

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Billhartz et al.
U.S. Patent No.: 7,110,779 Attorney Docket No. 50095-0111IP1
Issue Date: September 19, 2006
Appl. Serial No.: 10/767,794
Filing Date: January 29, 2004
Title: WIRELESS COMMUNICATIONS SYSTEM INCLUDING
A WIRELESS DEVICE LOCATOR AND RELATED
METHODS

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 7,110,779 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBITS

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APPLE-1003	Declaration of Dr. Zhi Ding
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APPLE-1005	U.S. Patent 6,453,168 to McCrady (“McCrady”)
APPLE-1006	U.S. Patent 7,511,604 to Raphaeli, <i>et al.</i> (“Raphaeli”)
APPLE-1007	U.S. Patent 6,070,079 to Kuwahara (“Kuwahara”)
APPLE-1008	WO2003098528 to Raphaeli, <i>et al.</i> (“Raphaeli”)
APPLE-1009	U.S. Patent 7,058,414 to Rofheart (“Rofheart”)
APPLE-1010	Hargrave’s Communications Dictionary, 2001 (excerpts)
APPLE-1011	The Authoritative Dictionary of IEEE Standards Terms, 2000 (excerpts)
APPLE-1012	Federal Court Management Statistics June 2022 published by the Administrative Office of the U.S. Courts, retrieved from https://www.uscourts.gov/sites/default/files/fcms_na_distprofile0630.2022_0.pdf on August 19, 2022
APPLE-1013	Scheduling Order, <i>Speir Technologies Ltd. v. Apple Inc.</i> , Case 6:22-cv-00077-ADA (WDTX)

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APPLE-1019	U.S. Patent 6,181,944 to Uebayashi <i>et al.</i> ("Uebayashi")
APPLE-1020	U.S. Patent 5,945,948 to Buford <i>et al.</i> ("Buford")
APPLE-1021	U.S. Patent 5,929,806 to Birchler <i>et al.</i> ("Birchler")
APPLE-1022	U.S. Patent 5,365,516 to Jandrell ("Jandrell")
APPLE-1023	U.S. Patent 6,760,882 to Gesbert <i>et al.</i> ("Gesbert")
APPLE-1024	U.S. Patent App. Pub. 2006/0234725 to Litwin ("Litwin")
APPLE-1025	U.S. Patent App. Pub. 2002/0136226 to Christoffel <i>et al.</i> ("Christoffel")
APPLE-1026	C. Eisenhart, "Realistic Evaluation of the Precision and Accuracy of Instrument Calibration Systems," JOURNAL OF RESEARCH of the National Bureau of Standards-C. Engineering and Instrumentation, Vol. 67C, No.2, April-June

1963 (“Eisenhart”). Retrieved from
https://nvlpubs.nist.gov/nistpubs/jres/67C/jresv67Cn2p161_A1b.pdf on September 6, 2022.

- APPLE-1027 U.S. Patent Publication 2003/0013146 to Werb (“Werb”)
- APPLE-1028 U.S. Patent Publication 2005/0130634 to Godfrey (“Godfrey”)
- APPLE-1029 U.S. Provisional No. 60/515,701 (“Godfrey-Provisional”)
- APPLE-1030 ANSI/IEEE Std 802.11, *Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications* (Aug. 20, 1999) (“IEEE 802.11”)
- APPLE-1031 Order Resetting Markman Hearing, *Speir Technologies Ltd. v. Apple Inc.*, Case 6:22-cv-00077-ADA (WDTX)
- APPLE-1032 L. van der Perre, S. Thoen, P. Vandenameele, B. Gyselinckx and M. Engels, “Adaptive loading strategy for a high speed OFDM-based WLAN,” IEEE GLOBECOM 1998 (Cat. NO. 98CH36250), 1998, pp. 1936-1940.

LISTING OF CLAIMS

Claim 1	
[1.pre]	A wireless communications system comprising:
[1.a.i]	a plurality of wireless communications devices each having a device type associated therewith from among a plurality of different device types,
[1.a.ii]	each WLAN device having a unique identifier (UID) associated therewith, and
[1.a.iii]	each device type having a known device latency associated therewith; and
[1.b.i]	a wireless device locator comprising at least one antenna and a transceiver connected thereto, and
[1.b.ii]	a controller for cooperating with said transceiver for
[1.b.iii]	transmitting a plurality of location finding signals to a target wireless communications device from among said plurality of wireless communications devices and
[1.b.iv]	inserting the UID for said target wireless communications device in each of the location finding signals;
[1.c]	said target wireless communications device transmitting a respective reply signal for each of said location finding signals based upon the UID in the location finding signals;
[1.d]	said controller of said wireless device locator also for
[1.d.i]	cooperating with said transceiver for receiving the reply signals,
[1.d.ii]	determining a propagation delay associated with the transmission of each location finding signal and the respective reply signal therefor based upon the known device latency of said target wireless communications device, and
[1.d.iii]	estimating a range to said target wireless communications device based upon a plurality of determined propagation

	delays.
Claim 2	
[2]	The wireless communications system of claim 1 wherein said controller estimates the range based upon an average of the propagation delays.
Claim 3	
[3.a]	The wireless communications system of claim 1 wherein said target wireless communications device generates unsolicited signals including the UID thereof;
[3.b]	wherein said controller cooperates with said transceiver to receive at least one unsolicited signal from said target device; and
[3.c]	wherein said controller determines the UID for said target wireless communications device from the at least one unsolicited signal.
Claim 4	
[4]	The wireless communications system of claim 3 wherein said controller determines the device type of said target wireless communications device based upon the UID thereof.
Claim 5	
[5.a]	The wireless communications system of claim 4 wherein the UIDs comprise media access control (MAC) addresses of respective wireless communications devices, and
[5.b]	wherein said controller determines the device type of said target wireless communications device based upon the MAC address thereof.
Claim 6	
[6.a]	The wireless communications system of claim 1 wherein said at least one antenna comprises a plurality of antennas; and
[6.b]	wherein said controller cooperates with said plurality of antennas to determine a bearing to said target wireless communications device based upon at least one of the

	received reply signals.
Claim 7	
[7]	The wireless communications system of claim 6 wherein the bearing is a three-dimensional bearing.
Claim 8	
[8]	The wireless communications system of claim 1 wherein said at least one antenna comprises at least one directional antenna.
Claim 9	
[9]	The wireless communications system of claim 1 wherein said wireless device locator further comprises a portable housing carrying said at least one antenna, said transceiver, and said controller.
Claim 10	
[10]	The wireless communications system of claim 1 wherein said wireless communications devices comprise wireless local area network (WLAN) devices.
Claim 11	
[11]	The wireless communications system of claim 1 wherein said wireless communications devices comprise mobile ad-hoc network (MANET) devices.
Claim 12	
[12]	The wireless communications system of claim 1 wherein said wireless communications devices comprise cellular communications devices.
Claim 13	
[13.pre]	A wireless communications system comprising:
[13.a.i]	a plurality of wireless local area network (WLAN) devices each having a device type associated therewith from among a plurality of different device types,
[13.a.ii]	each WLAN device having a unique identifier (UID) associated therewith, and
[13.a.iii]	each device type having a known device latency associated

	therewith; and
[13.b.i]	a wireless device locator comprising at least one antenna and a transceiver connected thereto, and
[13.b.ii]	a controller for cooperating with said transceiver for
[13.b.iii]	transmitting a plurality of location finding signals to a target WLAN device from among said plurality of WLAN devices and
[13.b.iv]	inserting the UID for said target wireless communications device in each of the location finding signals;
[13.c]	said target WLAN device transmitting a respective reply signal for each of said location finding signals based upon the UID in the location finding signals;
[13.d]	said controller of said wireless device locator also for
[13.d.i]	cooperating with said transceiver for receiving the reply signals,
[13.d.ii]	determining a propagation delay associated with the transmission of each location finding signal and the respective reply signal therefor based upon the known device latency of said target WLAN device, and
[13.d.iii]	estimating a range to said target WLAN device based upon an average of a plurality of determined propagation delays.
Claim 14	
[14.a]	The wireless communications system of claim 13 wherein said target WLAN device generates unsolicited signals including the UID thereof;
[14.b]	wherein said controller cooperates with said transceiver to receive at least one unsolicited signal from said target WLAN device; and
[14.c]	wherein said controller determines the UID for said target WLAN device from the at least one unsolicited signal.

Claim 15	
[15]	The wireless communications system of claim 14 wherein said controller determines the device type of said target WLAN device based upon the UID thereof.
Claim 16	
[16a]	The wireless communications system of claim 15 wherein the UIDs comprise media access control (MAC) addresses of respective WLAN devices, and
[16b]	wherein said controller determines the device type of said target WLAN device based upon the MAC address thereof.
Claim 17	
[17.a]	The wireless communications system of claim 13 wherein said at least one antenna comprises a plurality of antennas; and
[17.b]	wherein said controller cooperates with said plurality of antennas to determine a bearing to said target WLAN device based upon at least one of the received reply signals.
Claim 18	
[18.pre]	A wireless device locator for locating a target wireless communications device having a unique identifier (UID) associated therewith, the wireless device locator comprising:
[18.a]	at least one antenna and a transceiver connected thereto; and
[18.b]	a controller for cooperating with said transceiver for
[18.c]	transmitting a plurality of location finding signals to the target wireless communications device,
[18.d]	inserting the UID for the target wireless communications device in each of the location finding signals, and
[18.e]	receiving a respective reply signal for each of said location finding signals generated by the target wireless communications device based upon the UID in the location finding signals,

[18.f]	determining a propagation delay associated with the transmission of each location finding signal and the respective reply signal therefor based upon a known device latency of the target wireless communications device, and
[18.g]	estimating a range to the target wireless communications device based upon a plurality of determined propagation delays.
Claim 19	
[19]	The wireless device locator of claim 18 wherein said controller estimates the range based upon an average of the propagation delays.
Claim 20	
[20.a]	The wireless device locator of claim 18 wherein the target wireless communications device generates unsolicited signals including the UID thereof;
[20.b]	wherein said controller cooperates with said transceiver to receive at least one unsolicited signal from the target device; and
[20.c]	wherein said controller determines the UID for the target wireless communications device from the at least one unsolicited signal.
Claim 21	
[21.a]	The wireless device locator of claim 18 wherein said at least one antenna comprises a plurality of antennas; and
[21.b]	wherein said controller cooperates with said plurality of antennas to determine a bearing to the target wireless communications device based upon at least one of the received reply signals.
Claim 22	
[22]	The wireless device locator of claim 18 wherein said at least one antenna comprises at least one directional antenna.

Claim 23	
[23]	The wireless device locator of claim 18 wherein said wireless device locator further comprises a portable housing carrying said at least one antenna, said transceiver, and said controller.
Claim 24	
[24]	The wireless device locator of claim 18 wherein the target wireless communications device comprises a wireless local area network (WLAN) device.
Claim 25	
[25]	The wireless device locator of claim 18 wherein the target wireless communications device comprises a mobile ad-hoc network (MANET) device.
Claim 26	
[26]	The wireless device locator of claim 18 wherein the target wireless communications device comprises a cellular communications device.
Claim 27	
[27.pre]	A method for locating a target wireless communications device from among a plurality of wireless communications devices, each wireless communications device having a device type associated therewith from among a plurality of different device types, each WLAN device having a unique identifier (UID) associated therewith, and each device type having a known device latency associated therewith, the method comprising:
[27.a]	transmitting a plurality of location finding signals to the target wireless communications device,
[27.b]	inserting the UID for the target wireless communications device in each of the location finding signals, and
[27.c]	receiving a respective reply signal for each of the location finding signals generated by the target wireless communications device based upon the UID in the locations signals;

[27.d]	determining a propagation delay associated with the transmission of each location finding signal and the respective reply signal therefor based upon the known device latency of the target wireless communications device; and
[27.e]	estimating a range to the target wireless communications device based upon a plurality of determined propagation delays.
Claim 28	
[28]	The method of claim 27 wherein the controller estimates the range based upon an average of the propagation delays.
Claim 29	
[29.a]	The method of claim 27 wherein the target wireless communications device generates unsolicited signals including the UID thereof; and further comprising:
[29.b]	receiving at least one unsolicited signal from the target device; and
[29.c]	determining the UID for the target wireless communications device from the at least one unsolicited signal.
Claim 30	
[30]	The method of claim 29 further comprising determining the device type of the target wireless communications device based upon the UID thereof.
Claim 31	
[31]	The method of claim 27 further comprising determining a bearing to the target wireless communications device based upon at least one of the received reply signals.
Claim 32	
[32]	The method of claim 27 wherein the target wireless communications device comprises a wireless local area network (WLAN) device.

Claim 33	
[33]	The method of claim 27 wherein the target wireless communications device comprises a mobile ad-hoc network (MANET) device.
Claim 34	
[34]	The method of claim 27 wherein the target wireless communications device comprises a cellular communications device.

I. INTRODUCTION

Claims 1-34 (“the Challenged Claims”) of U.S. Patent 7,110,779 (“the ’779 patent”) were not vetted thoroughly by the Office during prosecution. The file wrapper shows just one rejection/response before allowance based on an Examiner’s Amendment (*see* Section III.B). This Petition reveals that allowance was premature. The overly broad Challenged Claims are obvious, and proven so multiple times over in the grounds below based on new prior art references—McCrary, Raphaeli, Kuwahara, Rofheart, and Godfrey—that the Examiner never considered. *See* Section V. Accordingly, Apple Inc. (“Petitioner”) respectfully submits that the Board should institute *inter partes* review and ultimately find the Challenged Claims unpatentable.

II. IPR REQUIREMENTS—37 C.F.R. §42.104

A. Standing—37 C.F.R. §42.104(a)

Apple certifies that the ’779 patent is available for IPR, and that Apple is not barred or estopped from requesting this review.

B. Challenge and Relief—37 C.F.R. §42.104(b)

Petitioner requests IPR of the Challenged Claims on the following grounds.

Ground	’779 Patent Claims	Basis
1	1, 2, 8-10, 12-13, 18-19, 22-24, 26-28, 32, 34	§103: McCrary-Raphaeli
2	1, 3-6, 10-11, 13-17, 20-21, 24-25, 29-33	§103: McCrary-Raphaeli-Rofheart
3	6-7, 17, 21, 31	§103: McCrary-Raphaeli-Kuwahara
4	1-6, 8-34	§103: Rofheart-Raphaeli-Godfrey

Each reference pre-dates 2004-01-29 (“Critical Date”), which is the earliest date to which the ’779 patent claims priority.¹

Reference	Prior Art Date (at least as early as) ²	Basis (at least under)
McCrady (APPLE-1005)	2002-09-17	§102(b)
Raphaeli (APPLE-1006)	2003-05-04	§102(e)
Kuwahara (APPLE-1007)	2000-05-30	§102(b)
Rofheart (APPLE-1009)	2000-10-10	§102(e)
Godfrey (APPLE-1028)	2003-10-31	§102(e)

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

Because the Challenged Claims are obvious under any reasonable interpretation, no express constructions are required in this proceeding. To be clear, Petitioner reserves the right to address any construction proposed by Patent Owner or the Board. Petitioner also reserves the right to pursue constructions in district court that are necessary to decide matters of infringement.

For example, in district court, Petitioner construed the term “known device latency” as “predetermined latency for the given device type of the target wireless communication device.” APPLE-1017, 3. Patent Owner opposed this construction and argued that “known device latency” should be given its (presumably broader) plain meaning. *Id.*; APPLE-1018, 1-4. While pertinent to infringement, the parties’

¹ Petitioner does not concede that the ’779 patent is entitled to the claimed priority.

² See Sections V.A.1-2, V.B.1, V.C.1, V.D.1.

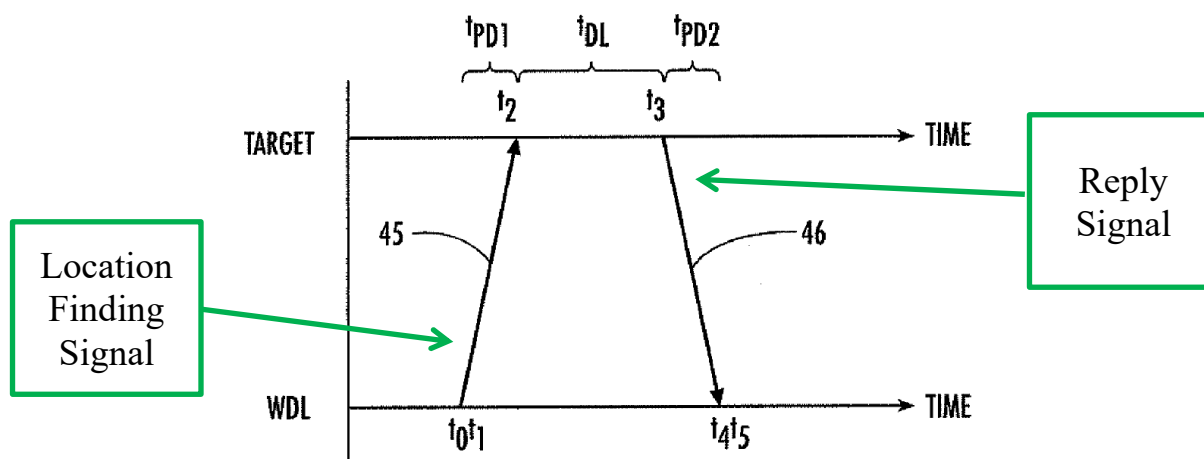
dispute has no bearing in this IPR because the prior art obviates the Challenged Claims under either party's interpretation.

III. THE '779 PATENT

A. Brief Description

The '779 patent describes “a wireless device locator which provides enhanced location features,” such as locating other devices in a wireless communications system via “active range finding.” APPLE-1001, 2:35-3:4, Abstract. In the patent's preferred embodiments, the device locator exchanges signals with a target device, determines a propagation delay of those signals using a known device latency of the target device, and estimates a range to the target device based upon determined propagation delays. *Id.*; APPLE-1003, ¶¶39-43.

The patent's active range finding includes a message/signal exchange where the locator transmits “a location finding signal 45” and the target device responds with a “reply signal 46.” APPLE-1001, 6:41-7:35, Fig. 3. A controller of the locator measures a “round trip time” (RTT) which includes propagation delays of the respective signals 45-46. *Id.* The controller then uses a “known device latency (*i.e.*, a mean latency) for the device type of the target device” (which approximates the actual device latency) to determine a propagation delay, and subsequently, a range to the target (*i.e.*, delay time multiplied by the speed of light yields a distance). *Id.*



APPLE-1001, Fig. 3.

B. Prosecution History Summary

The '779 patent issued on September 19, 2006 from U.S. Patent Application No. 10/767,794 (“the '794 application”), which was filed on January 29, 2004.

The Examiner’s first Office Action deemed a subset of the '794 application’s pending dependent claims (those including UID-based limitations, *e.g.*, Element [1.b.iv]) allowable if rewritten in independent format. APPLE-1002, 2006-02-24 Non-Final Rejection. The Applicant later authorized the Examiner to incorporate the allowable subject matter into the independent claims, and the Examiner responded by permitting the '794 application to grant. *Id.*, 2006-06-27 Notice of Allowance.

IV. LEVEL OF ORDINARY SKILL

A POSITA would have had a Bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and 2-3 years of experience in the design or development of wireless communication

systems/networks, including ranging/positioning systems or the equivalent. Additional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education. APPLE-1003, ¶¶20-22.

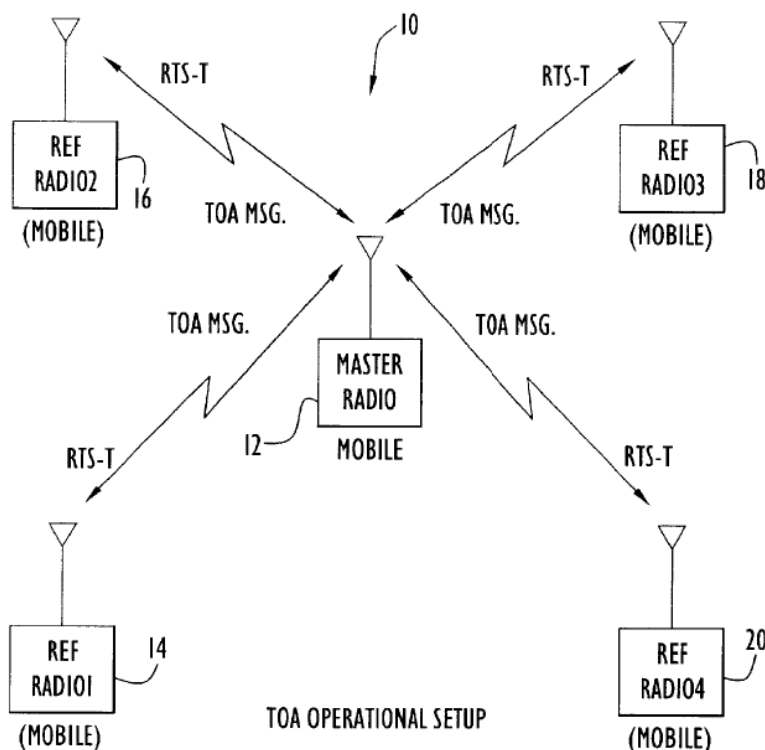
V. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1: Claims 1, 2, 8-10, 12-13, 18-19, 22-24, 26-28, 32, 34 are Obvious Over McCrady-Raphaeli

1. McCrady

McCrady issued on September 17, 2002, more than a year before the Critical Date, and thus qualifies as §102(b) prior art.

Like the '779 patent, McCrady is about estimating ranges between wireless devices. APPLE-1005, Abstract. For example, McCrady describes “a position location system 10 [that] includes a target or ‘master’ mobile communication device or ‘radio’ 12 communicating with four reference communication devices 14, 16, 18 and 20.” APPLE-1005, 6:44-56. These devices can be “any portable electronic device equipped with wireless transmission and reception capabilities.” *Id.*



APPLE-1005, Fig. 1.

McCrary further describes ranging message exchanges, where “[t]he master radio transmits outbound ranging messages to plural reference radios which respond by transmitting reply ranging messages.” *Id.*, Abstract. “Upon reception of the reply ranging message, the master radio determines the range to the reference radio from the signal propagation time calculated by subtracting the far-end turn around time from the round-trip elapsed time.” *Id.* In determining the “propagation time,” McCrary accounts for the device latency (*e.g.*, processing delay, antenna delay, etc.) of the reference radio as part of the subtracted “turn around time.” APPLE-1003, ¶¶52-55; APPLE-1005, 8:65-9:23, 10:44-59, 11:15-39, Figs. 4-5.

McCrary's messages can include addresses such as a destination address corresponding to the message's intended recipient, a source address corresponding to the message's source, or both. APPLE-1005, 8:38-46, 8:50-53; APPLE-1003, ¶55 (discussing that source/destination addresses are examples of UIDs).

2. Raphaeli

Raphaeli is a national stage application of a PCT application (PCT/IL2003/000358) filed on May 4, 2003, more than eight months before the Critical Date with an identical disclosure to Raphaeli. APPLE-1006, cover. The PCT application designated the United States and published under PCT Article 21(2) in English as WO2003/098528. APPLE-1008, cover. Accordingly, Raphaeli is §102(e) prior art as of the PCT filing date.

Like the '779 patent, Raphaeli's disclosure is about determining distances between wireless devices, such as wireless RF tags, based on measuring the round-trip propagation delay. APPLE-1006, Abstract, 1:10-15, 4:20-26, 6:50-54, 8:1-18, 22:16-36. Raphaeli also describes determining multiple roundtrip delays based on multiple responses from the target device and calculating an *average time delay* based on those roundtrip delays. APPLE-1006, 16:61-67, 17:1-4, 19:1-40; APPLE-1003, ¶60.

3. McCrady-Raphaeli Combination

The McCrady-Raphaeli combination incorporates Raphaeli's teachings about averaging propagation delays into McCrady's system. As a result, McCrady's calculation of the range between the master radio and a reference radio would have used the average propagation delay. APPLE-1003, ¶69; APPLE-1005, 9:23-30 (range equation).

A POSITA motivated to incorporate an averaging technique, such as described by Raphaeli (discussed below), would have appreciated the need for McCrady's system to calculate multiple propagation delays based on multiple ranging message exchanges. And it would have been apparent to a POSITA of ordinary creativity exercising basic common design sense that there were multiple predictable ways to achieve this result. APPLE-1003, ¶70.

First Combination Theory: A POSITA would have appreciated that McCrady's express disclosure already contemplates multiple message exchanges during a "frequency diversity" process, where the master radio "transmit[s] a sequence of M outbound ranging messages" on different frequencies and receives "M corresponding reply ranging messages." APPLE-1005, 14:35-65; *see also* Abstract, 7:14-26, 8:4-7, 11:54-58, 15:14-23, Figs. 2, 4, 5, 7; APPLE-1003, ¶71. The POSITA would have calculated the individual propagation delays (delay estimates) from the "M" ranging message exchanges on various frequencies, and then averaged

those delays as taught by Raphaeli.³ APPLE-1003, ¶¶72-73; APPLE-1006, 19:1-40 (discussing averaging).

Second Combination Theory: The POSITA would have contemplated the alternative approach of conducting multiple of McCrady's ranging message exchanges on a single frequency, determining corresponding delays, and averaging those delays as taught by Raphaeli. APPLE-1005, Abstract ("The master radio transmits outbound ranging messages..."), 7:14-26, 8:4-7, 14:35-65, 11:54-58, 15:14-23, Figs. 2, 4, 5; APPLE-1006, 9:3-21 ("interrogation" via "a sequence of

³ McCrady's message exchange technique employs "frequency diversity" to handle "severe multipath" interference. APPLE-1005, 5:12-27, 13:45-65. The POSITA would have seen the benefit of leveraging McCrady's technique to facilitate Raphaeli's teaching on averaging propagation delays. APPLE-1003, ¶73. For example, setting aside multipath interference, the POSITA would have understood that diversifying the sample of to-be-averaged propagation delays from a frequency perspective would reduce the impact of other types of interference such as co-channel interference and general channel noise. *Id.* Moreover, even with multipath interference, the POSITA would have averaged propagation delays produced from two or more of McCrady's "M" message exchanges that have favorable pulse-width evaluations. *Id.*; APPLE-1005, 15:24-47; APPLE-1006, 19:20-32.

pulses”), 19:1-40 (discussing averaging based on “a predetermined number of received pulses”); APPLE-1003, ¶¶74-75. A POSITA would have recognized that McCrady’s ranging message exchanges (*e.g.*, RTS-T/TOA message exchanges as discussed above) can occur on a single frequency because the message exchange is frequency agnostic. APPLE-1003, ¶¶74-75.

(a) Motivation

A POSITA contemplating McCrady’s system would have been familiar with references like Raphaeli that also describe techniques for determining the distance to a target wireless device. APPLE-1003, ¶76; APPLE-1005, 8:65-9:56 (“Once the two-way signal propagation time is determined, the range is then readily calculated...”), 10:44-11:39; APPLE-1006, 1:10-15 (“distance determination based on measuring the round trip delay”), 4:20-26, 6:50-54, 8:1-18, 22:16-36. In fact, a reference like Raphaeli would have been one of the top choices for the POSITA given its similarity to McCrady. As discussed above, like McCrady, Raphaeli describes measuring the round-trip delay during a message exchange between devices, and then using the delay to estimate a range between the devices. It is therefore no surprise that a POSITA would have been motivated to pursue the McCrady-Raphaeli combination for several reasons. APPLE-1003, ¶76.

First, a POSITA would have sought out teachings from references like Raphaeli on the notion of averaging multiple propagation delays based on

suggestions within McCrady. APPLE-1003, ¶¶77-78. McCrady, for example, uses “*averag[ing]* to reduce the variance” when “performing an internal delay calibration to reduce the variance of the delay estimate.” APPLE-1005, 10:44-59. McCrady also discloses “calculating the *mean* and standard deviation of [multiple] measured values [of antenna delay].” *Id.*, 11:15-23. A POSITA would have taken these various discussions on averaging as a suggestion to apply the same concept to other aspects of McCrady’s disclosure. APPLE-1003, ¶¶77-78. Accordingly, the POSITA would have viewed Raphaeli’s teaching to conduct multiple message exchanges and to average multiple propagation delays as consistent with McCrady’s suggestion. *Id.* Moreover, the use of averaging in other aspects of McCrady’s disclosure, such as in estimating a range, would have been one of the obvious “variations” that McCrady envisioned. *Id.*; APPLE-1005, 16:1-16 (discussing that “variations in the TOA processing scheme fall within the scope of the invention”).

Second, a POSITA would have expected Raphaeli’s teaching on averaging multiple propagation delays (either determined from message exchanges on the same or different frequencies) to predictably improve a similar system like McCrady’s by enhancing the precision of the estimated range. APPLE-1003, ¶¶79-80. Raphaeli’s express disclosure on this precision advantage would have reinforced the POSITA’s understanding. *Id.*; APPLE-1006, 19:33-40 (“By DSP 40 calculating an average time delay..., *the precision of the round trip delay determination is increased* relative

to a single delay measurement..., the pulse form of each received pulse is interpolated..., further *enhancing the precision* of the round trip delay determination.”).

Third, even without Raphaeli’s observation of improved precision, a POSITA would have recognized that unknown/random error(s) exists in the individual propagation delay estimates described by McCrady/Raphaeli due to channel noises, interferences, measurement errors, etc. APPLE-1003, ¶¶81-82. Thus, the POSITA would have sought to employ known methods for the purpose of obtaining a more precise representation of the delay estimate. *Id.* In this context, Raphaeli’s averaging technique would have been an obvious choice. *Id.* Averaging multiple measurements/estimates was a centuries-old and commonly used technique to produce an estimation value that summarizes or represents a set of values with reduced standard deviation (*i.e.*, reduced variance). *Id.*; APPLE-1026, 177; APPLE-1005, 10:44-59; APPLE-1019-1022. Applying this well-known concept in the context of McCrady yields the predictable outcome suggested by Raphaeli—*i.e.*, taking multiple measurements and averaging the corresponding delay estimates. APPLE-1003, ¶¶81-82.

(b) Reasonable Expectation of Success

As discussed, McCrady and Raphaeli both describe techniques for position/range determination in the context of wireless devices. APPLE-1003, ¶¶83-

85. Moreover, given McCrady's disclosure of multiple message exchanges (APPLE-1005, 14:35-65), the notion of ascertaining and averaging multiple delays based on those exchanges would have been straightforward from a POSITA's perspective. *Id.* Likewise, the POSITA would have expected Raphaeli's averaging technique to work in the context of McCrady because McCrady employed averaging in other aspects of its disclosure. *Id.*; APPLE-1005, 10:44-59, 11:15-23. Averaging sampled values would have been within the skill level of a POSITA because averaging is taught/used in a variety of engineering, science, and/or math courses that a POSITA would have taken (*see* relevant degrees as discussed in Section IV). APPLE-1003, ¶¶84-85.

Further, the McCrady-Raphaeli combination represents a combination of known elements each performing the functions it had been known to perform to produce the predictable result of combining/averaging multiple propagation delay values. *Id.* As such, a POSITA would have reasonably expected a successful outcome from combining Raphaeli's teachings on averaging propagation delays with McCrady's description of a position location system. *Id.*

4. Independent Claims 1, 18, 27

(a) Independent Claim 1

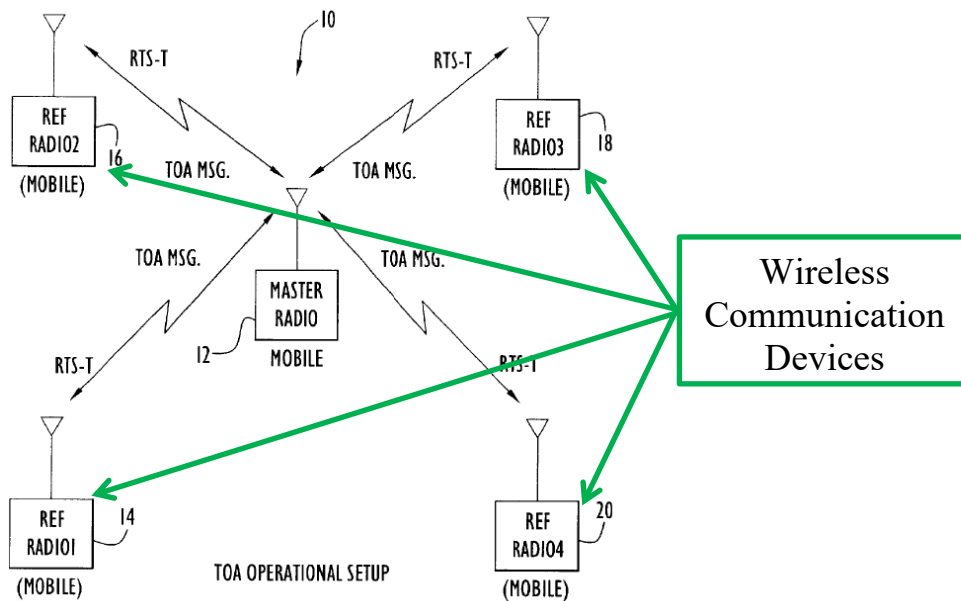
Element [1.pre]

McCrady-Raphaeli provides [1.pre]. APPLE-1003, ¶92. As discussed below, McCrady describes a "position location system 10" that includes wireless communications devices (*e.g.*, reference radios) and a wireless device locator (*e.g.*,

master radio). APPLE-1005, 6:44-56, Fig. 1.

Element [1.a.i]

McCrary-Raphaeli provides [1.a.i]. APPLE-1003, ¶¶93-94. For example, McCrary describes that “a position location system 10 includes a target or ‘master’ mobile communication device or ‘radio’ 12 communicating with *four reference communication devices 14, 16, 18 and 20.*” APPLE-1005, 6:44-56, 7:2-13. These devices can be “any portable electronic device equipped with wireless transmission and reception capabilities.” *Id.*



APPLE-1005, Fig. 1 (annotated).

Each of McCrary’s devices has an associated device type, such as “[1] a handheld or body-mounted radio; [2] any type of mobile telephone (e.g., analog cellular, digital cellular or satellite-based); [3] a pager or beeper device; a radio

carried on, built into or embedded in a ground-based or airborne vehicle; or [4] any portable electronic device equipped with wireless transmission and reception capabilities.” APPLE-1005, 6:44-56. A POSITA would have recognized that these enumerated devices comprise different device types. APPLE-1003, ¶94 (describing how a POSITA would have distinguished between these different known device types). Moreover, a POSITA reading McCrady would have distinguished between different types of devices based on their respective antenna hardware. *Id.*, ¶94.

Element [1.a.ii]

McCrady-Raphaeli provides [1.a.ii].⁴ APPLE-1003, ¶¶95-101.

“WLAN device...”

As discussed above, McCrady’s devices (master/reference radios) can be “**any** portable electronic device equipped with **wireless** transmission and reception capabilities.” APPLE-1005, 6:44-56, 7:2-13, Fig. 1. Accordingly, McCrady’s reference radios (“wireless communications devices” per analysis at [1.a.i]) include WLAN devices. APPLE-1003, ¶96; APPLE-1010 (definition of WLAN).

Even if Patent Owner were to argue that McCrady somehow lacks an express

⁴ This analysis treats “each WLAN device” in [1.a.ii] as referencing the “wireless communications devices” of [1.a.i] because [1.a.ii] immediately follows [1.a.i] and there are no other previously introduced devices. APPLE-1003, ¶95.

disclosure, the fact that the reference radios can be “any” device with the ability to transmit/receive wireless signals would have at least suggested or otherwise rendered obvious WLAN devices to a POSITA. APPLE-1003, ¶¶97-99. At the time of the ’779 patent in 2004, wireless mobile computing devices with WLAN capabilities were known, desirable, and commercialized. *Id.* Thus, when McCrady mentioned “any” wireless device, the POSITA would have contemplated WLAN devices. *Id.*; APPLE-1006, 25:19-33 (Raphaeli discussing various “transmission methods”); APPLE-1024, [0018]; APPLE-1025, [0011]; APPLE-1032 (discussing WLAN). Indeed, WLAN devices would have naturally come to mind given that McCrady’s background section discloses a WLAN and its use for transferring ranging information (TOAs). APPLE-1005, 2:58-60.

“having a unique identifier (UID) associated therewith”

McCrady’s master radio transmits an outbound ranging message (*e.g.*, RTS-T) that “includes a ***Destination Address*** 28 ... to ***indicate the reference radio*** to which the master radio is directing the RTS-T message.” APPLE-1005, 8:38-46; Sections IV.A.1, IV.A.4 ([1.b.iii]-[i.b.iv]). McCrady’s destination address is consistent with a POSITA’s understanding of a UID. APPLE-1003, ¶100. For example, McCrady’s description of the destination address shows that it is used to uniquely identify different message destinations, *i.e.*, reference radios, within the network in a manner that ensures the message is directed to and received by the

intended radio. This description is consistent with the specification and claims of the '779 patent, which contemplate that the UID includes an address of a device. APPLE-1003, ¶101 (discussing APPLE-1001, 3:38-45, 6:14-25, claim 5).

Element [1.a.iii]

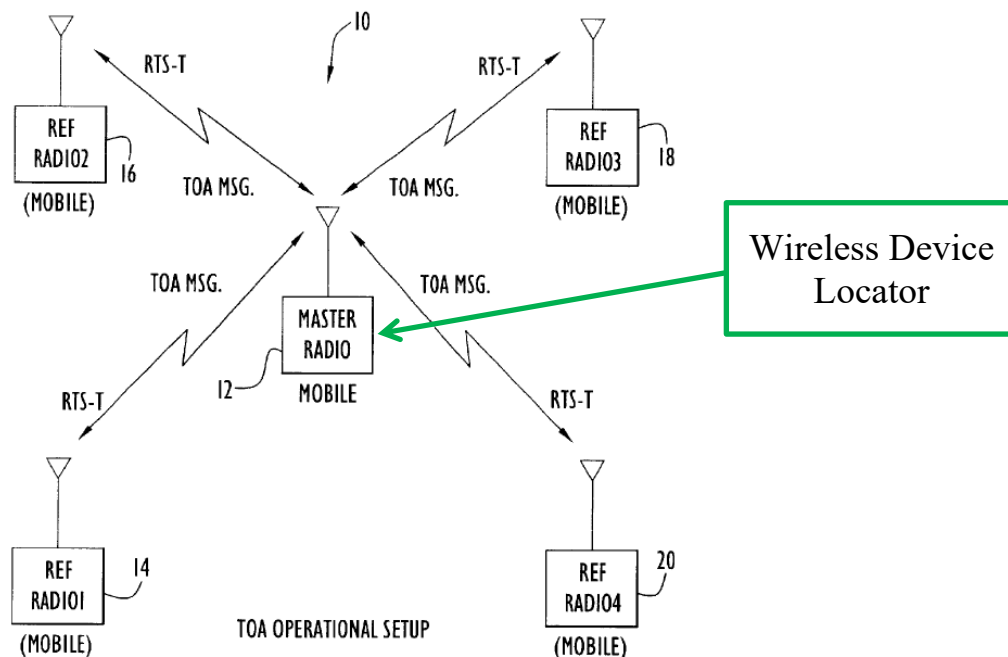
McCrady-Raphaeli provides [1.a.iii]. APPLE-1003, ¶¶102-106. McCrady explains that the reference radios (mapped to the claimed “wireless communication devices”) have an associated latency during the ranging message exchange—*e.g.*, a processing delay, *antenna delay*, etc. APPLE-1005, 8:65-9:23, 11:15-39, Fig. 5. As to the antenna delay latency, McCrady teaches that it is a predetermined value associated with a device type. *Id.*, 11:15-23 (“preloaded” and “constant”). Moreover, a POSITA would have understood that McCrady contemplates different known device latencies (plain meaning or “predetermined latency” discussed in Section II.C) vis-à-vis different antenna delay values for devices equipped with different types of antennas (“device type,” as discussed above). APPLE-1003, ¶103. A POSITA would have recognized that the antenna delay T_a for a given antenna type applies to any device with that antenna type (“device type”). *Id.*

To the extent Patent Owner argues that McCrady teaches a single antenna delay value covering all of the different types (which it does not), a POSITA would have been motivated to pursue a predictable variation with different delay values for devices with different types of antennas. APPLE-1003, ¶106. This approach would

have predictably increased the precision and accuracy of the estimated delay (as noted above) with no material impact on other aspects of McCrady-Raphaeli. *Id.*

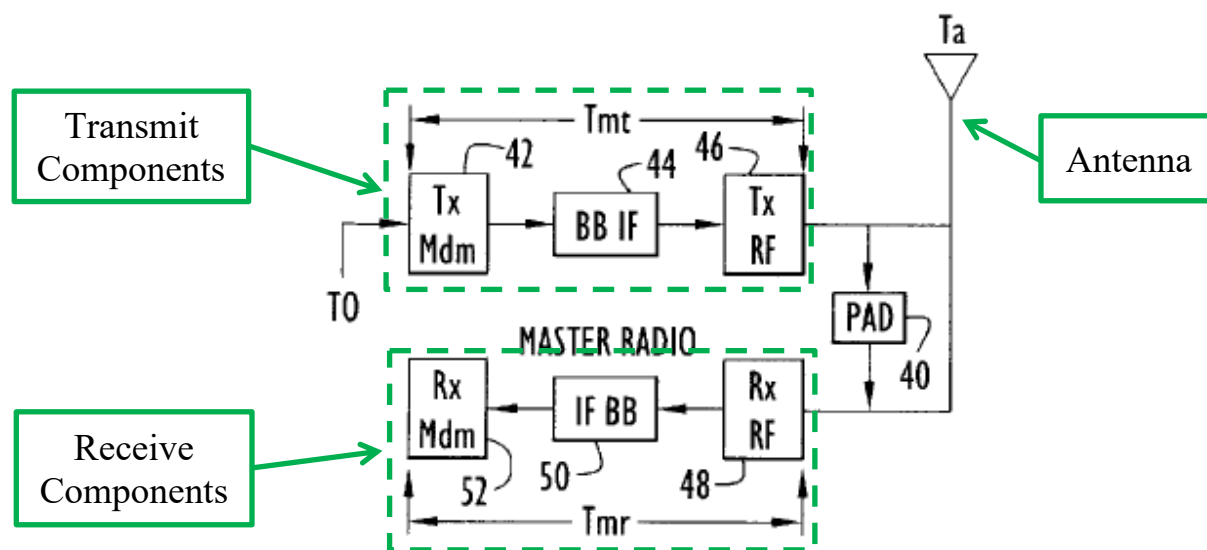
Element [1.b.i]

McCrady-Raphaeli provides [1.b.i]. APPLE-1003, ¶¶107-110. For example, McCrady describes that “*Master radio 12* communicates with the four reference radios 14, 16, 18 and 20 to *determine its location in three dimensions*” by “determin[ing] the range to each reference radio.” APPLE-1005, 7:14-21. The master radio’s functionality of locating reference radios to ascertain its own relative location is consistent with a POSITA’s understanding of a wireless device locator. APPLE-1003, ¶108.



APPLE-1005, Fig. 1 (annotated).

McCrary further explains that “master radio 12...includes an *antenna* coupled to a *transmitter and a receiver* for transmitting and receiving ranging messages.” APPLE-1005, 7:14-21. A receiver and a transmitter in the same device and coupled with the same antenna is consistent with a POSITA’s understanding of a *transceiver*. APPLE-1003, ¶110; APPLE-1005, 7:14-21, 10:44-59 (discussing that McCrary’s master radio includes receive components and transmit components coupled with an antenna (depicted in Fig. 5, below)); APPLE-1010 (transceiver “can both transmit and receive signals”); APPLE-1011 (transceiver is “[t]he combination of radio transmitting and receiving equipment in a common housing”).



APPLE-1005, Fig. 5 (annotated).

Element [1.b.ii]

McCrary-Raphaeli provides [1.b.ii]. APPLE-1003, ¶¶111-115. For example, McCrary’s master radio includes processor/processing circuitry. APPLE-1005,

8:65-9:23 (discussing “internal processing delays within the master radio”), 10:36-43 (“signal processors of the radios”), 10:44-59 (discussing that “the master radio initiates the TOA ranging process by performing an internal delay calibration using a loop back through pad 40 to determine internal delays”), 12:8-23 (discussing “communication acquisition processor 70”), 13:15-47 (discussing “TOA processor 92”), Figs. 6, 7 (*see* “TOA processing in DSP software”, where DSP stands for a digital signal processor). A POSITA would have understood that McCrady’s processor/processing circuitry ***controls*** the components of the master radio, including the transceiver ([1.b.i]). Thus, McCrady teaches the claimed “controller.” APPLE-1003, ¶113.

Regardless, even if Patent Owner argues that McCrady’s disclosure of processor/processing circuitry is deficient, the ’779 patent’s claims are no less obvious. As discussed for [1.a.i], McCrady contemplates known wireless communications devices such as mobile telephones. APPLE-1005, 6:44-56. McCrady further sought to maintain the “existing hardware and software” of these devices, (*id.*, 4:26-30, 7:42-43), which suggests a controller. APPLE-1003, ¶114. For example, wireless communications devices (*e.g.*, mobile phones) were known to include a conventional “hardware” component called a “controller” that performs central processing and controls onboard peripherals, including the transmitter/receiver (“transceiver,” as discussed at [1.b.i]). *Id.*; APPLE-1024,

[0018]-[0019]; APPLE-1023, 6:46-50. Again, McCrady's goal was to preserve this "existing hardware" in its master radio. APPLE-1005, 4:26-30, 7:42-43. Raphaeli's disclosure corroborates McCrady's suggestion on this point by describing in a similar context that "a single processor" can "perform the tasks of both DSP 40 and controller." APPLE-1006, 19:60-63, 18:22-42, 19:11-53, Fig. 3; APPLE-1003, ¶¶114-115.

Element [1.b.iii]

McCrady-Raphaeli provides [1.b.iii]. APPLE-1003, ¶¶116-119. The transmitter ([1.b.i] "transceiver") in the McCrady-Raphaeli combination, as controlled by the above-discussed controller, provides the claimed functionality under each of the alternative First/Second Combination Theories in Section V.A.3.

Under the First Combination Theory, the master radio's transmitter transmits a plurality of location finding signals to a target wireless communications device (McCrady's reference radio) during the "frequency diversity" process. According to the frequency diversity process, the master radio "transmit[s] a sequence of M outbound ranging messages" on different frequencies and receives "M corresponding reply ranging messages." APPLE-1005, 14:35-65; *see also* Abstract, 7:14-26, 8:4-7, 11:54-58, 15:14-23, Fig. 7; APPLE-1003, ¶118.

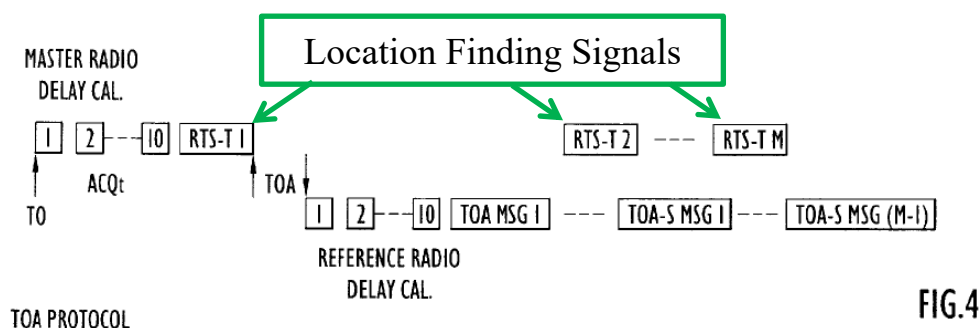


FIG.4

APPLE-1005, Fig. 4.

Under the Second Combination Theory, the master radio's transmitter transmits a plurality of location finding signals to a target wireless communications device on a single frequency. APPLE-1005, Abstract, 7:14-26, 8:4-7, Figs. 2, 5; APPLE-1006, 9:3-21, 19:1-40; APPLE-1003, ¶119.

Element [1.b.iv]

McCrary-Raphaeli provides [1.b.iv]. APPLE-1003, ¶¶120-123. For example, McCrary describes that "[t]he data portion of the RTS-T message includes a *Destination Address* 28 ...[which] *is used to indicate the reference radio to which the master radio is directing the RTS-T message.*" APPLE-1005, 8:38-46. A POSITA would have understood and expected that a device would insert (include) a destination address (UID) into a message before transmitting the message containing that address. This description is consistent with the specification of the '779 patent, which contemplates inserting/including a UID in a signal (*e.g.*, header packet). APPLE-1003, ¶121 (discussing APPLE-1001, 6:26-30).

Alternatively, it would have been obvious to a POSITA that McCrady's master radio (via controller, discussed for [1.b.ii]) inserts the destination address in the outbound ranging message (RTS-T) in order for the message to include the address. APPLE-1003, ¶122. For example, doing so would have been consistent with RTS-based protocols. *Id.*; APPLE-1005, 7:42-8:46; APPLE-1030, 41-42 (Section 7.2.1.1).

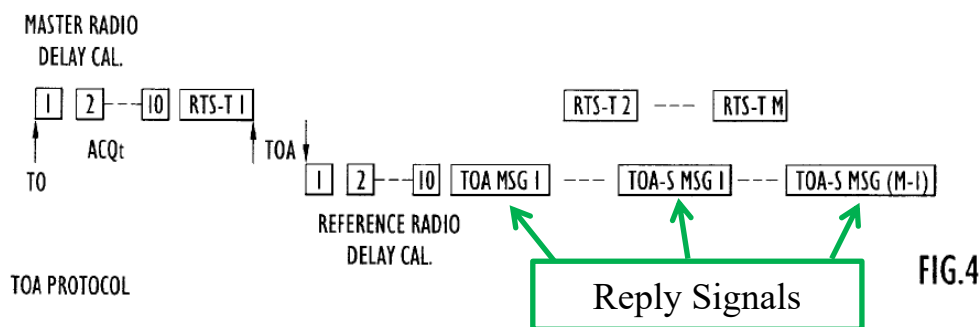
In sum, McCrady teaches and renders obvious inserting the UID (*i.e.*, destination address) for said target wireless communications device in each of the location finding signals (*i.e.*, RTS-T messages). APPLE-1003, ¶123; *see also* Section V.A.4 ([1.a.ii], [1.b.iii]).

Element [1.c]

McCrady-Raphaeli provides [1.c]. APPLE-1003, ¶¶124-126. As discussed for [1.a.ii] and [1.b.ii]-[1.b.iv], McCrady-Raphaeli involves transmitting a plurality of location finding signals (McCrady's ranging message, *e.g.*, outbound ranging message RTS-T, transmitted multiple times to facilitate the averaging technique taught by Raphaeli) to a target wireless communications device (McCrady's reference radio).

McCrady also teaches that the target device transmits reply signals (McCrady's reply ranging messages) for each location finding signal. APPLE-1005, 7:14-26, 8:39-50 (discussing the “*reply ranging message (TOA Msg.)*” transmitted

from each reference radio to the master radio”), 14:45-49 (discussing “the set of M carrier frequencies that will be used to transmit a sequence of M outbound ranging messages and M corresponding reply ranging messages”), 15:14-23, 11:54-58, Abstract (“reference radios [] respond by transmitting reply ranging messages.”).



APPLE-1005, Fig. 4 (annotated).

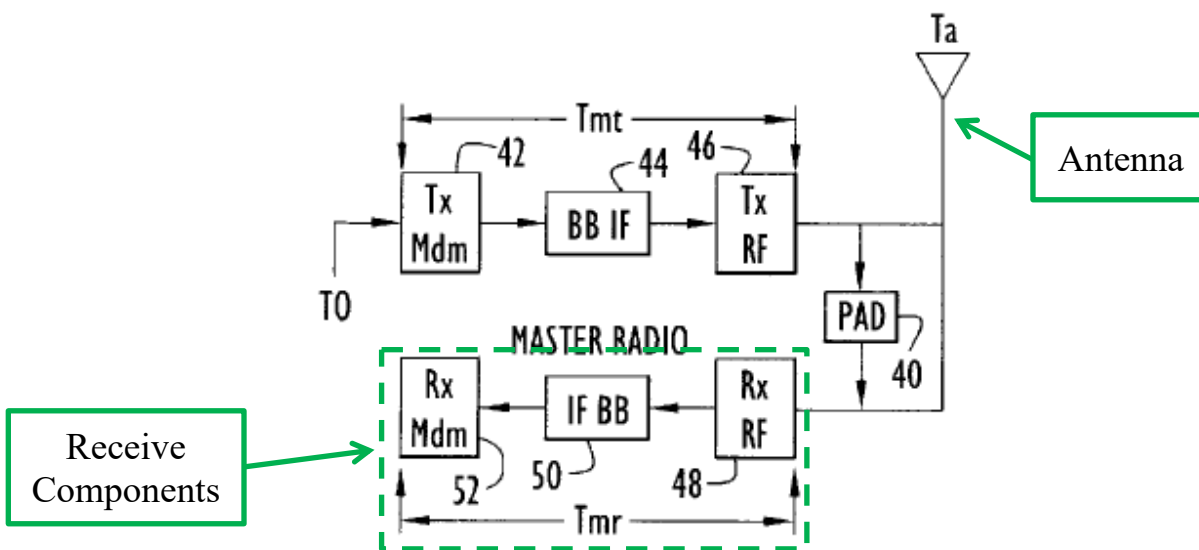
As discussed above, there is a UID (*e.g.*, destination address) in the location finding signals (*e.g.*, RTS-T messages) that corresponds to the target device. *See* Section V.A.4 ([1.a.ii], [1.b.iii]-[1.b.iv]). McCrady’s “Destination Address field is used to *indicate* the reference radio to which the master radio is directing the RTS-T message.” APPLE-1005, 8:38-46. McCrady’s reference radio transmits the reply if its address has been “indicated” in the RTS-T message. APPLE-1003, ¶126. As such, a POSITA would have recognized that McCrady’s reference radio transmits the reply *based upon the UID* (*e.g.*, destination address) in the location finding signals (*e.g.*, RTS-T messages). *Id.*

Element [1.d]

McCrary-Raphaeli provides [1.d]. APPLE-1003, ¶127; *see* Section V.A.4 ([1.b.ii]).

Element [1.d.i]

McCrary-Raphaeli provides [1.d.i]. APPLE-1003, ¶128. For example, McCrary describes that “master radio 12...includes an *antenna coupled to a transmitter and a receiver for transmitting and receiving ranging messages.*” APPLE-1005, 7:14-26; *see also* Abstract (“Upon *reception of the reply ranging message...*”), 10:44-59 (discussing receive components of the master radio); *see also* [1.b.i] (a receiver is a component of a “transceiver”).



APPLE-1005, Fig. 5.

Element [1.d.ii]

McCrady-Raphaeli provides [1.d.ii]. APPLE-1003, ¶¶129-131. For example, McCrady determines a propagation delay (round-trip propagation time (T_{RT})⁵) using the time of transmission (TT) of each location finding signal and the time of arrival (TOA) of each respective reply signal. APPLE-1005, 8:65-9:23 ($T_{RT} = TOA - TT - \Delta T_{TA} - \Delta T_{ID}$). McCrady's calculation also accounts for "turn around time (ΔT_{TA})," which includes "the reference radio transmitter and receiver delays T_{rt} and T_{rr} determined from the calibration process and *the estimated antenna delay T_a* ." *Id.*, 11:28-31. Accordingly, just as the propagation delay determination is based on the time of transmission (TT) and time of arrival (TOA), it is also based on estimated antenna delay (T_a) for the antenna type ("known device latency", per discussion at [1.a.iii]).

The First/Second Combination Theories (Section V.A.3) each involve averaging multiple propagation delays obtained by conducting multiple ranging message exchanges and calculating a propagation delay for each exchange. APPLE-

⁵ Alternatively, a POSITA would have recognized that McCrady's T_{RT} , when divided by two as described by McCrady, provides a one-way propagation delay. APPLE-1005, 9:24-56 (discussing that "Range=(Velocity)(T_{RT})/2"); APPLE-1003, ¶130.

1003, ¶131. In other words, a POSITA would have understood that averaging multiple delays requires ascertaining individual delays for separate message exchanges. *Id.*

Element [1.d.iii]

McCrary-Raphaeli provides [1.d.iii]. APPLE-1003, ¶¶132-134. For example, McCrary discloses an equation (Eq. 2) based on the propagation delay (*e.g.*, round-trip propagation time T_{RT} , per [1.d.ii]) to estimate a range to the target wireless communications device (McCrary's reference radio, per [1.a.i]). APPLE-1005, 9:24-30 ($\text{Range} = (\text{Velocity})(T_{RT})/2$).

The First/Second Combination Theories (Section V.A.3) each involve averaging determined propagation delays and using the average delay in the range estimation equation. APPLE-1006, 19:1-40 (discussing averaging). Accordingly, in the McCrary-Raphaeli combination, McCrary's range estimation formula converts to: $\text{Range}_{\text{average}} = (\text{Velocity})(T_{RT\text{-average}})/2$. APPLE-1003, ¶¶131-134. Here, $T_{RT\text{-average}}$ is an average of multiple propagation delays. A POSITA would have understood that an average is just one example of how a range can be “based upon a plurality of determined propagation delays” and that other examples are possible. *Id.*

(b) Independent Claim 18

Claim 18 is an apparatus claim that only includes the wireless device locator aspect of claim 1. The limitations of claim 18 are substantially similar to claim 1 and

are rendered obvious by McCrady-Raphaeli for the same reasons. APPLE-1003,

¶¶147-155. Note that claim 18 does **not** recite the WLAN limitation of [1.a.ii].

Element	Corresponding Element Analysis
[18.pre]	[1.a.i]-[1.a.iii], [1.b.i]
[18.a]	[1.b.i]
[18.b]	[1.b.ii]
[18.c]	[1.b.iii]
[18.d]	[1.b.iv]
[18.e]	[1.d.i], [1.c]
[18.f]	[1.d.ii], [1.a.iii]
[18.g]	[1.d.iii]

(c) *Independent Claim 27*

Claim 27 is an independent method claim that mirrors the system claim recited in claim 1. The limitations of claim 27 are substantially similar to claim 1 and are rendered obvious by McCrady-Raphaeli for the same reasons. APPLE-1003, ¶¶156-162.

Element	Corresponding Element Analysis
[27.pre]	[1.a.i]-[1.a.iii]
[27.a]	[1.b.iii]
[27.b]	[1.b.iv]
[27.c]	[1.d.i], [1.c]
[27.d]	[1.d.ii]
[27.e]	[1.d.iii]

5. Claims 2, 19, 28 and Independent Claim 13

McCradly-Raphaeli provides [2], [19], and [28] (*average of the propagation delays*). APPLE-1003, ¶¶163-165. As discussed for claim 1, the McCradly-Raphaeli combination includes a controller (*see* [1.b.ii], [1.d]) that determines multiple propagation delays (*see* [1.d.ii]) and estimates the range based upon an average of the propagation delays using the equation: $Range_{average} = (Velocity)(T_{RT-average})/2$ (*see* [1.d.iii]).

McCradly-Raphaeli also provides independent claim 13 which parallels system claim 1 and further requires that an average is used to estimate the range (claim 2).⁶ APPLE-1003, ¶¶135-146. The table below maps the elements of claim 13 to corresponding elements of claims 1-2.

Element	Corresponding Element Analysis
[13.pre]	[1.pre]
[13.a.i]-[13.a.iii]	[1.a.i]-[1.a.iii]
[13.b.i]-[13.b.iv]	[1.b.i]-[1.b.iv], [1.a.ii]
[13.c]	[1.c], [1.a.ii]
[13.d]	[1.d]
[13.d.i]	[1.d.i]
[13.d.ii]	[1.d.ii], [1.a.ii]
[13.d.iii]	[1.d.iii], [2], [1.a.ii]

⁶ Claim 13 includes that the devices are WLAN devices (which is addressed for both claims 1 and 10).

Note that claim 13 specifies throughout its claim elements that the plurality of devices are “WLAN devices,” where claim 1 specifies “WLAN devices” only in Element [1.a.ii]. The discussion at Element [1.a.ii] regarding the obviousness of “WLAN” devices in view of McCrady (Section V.A.4) applies equally throughout the various elements of claim 13 ([13.a.i]-[13.a.ii], [13.b.ii], [13.c], [13.d.ii]-[13.d.iii]).

6. Claims 8, 22

McCrady-Raphaeli provides [8] and [22] (*directional antenna*). APPLE-1003, ¶¶166-170. For example, Raphaeli describes that “[t]he wide band broadcast interrogation signal may be transmitted in a specific direction, by using for example a *directional antenna*.” APPLE-1006, 8:50-62.

A POSITA would have recognized that directional antennas were often used in devices (such as McCrady’s radios) to transmit/receive signals in specific directions. APPLE-1003, ¶¶167-169. And the known, predictable benefits of transmitting/receiving signals in specific directions would have prompted a POSITA to employ a directional antenna in McCrady’s master radio. *Id.* (explaining how directional antennas were known to reduce signaling collisions and multipath interference); APPLE-1005, 7:14-21 (“master radio 12...includes an antenna”); APPLE-1006, 4:12-14, 4:52-57, 14:61-67, 16:45-54.

7. Claims 9, 23

McCrary-Raphaeli provides [9], [23] (*portable housing*). APPLE-1003, ¶¶171-172. As discussed for [1.b.i]-[1.b.ii], McCrary teaches a wireless device locator (e.g., “master radio”) which includes various components, e.g., an antenna, transceiver, and controller. McCrary further describes that a “mobile radio is any *portable device* capable of transmitting and/or receiving communication signals,” such as a mobile/cellular telephone. APPLE-1005, 6:44-56, 6:57-7:13, 17:41-42. A POSITA would have recognized that a portable electronic device, e.g., a mobile telephone, has a housing that carries its components. APPLE-1003, ¶171.

8. Claims 10, 24, 32

McCrary-Raphaeli provides [10], [24], and [32] (*WLAN devices*) in that McCrary, as discussed for [1.a.ii], teaches, suggests, or renders obvious that the target wireless communications devices comprise WLAN devices. APPLE-1003, ¶¶173-175.

9. Claims 12, 26, 34

McCrary-Raphaeli provides [12], [26], and [34] (*cellular communications device/devices*). APPLE-1003, ¶¶176-178. As discussed for [1.a.i], McCrary discloses wireless communications devices, e.g., master or reference radios. McCrary further describes that “a mobile communication device or mobile radio” can be “any type of mobile telephone (e.g., analog *cellular*, digital cellular or satellite-based”). APPLE-1005, 6:44-56, 7:2-13, 17:41-42 (“*cellular telephones*”).

B. GROUND 2: Claims 1, 3-6, 10-11, 13-17, 20-21, 24-25, 29-33 are Obvious Over McCrady-Raphaeli-Rofheart

1. Rofheart

Rofheart's filing date of October 10, 2000 is years before the Critical Date. Accordingly, Rofheart qualifies as §102(e) prior art.

Like the '779 patent, Rofheart describes estimating ranges between wireless devices. APPLE-1009, 2:3-8. For example, Rofheart describes a “wireless network 300 [that] includes a local device 301 linked to a *first remote device 302, a second remote device 303 and N number of additional remote devices 300N.*” APPLE-1009, 17:18-22.

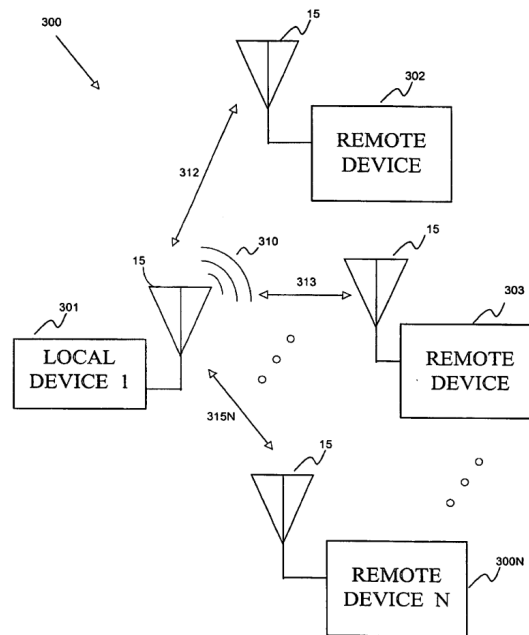
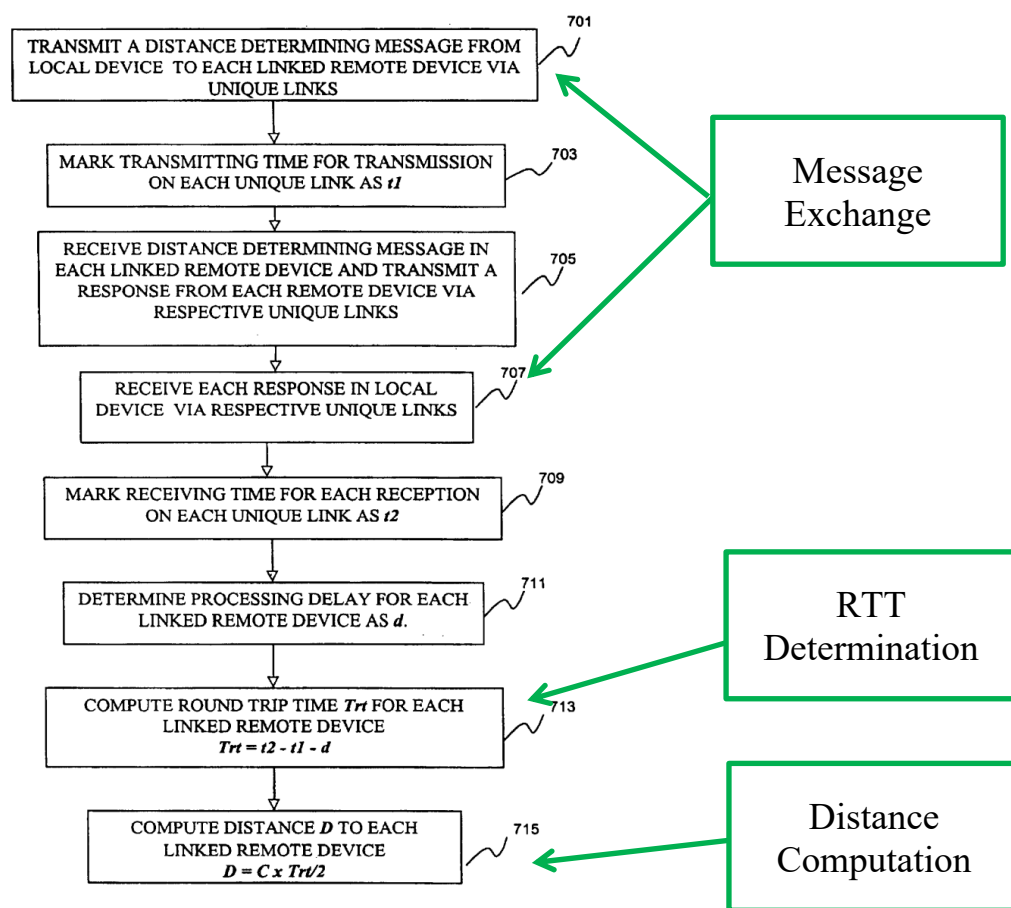


FIGURE 3

APPLE-1009, Fig. 3. These “remote devices” in Rofheart can take a variety of forms, including WLAN devices, mobile ad-hoc network (MANET) devices, and mobile/cellular telephones. APPLE-1009, 17:13-37, 15:50-53.

Rofheart further describes “transmitting a message from a local device to a remote device via an ultra wide band (UWB) wireless medium and receiving a response from the remote device via the UWB wireless medium.” APPLE-1009, 3:61-4:4. According to Rofheart, “[a] time between the transmitting of the message and the receiving of the response is then determined and a function is performed in the local device based on the round trip time [(RTT)] determined.” *Id.*; *see also* 4:5-21. Figure 7 (below) depicts one example of a process in Rofheart that includes a message exchange, determination of RTT, and distance computation.



APPLE-1009, Fig. 7, 23:59-25:31.

The RTT (*Trt*) takes into account a processing delay (“*d*”) of the remote device (*e.g.*, delay between receiving a message and transmitting a response), where the processing delay is based on a device/radio type indicated by the remote device via, *e.g.*, an independent (unsolicited) signal. APPLE-1009, 4:5-21, 20:62-66, 24:36-55; APPLE-1003, ¶68.

2. McCrady-Raphaeli-Rofheart Combination

(a) Motivation

A POSITA would have been motivated to incorporate into the McCrady-Raphaeli-Rofheart combination (1) Rofheart’s teaching that the wireless devices comprise WLAN or MANET devices; and (2) Rofheart’s teaching about an independent signal (APPLE-1009, 24:36-55; *see also* [3.a] below). APPLE-1003, ¶¶179-186.

WLAN/MANET

A POSITA would have incorporated Rofheart’s teaching on WLAN or MANET devices based on McCrady’s instruction that its master/reference radios can be implemented as “*any* portable electronic device equipped with *wireless* transmission and reception capabilities.” APPLE-1005, 6:44-7:13, 17:41-42; APPLE-1003, ¶180. As discussed at Section V.A.4 ([1.a.ii], McCrady teaches, suggests, or renders obvious WLAN devices. Additionally, and to the extent Patent Owner argues otherwise, a POSITA would have taken McCrady’s instruction to use

“any” wireless device as a cue to seek out analogous references like Rofheart with even more explicit teachings about various suitable device types for a range finding system. APPLE-1003, ¶180. To that end, the POSITA would have recognized that Rofheart’s WLAN/MANET devices implicate the broad class of wireless portable devices that McCrady prescribed. APPLE-1009, 17:13-30; APPLE-1003, ¶180.

Additionally, a POSITA would have been motivated to provide compatibility for many different device types, including those disclosed by Rofheart, for the purpose of expanding McCrady’s system to function in a variety of diverse applications. APPLE-1005, 1:19-64 (“The capability to rapidly and accurately determine the physical location of a mobile communication device would be of great benefit in a variety of applications.”); APPLE-1003, ¶181.

Independent Signal

A POSITA would have been motivated to incorporate into the McCrady-Raphaeli-Rofheart combination Rofheart’s teaching about an independent signal. APPLE-1003, ¶¶182-184.

First, in addition to indicating the existence of a target device, Rofheart’s independent signal provides relevant information about the target device, including its radio type and UID. APPLE-1009, 24:36-55; *see also* [3.a]; APPLE-1003, ¶182. Upon receiving the kind of independent signal taught by Rofheart, McCrady’s master device would discover a new device (or rediscover an old device) which

could subsequently serve as one of McCrady's reference radios. McCrady describes that it is advantageous to acquire new devices which could be used as reference radios, and the POSITA would have been motivated to utilize Rofheart's teaching on independent signals as a mechanism for new-device acquisitions. APPLE-1005, 5:28-39 ("...the system of the present invention can use a set of reference radios that includes fixed and/or mobile radios, wherein *the set of radios* relied upon to determine the location of a mobile communication device *can vary over time...*"); APPLE-1003, ¶183.

Second, the use of Rofheart's independent signal to convey device information would have been one of the obvious variations that McCrady envisioned. APPLE-1005, 7:65-8:3 ("not limited to any particular protocol", "any suitable message structure"), 16:1-16 (discussing that "variations in the TOA processing scheme fall within the scope of the invention"); APPLE-1003, ¶184. The fact that independent signals are well-known in protocols such as IEEE 802.11 and in other position-related systems further reinforces the point that they would have been one of McCrady's obvious variations. APPLE-1030, 39, 43-44 (Sections 7.1.3.3.5, 7.2.2); APPLE-1027, [0049], [0064], [0042]-[0044]; APPLE-1003, ¶184.

(b) Reasonable Expectation of Success

A POSITA would have had a reasonable expectation that the McCrady-Raphaeli-Rofheart combination would produce a successful outcome. APPLE-1003,

¶185. When contemplating McCrady's system, the POSITA would have been familiar with analogous references like Rofheart. *Id.* Moreover, the POSITA would have heeded McCrady's express teaching that its ranging message exchanges are compatible with "any" type of wireless device, including Rofheart's WLAN/MANET devices. *Id.*; APPLE-1005, 6:44-7:13.

Additionally, a POSITA would have reasonably expected a successful outcome from combining Rofheart's teaching about an independent signal with McCrady's description of a position location system. Rofheart's independent signal would serve the same purpose in the context of McCrady as it does in Rofheart, *e.g.*, facilitating discovery (or rediscovery) of a remote target device by a local device. APPLE-1003, ¶186.

3. Independent Claims 1, 13

To the extent Patent Owner traverses the McCrady obviousness analysis regarding WLAN devices at Section V.A.4 ([1.a.ii]), McCrady-Raphaeli-Rofheart provides claims 1 and 13 through integration of Rofheart's even more explicit teachings regarding WLAN devices. For example, Rofheart describes an embodiment where its wireless network 300 is a WLAN. APPLE-1009, 17:13-22, Fig. 3. Devices that communicate within a WLAN are consistent with a POSITA's understanding of WLAN devices. APPLE-1003, ¶¶188-189.

4. Claims 3, 14, 20, 29

Claims 3, 14, 20, and 29 are directed to the notion of using unsolicited signals from the target device to determine the UID for the target device.

Elements [3.a], [14.a], [20.a], [29.a]

McCrady-Raphaeli-Rofheart provides [3.a], [14.a], [20.a], [29.a]. APPLE-1003, ¶¶190-205.

“said target wireless communications device generates unsolicited signals”

McCrady-Raphaeli-Rofheart provides this aspect of these claim elements based on Rofheart’s teachings regarding “independent signals.” APPLE-1003, ¶¶190-191. For example, Rofheart describes that:

the local device 201 receives information from each remote device about the radio type of the remote device, as part of the reply and/or response received from the remote devices as discussed with respect to steps 507 and 707 respectively. *Alternatively*, the type information may be received as part of an *independent signal* sent by the remote devices.

APPLE-1009, 24:36-55. A POSITA would have understood that the “independent” modifier (bolded-above) teaches and suggests that the “signal” is an unsolicited signal. APPLE-1003, ¶190. That is, as an *alternative* to receiving “type information” in a “reply and/or response,” the local device can receive this “type information” without prompting from the remote device as part of an “independent signal.” Thus, the POSITA would have appreciated Rofheart’s teaching that the independent signal

is unsolicited—*e.g.*, it is ***not*** in reply/response to another signal. *Id.*

The analysis above satisfies these elements including under an interpretation that requires the claimed “target wireless communications device” to have the capability to send “unsolicited signals.” APPLE-1003, ¶191. These elements are also satisfied under an interpretation that requires the device to send multiple “unsolicited signals.” *Id.* A POSITA would have recognized that multiple unsolicited signals are generated/sent in Rofheart, *e.g.*, a device entering and reentering after exiting the network would cause multiple respective signals to be generated/sent. *Id.*; APPLE-1009, 19:17-62, 19:63-20:9, 24:36-55, Fig. 4.

“including the UID thereof”

McCrary describes that a message can include a source of the message, which a POSITA would have understood to be a source address. APPLE-1005, 8:50-53 (“the reference radio identifies the destination master radio ***and may also identify itself as the message source***”); 8:38-46. Further, McCrary’s description of source/destination addresses shows that they are used to uniquely identify different message sources/destinations, *i.e.*, reference radios, within the network. APPLE-1005, 8:38-46; Section V.A.4 ([1.a.ii]); APPLE-1003, ¶192.

Alternatively, it would have been obvious to a POSITA to include a UID in the above-discussed independent (unsolicited) signal from McCrary’s reference (target) device to achieve the predictable benefit of enabling McCrary’s master

device to associate information in the signal to the corresponding reference device. APPLE-1003, ¶193. A POSITA would have understood that McCrady's teachings about including a source address (UID) in a message applies to any of the messages between the master and reference devices, including the independent (unsolicited) signal. *Id.* Moreover, it was well-known to include UIDs such as source addresses in messages to identify the source of the message. *Id.*; APPLE-1005, 8:50-53, 8:38-46; APPLE-1009, 20:62-21:5; 24:36-55; APPLE-1030, 9, 43-44 (Sections 7.1.3.3.5, 7.2.2).

Elements [3.b], [14.b], [20.b], [29.b]

McCrady-Raphaeli-Rofheart provides [3.b], [14.b], [20.b], [29.b] (receive at least one unsolicited signal from said target device). APPLE-1003, ¶¶190-205. As discussed above, McCrady discloses a controller ([1.b.ii]) that cooperates with the transceiver ([1.d.i], [1.b.ii]) to receive signals ([1.d.i]). A POSITA would have recognized that the above-discussed controller/transceiver is not limited to receiving reply signals from the target device and is capable of receiving other types of signals including the unsolicited signal discussed at [3.a]. APPLE-1003, ¶194; APPLE-1005, 7:19-21 (“*other communications*”).

Elements [3.c], [14.c], [20.c], [29.c]

McCrady-Raphaeli-Rofheart provides [3.c], [14.c], [20.c], [29.c] (determines the UID for said target wireless communications device). APPLE-1003, ¶¶190-205.

As discussed for [3.a]-[3.b], the unsolicited signal includes the UID of the target device. A POSITA would have understood and expected that processing a received message (*see* [3.b]) containing data fields such as a UID (*see* [3.a], *e.g.*, source address) includes extracting one or more fields from the message and determining their corresponding values—*e.g.*, a controller ([1.b.ii]) determines the UID based on the corresponding UID data field. APPLE-1005, 8:50-53, 8:38-46; APPLE-1009, 20:62-21:5; APPLE-1003, ¶195.

Alternatively, it would have been obvious to a POSITA to determine (*e.g.*, decode, extract, identify, etc.) the UID from the received unsolicited signal (*see* [3.a]-[3.b]) in order to determine which device sent the signal. APPLE-1005, 8:50-53, 8:38-46; APPLE-1009, 20:62-21:13, 24:36-55; APPLE-1003, ¶196. A POSITA would have been motivated to do this so that information in the signal, such as the device type, can be associated with the appropriate device for later use. APPLE-1009, 20:62-21:13, 24:36-55; APPLE-1003, ¶196. *See also* Sections V.D.5-V.D.6.

5. Claims 4, 15, 30

McCrady-Raphaeli-Rofheart provides [4], [15], and [30] (*determines the device type based upon the UID*). APPLE-1003, ¶¶206-208. For example, Rofheart determines a device type (which Rofheart calls a “radio type”) of a target wireless communications device. *Id.*; APPLE-1009, 24:36-55 (discussing that “*the local device 201 receives information from each remote device about the radio type of*

the remote device, as part of the reply and/or response” and that “*the type information may be received as part of an independent signal* sent by the remote devices.”).

A POSITA would have recognized that Rofheart’s determination of a device type is “based upon the UID thereof” at least because storage and retrieval of information pertaining to a remote device in Rofheart is based on the remote device’s UID. APPLE-1003, ¶207; APPLE-1009, 24:10-21 (“[e]ach transmit time *t1* is *associated with one of the unique identifiers*...so that the transmit times *may be retrieved* to determine the distance to each remote device.”), 24:22-35, 25:1-8. In more detail, a POSITA would have recognized that after Rofheart’s local device receives an “independent signal” that provides the device/radio type of the remote device (claim 3), Rofheart’s local device would store the device type under the remote device’s UID. APPLE-1003, ¶207. Rofheart’s local device would then determine the device type by using the remote device’s UID to retrieve the stored device type. *Id.*

Alternatively, it would have been obvious to a POSITA to store the device type in the device’s memory based on the UID, such that the device type can be retrieved using the UID when the controller determines a propagation delay (*e.g.*, computes the round trip time). APPLE-1003, ¶208. Indeed, it is well-known to a POSITA to store additional information about a device (including its device type)

based on its UID. *See, e.g.*, APPLE-1009, 24:10-55, 25:1-8; APPLE-1028, [0071], [0055]-[0056], [0058], [0060], Figs. 4-5, 8; APPLE-1003, ¶208. Moreover, a POSITA would have been motivated to store the device type and retrieve it based on UID (and accordingly, determine the device type based on UID) because a POSITA would have wanted to track such information using UIDs in order to use the right device type. APPLE-1003, ¶208.

6. Claims 5, 16

Elements [5.a]/[1.6a]

McCrary-Raphaeli-Rofheart provides [5.a], [16.a] (*the UIDs comprise MAC addresses*). APPLE-1003, ¶¶211-214. As discussed for claims 1 and 3, McCrary's devices have UIDs, *e.g.*, addresses, which are used as a message's source or destination address. McCrary's addresses are consistent with a POSITA's understanding of a MAC address (*i.e.*, an address that is used to identify a device on a network). APPLE-1003, ¶211; APPLE-1028, [0081]; APPLE-1029, 20-21; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.4-5, 7.2.2).

Alternatively, it would have been obvious to implement McCrary's source addresses as MAC addresses, which are well-known. APPLE-1003, ¶211. For example, Rofheart discloses that "[t]he transmitting and receiving steps are preferably performed *in accordance with a Media Access Control (MAC) protocol*"—a MAC address. APPLE-1009, 3:66-4:1, 18:20-25, 20:17-21; APPLE-

1028, [0081]; APPLE-1029, 20-21; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.4-5, 7.2.2); APPLE-1003, ¶211.

Elements [5.b]/[16.b]

McCradly-Raphaeli-Rofheart provides [5.b], [16.b] (*determines the device type based upon the MAC address*). APPLE-1003, ¶¶211-214. As discussed for claim 4, the McCradly-Raphaeli-Rofheart combination determines the device type of said target wireless communications device based upon the UID thereof, which applies here because a MAC address is a type of UID. *Id.*

7. Claims 6, 17, 21

McCradly-Raphaeli-Rofheart provides [6.a], [17.a], [21.a] (*plurality of antennas*). APPLE-1003, ¶¶215-222. Rofheart describes that “**multiple antennas** on the local device 901 may provide the relevant spatial information to resolve the distance.” APPLE-1009, 31:19-38.

McCradly-Raphaeli-Rofheart provides [6.b], [17.b], [21.b] (*determine a bearing*). APPLE-1003, ¶¶215-222. Rofheart describes that “the spatial separation between the antennas is enough to **resolve position information**, in combination with the known range information” and that by “having **multiple antennas that produce a directional antenna pattern**,...it [is] possible **to resolve the spatial locations of the remote device**.” APPLE-1009, 31:19-38. Further, like McCradly, Rofheart uses a received reply signal to estimate the range to a target device (*see* Section V.D.2,

claim 1). A POSITA would have recognized that Rofheart's "position information"/"spatial location" provides a **bearing** to the target device. APPLE-1003, ¶¶217-218. This understanding is further confirmed by Rofheart's "local device [which] displays a graphical map of the *position of remote devices in relation to the local device*." APPLE-1009, 31:39-43.

A POSITA would have been motivated to incorporate into the McCrady-Raphaeli combination Rofheart's teachings about using multiple antennas and their use to determine "position information"/"spatial location" (e.g., a "bearing") based on the received signals (APPLE-1009, 31:19-43) for the purpose of increasing the accuracy and/or efficiency of McCrady's system. APPLE-1003, ¶218.

8. Claims 10, 24, 32

For the same reasons discussed regarding independent claims 1 and 13, McCrady-Raphaeli-Rofheart provides [10], [24], [32] (*WLAN devices*). APPLE-1003, ¶¶223-225.

9. Claims 11, 25, 33

McCrady-Raphaeli-Rofheart provides [11], [25], [33] (*mobile ad-hoc network (MANET) devices*) through integration of Rofheart's teachings regarding MANET devices. APPLE-1003, ¶¶226-228. For example, Rofheart describes an embodiment where its wireless network 300 is a "wireless **network** in which wireless devices make point to point connections, or point to multipoint connections on the shared

channel of a piconet.” APPLE-1009, 17:13-37; *see also* 17:60-63, 26:40-50. Rofheart also describes that its teachings “may be implemented in an *ad hoc* system wherein any device in the network can act as a master and/or a slave device and no access point is needed.” *Id.* Rofheart’s devices on such a wireless network “may be a *mobile* device such as a mobile telephone, a laptop computer or personal digital assistant (PDA).” *Id.*

10. Claim 31

McCrary-Raphaelli-Rofheart provides [31] (*bearing*). APPLE-1003, ¶222; Section V.B.7 ([6.b]).

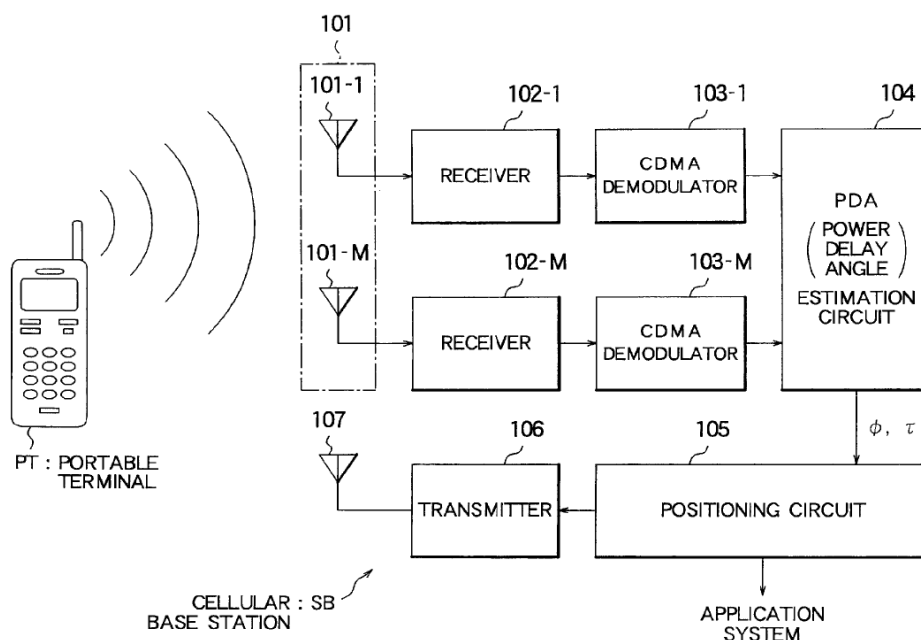
C. GROUND 3: Claims 6-7, 17, 21, 31 are Obvious Over McCrary-Raphaelli-Kuwahara

1. Kuwahara

Kuwahara issued on May 30, 2000, years before the Critical Date, and thus qualifies as §102(b) prior art.

Like the ’779 patent, Kuwahara is about determining the position of a wireless device. APPLE-1007, Abstract. As shown in Figure 1 (below), Kuwahara describes a “cellular base station” with “*an array antenna 101 having first through M-th antenna elements 101-1 through 101-M* for receiving signals transmitted by [a] portable terminal PT.” *Id.*, 2:66-3:3. The cellular base station further includes: (i) “PDA (power delay angle) estimation circuit 104 [] for estimating an incident direction, delay time, [etc.]” of signals received from the portable terminal; and (ii)

“positioning circuit 105 [] for *establishing the position of the portable terminal PT on the basis of the incident direction* and delay time.” *Id.*, 3:10-20.



APPLE-1007, Fig. 1.

2. McCrady-Raphaeli-Kuwahara Combination

(a) Motivation

A POSITA would have been motivated to incorporate into the McCrady-Raphaeli combination (1) Kuwahara’s teachings on using multiple antennas to receive signals from a portable terminal device, and (2) Kuwahara’s teachings on determining, based on the received signals, an incident direction representing an angle (“bearing”) between Kuwahara’s base station and portable terminal. APPLE-1003, ¶¶231-238.

Multiple Antennas

A POSITA would have incorporated Kuwahara's teachings regarding an array antenna, *i.e.*, multiple antennas, in the context of McCrady's master radio based on an understanding that doing so would promote increased position accuracy and combat multi-path signal interference. APPLE-1003, ¶232; APPLE-1007, 3:59-67 (Kuwahara discussing use of an array antenna and multi-path in an urban environment), 2:11-19 ("hardly affected in an urban area" and "capable of carrying out positioning with high accuracy"), 10:40-46; APPLE-1023, 1:36-45. Kuwahara's accuracy and interference mitigation benefits are consistent with McCrady's desire to "***quickly and accurately determin[e] the three-dimensional indoor or outdoor position*** of a compact mobile communication device." APPLE-1005, 3:46-51; APPLE-1003, ¶234.

Incident Direction (Bearing)

A POSITA would have incorporated Kuwahara's teachings on "estimating the incident direction" of received signals (APPLE-1007, 3:10-20, *see also* [6.b] below) for the purpose of predictably improving the accuracy and/or efficiency of McCrady's approach to position determination. APPLE-1003, ¶235. For example, a POSITA would have understood that using Kuwahara's incident direction would provide not only the distance (range) to a particular reference radio in McCrady but also the direction of the reference radio relative to the master radio. APPLE-1003,

¶237. From the POSITA's perspective, this additional direction information would enable the master radio to determine its position with greater accuracy and/or by communicating with fewer than all four reference radios, *e.g.*, just one. APPLE-1003, ¶237.

(b) Reasonable Expectation of Success

A POSITA would have had a reasonable expectation that the McCrady-Raphaeli-Kuwahara combination would produce a successful outcome. APPLE-1003, ¶238. These references address the common problem of determining the position/range of wireless devices using estimations of signal delay time. *Id.* Moreover, given that McCrady's master radio already receives responses from location finding signals using an antenna (APPLE-1005, 7:14-21), it would have been straightforward for a POSITA to employ Kuwahara's teachings about using a particular type of antenna—*i.e.*, an array antenna, which includes multiple antennas. APPLE-1003, ¶238.

3. Claims 6, 17, 21

Elements [6.a], [17.a], [21.a]

McCrady-Raphaeli-Kuwahara provides [6.a], [17.a], [21.a] (plurality of antennas). APPLE-1003, ¶¶240-251. Kuwahara describes “***an array antenna*** for receiving a transmission signal transmitted by the portable terminal.” APPLE-1007, Abstract. Concerning Fig. 1, Kuwahara further describes that “cellular base station SB comprises an ***array antenna 101*** having ***first through M-th antenna elements***

101-1 through 101-M for receiving signals transmitted by the portable terminal PT.”

Id., 2:66-3:27.

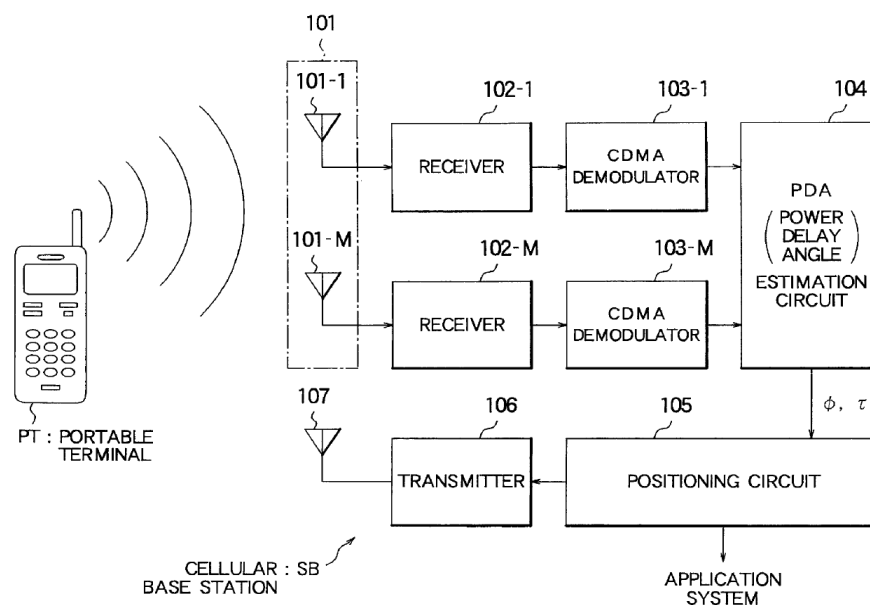


FIG. 1

Id., Fig. 1, 8:44-65, Fig. 6. A POSITA would have recognized that an array antenna includes multiple antennas, such as shown by antenna elements 101-1 to 101-M in Fig. 1. APPLE-1003, ¶240.

Elements [6.b], [17.b], [21.b]

McCrady-Raphaeli-Kuwahara provides [6.b], [17.b], [21.b] (*determine a bearing*). APPLE-1003, ¶¶240-251. As discussed, the combination features a master radio with a controller ([1.b.ii], [1.d], Ground 1) and an array antenna (which includes multiple antennas) ([6.a]) to receive signals from a target reference radio (“wireless communications device” per [1.a.i], Ground 1). The combination further includes Kuwahara’s teaching about determining, based upon at least one of the

received signals, an incident direction (e.g., θ_i): “***A PDA (power delay angle) estimation circuit 104 is for estimating an incident direction, delay time, and relative power from the demodulated signals.***” APPLE-1007, 2:66-3:27, 4:9-45, 8:16-23.

A POSITA would have recognized that Kuwahara’s “incident direction” represents an angle between Kuwahara’s base station and portable terminal (i.e., this angle provides a “bearing” to the target device). APPLE-1003, ¶¶241-247; APPLE-1011 (“bearing”); APPLE-1007, 8:66-9:25 (discussing a “direct wave” in “an incident direction of -60 degrees”). This understanding is further confirmed by Kuwahara’s disclosure about using an incident direction to find a relative position between devices. APPLE-1007, 10:1-14, Abstract, 8:66-9:25, Fig. 7; APPLE-1003, ¶¶241-247 (citing APPLE-1001, 9:3-34).

4. Claim 7

McCrady-Raphaeli-Kuwahara provides [7] (three dimensional bearing). APPLE-1003, ¶¶252-253. For example, McCrady discloses that “there remains a need for a commercially viable position location system capable of quickly and accurately determining the ***three-dimensional indoor or outdoor position*** of a compact mobile communication device.” APPLE-1005, 3:46-51. Further, Kuwahara describes “2D-Unitary ESPRIT,” “which was conceived to perform two-dimensional parameter estimation (***direction/angular height, incident***

direction/delay time and the like).” APPLE-1007, 4:9-12. A POSITA would have recognized that Kuwahara’s “direction” and/or “incident direction” can be expressed as an angle which provides a two-dimensional bearing (*e.g.*, 2D bearing in an X-Y plane), which, when combined with angular height (angle based on a device’s height from the X-Y plane), provides a three-dimensional bearing. APPLE-1003, ¶253.

5. Claim 31

McCrary-Raphaeli-Kuwahara provides [31] (*bearing*). APPLE-1003, ¶254; Section V.C.3 ([6.b]).

D. GROUND 4: Claims 1-6, 8-34 are Obvious Over Rofheart-Raphaeli-Godfrey

1. Godfrey

Godfrey published on June 16, 2005, and claims priority to Godfrey-Provisional, which was filed before the Critical Date on October 31, 2003. APPLE-1028, cover. Godfrey qualifies as §102(e) prior art (see *Dynamic Drinkware* analysis below).

Godfrey’s Disclosure

Godfrey relates to “location awareness in wireless networks and more particularly to identifying and communicating with proximate wireless stations,” such as “notebook (or ‘laptop’) computers, handheld computers, ...portable digital assistants (PDAs), cellular phones, etc.” APPLE-1028, [0003], [0033]; APPLE-1029, 1, 5. In short, Godfrey provides “a method...for determining a proximity of

one or more wireless devices to a first wireless device.” APPLE-1028, [0009]; APPLE-1029, 6.

Godfrey’s location-awareness techniques employ communications based on the well-known IEEE 802.11 standard, *e.g.*, transmitting/sending a frame (or “message”) that includes MAC addresses (UIDs) to convey information about the frame’s source and destination. APPLE-1028, [0033], [0081]; APPLE-1029, 5, 20-21; APPLE-1003, ¶72. Godfrey further describes storing device type information received from a device in a table based on the device’s MAC address. APPLE-1028, [0071], [0056]-[0060]; APPLE-1029, 17, 13.

Dynamic Drinkware Analysis

Godfrey and Godfrey-Provisional share virtually identical figures and specifications, the only differences being: (A) paragraphs [0009-0012] in Godfrey’s summary are not in Godfrey-Provisional; and (B) Godfrey-Provisional contains additional appendices. Given their corresponding disclosures, it is clear that Godfrey-Provisional supports at least one claim of Godfrey. APPLE-1003, ¶70. For example, the four method steps of Godfrey’s independent claim 1 (*i.e.*, providing network information; comparing the network information; identifying wireless devices; notifying a user) are disclosed at least at pages 15-17 of Godfrey-Provisional. *Id.* Additionally, Godfrey’s independent claim 23, which merely requires an access point and a wireless device that raises a notification regarding

other devices within its proximity, is supported by Godfrey-Provisional's disclosure of access point 220 and wireless station 202 at pages 9-12 and Figures 2-3. *Id.* Parallel citations to Godfrey (APPLE-1028) and Godfrey-Provisional (APPLE-1029) are provided throughout this Petition.

2. Rofheart-Raphaeli-Godfrey Combination

(a) Motivation

A POSITA would have been motivated to incorporate into the Rofheart-Raphaeli-Godfrey combination (1) Raphaeli's teachings about averaging propagation delays, and (2) Godfrey's teachings about including, in a frame/message to a target device, a destination MAC address (UID) corresponding to the target device. APPLE-1003, ¶255.

Averaging

In Rofheart-Raphaeli-Godfrey, Rofheart's calculation of the range between devices would have used the averaged propagation delay. APPLE-1003, ¶256; APPLE-1009, 25:1-31 (distance/range equation). A POSITA motivated to incorporate an averaging technique, such as described by Raphaeli, would have appreciated the need for Rofheart's system to conduct multiple ranging message exchanges and calculate multiple corresponding propagation delays. APPLE-1003, ¶¶256-257. In other words, the POSITA would have contemplated conducting multiple of Rofheart's ranging message exchanges, determining corresponding

delays, and averaging those delays as taught by Raphaeli. APPLE-1009, Abstract, 23:59-25:31, Fig. 7; APPLE-1006, 9:3-21 (“interrogation” via “a sequence of pulses”), 19:1-40 (discussing averaging based on “a predetermined number of received pulses”).

A POSITA looking to improve Rofheart’s system would have been familiar with references such as Raphaeli because both describe distance determination of wireless devices. APPLE-1003, ¶258. Further, as discussed above, both describe message exchanges and measuring the round-trip delay. *Id.*; Sections V.A.2, V.B.1. Also, both employ wireless technology such as ultra wide band (UWB). APPLE-1009, Abstract, 3:61-4:4; APPLE-1006, 25:19-33. It is therefore no surprise that a POSITA would have been motivated to pursue the Rofheart-Raphaeli-Godfrey combination for multiple reasons. APPLE-1003, ¶¶258-263.

First, a POSITA would have expected Raphaeli’s teaching on averaging multiple propagation delays to predictably improve a similar system like Rofheart’s by enhancing the precision of the estimated range. APPLE-1003, ¶259. Raphaeli’s express disclosure on this precision advantage would have reinforced the POSITA’s understanding. *Id.*; APPLE-1006, 19:33-40 (“By DSP 40 calculating an average time delay..., *the precision of the round trip delay determination is increased* relative to a single delay measurement..., the pulse form of each received pulse is interpolated..., further *enhancing the precision* of the round trip delay

determination.”).

Second, even without Raphaeli’s observation of improved precision, a POSITA would have recognized that unknown and often random additive error exists in the individual propagation delay estimates described by Rofheart/Raphaeli due to channel noises, interferences, measurement errors, etc. APPLE-1003, ¶¶261-262. Thus, the POSITA would have sought to employ known methods for the purpose of obtaining a more precise representation of the delay estimate. *Id.* In this context, Raphaeli’s averaging technique would have been an obvious choice. *Id.* Averaging multiple measurements/estimates was a centuries-old and commonly used technique to produce a value that summarizes or represents a distribution of possible outcomes with reduced standard deviation (*i.e.*, reduced variance). *Id.*; APPLE-1005, 10:44-59. Applying this well-known concept in the context of Rofheart yields the predictable outcome suggested by Raphaeli—*i.e.*, taking multiple measurements and averaging the corresponding delay estimates. APPLE-1003, ¶¶261-262.

Third, a POSITA would have been motivated to incorporate Raphaeli’s averaging technique based on an understanding that the concomitant accuracy and precision benefits of this approach would be particularly advantageous in Rofheart’s system. APPLE-1003, ¶263. For example, Rofheart describes embodiments where accuracy and precision are of paramount importance because the ability of a remote

device to transact with the local device depends on the relative distance between the two. APPLE-1009, 2:1-8, 3:41-55, 4:22-36, 18:45-54. In other words, the relative distance serves as an “authentication criteria” that determines whether a remote device is “blocked” or “enabled.” *Id.*, 21:23-65. In this context, erroneous delay estimates (and thus erroneous distance determinations) would cause false positive or false negative authentications, diminishing the system’s effectiveness. APPLE-1003, ¶263. Averaging multiple delay estimates instead of using a single point value would reduce the likelihood of false positive/negative authentications. *Id.*

MAC Address (UID)

For multiple reasons, a POSITA would have been motivated to incorporate into the Rofheart-Raphaeli-Godfrey combination Godfrey’s teachings about including, in a frame/message to a target device, a destination MAC address (UID) corresponding to the target device. APPLE-1003, ¶¶264-267.

First, a POSITA would have been motivated to incorporate Godfrey’s teachings on MAC addresses based on Rofheart’s instruction that “any other MAC protocol may be used to practice the present invention.” APPLE-1009, 18:15-20; APPLE-1003, ¶265. A POSITA would have taken this instruction from Rofheart as a cue to seek out analogous references like Godfrey that provide additional types of suitable MAC protocols in the context of location-aware systems. APPLE-1003, ¶265.

As discussed above, Godfrey's location awareness system describes communications based on a MAC protocol provided by IEEE 802.11 in which UIDs (called MAC addresses) are used to convey information about a frame, particularly its source and destination. In fact, Rofheart describes that IEEE 802.11 includes an exemplary MAC protocol. APPLE-1009, 17:56-18:25. Thus, Rofheart's teaching to explore various MAC protocols would have led the POSITA to Godfrey's teachings on this subject. APPLE-1003, ¶266.

Second, a POSITA would have been motivated to incorporate Godfrey's teachings on MAC addresses based on the understanding that MAC addresses were routinely used to identify communications devices. APPLE-1003, ¶267. Thus, the POSITA would have recognized that using destination MAC addresses would enable Rofheart's local device to designate the desired recipient of the distance determining message. Then, as Godfrey teaches, a remote device that receives the distance determining message would be able to independently (*e.g.*, without a dedicated wireless link) confirm whether it is the intended recipient of that message. *Id.*; APPLE-1028, [0081] ("***receipt*** intended frame[s]"), [0083]; APPLE-1029, 20-21.

(b) Reasonable Expectation of Success

As discussed above, Rofheart and Raphaeli describe systems and techniques for determining the position/range of wireless devices. Godfrey also relates to location/positioning in wireless networks. APPLE-1003, ¶¶268-272.

Given that Rofheart's device already receives responses from location finding signals, the notion of ascertaining and averaging multiple delays based on a plurality of those responses would have been straightforward from a POSITA's perspective. *Id.* Moreover, a POSITA would have been well versed in using averaging techniques. APPLE-1003, ¶269. Even beyond Raphaeli, a POSITA's knowledge about averaging is shown in analogous references such as McCrady. *See* Section V.A.3; APPLE-1005, 10:44-59. Additionally, averaging sampled values would have been within the skill level of a POSITA. APPLE-1003, ¶269.

Further, a POSITA would have known that including MAC addresses in communications messages was well-known and broadly applicable across a wide range of wireless protocols. APPLE-1028, [0031], [0081]; APPLE-1029, 20-21; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.4-5, 7.2.2). Accordingly, it would have been evident to a POSITA that Godfrey's teachings on MAC addresses could be incorporated with Rofheart's teachings without changing the well-known properties of MAC addresses or the positioning functionality of Rofheart. APPLE-1003, ¶¶270-271.

3. Independent Claims 1, 18, 27

(a) Independent Claim 1

Element [1.pre]

Rofheart-Raphaeli-Godfrey provides [1.pre]. APPLE-1003, ¶274. As discussed below, Rofheart describes a system (*e.g.*, wireless network 300) which

includes wireless communications devices (*e.g.*, remote devices 302, 303, 300N) and a wireless device locator (*e.g.*, local device 301). APPLE-1009, 17:18-22.

Element [1.a.i]

Rofheart-Raphaeli-Godfrey provides [1.a.i]. APPLE-1003, ¶¶275-277. Rofheart describes “[t]he wireless network 300 includes a local device 301 linked to a *first remote device 302*, a *second remote device 303* and *N number of additional remote devices 300N* via UWB links 312, 313, and 315N respectively.” APPLE-1009, 17:18-22.

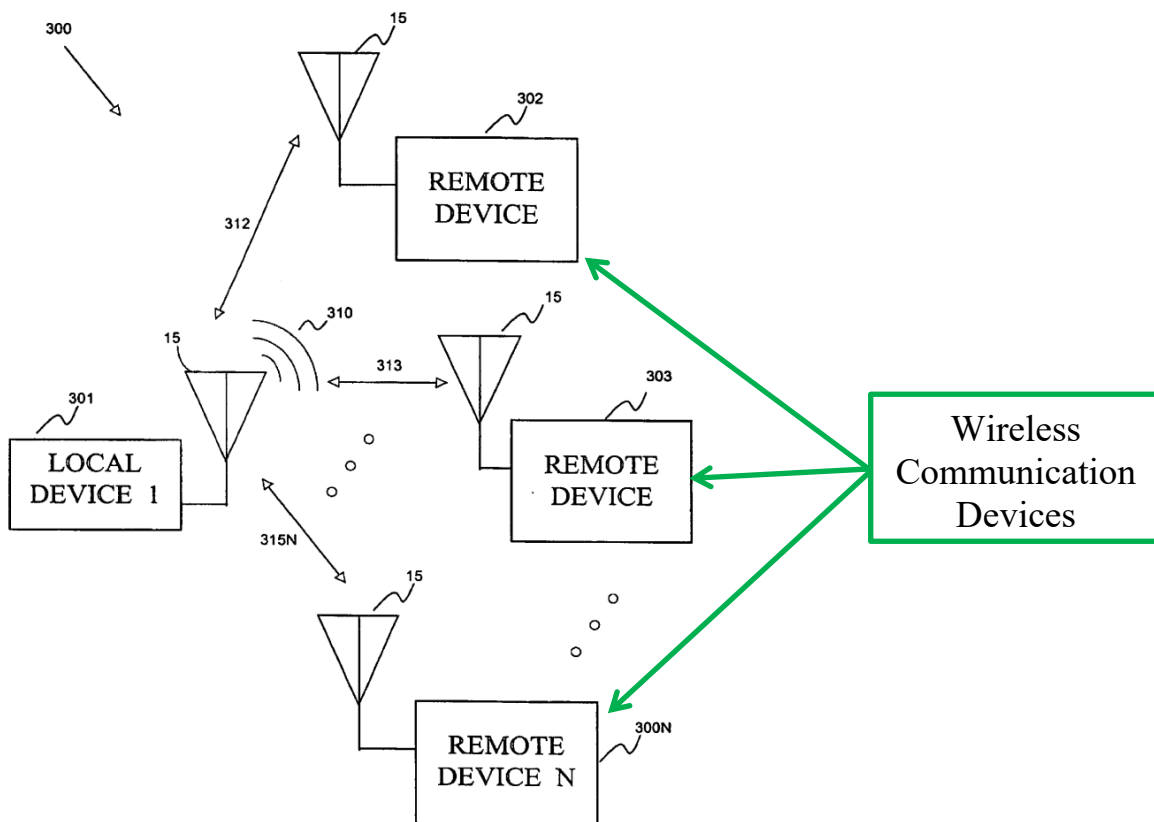


FIGURE 3

APPLE-1009, Fig. 3 (annotated).

Each of Rofheart's remote devices 302/303/300N has a "radio type" associated therewith from among a plurality of different device types—*e.g.*, a "mobile telephone, a laptop computer or [PDA]." APPLE-1009, 17:25-30, 24:36-55 ("the *radio type* of the remote device"). Rofheart's "radio type" is consistent with a POSITA's understanding of the claimed "device type." APPLE-1003, ¶277. Indeed, Rofheart uses the terms "device type" and "radio type" interchangeably. APPLE-1009, 24:36-55.

Element [1.a.ii]

Rofheart-Raphaeli-Godfrey provides [1.a.ii]. APPLE-1003, ¶278. For example, Rofheart discloses: "Each reply message includes a *unique identifier associated with the remote device* from which the reply is transmitted. The unique identifier may be a device address stored in ROM 209, for example, or a unique delay time for the remote device as will be described below." APPLE-1009, 20:62-66. A POSITA would have recognized that each of Rofheart's remote devices has an associated UID because the remote device includes its UID in the reply message. APPLE-1003, ¶278. Further, Rofheart discloses that the devices are WLAN devices as discussed in Sections V.B.3 and V.B.8. *See* APPLE-1009, 17:13-22, Fig. 3. *See also* discussion below at [1.b.iv] and [1.c] regarding Godfrey's teachings on UIDs in the form of MAC addresses.

Element [1.a.iii]

Rofheart-Raphaeli-Godfrey provides [1.a.iii]. APPLE-1003, ¶279. Rofheart acknowledges that each of the remote devices has an associated processing delay, which is “the time delay between the remote device receiving the distance determining message and transmitting a response.” APPLE-1009, 24:36-55; *see also* 4:5-21. Rofheart’s “processing delay” is a predefined latency value stored in memory of the local device and keyed to each of the different radio/device types contemplated by Rofheart. APPLE-1009, 4:5-21 (“the local device 301 then refers to a look up table (LUT)...to determine a *predefined processing delay* for the radio type”); APPLE-1003, ¶279. Accordingly, Rofheart provides the claimed “known device latency” under either party’s proposed construction. *Id.*; Section II.C.

Element [1.b.i]

Rofheart-Raphaeli-Godfrey provides [1.b.i]. APPLE-1003, ¶¶280-281. For example, Rofheart describes “[t]he wireless network 300 includes a *local device 301*.” APPLE-1009, 17:18-22. The local device 301 is designed to locate wireless remote devices, and is therefore consistent with a POSITA’s understanding of a wireless device locator. APPLE-1003, ¶280; APPLE-1009, 31:19-43, Abstract.

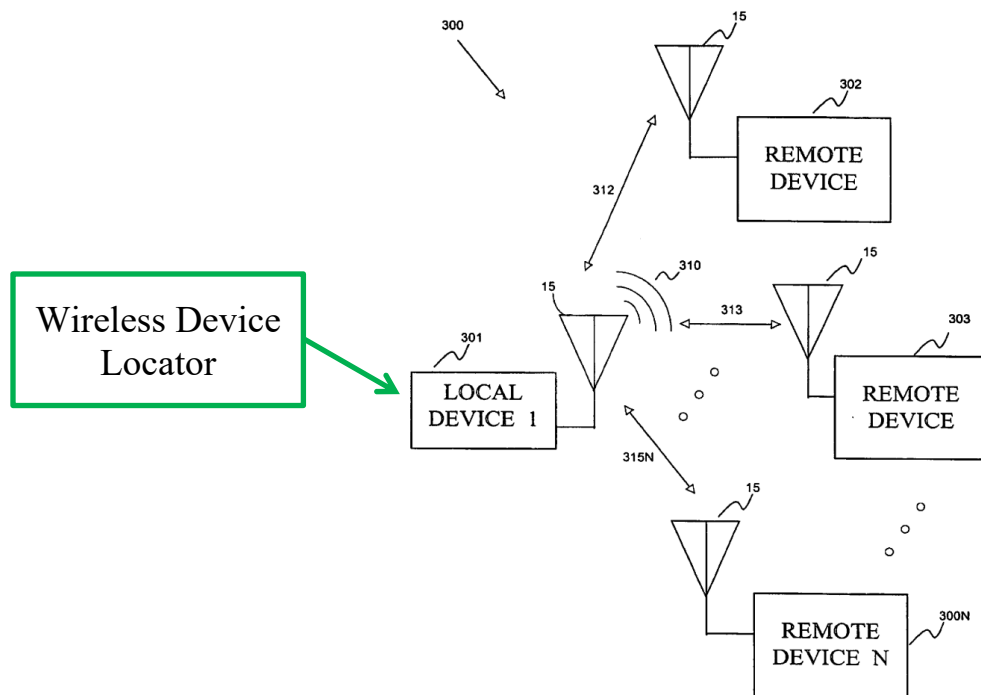


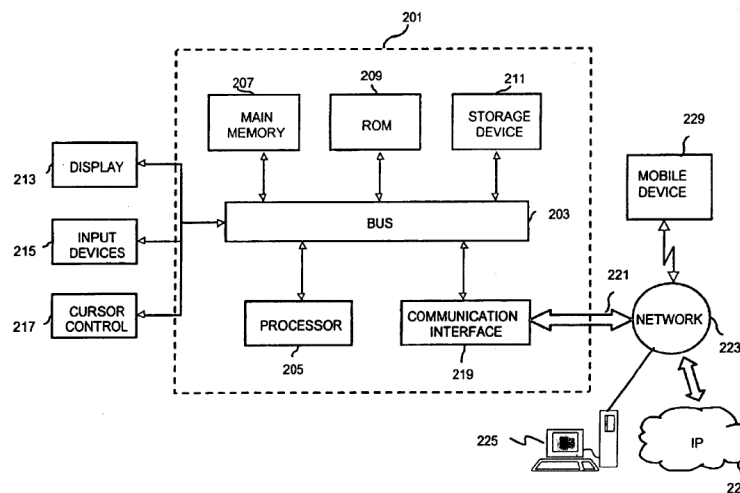
FIGURE 3

APPLE-1009, Fig. 3 (annotated).

Rofheart describes that “*local device 301...includes a UWB transceiver*, such as the transceiver described in FIG. 1a or 1c, that transmits and receives a UWB signal 310 via a *UWB antenna* such as antenna 1,15 also described in FIGS. 1a and 1c.” APPLE-1009, 17:38-46; *see also id.*, 5:52-57 (“In FIG. 1a, the *transceiver* includes three major components, namely, receiver 11, radio controller and interface 9, and transmitter 13”), 5:66-6:1 (discussing an antenna), 10:44-50 (discussing an antenna), 11:10-16, 15:60-63 (discussing a communication interface), FIGS. 1a, 1c, 2, 3. A POSITA would have recognized that Rofheart’s transceiver is connected to Rofheart’s antenna because both are included in the same local device and the transceiver transmits/receives signals via the antenna. APPLE-1003, ¶281.

Element [1.b.ii]

Rofheart-Raphaeli-Godfrey provides [1.b.iii]. APPLE-1003, ¶¶282-283. Rofheart's local device includes a "*processor system 201*" that 1) "performs a portion or all of the processing steps of the [disclosure] in response to the processor 205 executing ...instructions" and 2) "*transmit[s] notifications and receive[s] data*, including program code, through the network(s), the network link 221 and the *communication interface 219*." APPLE-1009, 14:14-18, 15:60-63, 15:23-43, 17:38-46, 5:52-65 (discussing "*radio controller and interface 9*"), FIGS. 1a, 1c, 2, 3. A POSITA would have understood that Rofheart's processor system, including processor 205, *controls* other components of Rofheart's local device ("wireless device locator" per analysis at [1.b.i]) including the communication interface, which includes Rofheart's transceiver discussed in [1.b.i]. APPLE-1003, ¶283; APPLE-1009, 15:23-43. Thus, Rofheart teaches the claimed "controller" which cooperates with said transceiver. APPLE-1003, ¶283.



APPLE-1009, Fig. 2.

Element [1.b.iii]

Rofheart-Raphaeli-Godfrey provides [1.b.iii]. APPLE-1003, ¶¶284-286. Rofheart teaches transmitting a plurality of location finding signals to a target remote device (“wireless communications device” per analysis at [1.a.i]) and receiving associated responses. APPLE-1009, 23:59-65 (“In step 701, *a distance determining message* is generated in the local device 301 and *transmitted to each linked remote device 302, 303, and 300N.*”), 19:63-20:9 (discussing that “the *loop [of FIG. 4]* serves to update distance information for linked remote devices” and “the local device 301 *repeatedly determines distance* to each linked remote device”). As discussed at Section V.D.2, in the Rofheart-Raphaeli-Godfrey combination, Rofheart’s ranging message exchange—including the UWB *distance determining message* (“location finding signal”)—is performed multiple times to generate multiple propagation delay estimates, which are subsequently combined by Raphaeli’s averaging technique. APPLE-1003, ¶286; APPLE-1006, 9:3-21, 19:1-40.

Element [1.b.iv]

Rofheart-Raphaeli-Godfrey provides [1.b.iv] through integration of Godfrey’s MAC address (UID) teaching into Rofheart’s distance determining messages (location finding signals per [1.b.iii]). APPLE-1003, ¶¶287-292. As discussed above at Section V.D.1, Godfrey discloses a UID called a “MAC address” in a frame/message, the MAC address corresponding to the address of the

frame/message's intended recipient (UID for said target wireless communications device). APPLE-1028, [0081]; APPLE-1029, 20-21; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.4, 7.2.2).

Godfrey's "MAC address" is consistent with a POSITA's understanding of a UID. APPLE-1003, ¶288. Indeed, the POSITA would have appreciated that a MAC address is typically used to uniquely identify devices in a communications network. *Id.* Additionally, Godfrey's description of a MAC address shows that it is used to uniquely identify different message destinations—*i.e.*, "wireless stations," such as mobile devices (analog to Rofheart's remote devices)—within the network in a manner that ensures the message is directed to and received by the intended station/device. APPLE-1028, [0033], [0081]; APPLE-1029, 5, 20-21. This description is consistent with the specification and claims of the '779 Patent, which contemplate that the UID includes an address of a device. APPLE-1003, ¶289 (discussing APPLE-1001, 3:38-45, 6:14-25, claim 5).

A POSITA would have understood and expected that a device would insert (include) a MAC address (UID) into a frame/message before transmitting the frame/message containing that MAC address. APPLE-1028, [0081]-[0085], Figs. 12A-12C, [0009] (including a MAC address); APPLE-1029, 15-17, 20-22, Figs. 12A-12C; APPLE-1003, ¶290. This description is consistent with the specification of the '779 Patent which contemplates inserting/including a UID in a signal (*e.g.*,

header packet). APPLE-1003, ¶291 (discussing APPLE-1001, 6:26-30). Alternatively, it would have been obvious to a POSITA that Rofheart's local device inserts the MAC address in the message/frame in order for the message/frame to include the address. For example, doing so would have been consistent with IEEE 802.11, which is referenced by Godfrey and Rofheart. APPLE-1028, [0081]; APPLE-1029, 20-21; APPLE-1009, 17:56-18:25; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.4, 7.2.2); APPLE-1003, ¶292.

Element [1.c]

Rofheart-Raphaeli-Godfrey provides [1.c]. APPLE-1003, ¶¶293-294. As discussed for [1.a.i]-[1.a.iii] and [1.b.iii], Rofheart discloses a target wireless communications device (Rofheart's remote device) and transmission of location finding signals (Rofheart's distance determining messages). Rofheart further discloses that the target device transmits a reply signal (Rofheart's response) for each location finding signal. APPLE-1009, 24:22-31 (discussing that in "step 705, *the linked remote devices 301, 302, and 300N* receive the distance determining message via a respective unique link and *transmit a response to the local device 301 over the same unique link.*"), Fig. 7 (step 705).

As discussed for [1.b.iii]-[1.b.iv], Rofheart-Raphaeli-Godfrey provides location finding signals that include a UID for a target wireless communications device. Further, a POSITA would have found it obvious to base the reply signal from

the target device upon the UID in the location finding signal. APPLE-1003, ¶294. For example, Godfrey discloses a procedure where a recipient device matches a UID called a MAC address in a received frame (*e.g.*, message) to its own MAC address, and if there is a match, the device knows that it is the intended recipient of the frame. APPLE-1028, [0083]; APPLE-1029, 20-21; *see also* APPLE-1030, 43-44 (Section 7.2.2). In the context of the Rofheart-Raphaeli-Godfrey combination, the POSITA would have recognized that when a recipient device determines that it is the intended recipient of a location finding signal frame (*vis-à-vis* matching the UID: MAC address), the device would process the frame and transmit a reply. APPLE-1003, ¶294.

Element [1.d]

Rofheart-Raphaeli-Godfrey provides [1.d]. APPLE-1003, ¶295. As discussed for [1.b.ii], Rofheart teaches a controller.

Element [1.d.i]

Rofheart-Raphaeli-Godfrey provides [1.d.i]. APPLE-1003, ¶296. For example, Rofheart describes that “*the local device 301 receives responses* sent from the linked remote devices via respective unique links and marks a receive time *t2* for each response received as seen in step 709.” APPLE-1009, 24:28-31, Fig. 7 (step 707).

Element [1.d.ii]

Rofheart-Raphaeli-Godfrey provides [1.d.ii]. APPLE-1003, ¶¶297-301. For example, Rofheart determines a propagation delay associated with the transmission of each location finding signal (transmitted at “time t1”), the respective reply signal therefor (received at “time t2”), and the processing delay of the remote device (the claimed known device latency, per analysis at [1.a.iii]. APPLE-1009, 24:10-21 (“the local device 301 marks a *time t1* as the transmitting time”), 24:22-35 (“the local device 301...marks a receive *time t2* for each response received”), 24:10-55 (discussing “*processing delay d*” for each device type), Fig. 7.

Rofheart uses time t1, time t2, and processing delay d to determine the propagation delay, which Rofheart refers to as the “round-trip time Trt” and calculates according to the formula: $Trt = t2 - t1 - d$.⁷ See APPLE-1009, 25:1-31 (“*the round trip time is the time that the distance determining signal and the response signal travel through the wireless medium* and is different for each remote device”).

⁷ Alternatively, a POSITA would have recognized that Rofheart’s round-trip time Trt, when divided by two as described by Rofheart, provides a one-way propagation delay. APPLE-1009, 25:1-31 (discussing “ $D=c \times Trt/2$ ”); APPLE-1003, ¶300.

The Rofheart-Raphaeli-Godfrey combination (Section V.D.2) involves averaging multiple propagation delays obtained by conducting multiple ranging message exchanges and calculating a propagation delay for each exchange. APPLE-1003, ¶301. A POSITA would have understood that averaging multiple delays requires ascertaining individual delays for separate message exchanges. *Id.*

Element [1.d.iii]

Rofheart-Raphaeli-Godfrey provides [1.d.iii]. APPLE-1003, ¶¶302-303. Rofheart discloses a range estimate equation (Eq. 10) which is based on propagation delay, *e.g.*, round-trip time Trt as discussed for [1.d.ii], to estimate a range “distance D ” to the device. The equation is: $D = c \times Trt/2$, “where c is the speed of light which is the speed at which an RF signal travels through the wireless medium.” APPLE-1009, 25:1-31.

The Rofheart-Raphaeli-Godfrey combination (Section V.D.2) involves averaging determined propagation delays and using the average delay value in the range estimation equation. APPLE-1003, ¶303; APPLE-1006, 19:11-40 (discussing averaging). In the Rofheart-Raphaeli-Godfrey combination, Rofheart’s range estimation formula converts to: $D_{average} = c \times Trt_{average}/2$. Here, $Trt_{average}$ represents an average of multiple propagation delays. APPLE-1003, ¶301.

(b) Independent Claim 18

The limitations of claim 18 are substantially similar to claim 1 and are rendered obvious by Rofheart-Raphaeli-Godfrey for the same reasons. APPLE-1003, ¶¶316-324.

Element	Corresponding Element Analysis
[18.pre]	[1.a.i]-[1.a.iii], [1.b.i]
[18.a]	[1.b.i]
[18.b]	[1.b.ii]
[18.c]	[1.b.iii]
[18.d]	[1.b.iv]
[18.e]	[1.d.i], [1.c]
[18.f]	[1.d.ii], [1.a.iii]
[18.g]	[1.d.iii]

(c) Independent Claim 27

The limitations of claim 27 are substantially similar to claim 1 and are rendered obvious by Rofheart-Raphaeli-Godfrey for the same reasons. APPLE-1003, ¶¶325-331.

Element	Corresponding Element Analysis
[27.pre]	[1.a.i]-[1.a.iii]
[27.a]	[1.b.iii]
[27.b]	[1.b.iv]
[27.c]	[1.d.i], [1.c]
[27.d]	[1.d.ii]
[27.e]	[1.d.iii]

4. Claims 2, 19, 28 and Independent Claim 13

Rofheart-Raphaeli-Godfrey provides [2], [19], [28] (average of the propagation delays). APPLE-1003, ¶¶332-334. As discussed for claim 1, the Rofheart-Raphaeli-Godfrey combination includes a controller ([1.b.ii], [1.d]) that determines multiple propagation delays ([1.d.ii]), and estimates the range based upon an average of the propagation delays using the equation: $D_{average} = c \times Trt_{average}/2$ ([1.d.iii]). APPLE-1009, 25:1-31.

Rofheart-Raphaeli-Godfrey provides independent claim 13 which parallels system claim 1 and further requires that an average is used to estimate the range (claim 2).⁸ APPLE-1003, ¶¶304-315. The table below maps the elements of claim 13 to corresponding elements of claims 1-2.

Element	Corresponding Element Analysis
[13.pre]	[1.pre]
[13.a.i]-[13.a.iii]	[1.a.i]-[1.a.iii]
[13.b.i]-[13.b.iv]	[1.b.i]-[1.b.iv], [1.a.ii]
[13.c]	[1.c], [1.a.ii]
[13.d]	[1.d]
[13.d.i]	[1.d.i]
[13.d.ii]	[1.d.ii], [1.a.ii]
[13.d.iii]	[1.d.iii], [2], [1.a.ii]

⁸ Claim 13 includes that the devices are WLAN devices (which is addressed for both claims 1 and 10).

5. Claims 3, 14, 20, 29

Claims 3, 14, 20, and 29 are directed to the notion of using unsolicited signals from the target device to determine the UID for the target device.

Elements [3.a], [14.a], [20.a], [29.a]

Rofheart-Raphaeli-Godfrey provides [3.a], [14.a], [20.a], [29.a]. APPLE-1003, ¶¶335-349.

“said target wireless communications device generates unsolicited signals”

Rofheart-Raphaeli-Godfrey provides this aspect of [3.a], [14.a], [20.a], [29.a] based on Rofheart’s teachings regarding “independent signals” as discussed in Section V.B.4.

“including the UID thereof”

Like Rofheart’s “reply and/or response,” a POSITA would have understood and expected Rofheart’s “independent signal” (unsolicited signal) would also include a *“unique identifier* associated with the remote device.” APPLE-1009, 20:62-21:5; *see also* analysis at [1.a.ii]. For example, a POSITA would have recognized and expected that even with an independent signal, a remote device still would identity itself through a UID to enable the local device to associate information in the signal with the corresponding remote device. APPLE-1003, ¶336.

Alternatively, it would have been obvious to a POSITA to include a UID in Rofheart’s independent signal such that the local device is able to associate

information in the signal to the corresponding remote device. APPLE-1003, ¶337. Moreover, it was well-known to include UUIDs such as source addresses in signals to identify the source. *Id.*; APPLE-1009, 20:62-21:5; 24:36-55; APPLE-1028, [0081]; APPLE-1029, 20-21; APPLE-1005, 8:50-53, 8:38-46; APPLE-1030, 39, 43-44 (Sections 7.1.3.3.5, 7.2.2).

Elements [3.b], [14.b], [20.b], [29.b]

Rofheart-Raphaeli-Godfrey provides [3.b], [14.b], [20.b], [29.b] (receive at least one unsolicited signal from said target device). APPLE-1003, ¶¶335-349. As discussed above, Rofheart discloses a controller ([1.b.ii]) that cooperates with the transceiver ([1.d.i], [1.b.ii]) to receive signals ([1.d.i]) including Rofheart's independent signals (unsolicited signals per [3.a.]). APPLE-1009, 24:36-55 ("the type information may be *received* as part of an *independent signal* sent by the remote device"). A POSITA would have recognized that the above-discussed controller/transceiver is not limited to receiving reply signals from the target device and is also designed to receive other types of signals, including Rofheart's independent signal. APPLE-1003, ¶338.

Elements [3.c], [14.c], [20.c], [29.c]

Rofheart-Raphaeli-Godfrey provides [3.c], [14.c], [20.c], [29.c] (determines the UUID for said target wireless communications device). APPLE-1003, ¶¶335-349. Rofheart discloses that "the type information may be received as part of an

independent signal sent by the remote device.” APPLE-1009, 24:36-55. As discussed for [3.a]-[3.b], the unsolicited signal includes the UID of the target device. A POSITA would have understood and expected that processing a received signal (see [3.b]) containing data fields such as a UID ([3.a]) includes extracting one or more fields from the signal and determining their corresponding values, e.g., a controller ([1.b.ii]) determines the UID based on the corresponding UID data field. APPLE-1009, 20:62-21:5; APPLE-1003, ¶339.

Alternatively, it would have been obvious to a POSITA to determine (e.g., decode, extract, identify, etc.) the UID from the received unsolicited signal (see [3.a]-[3.b]) in order to determine which device sent the signal because it was well-known to do so. APPLE-1009, 20:62-21:13, 24:36-55; APPLE-1003, ¶340. In addition to it being well-known to filter/match based on a MAC address, a POSITA would have been motivated to do this so that information in the signal, such as the device type, can be associated with the appropriate device for later use. APPLE-1009, 20:62-21:13, 24:36-55; Section V.D.3 ([1.c], filtering/matching based on MAC address as described in Godfrey and IEEE 802.11); APPLE-1003, ¶340. *See also* Sections V.D.6-V.D.7.

6. Claims 4, 15, 30

Rofheart-Raphaeli-Godfrey provides [4], [15], [30] (*determines the device type based upon the UID*). *See* Sections V.D.5, V.B.5 (mapping Rofheart’s teachings

to Elements [4], [15], [30]); APPLE-1003, ¶¶350-352.

7. Claims 5, 16

Elements [5.a]/[16.a]

Rofheart-Raphaeli-Godfrey provides [5.a], [16.a] (*the UUIDs comprise MAC addresses*). APPLE-1003, ¶¶353-356. As discussed in Section V.D.3 ([1.b.iv]), Godfrey describes communications based on a MAC protocol provided by IEEE 802.11 in which a UUID called a MAC address is used to convey information about the source of a message. APPLE-1028, [0081]; APPLE-1029, 20-21. A POSITA would have recognized that *each* device has its own unique source address such that Rofheart's local device is able to associate information in a received message with the specific device that sent the message. APPLE-1003, ¶353.

Elements [5.b]/[16.b]

Rofheart-Raphaeli-Godfrey provides [5.b], [16.b] (*determines the device type based upon the MAC address*). APPLE-1003, ¶¶353-356. As discussed for claim 4, the Rofheart-Raphaeli-Godfrey combination determines the device type of said target wireless communications device based upon the UUID thereof, which applies here because a MAC address is a type of UUID. *Id.*

8. Claims 6, 17, 21

Claims 6, 17, 21 are directed to using a plurality of antennas to determine the bearing of a target device. Rofheart-Raphaeli-Godfrey provides claims 6 ([6.a]-

[6.b]), 17 ([17.a]-[17.b]), 21 ([21.a]-[21.b]) through Rofheart's teachings of multiple antennas and determining a "position information"/"spatial location" (*see* Rofheart discussion above at Ground 2, Section V.B.7). APPLE-1003, ¶¶357-364.

9. Claims 8, 22

Rofheart-Raphaeli-Godfrey provides [8] and [22] (*directional antenna*). APPLE-1003, ¶¶365-367. For example, Rofheart describes that "the spatial separation between the antennas is enough to *resolve position information*, in combination with the known range information" and that "by having *multiple antennas that produce a directional antenna pattern*, ...it [is] possible *to resolve the spatial locations of the remote device*." APPLE-1009, 31:19-38.

Alternatively, Raphaeli discloses a directional antenna. APPLE-1006, 8:50-62 (discussing that "[t]he wide band broadcast interrogation signal may be transmitted in a specific direction, by using for example a *directional antenna*"). *See* Raphaeli discussion above in Ground 1, Section V.A.6.

10. Claims 9, 23

Rofheart-Raphaeli-Godfrey provides [9], [23] (*portable housing*). APPLE-1003, ¶¶368-369. As discussed for [1.b.i]-[1.b.ii], Rofheart discloses a wireless device locator (*e.g.*, "local device 301") which includes components, *e.g.*, antenna, transceiver, and controller. Rofheart describes that the local device "may be a mobile device such as a mobile telephone, a laptop computer or [PDA]." APPLE-1009,

17:13-30, 26:40-50. A POSITA would have recognized that a portable electronic device, *e.g.*, a mobile telephone, has a housing that carries its components. APPLE-1003, ¶368.

11. Claims 10, 24, 32

Rofheart-Raphaeli-Godfrey provides [10], [24], [32] (*WLAN devices*) through Rofheart's teachings regarding WLAN devices as discussed in Ground 2, Sections V.B.3 and V.B.8. APPLE-1003, ¶¶370-372.

12. Claims 11, 25, 33

Rofheart-Raphaeli-Godfrey provides [11], [25], [33] (*mobile ad-hoc network (MANET) devices*) through Rofheart's teachings regarding MANET devices as discussed in Ground 2, Section V.B.9. APPLE-1003, ¶¶373-377.

13. Claims 12, 26, 34

Rofheart-Raphaeli-Godfrey provides [12], [26], [34] (*cellular communications device/devices*). APPLE-1003, ¶¶378-380. As discussed for [1.a.i], Rofheart discloses wireless communications devices. Rofheart further describes that “[e]ach of the wireless devices 301 through 300N may be a ***mobile device such as a mobile telephone***, a laptop computer or [PDA].” APPLE-1009, 17:13-30. A POSITA would have recognized that mobile devices such as mobile telephones comprise cellular communications devices, which is consistent with Rofheart disclosure that a cellular telephone is a type of mobile device. APPLE-1003, ¶378; APPLE-1009, 15:50-53.

14. Claim 31

Rofheart-Raphaeli-Godfrey provides [31] (*bearing*). APPLE-1003, ¶381; Sections V.D.8 ([6.b]), V.B.7 ([6.b]).

VI. DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. The *Fintiv* Factors Favor Institution—§314(a)

Institution is consistent with the Director’s recent guidance on applying the *Fintiv* Factors. First and foremost, the merits of the Petition are “compelling,” and this “alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*.” *Director’s Memo*, 3-5. Grounds 1-4 present independent and distinct theories of obviousness which, “if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.” *Id.*, 4. Regardless, even if the Board were to address the full *Fintiv* framework, a holistic analysis of the factors favors institution.

1. Factor 1

Factor 1 is neutral because neither party in the litigation has, as of yet, requested a stay.

2. Factor 2

The Board’s projected Final Written Decision date in June 2024 is more reliable than the District Court’s scheduled date for “Jury Selection/Trial” on October 3, 2023. APPLE-1013, 5; *Director’s Memo*, 8 (“scheduled trial dates are unreliable and often change.”). For example, the District Court’s median time from

filing to trial was recently calculated as 28.3 months (APPLE-1012, 37), which would yield an estimated trial date in April 2024. This uncertainty in the District Court’s trial date weighs in favor of institution. And, even if it did not, “the proximity to trial should not alone outweigh” other relevant factors. *Director’s Memo*, 8.

3. Factor 3

This factor favors institution because Petitioner worked diligently to overcome the challenging circumstances of the litigation and file this Petition. For one, months after initiating the litigation in January 2022 (APPLE-1014), Patent Owner amended its complaint in March 2022 to add two new patents (APPLE-1015). Additionally, Patent Owner’s original and amended complaints identified just a single claim for each of the multiple asserted patents and did not identify the complete list of nearly forty asserted claims until serving its preliminary infringement contentions in April 2022 (APPLE-1016).

As a result of Petitioner’s diligence, the litigation still is in its early stages. Beyond exchanging preliminary infringement/invalidity contentions and claim construction briefs, the parties have yet to expend significant resources on the merits of the ’779 patent. APPLE-1013. The *Markman* hearing—originally scheduled for October 4, 2022 and now delayed by ***more than two months*** until at least December 16, 2022—would mark the Court’s first meaningful involvement regarding the scope and validity of the ’779 patent. APPLE-1031.

4. Factor 4

Petitioner asks the Board to consider the unique challenges raised in the Petition. *See Fintiv*, 12-13. If instituted, Petitioner will not pursue in the litigation invalidity challenges against the '779 patent that are the same as Grounds 1-4 in this Petition, thereby mitigating the risk of duplicated effort and inconsistent decisions.

5. Factor 5

Petitioner and Patent Owner are parties to the litigation, which favors institution or is neutral given the uncertainty of the trial date.

6. Factor 6

As discussed, the strength of Grounds 1-4 strongly favors institution.

B. The *Advanced Bionics* Test Favors Institution—§325(d)

McCrary, Raphaeli, Kuwahara⁹, Rofheart, and Godfrey were not considered or cited in the prosecution of the '779 patent, and consequently, each is being considered for the first time in this IPR proceeding. Thus, none of the Grounds involve the same or substantially the same prior art or arguments previously presented to the Office. 35 U.S.C. §325(d).

⁹ Kuwahara is not the same as the cited/considered references bearing the “Kuwahara” label on the '779 patent or its history. APPLE-1001, cover; APPLE-1002.

VII. FEES—37 C.F.R. §42.103

Petitioner authorizes charge to Deposit Account No. 06-1050 for the necessary fees.

VIII. MANDATORY NOTICES—37 C.F.R §42.8(a)(1)

A. Real Party-In-Interest—37 C.F.R. §42.8(b)(1)

Petitioner Apple Inc. is the only real party-in-interest. No other party had access to or control over the filing of this Petition, and Petitioner did not file this Petition for the benefit of any other party or entity.

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

Petitioner is not aware of any disclaimers, reexamination certificates, or petitions for *inter partes* review for the '779 patent.

Petitioner filed an *inter partes* review petition for U.S. Patent No. 7,321,777 (which is a continuation of the '779 patent) on September 9, 2022. The case number for that proceeding is IPR2022-01512. Recently, on November 29, 2022, a notice of filing date accorded issued in IPR2022-01512. Given the subject matter overlap between the related '777 and '779 patents, in addition to the overlapping prior art applied in IPR2022-01512, promptly issuing a notice of filing date accorded here may promote fairness and efficiency by facilitating the alignment of schedules between the two co-pending and related proceedings.

Additionally, the '777 patent is the subject of an IPR petition filed by Unified Patents, LLC in IPR2022-00987. Apple is not a real party-in-interest to IPR2022-

00987. Unified Patents is not a real party-in-interest in this proceeding, and is not in privity with Apple.

The '779 patent is a subject of civil actions captioned: *Speir Technologies Ltd. v. Apple Inc.*, Case 6:22-cv-00077-ADA (WDTX), filed on January 10, 2022; and *Speir Technologies Ltd. v. Samsung Electronics Co., Ltd. et al.*, Case 2:21-cv-00474 (EDTX), filed on December 30, 2021.

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

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR50095-0111IP1@fr.com,

Respectfully submitted,

Dated: November 30, 2022

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CERTIFICATION UNDER 37 CFR §42.24

Under the provisions of 37 CFR §42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,952 words, which is less than the 14,000 allowed under 37 CFR §42.24.

Dated: November 30, 2022

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on November 30, 2022, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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