wherein the operational instructions, upon execution, further cause the processor to output to the touch screen an estimated position of the at least one remote device based on information received at one of the plurality of wireless transceivers via a wireless network.
Claim 3	The mobile communication device of claim 2, wherein, the operational instructions, upon execution, further cause the processor to output on the touch screen the estimated position of the at least one remote device based on information received from a second mobile communication device.
Claim 4	The mobile communication device of claim 3, wherein the second mobile communication device is paired with the at least one remote device.
Claim 5	The mobile communication device of claim 3, wherein the second mobile communication device is not paired with the at least one remote device.
Claim 6	The mobile communication device of claim 3, wherein the operational instructions, upon execution, further cause the processor to transmit an audio alert request signal to the at least one remote device via the wireless network.
Claim 7(a)	The mobile communication device of claim 6, wherein the at least one remote device includes a plurality of remote devices and wherein the operational instructions further cause the processor to
Claim 7(b)	(i) output to the touch screen a representation of the plurality of remote devices,
Claim 7(c)	(ii) receive user input from the touch screen selecting one of the plurality of remote devices, and
Claim 7(d)	(iii) output to the touch screen the estimated distance to the selected one of the plurality of remote devices and the direction to the selected one of the plurality of remote devices.
Claim 8	The mobile communication device of claim 7, wherein the operational instructions, upon execution, further cause the processor to receive input from the touch screen defining names for one or more of the plurality of remote devices.

Claim Designation	Claim Language
Claim 9	The mobile communication device of claim 7, additionally comprising an orientation sensor coupled to the processor and wherein the operational instructions further cause the processor to determine a direction to one or more of the plurality of remote devices based on a manual rotation of the mobile communication device.
Claim 10	The mobile communication device of claim 9, wherein the operational instructions, upon execution, further cause the processor to determine a direction to one or more of the plurality of remote devices based on a strength of a signal received from the one or more of the plurality of remote devices at one or more of the plurality of wireless transceivers.
Claim 11 [P]	A mobile communication device comprising:
Claim 11(a)	a plurality of wireless transceivers including a Bluetooth transceiver, a long-range transceiver configured to send and receive telephone calls via a telephony network and to communicate Internet data, and one or more ultrawideband transceivers coupled to two or more antennas;
Claim 11(b)	a memory that stores operational instructions;
Claim 11(c)	a touch screen;
Claim 11(d)	an orientation sensor to detect rotation of the mobile communication device; and
Claim 11(e)(i)	a processor coupled to the plurality of wireless transceivers, the memory, the touch screen and the orientation sensor,
Claim 11(e)(ii)	wherein the processor is configured to execute the operational instructions, which upon execution, cause the processor to:
Claim 11(e)(iii)	present a graphical user interface via the touch screen;
Claim 11(e)(iv)	in response to a pair request from a user received at the graphical user interface, pair the mobile communication device with at least one remote device;
Claim 11(e)(v)	in response to an audio alert request from the user received at the graphical user interface, transmit an audio alert request signal to the at least one remote device via the Bluetooth transceiver;

Claim Designation	Claim Language
Claim 11(e)(vi)	estimate a distance between the mobile communication device and the at least one remote device based on ultra-wideband communication between the one or more ultra-wideband transceivers and the at least one remote device and time of flight calculations;
Claim 11(e)(vii)	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; and
Claim 11(e)(viii)	output to the graphical user interface the estimated distance to the at least one remote device and an arrow pointing in the direction of the at least one remote device.
Claim 12(a)	The mobile communication device of claim 11, wherein the at least one remote device includes a plurality of remote devices and wherein the operational instructions further cause the processor to
Claim 12(b)	(i) output to the touch screen a representation of the plurality of remote devices,
Claim 12(c)	(ii) receive user input from the touch screen selecting one of the plurality of remote devices, and
Claim 12(d)	(iii) output to the touch screen the estimated distance to the selected one of the plurality of remote devices and the direction to the selected one of the plurality of remote devices.
Claim 13	The mobile communication device of claim 12, wherein the operational instructions, upon execution, further cause the processor to receive input from the touch screen defining names for one or more of the plurality of remote devices.
Claim 14	The mobile communication device of claim 13, wherein the operational instructions, upon execution, further cause the processor to determine the direction to one or more of the plurality of remote devices based on a strength of a signal received from the one or more of the plurality of remote devices at one or more of the plurality of wireless transceivers.

Claim Designation	Claim Language
Claim 15	The mobile communication device of claim 14, wherein the operational instructions, upon execution, further cause the processor to output to the touch screen an estimated position of the one or more of the plurality of remote devices based on information received at one of the plurality of wireless transceivers from a wireless network.
Claim 16	The mobile communication device of claim 15, wherein the operational instructions, upon execution, further cause the processor to output on the touch screen an estimated position of the one or more of the plurality of remote devices based on information received from a second mobile communication device.
Claim 17	The mobile communication device of claim 16, wherein the second mobile communication device is paired with the at least one remote device.
Claim 18	The mobile communication device of claim 16, wherein the second mobile communication device is not paired with the at least one remote device
Claim 19	The mobile communication device of claim 16, wherein the operational instructions, upon execution, further cause the processor to transmit an audio alert request signal to the at least one remote device via the wireless network.

APPENDIX OF EXHIBITS

Exhibit 1001	U.S. Patent No. 11,350,246 to Howard et al.
Exhibit 1002	File History of U.S. Patent No. 11,350,246
Exhibit 1003	Declaration of R. Michael Buehrer, Ph.D.
Exhibit 1004	U.S. Patent Publication No. 2008/0068265A1 to Kalliola et al.
Exhibit 1005	U.S. Patent No. 6,487,595 to Turunen et al.
Exhibit 1006	U.S. Patent Publication No. 2008/0204322A1 to Oswald et al.
Exhibit 1007	U.S. Patent Publication No. 2008/0320587A1 to Vauclair et al.
Exhibit 1008	U.S. Patent Publication No. 2008/0125040A1 to Kalayjian
Exhibit 1009	U.S. Patent Publication No. 2009/0058651 to Thorn
Exhibit 1010	U.S. Patent Publication No. 2010/0279652 to Sharp et al.
Exhibit 1011	THL's Opening Claim Construction Brief dated September 14, 2023
Exhibit 1012	Expert Report of Dr. Martin J. Feuerstein Rebutting Apple's Proposed Construction of "Signal Delay"
Exhibit 1013	THL's Infringement Contentions
Exhibit 1014	ISO/IEC 24730-2:2006(E) <i>Information technology – Real-time locating systems (RLTS) – Part 2: 2,4 GHz air interface protocol</i> . International Organization for Standardization and the International Electrotechnical Commission (2006)
Exhibit 1015	Hui Liu, Houshang Darabi, Pat Banerjee, and Jing Liu, <i>Survey of Wireless Indoor Positioning Techniques and Systems</i> , IEEE Transactions on Systems, Man, and Cybernetics-Part C: Applications and Reviews, Vol. 37, No. 6 (November 2007)
Exhibit 1016	<i>A Comprehensive Look into the RTLS System</i> , https://www.mokosmart.com/look-into-rtls-system/ (August 2021, retrieved August 25, 2023)
Exhibit 1017	Roy Want, Andy Hopper, Veronica Falcão, and Jonathan Gibbons, <i>The Active Badge Location System</i> , ACM Transactions on Information Systems, Vol. 10, No. 1 (January 1992)
Exhibit 1018	Paramvir Bahl and Venkata N. Padmanabhan, <i>RADAR: An In-Building RF-based User Location and Tracking System</i> , Proceedings IEEE INFOCOM 2000. Conference on Computer Communications. Nineteenth Annual Joint Conference of the IEEE Computer and Communications Societies pp. 775-784 vol.2, (March 2000)
Exhibit 1019	Bob Paddock, <i>A Guide to online information about: Radio Frequency Identification (RFID)</i> ,

	https://web.archive.org/web/20060513161655/http://archive.chipcenter.com/circuitcellar/october00/c1000rp52.htm (August 2001, retrieved September 7, 2023)
Exhibit 1020	Gwen Moritz, <i>Larry W. Fullerton: World Class Innovator, Arkansas Business</i> , https://www.arkansasbusiness.com/article/58921/larry-w-fullerton-world-class-innovator (Apr. 15, 2002)
Exhibit 1021	IEEE Standard for Information technology– Local and metropolitan area networks– Specific requirements– Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs): Amendment 1: Add Alternate PHYs, IEEE Std 802.15.4a-2007 (Amendment to IEEE Std 802.15.4-2006) (2007)
Exhibit 1022	Kaveh Pahlavan, Xinrong Li, and Juha-Pekka Mäkelä, <i>Indoor Geolocation Science and Technology</i> , IEEE Communications Magazine (March 2002)
Exhibit 1023	Jeffrey Hightower and Gaetano Borriello, <i>A Survey and Taxonomy of Location Systems for Ubiquitous Computing</i> , Technical Report UW-CSE 01-08-03 (August 2001)
Exhibit 1024	<i>PARC History – A Legacy of Innovation and Inventing the Future</i> , https://www.parc.com/about-parc/parc-history/ (retrieved June 26, 2023)
Exhibit 1025	Guifx, <i>Touchscreens That Changed the World</i> , https://www.guifx.com/touchscreens-that-changed-the-world/ (retrieved June 26, 2023)
Exhibit 1026	<i>iPhone User's Guide</i> , Apple Inc. (2007)
Exhibit 1027	<i>Majority of smart phones now have touch screens</i> , https://www.canalys.com/newsroom/majority-smart-phones-now-have-touch-screens 2/7 (February 8, 2010, retrieved October 11, 2023)
Exhibit 1028	Steve Kolokowsky and Trevor Davis, <i>Touchscreens 101: Understanding Touchscreen Technology and Design</i> , Cypress Semiconductor Corp. (June 2009)
Exhibit 1029	U.S. Patent Publication No. 2006/0026521A1 to Hotelling et al.
Exhibit 1030	<i>The History of Bluetooth</i> , The History of Bluetooth - Auris, Inc (theauris.com) Auris, Inc. (retrieved June 26, 2023)
Exhibit 1031	<i>Ericsson T39 User's Guide First Edition</i> , Ericsson Mobile Communications AB (March 2001)

Exhibit 1032	<i>How does Bluetooth work?</i> , Scientific American https://www.scientificamerican.com/article/experts-how-does-bluetooth-work/#:~:text=Bluetooth%20technology%20uses%20the%20principles,devices%20that%20are%20actively%20inquiring, (November 5, 2007, retrieved September 8, 2023)
Exhibit 1033	IEEE Std. 802.15.1-2005, entitled “IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 15.1: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Wireless Personal Area Networks (WPANs)”
Exhibit 1034	<i>Specification of the Bluetooth System</i> , Bluetooth Core Specification version 1.2 (05 November 2003) (“Bluetooth Specification”)
Exhibit 1035	Varun Almalu and David Cheng, <i>Bluetooth Triangulator</i> , Department of Computer Science and Engineering, University of California, San Diego, (2006)
Exhibit 1036	Josef Hallberg, Marcus Nilsson, Kåre Synnes, <i>Positioning with Bluetooth</i> , 10 th International Conference on Telecommunications (April 2003)
Exhibit 1037	Julie A. Kientz, Shwetak N. Patel, Arwa Z. Tyebkhan, Brian Gane, Jennifer Wiley, and Gregory D. Abowd, <i>Where’s My Stuff? Design and Evaluation of a Mobile System for Locating Lost Items for the Visually Impaired</i> , Proceedings of the 8 th international ACM SIGACCESS conference on Computers and accessibility (October 2006)
Exhibit 1038	Harry Newton, <i>Newton’s Telecom Dictionary</i> (20th updated and expanded edition ed. 2004)
Exhibit 1039	P. Orsatti, F. Piazza & Q. Huang, <i>A 20-mA-Receive, 55-mA-Transmit, Single-Chip GSM Transceiver in 0.25-μm CMOS</i> , 34 IEEE Journal of Solid-State Circuits 1869 (1999)
Exhibit 1040	Aaron Beach, Mike Gartrell & Richard Han, <i>Solutions to Security and Privacy Issues in Mobile Social Networking</i> , 4 in 2009 International Conference on Computational Science and Engineering 1036 (2009)
Exhibit 1041	Christian Bettstetter, Hans-Jorg Vogel & Jorg Eberspacher, <i>GSM Phase 2+ General Packet Radio Service GPRS: Architecture, Protocols, and Air Interface</i> , 2 IEEE Communications Surveys 2 (1999)

Exhibit 1042	J.C. Haartsen & S. Mattisson, <i>Bluetooth-A New Low-Power Radio Interface Providing Short-Range Connectivity</i> , 88 Proceedings of the IEEE 1651 (2000)
Exhibit 1043	T.Q.S. Quek & M.Z. Win, <i>Analysis of UWB Transmitted-Reference Communication Systems in Dense Multipath Channels</i> , 23 IEEE Journal on Selected Areas in Communications 1863 (2005)
Exhibit 1044	S. Venkatesh and R. M. Buehrer, <i>Multiple-access insights from bounds on sensor localization</i> , 2006 International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM'06), Buffalo-Niagara Falls, NY, USA, (2006)
Exhibit 1045	Christian Gehrmann, Joakim Persson & Ben Smeets, <u>Bluetooth Security</u> (2004)

CERTIFICATION OF WORD COUNT

The undersigned certifies pursuant to 37 C.F.R. §42.24 that the foregoing Petition for *Inter Partes* Review, excluding any table of contents, mandatory notices under 37 C.F.R. §42.8, certificates of service or word count, or appendix of exhibits, contains 13,774 words according to the word-processing program used to prepare this document (Microsoft Word).

Dated: January 19, 2024

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**CERTIFICATE OF SERVICE ON PATENT OWNER
UNDER 37 C.F.R. § 42.105(a)**

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned certifies that on January 19, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and Exhibits were provided via Federal Express to the Patent Owner by serving the correspondence address of record for the '246 Patent:

Garlick & Markison
2025 Guadalupe Street, Suite 260
Austin, TX 78705

Further, a courtesy copy of this Petition for *Inter Partes* Review was sent via email to Patent Owner's litigation counsel:

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