

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC.; SAMSUNG ELECTRONICS CO., LTD.; AND
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

NARISTE NETWORKS PTY. LTD.
Patent Owner.

**DECLARATION OF SCOTT ANDREWS
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. RE48,206**

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LIST OF EXHIBITS¹

Ex-1001	U.S. Patent No. RE48,206
Ex-1002	Declaration of Scott Andrews
Ex-1003	Curriculum Vitae of Scott Andrews
Ex-1004	Prosecution History of U.S. Patent No. RE48,206
Ex-1005	U.S. Patent No. 5,982,324 to Watters (“Watters”)
Ex-1006	U.S. Patent Publication No. 20020151314 to Nohara (“Nohara”)
Ex-1007	U.S. Patent No. 6,975,941 to Lau (“Lau”)
Ex-1008	INTENTIONALLY LEFT BLANK
Ex-1009	INTENTIONALLY LEFT BLANK
Ex-1010	INTENTIONALLY LEFT BLANK
Ex-1011	INTENTIONALLY LEFT BLANK
Ex-1012	INTENTIONALLY LEFT BLANK
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Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK
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Ex-1020	Claim Mapping Table

¹ Four-digit pin citations that begin with 0 are to the page stamps added by Samsung and Google in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex-1021	Nariste Networks Pty. Ltd.’s Sur-Reply in Opposition to Defendants’ Rule 12(b)(6) Motion to Dismiss Under 35 U.S.C. § 251 and the Rule Against Recapture
Ex-1022	Yilin Zhao, Vehicle Location and Navigation Systems 43–81 (Illustrated ed. 1997).
Ex-1023	U.S. Patent No. 5,592,173 to Lau et al (“Lau”)
Ex-1024	U.S. Patent No. 6,748,224 to Chen et al (“Chen”)
Ex-1025	U.S. Patent No. 6,889,053 to Chang et al (“Chang”)
Ex-1026	U.S. Patent No. 5,663,734 to Krasner et al (“Krasner”)
Ex-1027	U.S. Patent No. 5,594,453 to Rodal et al (“Rodal”)
Ex-1028	U.S. Patent No. 7,409,188 to Syrjarinne et al (“Syrjarinne”)
Ex-1029	U.S. Patent Publication No. 20050083230 to Harvey et al (“Harvey”)
Ex-1030	Xinrong Li, Kaveh Pahlavan, and Jacques Beneat, Performance of TOA estimation Techniques in Indoor Multipath Channels 911–915 (2002).
Ex-1031	Flowchart, https://en.wikipedia.org/w/index.php?title=Flowchart&oldid=1169392868 (last visited Aug. 30, 2023).
Ex-1032	Central processing unit, https://en.wikipedia.org/w/index.php?title=Central_processing_unit&oldid=1172444772 (last visited Aug. 30, 2023).
Ex-1033	Samir S. Soliman and Charles E. Wheatley, Geolocation technologies and applications for third generation wireless 229–251 (2002).
Ex-1034	Samir Soliman, Parag Agashe, Ivan Fernandez, Alkinoos Vayanos, Peter Gaal, and Milan Oljaca, gpsOne™: A hybrid position location system 330–335 (2000).
Ex-1035	A. M. Turing, On Computable Numbers, With an Application to the Entscheidungsproblem 230–265 (1936)

Ex-1036	Defendants' Motion to Transfer Venue to the Northern District of California Under 28 U.S.C. § 1404(a)
Ex-1037	Defendants' Rule 12(b)(6) Motion to Dismiss Under 35 U.S.C. § 251 and the Rule Against Recapture
Ex-1038	Nariste Networks Pty. Ltd.'s Response in Opposition to Defendants' Rule 12(b)(6) Motion to Dismiss Under 35 U.S.C. § 251 and the Rule Against Recapture
Ex-1039	Defendants' Reply in Support of Rule 12(b)(6) Motion to Dismiss Under 35 U.S.C. § 251 and the Rule Against Recapture (Dkt. 23)
Ex-1040	Plaintiff's Disclosure of Asserted Claims and Infringement Contentions and Identification of Document Production Accompanying Disclosure

I. INTRODUCTION

1. I have been retained as an independent expert witness on behalf of Google LLC.; Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (collectively, “Petitioner”) in the above-captioned inter partes review (“IPR”) relating to U.S. Patent No. RE48,206 (“the ’206 Patent”) (Ex-1001).

2. I understand that Petitioner is petitioning for IPR of Claims 37-45 of the ’206 Patent and requests that the United States Patent and Trademark Office (“PTO”) cancel those claims.

3. In preparing this Declaration, I have reviewed the ’206 Patent and considered the documents identified below in light of the general knowledge in the relevant art. In forming my opinions, I relied upon my education, knowledge, and experience, and considered the level of ordinary skill in the art as I discuss below.

4. I am being compensated for my work in this matter at my standard consulting rate, which is \$500 per hour, plus actual expenses. My compensation is not dependent in any way upon the outcome of this matter.

II. BACKGROUND AND QUALIFICATIONS

5. All of my opinions stated in this Declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this Declaration.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as Ex-1003. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this Declaration.

7. I have over 30 years of professional experience in the field of mobile devices and technologies and systems, including handheld communications and navigation devices, vehicle information systems and vehicle safety and control systems, and the sensor systems that are used in these devices. Further, I have authored numerous published technical papers and am a named inventor on 13 U.S. and foreign patents.

8. I received a Bachelor of Science degree in Electrical Engineering from University of California, Irvine in 1977, and a Master of Science degree in Electronic Engineering from Stanford University in 1982.

9. From 1977 to 1979, I worked at Ford Aerospace where I designed, tested, and delivered microwave radar receiver systems.

10. From 1979 to 1983, I worked at Teledyne Microwave, where I developed high reliability microwave components and developed CAD tools.

11. From 1983 to 1996, I worked at TRW, Inc., having held various positions. From 1983 to 1985, I was a Member of the technical staff and a Department Manager in the Space Electronics sector. Between 1985 and 1990 I was a project manager working on various communications systems projects including the US DoD Advanced Research Projects Administration (ARPA) MIMIC Program. Between 1990 and 1993, I was the Manager of MMIC (monolithic-microwave-integrated-circuit) Products Organization. In this role, I developed business strategy and managed customer and R&D programs. During this time, I also developed the first single chip 94 GHz Radar, used for automotive cruise control and anti-collision systems. In 1993, I transferred to the TRW Automotive Electronics Group, and managed about 30 engineers in the Systems Engineering and Advanced Product Development organization. In this role, I managed advanced development programs such as automotive radar, adaptive cruise control, occupant sensing, automatic crash notification systems, in-vehicle information systems, and other emerging transportation products.

12. During this time, I also worked with various types of location determining equipment. For example, one system I developed in 1992, used a pager based system that triangulated the user's position and then used that position to provide information about and direction to user selected points of interest.

13. I was employed as a Project General Manager in the Electronics Division of Toyota Motor Corporation at Toyota headquarters in Toyota City, Japan from April 1996 to around April 2000. In this position, I was responsible for leading the development of vehicle telematics systems, infotainment systems, including on-board and off-board navigation systems, mobile device integration systems, traffic information systems, vehicle communications systems, safety applications, and automated vehicle control systems. At this time, global positioning system (GPS) equipment had become inexpensive enough that nearly all of the location based systems we developed relied on GPS to determine the user/vehicle location. In particular, between 1997 and 2000, I was responsible for the development of several vehicle tracking systems in the United States and Europe. These systems used a GPS receiver coupled with a cellular telephone transceiver and a processor to provide the vehicle position and other status information to a monitoring center.

14. Since late 2001, I have been a consultant for Cogenia Partners, LLC, focusing on systems engineering, business development and technical strategy supporting automotive and information technology. Between 2004 and 2006, I was engaged in various engineering projects with automobile manufacturers developing technology and standards for connected vehicle applications. Between 2006 and 2010, I served as the chief system architect for the US DOT sponsored Vehicle

Infrastructure Integration (VII) program, (later known as “Intellidrive”), and currently referred to as “connected vehicles.” This was a location based system using GPS to determine the position of the vehicle, and a short range radio data system to provide information to the vehicle from the roadside, to collect information from the vehicle, for example for traffic measurement, and to exchange information between vehicles to support various safety applications. As part of this project, I provided extensive background support for the US DOT ITS Joint Program Office about positioning systems and their capabilities and limitations.

15. Between 2010 and 2019, I served on various other US DOT Projects associated with connected vehicles. For example, recently I was the technical lead on a project funded by the National Highway Traffic Safety Administration (NHTSA) to develop requirements for connected vehicle safety systems in preparation for NHTSA regulations governing such systems. I also served as a technical consultant on multiple projects sponsored by the Federal Highway Administration (FHWA) related to connected vehicle technology research. In one FHWA project, I developed a precision location and timing system that was able to record and report the user vehicle location to an accuracy of about 1 cm and time with an accuracy of about 100 nanoseconds. This system allowed us to track the

precise trajectory of a vehicle as it moved through a test facility and supported the accurate characterization of other systems being tested.

16. In the various positions mentioned above, I was responsible for research and development projects relating to numerous mobile information systems, navigation systems, user interface systems, sensory systems, control systems and safety systems, and also had the opportunity to collaborate with numerous researchers and suppliers to the auto industry. I, therefore, believe that I have a detailed understanding of the state of the art during the relevant period, as well as a sound basis for opining how persons of skill in the art at that time would understand the technical issues in this case.

III. INFORMATION CONSIDERED

17. In preparation for this declaration, I have considered the materials I discuss in this declaration, including, for example, the '206 Patent, the references cited by the '206 Patent, the prosecution histories of the '206 Patent and applications from which it derives (including the references cited therein), various background articles and materials referenced in this declaration, and the prior art references identified in this declaration. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

18. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

19. I have been informed and understand that in an IPR proceeding, claims are to be interpreted according to the Phillips claim construction standard. I have been informed and understand that claim construction is a matter of law and that the final claim constructions for this proceeding will be determined by the Patent Trial and Appeal Board (“PTAB”).

B. Written Description

20. I understand that determining whether a particular patent or printed publication constitutes prior art to a challenged patent claim can require determining the effective filing date (also known as the priority date) to which the challenged claim is entitled. I understand that for a patent claim to be entitled to the benefit of the filing date of an earlier application to which the patent claims priority, the earlier application must have described the claimed invention in sufficient detail to convey with reasonable clarity to the POSITA that the inventor had possession of the claimed invention as of the earlier application’s filing date. I understand that a disclosure that merely renders the claimed invention obvious is

not sufficient written description for the claim to be entitled to the benefit of the filing date of the application containing that disclosure.

C. Perspective of One of Ordinary Skill in the Art

21. I have been informed and understand that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I understand that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

D. Obviousness

22. I have been informed and understand that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

23. I understand that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long

felt but unmet need, failure of others, copying by others, and skepticism of experts).

24. I understand that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I understand that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I further understand that a POSITA is presumed to know the relevant prior art. I understand that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

25. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I understand that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;

- whether the combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;

- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

26. I understand that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I understand, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

27. It is my opinion that Claims 37-45 of the '206 Patent would have been obvious under 35 U.S.C. § 103 on the following grounds:

- **Ground 1:** Claims 37-45 are rendered obvious by U.S. Patent No. 5,982,324 to Watters (“Watters,” Ex-1005).
- **Ground 2:** Claims 37, 40, and 43 are rendered obvious by U.S. Patent Publication No. 2002/0151314 to Nohara (“Nohara,” Ex-1006).
- **Ground 3:** Claims 38, 41, and 44 are rendered obvious by Watters in view of U.S. Patent No. 6,975,941 to Lau (“Lau,” Ex-1007).
- **Ground 4:** Claims 37-45 are rendered obvious by Watters in view of

Nohara.

- **Ground 5:** Claims 38, 41, and 44 are rendered obvious by Watters in view of Nohara and Lau.

VI. THE CHALLENGED PATENT

28. The '206 Patent relates to power conservation for GPS-enabled devices. Ex-1001, 1:22-24. More specifically, noting the high power consumption of continuous use of GPS positioning, the patent provides a GPS-equipped mobile device that also has “a system for adaptively predicting when a GPS-enabled wireless communication device should be powered on.” Ex-1001, 2:14-16, 3:40-44. As reflected in Figure 2, when not using GPS, GPS power-on timing may be predicted “using adaptive-filters [including neural networks] and machine-learning techniques.” *Id.*, 5:62-65, 6:41-43. I note that none of the reissued claims appear to relate to any such adaptive filters, adaptive predictions, or neural networks.

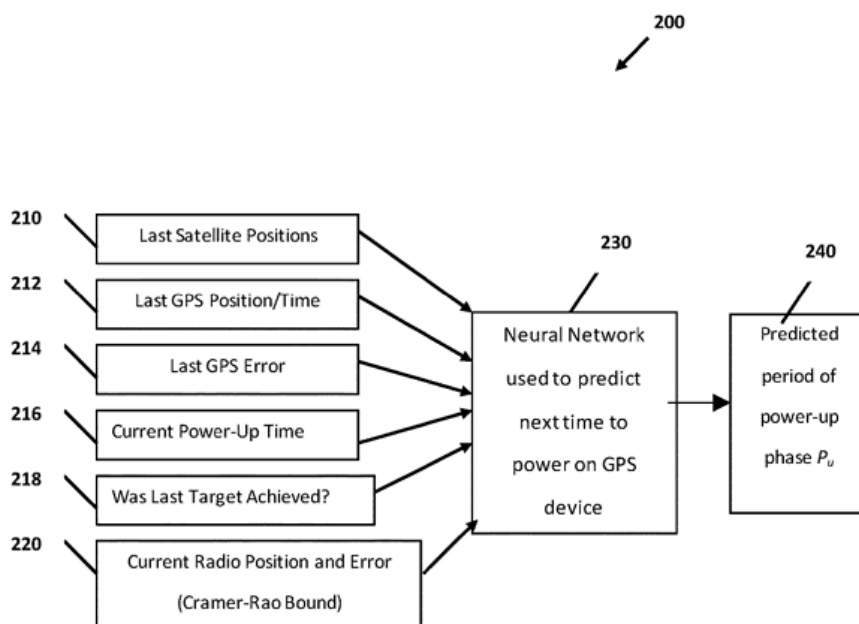


FIG. 2 (Amended)

Id., Fig. 2. For example, the '206 Patent explains that “neural network module 230 predicts the next time to power on the GPS device” and does so “dependent upon various inputs including the last satellite positions 210, the last GPS position/time 212, the last GPS error 214, the current power-up time 216, information about whether or not the last target [] was achieved 218, and the current radio position and error 220.” *Id.*, 6:55-56, 6:57-62.

29. The '206 Patent is a re-issue patent. During the reissue proceedings, all original claims were cancelled and new Claims 37-45 were added. The reissued independent claims use information “determined from the wireless communications network, said wireless communications network being different

from said GPS” to make a determination of when to power on the GPS. The reissued claims thus require that the determination is based on information from a wireless communication network, such as cellular infrastructure, rather than GPS-provided information. As I discuss in further detail below, the challenged claims are obvious over prior art describing the same capabilities.

VII. PATENT PROSECUTION HISTORY

30. I understand that the '206 Patent is an indirect reissue of US Patent No. 8,022,870 (“the '870 Patent”), which was filed as App. No. 11/661,707 and originally issued on September 20, 2011. Ex-1001, Cover.

31. I further understand that the '206 file history has been submitted as Ex-1004. The application for the '206 Patent, Application No. 15/376,627 (“'627 application”), was filed on December 12, 2016. The applicant filed a re-issue declaration, affirming that the original patent was “wholly or partially inoperative or invalid” “by reason of the patentee claiming more or less than he had a right to claim.” Ex-1004, 0230. The applicant went on to explain that broader new claims are presented “thus broadening the original scope of the invention.” *Id.*, 0229. In the amendment filed on December 12, 2016, Claims 1-36 were canceled and the Applicant added Claims 37-45. *Id.*, 0019-0022.

32. On July 15, 2020, the Examiner issued a notice of allowance stating that the previously applied prior art “does not explicitly teach the use of a position

determined from the wireless communications network, wherein the wireless communications network is different from the GPS.” Ex-1004, 0371. The Examiner explained that “[i]n the [applied prior art] system, all positions are derived from the GPS.” *Id.*

VIII. LEVEL OF ORDINARY SKILL IN THE ART

33. One of ordinary skill in the art would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience in the research, design, development, and/or testing of GPS and/or cellular positioning devices and techniques, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa.

34. I am well qualified to determine the level of ordinary skill in the art. First, I am very familiar with the technology of the ’206 Patent as of the September 2004 timeframe. As mentioned above, I had acquired significant experience relating to GPS-based navigation and mapping systems by 2004. Specifically, by 2004, I had over a decade of experience working with geolocation-based technologies that included, for example, location-based services, navigation systems, mapping systems, vehicle infotainment systems and various mobile devices, and had been responsible for hiring and managing engineers engaged in the development of these types of systems. *See e.g.*, Ex-1003.

IX. TECHNOLOGY BACKGROUND

35. To provide background for the element-by-element analysis of the claims to follow, below I will present an overview of the state of the art existing at the time of the alleged invention relating to geolocation generally, and as it relates to locating mobile devices using GPS and cellular technologies, among other relevant technology. As I will describe below from a high-level functional perspective, in the next section based on specific prior art, and then in subsequent sections on a limitation-by limitation basis, all of these technologies and positioning techniques were well-known to those of ordinary skill in the art at the time of the alleged invention claimed in the '206 Patent, and a POSITA would have readily understood the combination of elements of Claims 37-45 to have been obvious.

A. Geolocation Generally

36. Navigation, and numerous other safety and convenience systems rely on determining the state² of the vehicle (aircraft, ship, car, mobile device, etc.) with reasonable accuracy. This position can then be used to locate the vehicle on a map, for example to inform or support the user, or to control the position of the vehicle relative to known structures or hazards.

² In general, this state is represented by a set of state parameters that include latitude, longitude, altitude or elevation, time, speed heading and other related information.

37. Traditionally, navigation has used two methods for determining location, celestial navigation and what is known as “Dead Reckoning.” Celestial navigation involves measuring the positions of stars and planets at known times, and then converting those measurements to a position estimate using tables describing the well-established motions of these celestial objects. Celestial navigation involves measuring the positions of stars and planets at known times, and then converting those measurements to a position estimate using tables describing the well-established motions of these celestial objects. This celestial navigation process involves measuring the elevation of the object from the horizon using a telescope-like device called a sextant. By noting the name of the object, the elevation and the time, the observer can then determine where on the earth the object would be visible at that elevation at that specific time. As shown in Figure 1, an object in the sky will be observed at a specific elevation at a specific time only when viewed from anywhere on a unique circle on the earth’s surface.

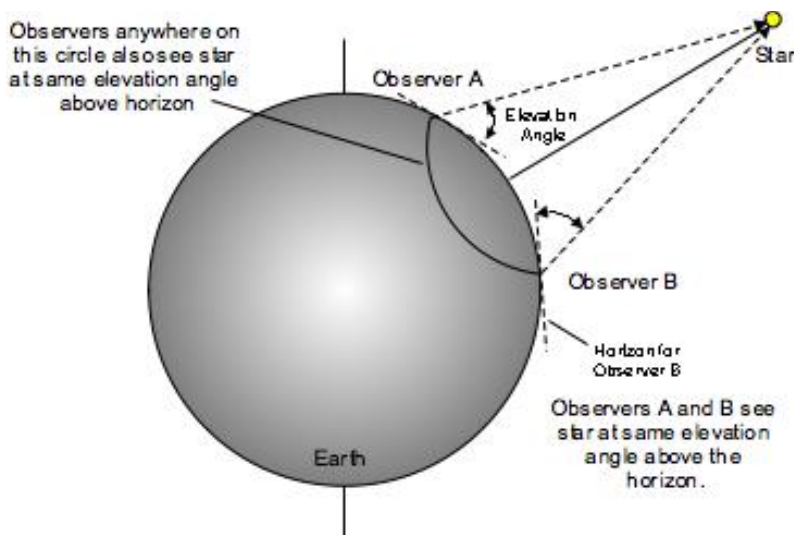


Figure 1
Star Viewed From Two Points On Earth Shows Same Elevation Angle

38. The observer uses a detailed table that describes the orbits of bright stars, the sun, the moon and the planets (depending on what celestial object is being observed) to determine exactly where this circle (or a small segment of it in his local vicinity) is on the Earth's surface. This table is called an ephemeris.

39. By measuring one object, the observer knows they are somewhere on that circle. By measuring two objects, they can define two circles, and the position is one of the two places where the circles intersect. As shown in Figure 2, by measuring a third object, and thereby creating a third circle, the observer can resolve their position to the one place where all three circles cross. More object measurements will produce more overlapping circles, and thus the more confident the observer can be in the accuracy of the position estimate.

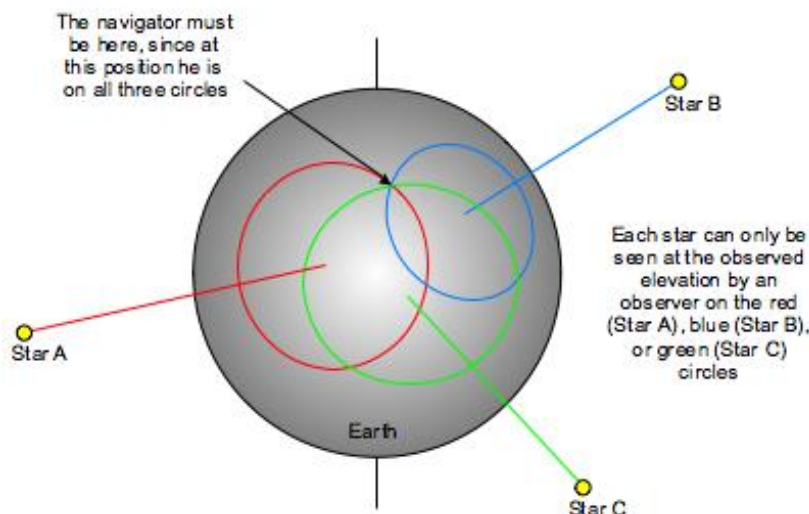


Figure 2
Multiple Observations Produce Multiple Position Lines.
Point of Mutual Intersection Is Position

40. Dead Reckoning uses a known location of a starting point (originally a point of land, or a buoy in a harbor). As the vehicle moves, its heading and speed are recorded, and each time the heading or speed changes, a new record is made (originally this record was made in the ship's log), thereby creating a chain of vectors with direction according to the heading at that time, and distance equal to the speed time on that course. By linking together these changes the navigator can plot the course traveled and determine roughly where they are after traveling some distance over time.

41. These two methods (Dead Reckoning and celestial navigation) have served navigators well for centuries, but they have serious drawbacks. Celestial navigation lacks fine accuracy (because you have to measure the elevation of a star from the horizon, and this may be challenging on the deck of a floating ship, or

flying aircraft, and is impractical in a moving automobile) and it suffers greatly from the fact that it cannot be used effectively in daylight or under cloud cover. Dead Reckoning assumes that speed and heading can be measured reasonably accurately, but it does not inherently take into account effects from errors in these measurements either from the sensor errors, or from external effects such as current or wind. Dead Reckoning works well over short distances, but if used for a long time, the errors in heading and speed measurement accumulate, and the position estimate can drift off the true position by significant amounts.

B. Global Positioning System (GPS)

42. To provide a more reliable and accurate alternative to celestial navigation, the U.S. government built a constellation of satellites known as the Global Positioning System (GPS).³ This system operates in a way reminiscent of celestial navigation, but re-created in an electronic form.

43. The satellites are arranged in earth orbit in a way that allows several of them to always be visible from any point on the globe. As a result, it is possible to use the system at any time of day, and under most weather situations. In operation, the satellites transmit a repeating signal that contains a variety of

³ The GPS system is variously known as the Global Navigation Satellite System (GNSS), Navistar, and simply the Global Positioning System (GPS). Its European counterpart is the Galileo System, and a Russian counterpart is known as GLONASS. All of these systems operate similarly.

information used by a receiver to determine the orbital location of the satellite (also called an ephemeris). This coded message is also used to determine the time delay of the signal from the satellite. Using this delay, it is possible to determine the distance between the satellite and the receiver. This distance represents the radius of a sphere centered on the satellite. In a manner similar to the celestial navigation process described above, with the distance to one satellite the user will know they are somewhere on that sphere. If the distance to two satellites is known, the user will know they are somewhere on the intersection of the two spheres (a circle), and if three satellites are known, they will know they are at the point where the three circles intersect. In practice, four satellite signals are generally required in order to correct for the fact that the receiver does not have a highly accurate atomic clock, so the addition of a fourth signal allows the determination of position in three dimensions, and the current GPS time.

44. The determination of the position of the receiver is done by solving a system of equations, known as “the GPS equation.” This is shown below.⁴

⁴ See Vehicle Location and Navigation Systems by Yilin Zhao, ©1997, Artech House, Inc., ISBN 0-89006-861-5 (Ex-1022), page 69.

$$\begin{aligned}p_1 &= \sqrt{(x - x_1)^2 + (y - y_1)^2 + (z - z_1)^2} + c(dt - dT_1) \\p_2 &= \sqrt{(x - x_2)^2 + (y - y_2)^2 + (z - z_2)^2} + c(dt - dT_2) \\p_3 &= \sqrt{(x - x_3)^2 + (y - y_3)^2 + (z - z_3)^2} + c(dt - dT_3) \\p_4 &= \sqrt{(x - x_4)^2 + (y - y_4)^2 + (z - z_4)^2} + c(dt - dT_4)\end{aligned}$$

45. In this equation, p_1 represents the measured pseudorange for satellite 1 (where 1 is the number of the satellite); x_1 , y_1 and z_1 represent the position of satellite 1; x , y and z represent the position of the receiver, dt represents the offset between the receiver clock and the time the satellites transmitted their signals, and dT_1 is a time correction provided for each satellite to account for any clock errors at the satellite. Indices 2-4 in the remaining three equations represent similar quantities (pseudorange, x , y , and z position, and time delay) related to additional satellites. Ignoring the dT_i terms for simplicity, the time offset between the actual time, and the receiver time is just the term dt , and since the clocks in the satellites are all synchronized, this value is the same for all satellites for any given receiver. What this means is that the range to any given satellite based on time of flight measured by the receiver is off by this time delay times the speed of light, hence this $c(dt)$ correction term in the GPS equation.

46. This equation with four measured pseudoranges (from four satellites) represents a system of four equations with four unknowns (x , y , z and dt). If signals from only four GPS satellites are received, then the GPS receiver solves this system of four equations and four unknowns, and thereby determines x , y , z and dt . That is, its x , y , and z position and the time offset between its clock and the satellite clock. (*See, e.g., Ex-1022, pages 69-70.*) If more than four signals are present, then the satellite has what is known as an “over specified” system of equations, and it then uses well-known approximation methods such as Least Squares or Newton’s method to obtain a best fit solution.

47. To perform these computations, the receiver must also obviously know the orbital positions of the satellites, x_i , y_i , and z_i at the time the signals were sent. This information is computed based on information contained in the GPS navigation message. Specifically, a GPS receiver uses the bits of the GPS navigation message from each satellite to determine the pseudorange for that satellite, but over time, it also uses information contained in the message itself (coded in the bits of the message) to determine the orbital path for each satellite, and thus the x_i , y_i , and z_i position of the satellite in its orbit at the time the signal was sent.

C. Acquiring GPS Signals

48. A key challenge with GPS is that in order to allow all of the satellites to transmit their signals simultaneously, the signals are coded⁵. The data symbols (the ones and zeros of the data message) are thus embedded in noise created by all of the satellites in view of the receiver.

49. This system works well, but it also results in a time consuming process when the receiver does not know which satellites are in view or what their time offsets are. Since the receiver does not know specifically which satellites are in view at any given time, and since these signals are all offset in time by the time of flight between the satellite and the receiver, the receiver must not only determine which codes to look for, it also must determine the time offset for each code. This signal acquisition process, and the determination of the code and offset for a given signal is often referred to as a “cold start,” and once the code and offset for a given satellite have been determined, the receiver is said to have “locked onto” the satellite signal. Since there are a number of satellites and a large number

⁵ This coding is based on Code Division Multiple Access (CDMA), where each bit (a one or a zero) in a message from any given satellite is represented by a fairly long sequence of signal phase transitions (called “chips”). The codes are designed so that the signals from other satellites simply appear as noise when one is tracking a particular signal. The tracking is performed using a matched filter that specifically correlates this noise, seeking to identify a given code within the noise. In this way, all satellites can transmit at the same time on the same frequency, and the GPS receiver can use an array of matched filters (one for each satellite code) to recover the signals from each of the satellites simultaneously.

of possible time offsets, this locking on process can take significant time. The time required to perform this “cold start” is typically referred to as the “Time To First Fix” (TTFF), and this is a key performance metric for GPS receivers.

D. Conserving Power

50. GPS receivers include a fairly large number of circuits, including radios, correlators, and processing components. Since not all systems require position information all the time, it is common to place a GPS receiver in standby mode when positioning information is not required, because this standby mode will use less power. Generally, simply turning off the GPS receiver entirely is not a viable approach because once the receiver is off, it must then perform a “cold start,” which, as I described above, is time consuming and results in a long TTFF. In a cold start state, “the GPS receiver has no GPS almanac, or it has no approximate knowledge of current time and location.” Ex-1033, 0010. “The GPS almanac gives an approximate satellite ephemeris” and “[i]t takes the receiver 12.5 min to download the almanac of the entire GPS constellation.” *Id.* To avoid this, many systems place the receiver in a standby mode wherein the GPS signals are still received, and tracked for time offset, but the actual position calculations, which can be computationally intensive and thus power consuming, are not performed. Another approach to conserving power is to maintain a record of the last known positions of the observed satellites when the receiver is powered down,

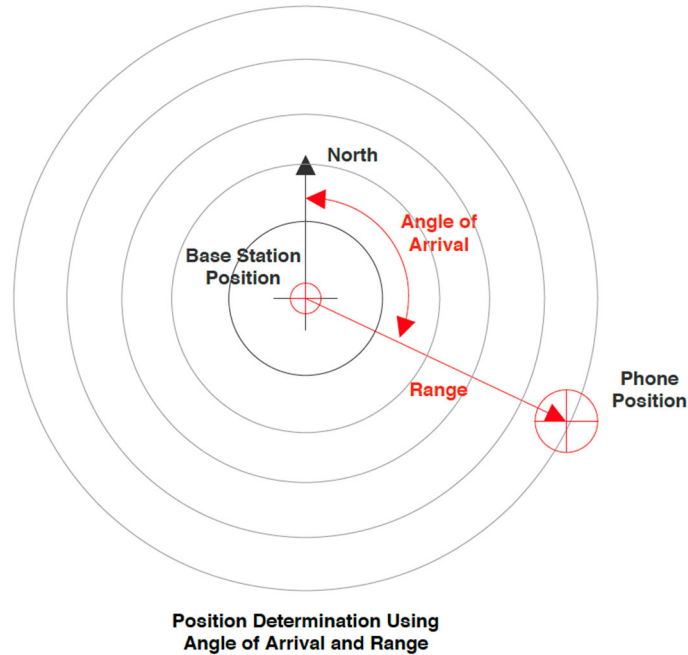
and to then extrapolate the positions, and thus the time offsets of the satellite based on their orbital data. Thus, “a GPS receiver that starts in this state will be able to determine a position in about 30 s.” *Id.*, 0011. An example of this approach is found in U.S. Patent No. 5,592,173 to Lau et al., (Ex-1023). Additionally, U.S. Patent No. 5,663,734 to Krasner et al., (Ex-1026) utilizes a method of power management for a GPS receiver and explains that “[p]ower dissipation is reduced over prior systems by receiving GPS signals from in view satellites; buffering these signals; and then turning off the GPS receiver.” Ex-1026, 3:52-54; *see also id.*, 18:19-19:19.

51. U.S. Patent No. 7,409,188 to Syrjarinne et al., (Ex-1028) explains that a GPS receiver consumes more power than current motion sensors based on MEMS (Micro-electromechanical systems) technology. Specifically, “[a] GPS receiver consumes substantially more power when in active mode (i.e., actively acquiring satellite or other ranging signals and recalculating position information)” than when the GPS is “not in active mode, i.e., is in standby (during which the GPS receiver simply holds in memory the last received ranging information and position calculations).” Ex-1028, 3:31-37. U.S. Patent Publication No. 2005/0083230 to Harvey et al., (Ex-1029) also refers to this standby mode or low-power mode as a “tricklestate” mode. Ex-1029 ¶15.

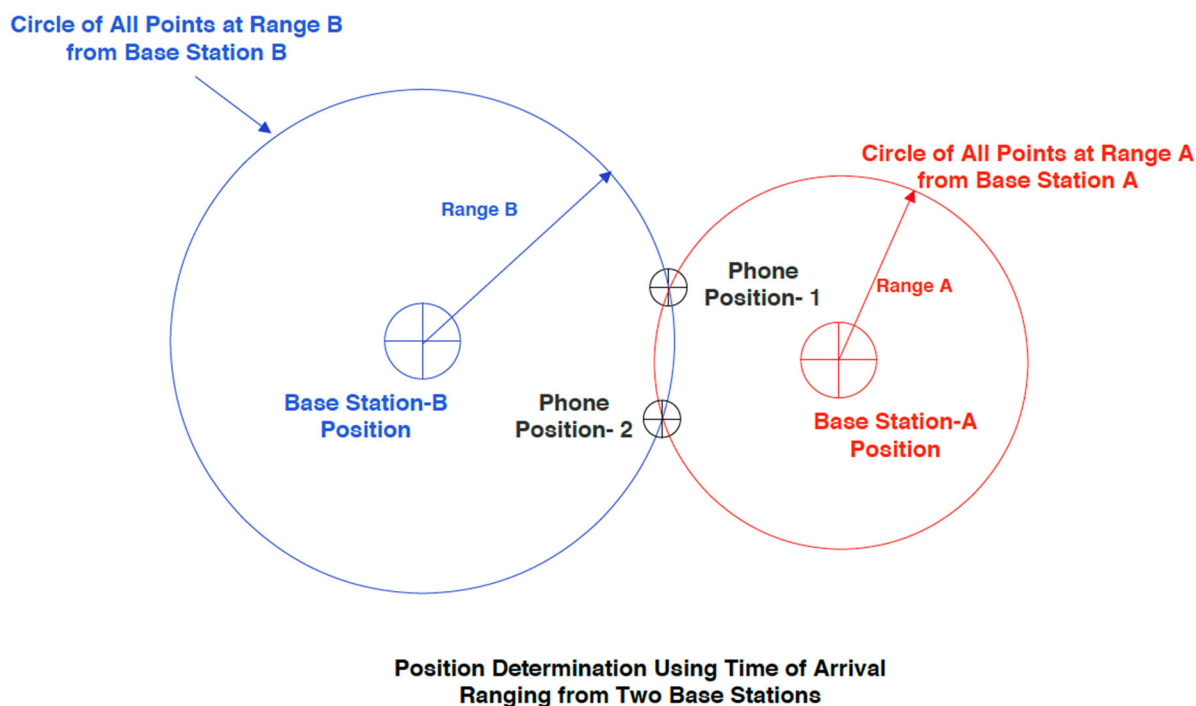
52. As discussed in *Geolocation technologies and applications for third generation wireless* (Ex-1033), “[t]he time required by a conventional GPS receiver to obtain a position fix depends upon the state of the GPS receiver.” Ex-1033, 0010. There are typically three common states: cold start state, warm start state, and hot start state. *Id.*, 0010-0011.

E. Cellular/Base Station Positioning

53. An alternative to GPS is the use of cellular signals to triangulate the position of a cell phone. There are several different basic forms of triangulation that can be used. Specifically, Angle of Arrival (AOA) and Time of Arrival (TOA) or Time Difference of Arrival (TDOA). *See* Ex-1034. The simplest form is based on a signal measurement from a base station. It uses a concept known as Angle of Arrival (AOA) wherein the bearing direction from the phone to the base station is estimated using a directional antenna, and the range is estimated using the signal strength. Knowing the direction and range between the base station and the phone, as well as the position of the base station, the approximate position of the phone can be estimated. This approach is illustrated below. The accuracy of this method of position determination depends on the accuracy of the range measurement, which is generally somewhat prone to error.

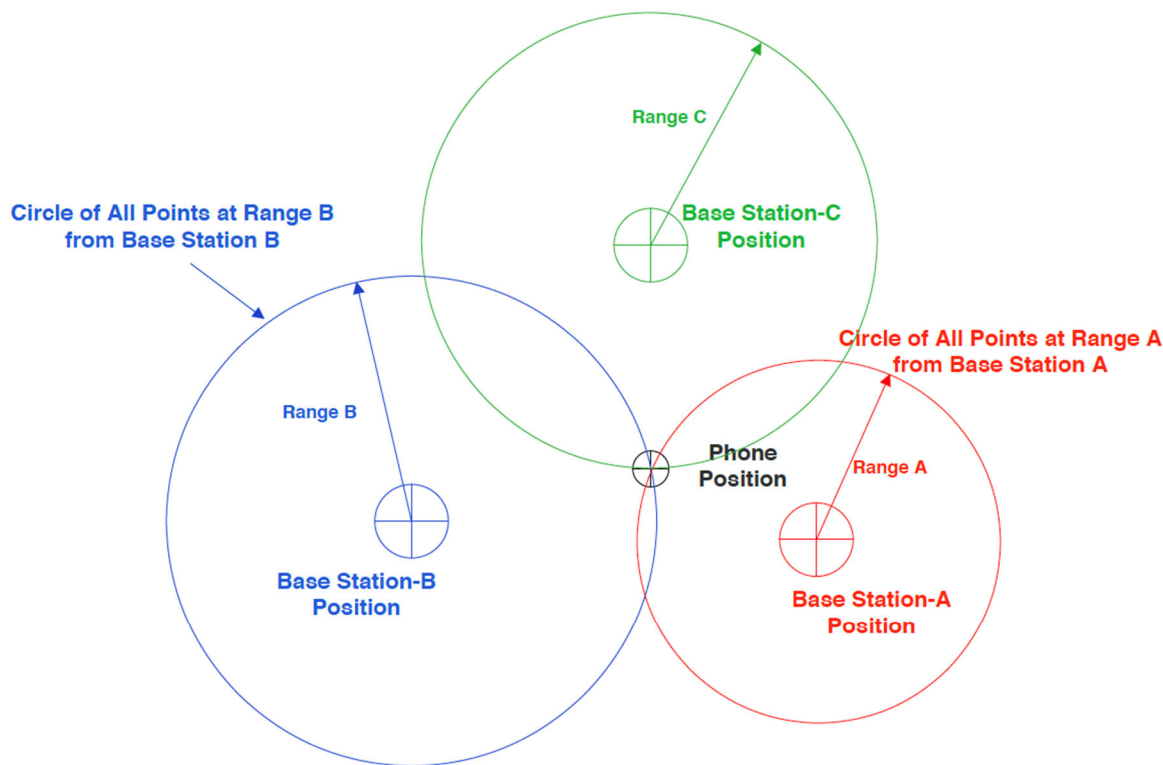


54. An alternate method that is used is known as “Time Of Arrival” (TOA). Since the cellular base station locations are known, it is a fairly simple matter to determine the distance between the cellular phone and the base station by measuring signal time of flight. As with celestial navigation and GPS, if the distance to one base station is known, it can be determined that the cell phone is located on a circle, centered on the base station, whose radius would create that time delay. If the distance to two base stations is known, then the position of the phone is at one of the two points where the two circles, each associated with the delay to their respective base stations, intersect. And, if three distances are known, the three resulting circles will intersect at only a single location, and this is the position of the cell phone. This is illustrated in the figure below.



55. An example of this approach is found in U.S. Patent No. 5,594,453 to Rodal et al., (Ex-1027) which utilizes the TOA method and discloses a “GPS receiver [that] computes the location and the time of day from the time of arrival (TOA).” Ex-1027, 4:62-64.

56. As can be seen in the figure, there is some uncertainty in the position of the phone because there are two possible locations where the range circles cross. This ambiguity can be resolved by using range measurements from three base stations as shown below.



**Position Determination Using Time of Arrival
Ranging from Three Base Stations**

57. In actual practice, the *differences* between the signal flight times is used rather than trying to measure absolute flight time, so this variation is known as “Time Difference Of Arrival” (TDOA).

58. These methods of triangulation using cellular signals were well known as of the filing date of the '206 Patent. For example, U.S. Patent No. 6,748,224 to Chen (Ex-1024), filed on December 16, 1998, describes a “local positioning system (LPS) uses the radio propagation parameters in a CDMA forward link or TDMA reverse link to establish a mobile station's position. Ex-1024, Abstract. Chen further describes that the system is based on TDOA. For

example: “The LPS is based on TDOA which uses measured phase shift or chip offset information of the pilot channel signals transmitted from particular base stations that are ‘visible’ to the mobile station. A TDOA triangulation approach requires time or propagation delay measurements from at least three ‘visible’ base stations.” Ex-1024, 3:51-56.

59. U.S. Patent No. 6,889,053 to Chang (Ex-1025), filed on July 26, 1999, describes a mobile phone location system based on a model of signal characteristics such as the received signal strength as a function of location. For example:

The location of a mobile wireless communication unit in the service area of a CDMA communications system is predicted utilizing two likelihood functions that define maximum likelihood estimators of the mobile unit's location, based on attribute measurements, such as but not limited to pilot signal strength, being made at the location of the mobile unit and reported back to a base station. One of the likelihood functions comprises a frequentist likelihood function and the other comprises a Bayesian-modified likelihood function. The likelihood functions are based on the assumption that there is an RF model which provides the probability a mobile unit is able to detect one or more attributes associated with an arbitrary base station, given it is located at an arbitrary location within the service area.

Ex-1025, Abstract.

F. GPS and Cellular Positioning Errors

60. While the techniques I described above for both GPS and cellular positioning provide reasonable accuracy, they are not error free.

61. GPS signals can pass through layers in the atmosphere of different densities, and thus the measured pseudoranges may include atmospheric and

ionospheric errors. Both GPS and cellular systems can suffer from clock errors wherein jitter in the clocks used to measure the time delays result in errors in the range estimates and consequentially errors in position. In some situations the geometry of the base stations or satellites is simply unfavorable. For example if the base stations or satellites are closely spaced, the angles of arrival of the signals will be nearly the same, and any error in the range measurement will be amplified⁶. More significantly, both types of signals may reflect off terrestrial objects such as buildings. This means that the receiver will receive the direct path signal, and may receive one or more copies of the signal reflected from these objects (essentially an echo of the signal). The result is that there will be some ambiguity or error in the measured time of arrival of the signal⁷. Since measuring the time of arrival of the signal is key to determining the range to the base station or satellite, any ambiguity

⁶ For example, if the position circles intersect at some large angle, for example 90 degrees, any error in the radius of the circle (range error) will have only a minor effect on the point of intersection. If instead the position circles cross at a small angle, the same error in the radius of the circles will cause the point of intersection to move significantly.

⁷ Note here that if the reflected path is extremely long, then the reflected signal will be received well after the direct signal, and this reflected signal can be ignored. However, if the reflected path is only slightly longer than the direct path, the two signals will be received at nearly the same time, and the time of arrival will be effectively blurred between them. This is akin to the observation with acoustic echoes. If one shouts into a canyon, the echoed return may occur a few seconds later, and it is easy to hear. However, if the echoes are closely spaced, the result is often garbled. This can be observed, for example, in a train station, where announcements are often unintelligible because the echoed sound is received nearly simultaneously with the direct sound.

in the time of arrival translates to error in the position. For example the paper *Performance of TOA estimation Techniques in Indoor Multipath Channels* by Li, et al,⁸ describes that long, multipath delays result in distinct signal arrival in time, while smaller delays result in the signals being received one on top of another, making resolution of the time of arrival ambiguous. For example in relation to Figure 1 reproduced below:

When a radio signal is passed through a multipath channel, the delay profile consists of multiple copies of delayed version of autocorrelation function of the transmitted signal as given by (5). Figure 1b shows the power delay profile obtained in a two-path channel. We can observe that when the difference between adjacent path delays is greater than $2xT$, clearly separated correlation peaks appear in the power delay profile so that the delay of the DLOS can be determined by finding the delay value that corresponds to the first peak.

...

When the difference between adjacent delays is smaller than $2xT_c$, the two delayed correlation functions overlap. Due to the construction and deconstruction effects between the two overlapped correlation functions, as shown in Fig. 1c large delay estimation error occurs if the TOA is estimated by detecting the first peak of the power delay profile.

⁸ Performance of TOA estimation Techniques in Indoor Multipath Channels by Xinrong Li, Kaveh Pahlavan, and Jacques Beneat 0-7803-7589-0/02/\$17.0020 002 IEEE (Ex-1030).

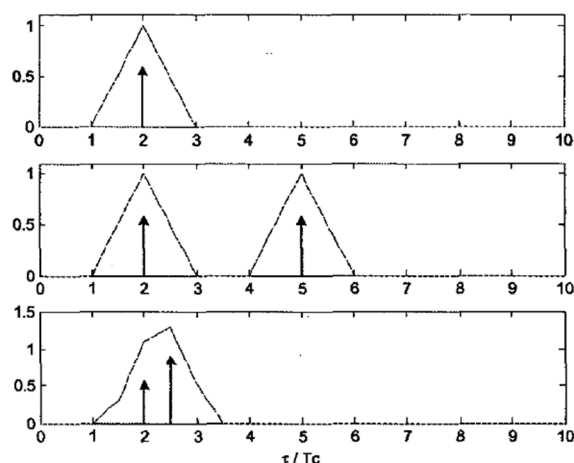


Fig. 1. Power delay profiles with different channel profiles. (a) Single-path channel with propagation delay $D = 2 \times T_c$; (b) two-path channel with signal attenuation parameters $\alpha_0 = \alpha_1$, and propagation delays $\tau_0 = 2 \times T_c$ and $\tau_1 = 5 \times T_c$; (c) two-path channel with signal attenuation parameters $\alpha_0 = 0.6 \times \alpha_1$, and propagation delays $\tau_0 = 2 \times T_c$, and $\tau_1 = 2.5 \times T_c$.

Li et al Figure 1

62. Essentially, the summation of the two slightly delayed signals results in the correlation peak being spread out over time, thus making an accurate determination of the actual arrival time more difficult.

63. These errors are somewhat deterministic, and result, for example, in uncertainty about the intersections of lines of position (e.g. the position circles I discussed above) and this means that the actual position is estimated from a set of possible positions identified by these intersections⁹. The error between these intersection points and the estimated position can then be used to estimate the error in the position estimate (known as *dilution of precision* or DOP). Since most

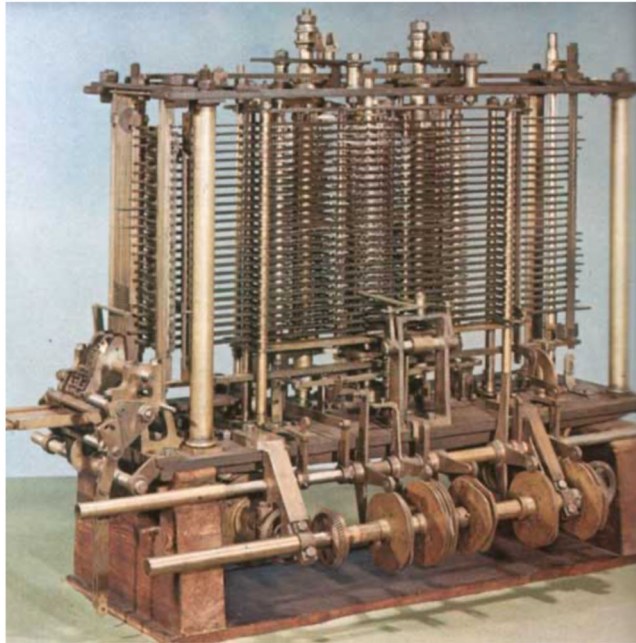
⁹ This estimate is typically performed using an error minimization or best fit technique such as a least square algorithm.

positioning systems are used to determine position on the surface of the earth, the resulting position error is a *horizontal* position error. Most positioning systems thus provide an estimate of the error in the position that is generally known as *horizontal dilution of precision*, or HDOP.

G. Processors and Controllers

64. Computer systems of various types have been in existence for thousands of years. An abacus is a rudimentary computer that is used to count and perform simple arithmetic operations. There is historical evidence that the abacus and related devices may date back as far as 2400 BC¹⁰. One of the first computers was developed by the mathematician Charles Babbage. The Analytical Engine, shown below was developed by Babbage in about 1847. It was essentially a mechanically operated, and mechanically programmed computing device.

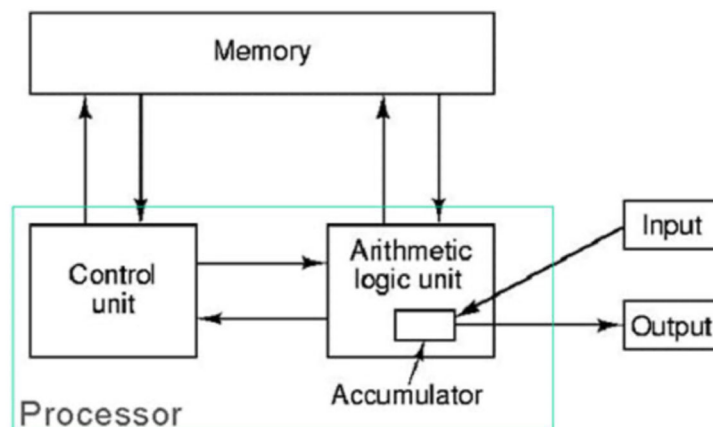
¹⁰ The History of Computing, Abacus Explained — Everything You Need To Know (2021); <https://history-computer.com/abacus/> Accessed 5/25/2022.



A model of the *Mill of Analytical Engine*, constructed about 1870 (© Science Museum, London)

65. In 1936, British mathematician Alan Turing published a paper titled *On Computable Numbers, With An Application To The Entscheidungsproblem*. See Ex-1035. This paper describes what is known as the “Turing machine,” which is a mathematically defined processor that performs operations based on instructions that are stored on a scannable “tape” (for example a paper tape with perforations representing the instructions). In around 1945, Hungarian mathematician John von Neumann conceived of an electronic implementation of a computing machine (similar mathematically to the Turing machine) that used a processor comprised of an arithmetic logic unit (ALU), and a control unit. The ALU was a logic device that would, based on binary controls, add and subtract binary numbers, and/or

perform various logical operations (AND, OR, NOT, etc.). Von Neumann¹¹. The binary controls were logic signals derived from data stored in a memory. This concept, illustrated below, became known as the “von Neumann Machine.” It is the functional core that resides in nearly every modern day computing device. A key concept for the von Neumann machine was to store the data that was to be operated on (the binary numbers to be added, subtracted or logically processed) in the same memory as the instructions. Thus, the memory would hold a sequence of binary coded instructions that would be used to direct the ALU to perform an operation. The control unit would read an instruction from memory, together with the data representing the numbers, and apply these to the ALU, which would then perform the specified operation. The result could be output from the computer, or stored back in the memory, where it could be used in subsequent processing steps.



¹¹ <https://history-computer.com/john-von-neumann-complete-history/> Accessed 5/25/2022.

66. Thus, a processor is essentially a set of logic circuits that can be configured based on programming data. While the physical logic gates of a processor do not change, the relationships between them can be controlled by programming instructions. Thus, a processor represents programmable logic.

67. This concept was reduced to practice in the 1940's primarily in support of the Allied war effort. Following the invention of the transistor in 1947, and subsequent development of integrated circuit technology, Intel released a set of four integrated circuits, known as the MCS-4,¹² that collectively implemented the processing unit (ALU and control unit), program memory, working memory, and I/O of a von-Neuman computer. The Intel 4004 processor was a 4-bit processing unit that could be used to implement relatively simple processing tasks using a small set (45) of primitive instructions. Between 1975 and 1983, the capability of these devices improved considerably, and from 1983 to the early 1990's, computing technology became practical and pervasive. For example:

This chapter is concerned with changes that are likely to take place in the immediate or short-term future, a future which comes to a close in 1982 or thereabouts. I have taken the Computer Revolution as starting in 1975 at about the time the first primitive microprocessors came on the market. Thus, in 1980, it is five years old, and its first era has about another two years to run. It will be largely concerned with gadgetry and gimmicks...

The second phase, the medium term future, should run from approximately

¹² Intel, The Story of Intel
(<https://www.intel.com/content/www/us/en/history/museum-story-of-intel-4004.html> (Accessed 4/13/2022)).

1983 to 1990, and it is then that computers will have their most important social effects.

The Micro Millennium¹³.

68. While systems such as the MCS-4 require multiple individual components to implement a full working computer, a microcontroller implements all of the required elements on a single chip. This a microcontroller includes a microprocessor, but also has its own program and working memory and its own I/O system. In practice, most microcontrollers offer a variety of different I/O components to suit a variety of applications. The first commercial microcontroller, the Texas Instruments TMS1000, was released in 1974. The only substantive difference then between micro controllers and microprocessors is that a microprocessor generally requires other components such as memory and I/O peripherals, whereas a microcontroller generally includes these components on a single chip.

69. A microprocessor is thus nothing more than an assembly of logic gates connected to various data storage elements (large scale memory elements and single word registers), and data input and output elements. Data is input to a register via an input interface or port (which, in a primitive system could just be a series of switches as shown below), software instructions retrieved from memory

¹³ Christopher Evans, The Micro Millennium (1979), page 73.

then direct the ALU to perform specific, logical steps using the data, and the result is either stored for additional processing, or it is provided externally via an output interface or port (which in a primitive system could be nothing more than a set of lights to indicate the binary value of the output, as shown below ¹⁴). Regardless of the sophistication of the input and output interfaces (switches asynchronous network interfaces, lights, buzzers, displays, etc.), or the scope of the software instructions, each of these elements: data input interface, data output interface, software data storage and processing/ALU is essential to a computer that is able to carry out some function. If data cannot be input or output, then the processor is useless. Similarly, the processor by itself cannot perform any functions, it is the processor as configured by the software and the input data that causes the resulting output. Thus, each of these elements are inseparable. Providing data to the processor is thus, for all practical purposes providing data to the software running in the processor, and vice versa.

¹⁴ The Altair 8800b was a micro-computer marketed to hobbyists in 1975. It was programmed by setting binary switches on the front panel. Data was also input using similar switches, and was read out using LED lights indicating the binary values of the output data words. The device was based on the Intel 8080 microprocessor.

<https://history-computer.com/altair-8800-complete-history-of-the-mits-altair-8800/>.



Altair 8800 Microcomputer

X. PRIORITY DATE

70. I understand that the earliest possible priority for the '206 Patent is an Australian patent application, AU 2004905024, filed on September 2, 2004. I further understand that all prior art references asserted in this petition are U.S. patents or patent publications that were published and/or filed before the earliest possible priority date of the '206 Patent.

XI. CLAIM CONSTRUCTION

71. I have been asked to apply the following constructions for my analysis. I agree that these constructions are consistent with how the terms would have been understood by a POSITA.

- A. Claim 40: “means for determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS”**

72. Recited Function: “determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on . . . dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS”.

73. Corresponding Structure¹⁵: “GPS-capable mobile telephones, laptop computers, Personal Digital Assistants (PDAs), and wireless sensor devices,” Ex-1001, 6:17-19, containing “a CPU ... [or] other processing units capable of processing data and carrying out operations.” Ex-1001, 11:63-66. The CPU is programmed with an algorithm that determines whether a remote terminal’s position error is “too large.” *Id.*, 7:43-45, Fig. 4 (step 412). That is, position error is compared to a threshold (e.g., acceptable error bound *ac*) to determine if “too large,” which then adjusts the power up period, *Pu*. *Id.*, 7:45-46. The power up

¹⁵ I understand that Petitioner is required to identify the closest disclosed structure/algorithm in the '206 Patent that relates to the recited function. I agree that this is the closest disclosed structure/algorithm in the '206 Patent that relates to the recited function. I have not been asked to consider, and I have not considered, whether this identified structure is sufficiently disclosed for performing the recited function.

period, *Pu*, is also a function of the recited “current radio position,” *Id.*, 6:62, determined using any of “a number of techniques,” *Id.*, 7:5-8, but, in the claims, is “determined from the wireless communication network.” Therefore, the algorithm for “determining when said embedded GPS module should be powered on” compares at least one of a position and position error to one or more thresholds, and equivalents.

74. In Summary, the construction I applied for this term is:

Function	Corresponding Structure
“determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS”	CPU or other processing unit programmed with a thresholding algorithm to determine when to power on said embedded GPS module based on comparing at least one of a position and position error to one or more thresholds, and equivalents

B. Claims 37, 40, and 43: “at least one of a current radio position and a position error of said mobile device”

75. I have been asked to apply both a “disjunctive” and “conjunctive” view of these terms in conducting my analysis. I take no position on which of these view is correct, because the prior art reads on the claims regardless of which view is correct.

76. I understand that in the underlying litigation, Patent Owner argues that this term should be interpreted “disjunctively,” such that “at least one of a current

radio position and a position error of said mobile device” means either “current radio position” or “position error.” *See* Ex-1021, 0004. In the context of the surrounding claim language, such as Claim 37’s recitation of “said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device,” a disjunctive interpretation means that the GPS’s power on state can depend on either quantity: current radio position or position error. I have applied this view of the claims in Ground 2 (Nohara alone) and also note that it is disclosed by Watters alone in Grounds 1 and 4, because Watters *discloses* the “conjunctive” view (both position and position error), but does not *require* that both be used simultaneously all the time, thus, it also discloses the “disjunctive” view as well.

77. I further understand that the claim element could be read “conjunctively,” to require both “current radio position” and “a position error,” meaning that the GPS’s power on state must depend on both quantities together. I have applied this view of the claims in Ground 1 (Watters alone) and Ground 4 (Watters in view of Nohara).

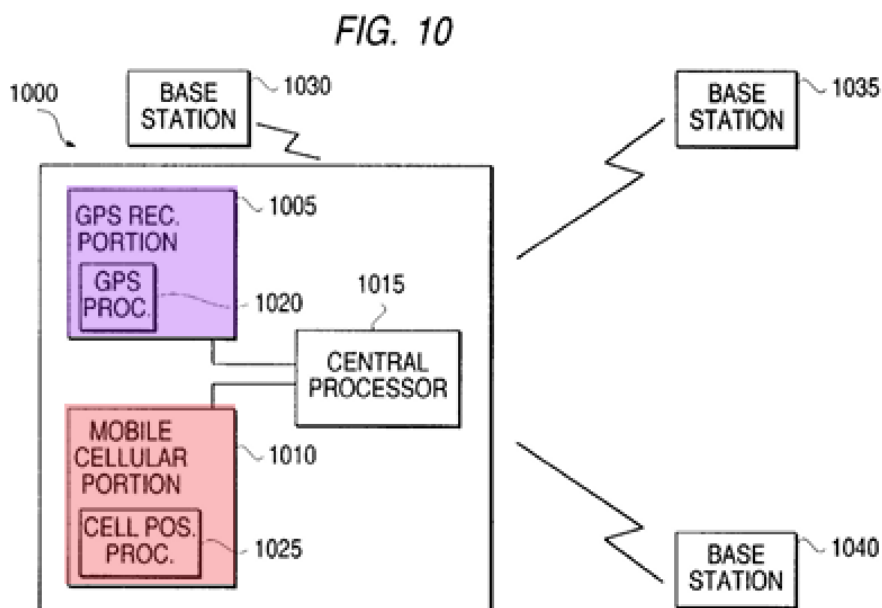
78. I reserve the right to offer opinions on any claim constructions proposed in this proceeding or to offer opinions on additional constructions in the district court.

XII. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART REFERENCES

A. Watters (Ex-1005)

79. Watters, titled “Combining GPS with TOA/TDOA of cellular signals to locate terminal,” was filed on May 14, 1998, and issued as U.S. Patent No. 5,982,324, on November 9, 1999. I understand Watters qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b).

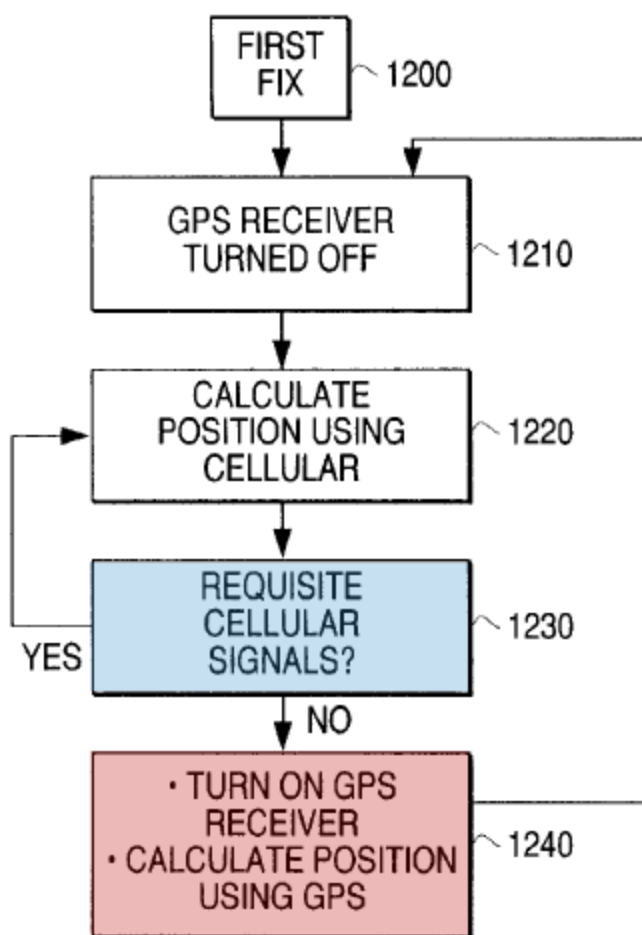
80. As shown in Figure 10, Watters discloses a mobile terminal that “includes a GPS receiver portion 1005, a mobile cellular portion 1010, and a central processor 1015.” Ex-1005, 19:48-50. Watters explains that “GPS receiver portion 1005 includes a GPS processor 1020 for calculating position, while the mobile cellular portion 1010 contains a cellular position processor 1025 that computes position using the cellular network infrastructure.” *Id.*, 19:54-58.



81. Watters also discusses the competing interests of reducing power consumption. For example, “[t]o save power consumption (i.e., save battery power), it may be desirable to rely on the cellular network infrastructure to calculate position.” Ex-1005, 22:38-40. As shown in Figure 12, a flowchart depicting the operation of the Figure 10 terminal¹⁶, Watters discloses an approach that includes the GPS receiver being turned on and utilized to determine position when “the cellular network infrastructure does not provide the necessary signals to determine position, or if a GPS recalibration was needed.” *Id.*, 22:41-44.

¹⁶ Figures 10, 11, and 12 refer to the “third aspect” of Watters’s invention. Ex-1005, 9:21-30. Figure 11 and Figure 12 are two alternative “flowcharts depicting operation of the position location system according to the third aspect,” depicted in the block diagram of Figure 10. *Id.* A POSITA would have considered all of these figures and teachings together, and nothing about them, or Watters’s explanations of them, precludes applying these respective teachings together. As I explained in my detailed technical background, ¶¶35-69, all of these teachings would have been routine to a POSITA at the time, and a POSITA would have understood how to use ordinary creativity to implement all of these well-understood and basic teachings.

FIG. 12



On the other hand, if “requisite cellular signals” are available at step 1230, then Watters does not proceed to turn on the GPS receiver (1240), but proceeds back to step 1220 and continues to use cellular positioning techniques, thus conserving power.

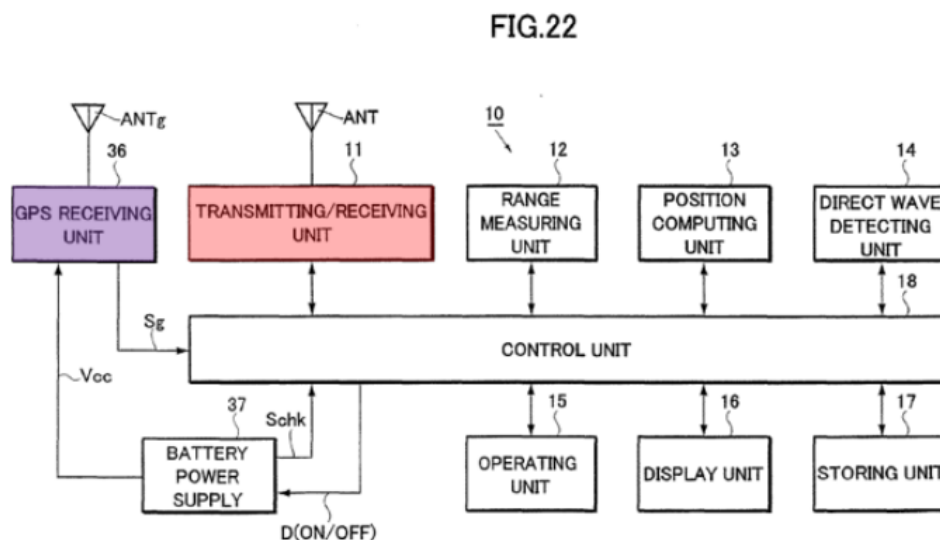
B. Nohara (Ex-1006)

82. Nohara, titled “Positioning apparatus, positioning method, and positioning system,” was filed on February 27, 2002, and issued as U.S. Patent

Application Publication No. 2002/0151314, published October 17, 2002. I

understand Nohara qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b).

83. Nohara teaches a “system for determining the present position of a mobile station by using radio waves coming from the mobile station to a plurality of base stations” and a “positioning means for determining the present position of the mobile station by using the GPS.” Ex-1006 ¶36. Nohara explains that “a mobile station, such as a cellular phone and a navigation system, is equipped with a GPS (Global Positioning System) receiving unit so that the GPS can be used to detect the present position of the mobile station.” *Id.* ¶294. Nohara’s GPS unit 36 (purple) is shown in Figure 22:

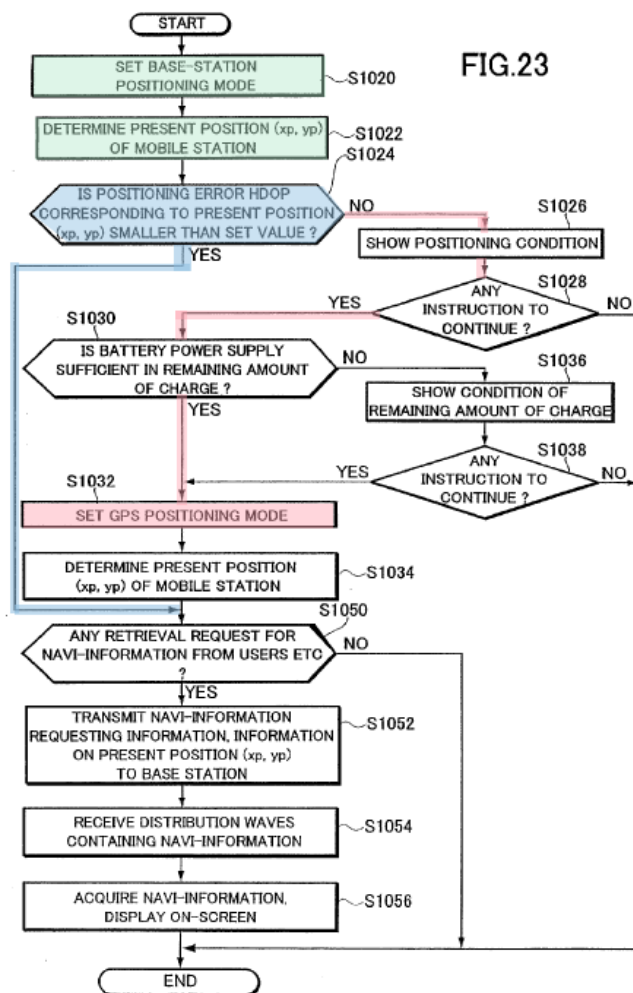


84. Also shown in Figure 22, Nohara has “transmitting/receiving unit” 11 (red) with an antenna (“ANT”) that is separate from the GPS unit 36 and ANTg, the

GPS antenna, for receiving the base station radio waves. Ex-1006 ¶297. In connection with Figure 3, Nohara describes “receiving unit 11 rx receives radio waves (reception waves) coming from base stations through the transmitting/receiving antenna ANT and an RF unit 19,” and “transmitting unit 11 tx transmits radio waves (transmission waves) to the base-station side through the RF unit 19 and the transmitting/receiving antenna ANT.” *Id.* ¶79.

85. Separate from GPS positioning, Nohara teaches determining the present position “by using radio waves coming from the mobile station to a plurality of base stations [and a] positioning means for determining the present position of the mobile station.” Ex-1006 ¶36. Nohara further suggests “switch[ing] to the positioning by the GPS positioning means in cases where the result of the positioning based on the communication waves among the base stations and the mobile station exceeds a predetermined positioning error.” *Id.*

86. As shown in Figure 23, which is a flowchart depicting how Figure 22’s system can be used, Nohara teaches powering on the GPS at step 1032 (below, blue) when a calculated Horizontal Dilution of Precision (HDOP) value (also called a “positioning error”), for “base-station positioning mode” is determined to be too high at Step 1024. Ex-1006, Fig. 23. The GPS is powered on when “battery power supply 37 [] outputs a predetermined supply voltage Vcc to operate the GPS receiving unit 36.” *Id.* ¶298, Fig. 22.



87. Nohara explains that if the HDOP error is below a threshold, specifically, “smaller than a predetermined set value” at step 1024, it proceeds to step 1050 as shown by the blue line in the Figure 23 flowchart and bypasses step 1032 (red), which powers on the GPS. Ex-1006 ¶307. In this way, Nohara explains, its system provides a non-GPS “base-station positioning mode which is capable of positioning with lower power consumption. Therefore, it is possible to reduce the power consumption of the battery power supply 37 significantly.” *Id.* ¶325. As the red line indicates, GPS power on at step 1032 occurs if the error is not

less than (i.e., is greater than) a “set value” at step 1024 and “when the battery power supply [] has a sufficient amount of charge remaining.” *Id.*

C. Lau (Ex-1007)

88. Lau, titled “Method and apparatus for intelligent acquisition of position information,” was filed on March 26, 2003, and issued as U.S. Patent No. 6,975,941, on December 13, 2005. I understand Lau qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e).

89. Lau discloses “a location monitoring system 100” which “operates to monitor the location of mobile devices using a Global Positioning System (GPS).” Ex-1007, 4:41-44. Lau explains the ability to save power and battery life by “the reduction in use of the GPS receiver 204 [which] also operates to reduce the demands on wireless network band width in transmitting and managing such location information.” *Id.*, 6:23-26. Lau states that “the GPS receiver is returned to a low-power state so as to conserve power.” *Id.*, 7:46-47. For example, “the low-power state (or powered-down state) can be a sleep mode or it can be a disabled mode.” *Id.*, 7:47-49. Lau explains that the GPS receiver is powered-up when “the motion [information for the mobile device] is greater than a threshold amount.” *Id.*, 7:27-28, 7:36-40.

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

90. The '206 Patent contains 9 claims, of which 37, 40, and 43 are independent. Claims 37, 40, and 43 are substantially the same except for claiming formalities (Claim 37 is a method claim, Claim 40 is an apparatus claim, and Claim 43 is a computer readable media claim). Like claim elements are discussed together in the below element by-element analysis. *See* Ex-1020 (summary table). To the extent there are meaningful differences, such differences are individually identified and discussed. As I explain below, the challenged claims are disclosed and/or taught by the prior art.

A. Ground 1: Claims 37-45 are obvious over Watters

1. Independent Claims 37, 40, and 43

a. **37[Pre]: A method of acquiring a position on a mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said method comprising:**

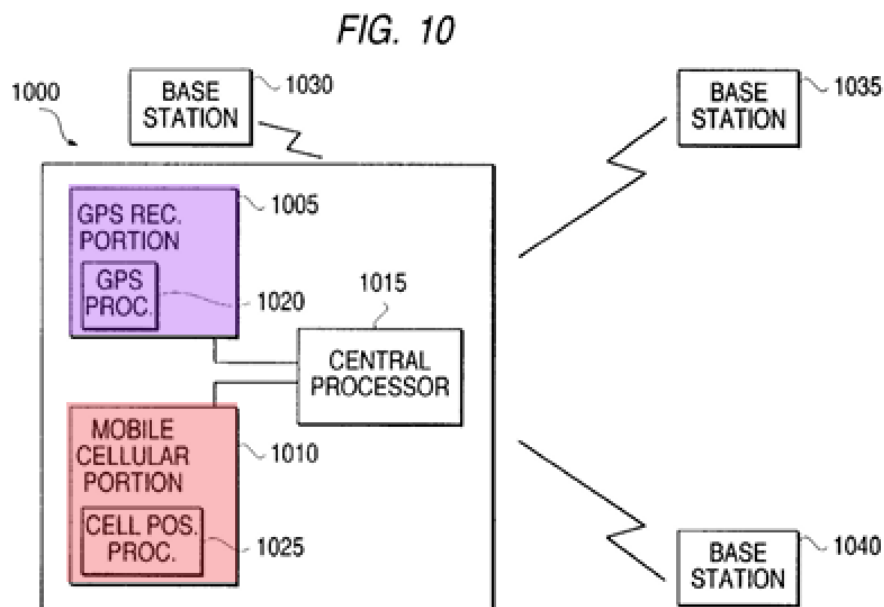
40[Pre]: A mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said mobile wireless communication device comprising:

43[Pre]: A computer program product for a mobile wireless communication device for a wireless communication network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said computer program product embodied on computer readable storage medium, said computer program product for acquiring a GPS position on said mobile wireless communication device, comprising:

91. In my opinion, Watters teaches the preambles of Claims 37, 40, and 43, to the extent they are limiting.

92. Watters teaches “an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques.” For example, as shown in Figure 10 (annotated), Watters discloses mobile terminal 1000, which includes “GPS receiver portion 1005 [annotated purple, below] [and] a mobile cellular portion 1010 [annotated red].” Ex-1005, 19:48-49.¹⁷ Watters teaches that “GPS receiver portion 1005” is an embedded GPS module for GPS capability such as calculating position. *Id.*, 19:54-56.

¹⁷ Throughout this Petition, all annotations and emphasis have been added, unless otherwise noted.



Id., Fig. 10.

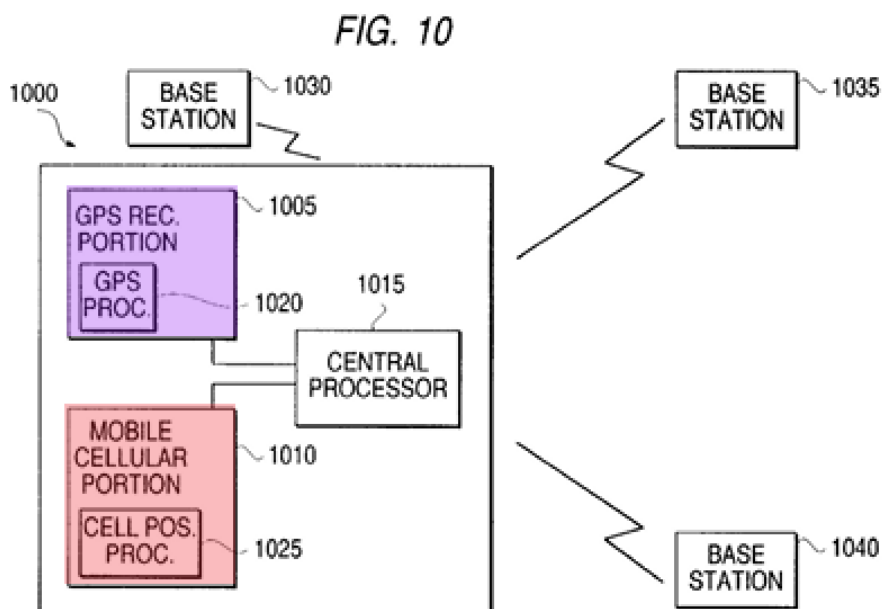
93. Watters's GPS Receiver portion 1005 "embedded" in the device as shown in Figure 10, in which the "GPS receiver portion 1005" is embedded in mobile terminal 1000. Ex-1005, Fig. 10.

94. Watters also teaches that the mobile wireless communication device possesses wireless communications capability for said wireless communications network. For example, "mobile cellular portion 1010" (red, above) is a mobile wireless communication device that "contains a cellular position processor [] that computes position using the cellular network infrastructure." Ex-1005, 19:56-58.

- b. **40[A]: an embedded GPS module providing a GPS capability for said mobile wireless communication device;**
- 43[A]: a first portion designed to interface with the GPS capability of said mobile wireless communication device;**

95. In my opinion, Watters teaches elements 40[A] and 43[A].

96. Watters's GPS module providing GPS capability includes element 1005 in Figure 10. Watters's GPS capability is provided for the whole mobile wireless communication device 1000 that contains embedded GPS receiver portion 1005.

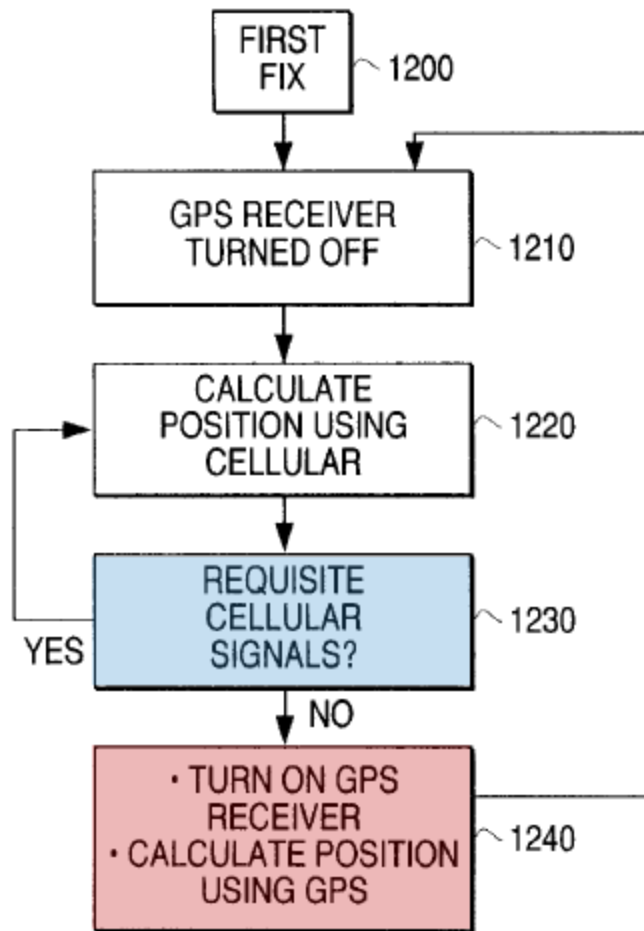


Id., Fig. 10.

97. A POSITA would have understood that Watters's central processor 1015 contains programming logic (a "first portion"¹⁸) to interface with the GPS capability in block 1005. I explained in my technology background, ¶¶64-69, that, for example, a processor, or central processor is programmable logic, or logic functions that can be controlled and configured based on programming instructions. As shown below, Watters includes logical operations, that a POSITA would have understood would be performed by the logic of the central processor executing programming instructions. For example, Figure 12 is a flowchart depicting one approach to the operation of the mobile terminal in Figure 10. Ex-1005, 9:28-30.

¹⁸ The term "portion" broadly refers to a portion of software or hardware (such as an ASIC or FPGA) that performs a function. Ex-1001, 4:4-26.

FIG. 12



98. A POSITA would have recognized that the Figure 12 flowchart, is an algorithmic representation of programming logic on central processor 1015 of Figure 10, which interfaces with both GPS and the wireless communication network portions, 1005 and 1010. *See* Ex-1031, 0002 (“[i]n the early 21st century, flowcharts were still used for describing computer algorithms.”). Further, as I point out in Ex-1032, “[a] central processing unit (CPU) or main processor [] is the most important processor in a given computer. Its electronic circuitry executes

instructions of a computer program, such as arithmetic, logic, controlling, and input/output (I/O) operations.” Ex-1032, 0001. A POSITA would have recognized this, at least in part, because central processing units were programmable devices, as exemplified by the description of control processing unit 940 of Figure 9 (a second aspect of Watters), which is similarly “programmed” to toggle between GPS signals (input B) and pseudosatellite signals obtained from the cellular network (input A). Ex-1005, 17:31-44. Further, a POSITA would have recognized that Watters’s controller, would operate by executing program instructions to cause the processor logic to toggle between GPS signals and pseudosatellite signals.

c. **37[A]: determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on,**

40[B]: and means for determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on

43[B]: and a second portion designed to determine when said embedded GPS module should be powered on, said embedded GPS module then being powered on,

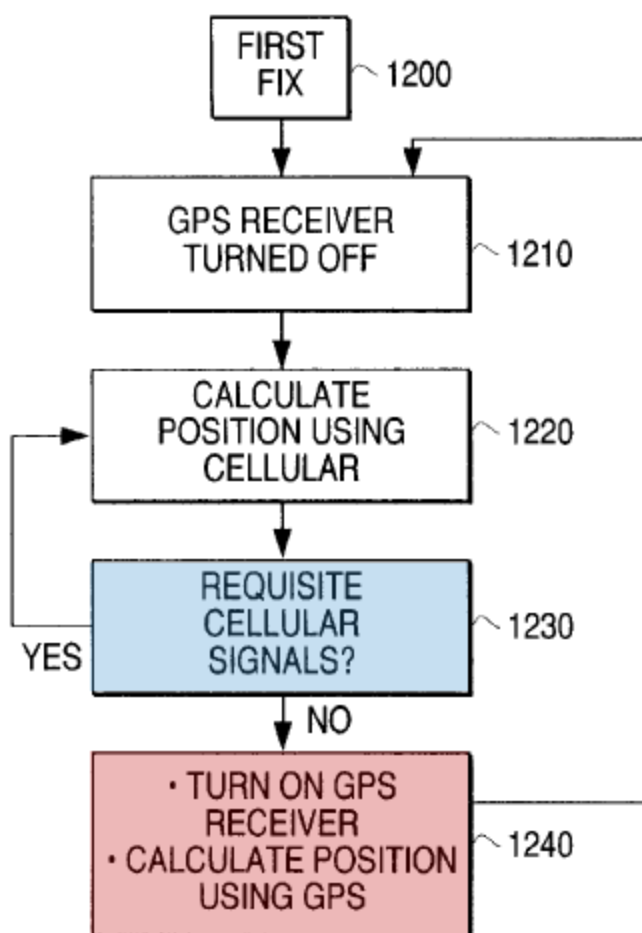
99. In my opinion, Watters teaches elements 37[A], 40[B], and 43[B].

100. Watters teaches determining when said embedded GPS module should be powered on and said embedded GPS module then being powered on.

Specifically, as shown in Figure 12, Watters teaches that the GPS receiver should be powered on when the “cellular network infrastructure does not provide the

necessary signals to determine position.” Ex-1005, 22:41-43. As shown in step 1210, the GPS is in a “turned off” state. *Id.*, Fig. 12. Step 1220 calculates the position of the device using the cellular infrastructure, and step 1230 evaluates the quality of that position (i.e., the “determining”). As shown, output from step 1230 (blue, below) is either a “yes” or a “no.” If the cellular position is not sufficient, e.g., because the required signals are not available (or, as I explain below, of poor quality), then the output is “no” and GPS is “turned on” and position is determined using GPS (below, red). Ex-1005, 22:47-23:2. A POSITA would have understood that if there are insufficient cellular signals, if the signal level is too low, or the available signals exhibit a poor geometrical configuration, then the position error would increase, and the signals may be deemed unsuitable for position determination. As I explain in my technology background, ¶¶60-63, GPS and cellular signals used to determine time of arrival can be subject to various errors, including multipath and low signal to noise ratio, and this can cause errors in the measurement of the time of arrival of the signals, which are manifested as errors in position. This can make the signals unsuitable for position determination.

FIG. 12



Id., Fig. 12.

101. Claim 40 requires a “means for determining,” which I have applied as described above in ¶74 and equivalents. Watters teaches the same or at least the equivalent structure and algorithm because it includes a mobile device, 1000, with processor, 1015, programmed to determine whether the position and/or position error are “too large,” (that is to say that it exceeds one or more of the applicable

thresholds) as I describe further in ¶¶104-114, below. Watters also teaches the function of using this structure as also I explain in ¶¶104-114.

102. Finally, Claim 43 requires a “second portion designed to determine when said embedded GPS module should be powered on. As I discussed above, ¶¶97-98, a POSITA would have included programming logic (the second portion) to evaluate Figure 12, step 1230, at central processor 1015. Additionally, in ¶98, I discuss that the “first” portion interfaces with the GPS capability in block 1005. Here, the different “second” portion recited in the claims corresponds to the different second portion at central processor 1015 that evaluates Figure 12, step 1230 (which receives position information from the cellular system in step 1220).

d. 37[B]: said when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

40[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

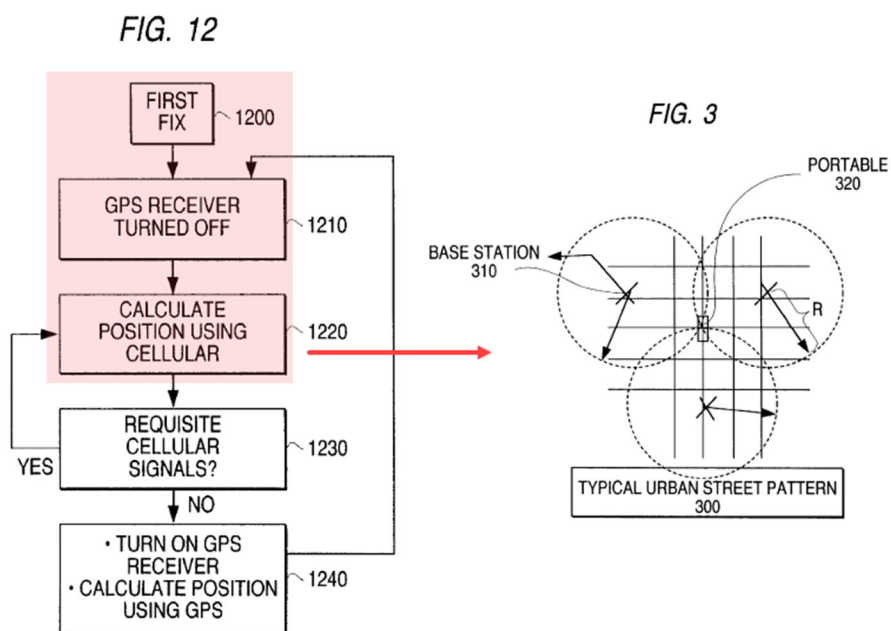
43[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

103. In my opinion, Watters teaches elements 37[B], 40[C] and 43[C].

104. Watters teaches the claims under the “conjunctive” view set out in ¶77, above, because it teaches to use both a “current radio position” and a “position error” to determine when to switch from cellular based positioning and power on GPS-based positioning.

105. Regarding a “current radio position ... determined from the wireless communications network, said wireless communications network being different from said GPS,” Watters discloses a mobile device such as the mobile terminal that “has the capabilities of calculating its position ... using the cellular network infrastructure[.]” Ex-1005, 19:36-38. As shown in Figure 12, Watters teaches obtaining a “first fix,” then, with “GPS receiver turned off,” “calculat[ing] position using cellular.” *Id.*, Fig. 12 (below, red). Watters explains that algorithms based on “time of arrival” or “TOA” of cellular base station signals (shown in Figure 3, below right) can be used to obtain an “accurate location fix.” Ex-1005, 5:14-25; *see also id.*, 5:26-34 (explaining the time difference of arrival (TDOA) method). As I explain in my technology background, ¶¶53-59, a well-known alternative to

GPS is the use of cellular signals to triangulate the position of wireless devices and a form of triangulation is Time Difference of Arrival (TDOA). For example, U.S. Patent No. 6,748,224 to Chen (Ex-1024), filed on December 16, 1998, describes a “local positioning system (LPS) uses the radio propagation parameters in a CDMA forward link or TDMA reverse link to establish a mobile station's position. Ex-1024, Abstract. Chen further describes that the system is based on TDOA. *See also* Ex-1034, 0001 (describing several different basic forms of triangulation that can be used, such as Angle of Arrival (AOA) and Time of Arrival (TOA) or Time Difference of Arrival (TDOA)). These references, and others described in my technical background section, make clear that TOA, TDOA, and comparable cellular infrastructure based positioning approaches were well known at the time.



Id., Fig. 3, Fig. 12.

106. The Watters cellular position calculation at 1220 is, therefore, a “current radio position ... determined from the wireless communications network, said wireless communications network being different from said GPS.”

107. After the cellular position is determined at step 1220, step 1230 determines whether that cellular position signal has the requisite accuracy for use. That is, whether it “embedded GPS module should be powered on being dependent on [both] *a current radio position* and *a position error* of said mobile device.”

108. First, Watters teaches determining “how far (in space) the mobile terminal has moved since the last GPS update.” Ex-1005, 22:59-60. Determining “how far” a device has traveled obviously requires knowing where travel started and the current position at the time travel ends. As shown in Figure 12, the starting position is determined by GPS at step 1200. The current position at the current time is determined at step 1220 by the by the cellular network. Accordingly, determining “how far” the device has traveled is based on the current radio position of the device determined by the cellular network. Watters explains that GPS is used “[i]f a predetermined amount of time has passed, such as two minutes, *or the mobile terminal has moved a predetermined distance, such as 100 meters[.]*” *Id.*, 22:61-63. Similarly, determining the travel distance of a device is done by comparing the starting position (based on GPS) and the current position (based on cellular). Thus, Watters compares the current radio position determined

from cellular sources using TOA to the previous GPS fix and, if that distance exceeds a threshold (e.g., 100 meters), turns the GPS back on to obtain a new fix.¹⁹ *Id.*, 22:63-64 (referring to Figure 12 (1240)). As I discuss in further detail below, the current position determined without GPS contains an error component that must also be factored into the distance moved threshold. However, for purposes of determining whether distance moved exceeds a threshold of 100 meter, a POSITA would assume the distance moved is equivalent to the current radio position minus starting position (previously acquired with GPS).

109. Watters teaches that position errors may also arise in several other ways, such as errors inherent in range measurements and clock/drift errors. *See, e.g.*, Ex-1005, 21:14-21 (“range measurements inherently contain an error”); 6:18-20 (“The error due to the drift grows larger the longer the mobile terminal clock is used.”). Watters system is designed such that it could both spatial (e.g., 100 meters) and temporal (e.g., 2 minutes) thresholds as a mechanism to turn on/off GPS. In fact, a POSITA would have understood to use both of the thresholds concurrently for maximum system responsiveness. For example, a POSITA would have found it obvious, as a routine design choice, to implement the GPS turn on

¹⁹ Under the “disjunctive” view set out in ¶76, where either “position” or “position error,” is sufficient to satisfy by the claims, the “position” determination I explain in this paragraph is sufficient to teach the claim limitation.

threshold so that, for example, turning on the GPS happens at the earlier of: 1) 100 meters having been travelled, or 2) two minutes having elapsed. This would have ensured that the system could address either spatial or temporal drift errors before either one becomes unacceptable.

110. Second, with these position error teachings in mind, Watters also teaches that the determination should also be based on a “position error.” Watters explains the errors inherent in cellular based approaches, such as TOA and TDOA based on “multi-path errors.” Ex-1005, 5:54-6:12, 23:41-44.²⁰ Because there is some unreliability in cellular-based techniques based on the quality of the signal (e.g., multi-path signal propagation), Watters explains that the “rate at which GPS updates are needed [in block 1240] will depend on the conditions under which the mobile is operating.” *Id.*, 22:64-66. For example, Watters teaches that the “100 meters” distance threshold described above should vary based on signal quality

²⁰ Watters teaches that position errors may also arise in several other ways, such as errors inherent in range measurements, and clock/drift errors. *See, e.g.*, Ex-1005, 21:14-21 (“range measurements inherently contain an error”); 6:18-20 (“The error due to the drift grows larger the longer the mobile terminal clock is used.”). Watters system is designed such that it could use both spatial (e.g., 100 meters) and temporal (e.g., 2 minutes) thresholds as a mechanism to turn on/off GPS. For example, a routine design choice would have been to implement the GPS turn on threshold so that, for example, turning on the GPS happens at the earlier of: 1) 100 meters having been traveled, or 2) 2 minutes having elapsed. This would have ensured that the system could address either, or both, spatial or temporal drift errors before either one, or both, becomes unacceptably large.

with “less frequent updates needed if ... cellular network infrastructure signals are known to be of good accuracy,” *id.*, 22:61-66, and, by contrast, more frequent updates needed if the signal quality is low, such as when multi-path propagation is present. *Id.*, 23:41-44 (GPS updates reduce multi-path problems).²¹

111. Moreover a signal with “good accuracy” leads to low positioning errors, while a signal of “poor accuracy” leads to relatively larger positioning errors. Specifically, a weak signal may indicate a multipath propagation, which would result in higher positioning errors in a TOA calculation. As I explain in my technology background, ¶¶60-63, multipath propagation was well-known signal propagation problem. For example, I discuss Ex-1030, which describes that multipath delays often result in resolution of the time of arrival being ambiguous and lead to poor accuracy. Watters’s “more frequent updates” thus would have been implemented when signals were of lower accuracy, resulting in correspondingly larger positioning errors. For example, a positional error caused

²¹ Watters also teaches using a timing threshold, e.g., “2 minutes,” as a way to address, for example, clock/drift errors caused by using the cellular-based positioning technique for too long. Additionally, Watters explains that “a determination is made [in block 1230] whether the requisite number of signals in the cellular network infrastructure are available for calculating position (e.g., three signals in the TDOA approach).” Ex-1005, 22:50-54. A POSITA would have understood that a signal may not be sufficiently “available” at step 1230 if the errors are deemed too high for the requisite signal to be reliably used, resulting in taking the “no” path of the decision tree coming from step 1230, leading GPS power on in step 1240.

by multi-path propagation, poor base-station geometry, or other signal issues may be compared to a threshold to adjust the timing of the next power up, thus making such power-up more frequent.” Accordingly, a POSITA would have recognized Watters as teaching “when said embedded GPS module should be powered on” based on both a position threshold and calibrating the position threshold by estimating position error from effects such as multi-path. As I explained above in my technology background discussion, ¶¶60-63, this is because the accuracy of this method depends on the range or conditions under which the mobile is operating which is prone to error. *See* Ex-1030, Fig. 1. In Watters, these determinations are based on comparisons to both a position threshold and position error threshold determined: Watters includes comparisons to a 100 meter positional threshold, and also a qualitative threshold to determine if position errors are of sufficiently “good accuracy.”

112. Further, as I discussed in my technology background, ¶¶60-63, multi-path signal propagation may affect TDOA positioning. Since measuring the time of arrival of the signal is key to determining the range to the base station or satellite, any ambiguity in the time of arrival translates to error in the position. Thus, multi-path spreads the time of arrival (since there are multiple times of arrival) and the error in the time of arrival increases with a concomitant increase in the error of the position. *See* Ex-1024, 3:51-56; Ex-1025, Abstract.

113. For example, if to comply with FCC E911 regulations in place at the time of the invention of Watters, a 100 meter error could be tolerated (*see* Ex-1033, 0002), then a POSITA would have recognized that a high accuracy position determined from strong, direct-path cellular signals, could assume that the “current position” is nearly as accurate as a GPS determined position would be and a new position would not be needed until the mobile device moved more than 100 meters (thus the threshold). However, if the cellular positioning was determined to be much less accurate, then the threshold would be decreased to require more frequent updates from the GPS (and hence when it should be “powered on”) to comply with E911 regulations.

114. Regarding Claim 40’s “means” term, Watters discloses the recited algorithm because the processor in the mobile device determines that the position and position error is “too high.” Specifically, the distance travelled (i.e., the current radio position) exceeds a positional threshold (e.g., 100 meters), which is adjusted to account for position error, turning on GPS in such cases where step 1230 determines that position and position error exceed a threshold for reliably using cellular-based positioning. Specifically, the system may determine that the distance traveled (i.e., the current radio position) exceeds a positional threshold (e.g., 100 meters), which threshold may itself be adjusted to account for position error by requiring more or less frequent updates.

2. Dependent Claims 38, 41, 44

- a. Claim 38: The method according to claim 37, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.**

Claim 41: The mobile device according to claim 40, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 44: The computer program product according to claim 43, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

115. In my opinion, Watters teaches Claims 38, 41, and 44.

116. Watters teaches powering up the GPS receiver from a low-power mode such as a TricklePower power-down mode. A POSITA would have understood that a TricklePower power-down mode is the same as a “tricklestate” as I discussed above regarding known power conservation techniques in ¶¶50-52. *See also* Ex-1029 ¶15 (referring to a standby mode or low-power mode as a “tricklestate” mode). The '206 Patent also describes the “TricklePower” mode as coming from the prior art. Ex-1001, 2:37-51. The '206 Patent makes clear that “TricklePower” is a brand or trade name associated with Laipac Technology, Inc. Ex-1001, 2:42-46, Cover. The '206 Patent was not associated with Laipac or its brands, so the patent makes clear that the claims would cover GPS modes of the kind that support low power modes, of which “TricklePower” is simply a known

example in the prior art. In my technology background, ¶¶50-52, I explain other known examples, such as those found in Ex-1023, Ex-1026, Ex-1028, Ex-1029 (discussing a lower power “tricklestate”), Ex-1033.

117. Watters explains that when the GPS receiver is first turned on from a fully powered down state, the GPS receiver calculates its initial position which is “known as a ‘first fix’ on location.” Ex-1005, 2:40-41. The “time-to-first-fix” (TTFF) “represents the time required for a receiver to acquire the satellite signals and navigation data, and to calculate its initial position.” *Id.* Watters explains that “[i]f the receiver has no estimate of current time and position and a recent copy of almanac data, then this process generally takes about 12.5 minutes.” *Id.*, 2:54-59. Additionally, Watters contemplates “turning on” the GPS every two minutes, *Id.* 22:47-65, which is substantially less than the 12.5 minute TTFF for a cold start, so a POSITA would have understood that Watters contemplates that the “turn off” does not entail fully powering down the GPS. Otherwise the 12.5 minute TTFF from cold start would not be compatible with turning the GPS on and off every 2 minutes. In order to avoid delays from a cold-start’s long TTFF, a POSITA would have understood to keep GPS in a low power state mode; this low-power stand-by mode would allow the GPS to start up faster by maintaining ephemeris and almanac data in memory. I explain in my technical background section discussing power conservation approaches above, ¶¶50-52, that a POSITA would recognize

that a cold start (no GPS information available) requires a lengthy TTFF (about 12 minutes), while a warm start, where recent GPS information is available, can obtain a TTFF in about 30 sec. *See also* Ex-1033, 0010-0011 (describing three common states: cold start state, warm start state, and hot start state.)

118. I continue in my technical background section to explain that when the GPS is in a low power state mode, the GPS receiver holds in memory of that last received ranging information and position calculations such as ephemeris and almanac data. *See* Ex-1028, 3:31-37. Further, my technical background section goes on to explain that the GPS may also continue to track the satellites so that it does not need to re-acquire them when it turns back on such as continuing to extract the signals from each satellite and determine the pseudoranges. This avoids having to start from scratch trying out each code template at each time offset on the received signals. *Id.*

119. This feature is envisioned by Claim 6 of Watters. Watters teaches that the GPS receiver may be only “substantially turned off” when a requisite number of cellular signals are being received. Ex-1005, Cl. 6. As I explained in above, ¶¶50-52, a POSITA would have understood that the GPS system may be “substantially [but not completely] turned off” by maintaining a low, keep-alive power to the device. *See* Ex-1028, 3:31-37. This would have maintained sufficient power in the GPS to maintain ephemeris data and avoid TTFF delays resulting

from a fully-powered-down cold start. Turning off the GPS receiver entirely is not a viable approach because the GPS receiver must then perform a “cold start,” which results in a long TTFF. *See* Ex-1023; Ex-1026, 3:52-54.

120. A device that is “substantially” turned off is not entirely turned off; instead, it operates in a lower power state than a full-power-on state. Since this is a lower power state, the “substantially turned off state” is useful because it is less taxing on system resources, such as battery power. In this substantially turned off state, the GPS system would perform only less power intensive tasks. These tasks would have included things such as maintaining ephemeris and almanac data. *See, e.g.,* Ex-1005, 2:39-59 (maintaining an “estimate of current time and position and a recent copy of almanac data”). Executing these lower powered tasks while the GPS is substantially turned off would avoid TTFF delays resulting from a fully-powered-down cold start, because the necessary predicate data for a full GPS fix would have been maintained, rather than having to be entirely reacquired from scratch.

121. Moreover, the '206 Patent discusses the need to “speed[] up the GPS acquisition of a mobile device relative to the acquisition from a cold start,” is describing the same TTFF problem that Watters calls out. Ex-1001, 2:23-24.

- b. **Claim 39: The method according to claim 37, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.**

Claim 42: The mobile device according to claim 40, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.

Claim 45: The computer program product according to claim 43, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.

122. In my opinion, Watters teaches Claims 39, 42, and 45.

123. Watters teaches determining the last location determined by GPS and determining position relative to base stations of the cellular network. Further, a POSITA would have understood that the last GPS-determined position would be a position compared to the cellular position, for determining whether the “100 meter” threshold I discussed in Section XIII.A.1.d was exceeded. As I discussed, in my technology background, ¶¶50-52, a GPS that is “not in active mode, i.e., is in standby” will “*simply hold[] in memory the last received ranging information and position calculations*).” Ex-1028, 3:31-37. As I discussed in ¶108, Watters

teaches determining “how far (in space) the mobile terminal has moved *since the last GPS update*.” Ex-1005, 22:59-60.

124. It should be noted that the last position determined by the GPS is also dependent on the position of at least four GPS satellites, so it is also based on “a last satellite position” as recited in the claim. I explain this in my technology background, ¶¶42-49, how GPS signals are transmitted, acquired, and used to determine position.

125. Furthermore, Watters teaches determining when the GPS receiver should be powered on dependent on a last time determined by the GPS. Watters explains that the GPS is used “[i]f a predetermined amount of time has passed, such as two minutes ... ” Ex-1005, 22:60-63. Thus, in order to determine that a predetermined amount of time has passed, a POSITA would have understood that the system would have also received the GPS time when the last GPS signal was received, and compared that to the current time. *Id.*, 22:63-64 (referring to Figure 12 (1240)). As I discussed in my technical background discussion, ¶¶50-52, a well-known approach to conserving power is to maintain a record of the last known positions of the observed satellites when the receiver is powered down, and to then extrapolate the positions when the receiver is returned from standby operation (i.e., is fully powered on). *See* Ex-1028, 3:31-37; Ex-1026, 3:52-54, 18:19-19:19. Thus, the GPS receiver would have the GPS time of when the last

GPS signal was received and would compare that to the current time in order to determine when to power back up.

B. Ground 2: Claims 37, 40, and 43 are obvious over Nohara (Ex-1006)

1. Independent Claims 37, 40, and 43

a. 37[Pre]: A method of acquiring a position on a mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said method comprising:

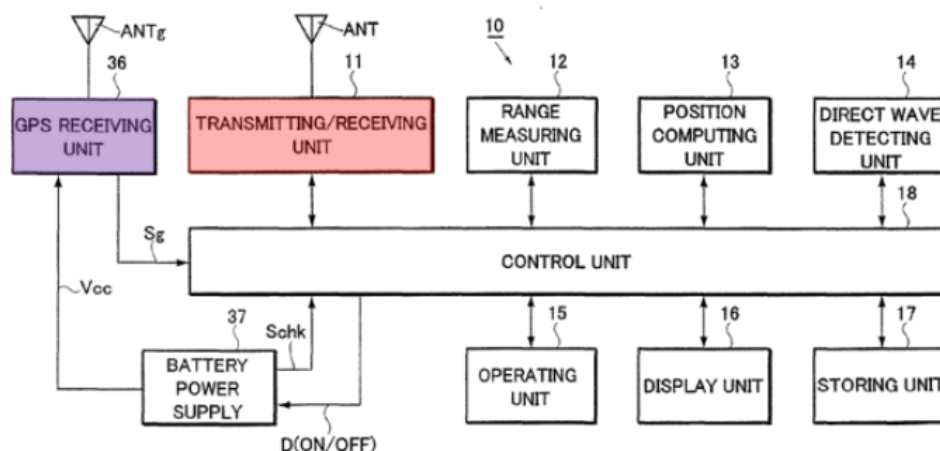
40[Pre]: A mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said mobile wireless communication device comprising:

43[Pre]: A computer program product for a mobile wireless communication device for a wireless communication network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said computer program product embodied on computer readable storage medium, said computer program product for acquiring a GPS position on said mobile wireless communication device, comprising:

126. In my opinion, Nohara teaches the preambles of Claims 37, 40, and 43, to the extent they are limiting.

127. Nohara teaches the use of “an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques.” Specifically, Nohara teaches both a “system for determining the present position of a mobile station by using radio waves coming from the mobile station to a plurality of base stations” and a “positioning means for determining the present position of the mobile station by using the GPS.” Ex-1006 ¶36. For example, as shown in Figure 22 below, Nohara discloses a mobile wireless communication device, mobile station 10, which includes GPS receiving unit 36 (purple) and transmitting/receiving unit 11 (red). Ex-1006, Fig. 22. Nohara teaches that GPS receiving unit 36 is an embedded GPS module for GPS capability that “can be used to detect the present position of the mobile station” and which is embedded in mobile station 10. *Id.* ¶294.

FIG.22



128. Specifically, GPS receiving unit 36 is for “generating a GPS signal Sg from the radio waves received at the receiving antenna ANTg.” Ex-1006 ¶296.

The “incoming waves from the GPS satellites are received, and the present position (xp,yp) of the positioning apparatus 10 is determined based on the GPS signal Sg output from the GPS receiving unit 36. *Id.* ¶315.

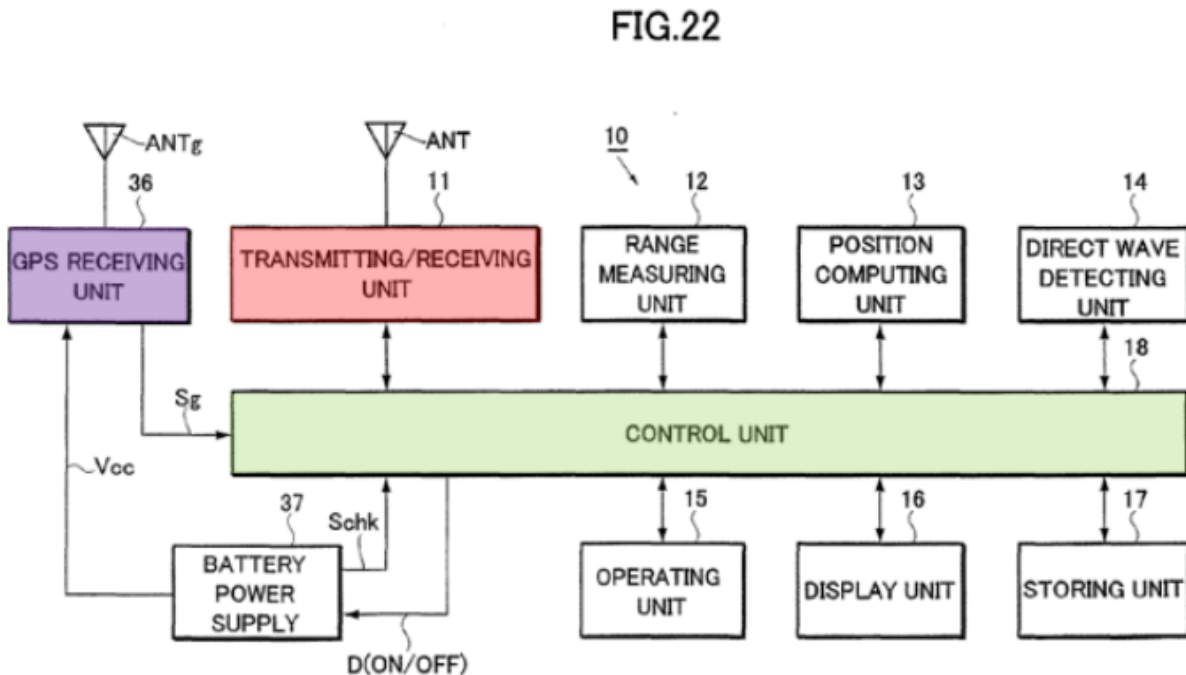
129. Nohara also teaches that the mobile wireless communication device possesses wireless communications capability for said wireless communications network. For example, Nohara discloses that “transmitting/receiving unit 11 for conducting communications with base stations.” Ex-1006 ¶297.

b. **40[A]: an embedded GPS module providing a GPS capability for said mobile wireless communication device;**

43[A]: a first portion designed to interface with the GPS capability of said mobile wireless communication device;

130. In my opinion, Nohara teaches elements 40[A] and 43[A], as I discussed with respect to the preambles of Claims 37, 40 and 43 in ¶¶127-129.

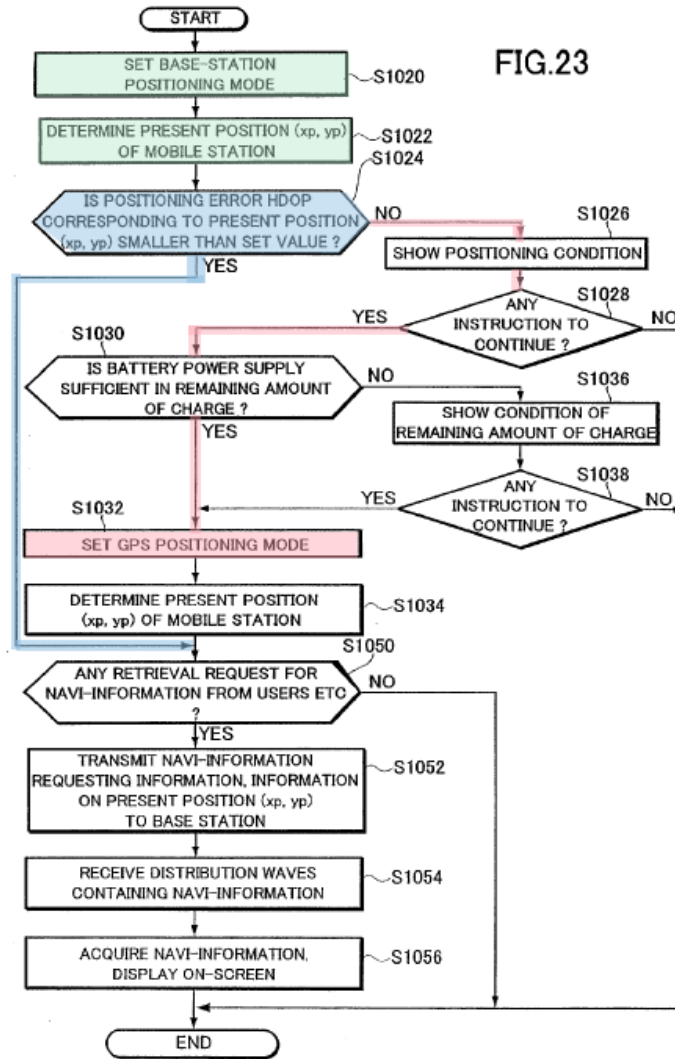
131. Nohara's GPS module providing GPS capability to mobile device 10 in which it is embedded. GPS receiving unit 36 (purple) is part of mobile station 10 in Figure 22, and provided GPS capability for it.



Ex-1006, Fig. 10.

132. A POSITA would have understood that Nohara's control unit 18 contains programming logic (a "first portion") to interface with the GPS capability

of GPS receiving unit 36. For example, Nohara teaches that control unit 18 (green, above) is capable of “exercising central control over the entire mobile station 10.” Ex-1006 ¶297. Nohara further teaches that the control unit is capable of “determining the present position (xp, yp) of the positioning apparatus 10 based on the GPS signal Sg supplied from the GPS receiving unit 36.” *Id.* ¶300. As I described in my technical background section relating to processors and controllers, ¶¶64-69, a POSITA would have understood a controller to be a type of processor that is logic that can be configured and controlled based on program instructions, that is it includes programming logic to carry out its assigned operations. For example, a POSITA would have recognized that the Figure 23 example, which similarly interfaces with both GPS and the wireless communication network portions, 36 and 11, would have been implemented using programming logic on control unit 18. As shown below in Figure 23, a POSITA would have also understood that Figure 23 discloses the algorithm that would be carried out according to the programming instructions *See* Ex-1031, 0002 (“[i]n the early 21st century, flowcharts were still used for describing computer algorithms.”). Further, as I pointed out in ¶98, “[a] central processing unit (CPU) or main processor—is the most important processor in a given computer. Its electronic circuitry executes instructions of a computer program, such as arithmetic, logic, controlling, and input/output (I/O) operations.” Ex-1032, 0001.



Id., Fig. 23.

c. 37[A]: determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on,

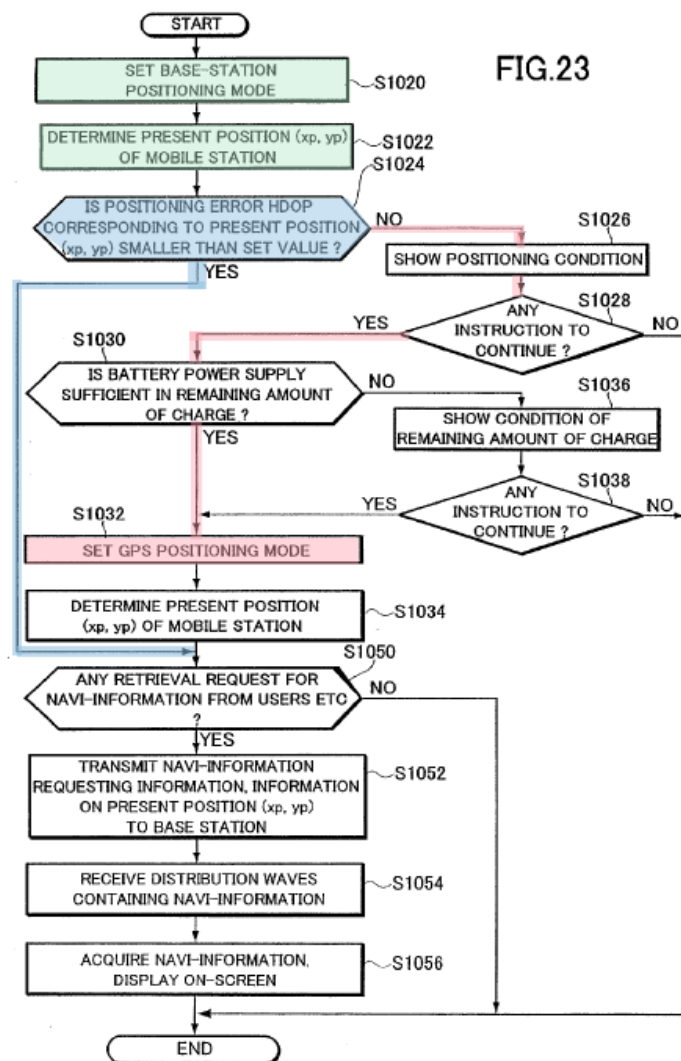
40[B]: and means for determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on

43[B]: and a second portion designed to determine when said embedded GPS module should be powered on, said embedded GPS module then being powered on,

133. In my opinion, Nohara teaches elements 37[A], 40[B], and 43[B].

134. Nohara teaches determining when said embedded GPS module should be powered on and said embedded GPS module then being powered on.

Specifically, Nohara teaches to power on GPS when a calculated Horizontal Dilution of Precision (HDOP) value (also called a “positioning error”), Ex-1007, ¶¶144, 147, for “base-station positioning mode” is too high. *Id.*, Fig 23 (Step 1024). I discuss Nohara’s use of “positioning error HDOP” further below in ¶¶139-147. As shown in Figure 23 below, at steps 1020 and 1022 (green, below), a current radio position is calculated using a “base-station positioning mode.” Step 1024 (blue, below), determines whether HDOP is smaller than a certain set value. If the answer is “no” (i.e., HDOP is larger than the set value), then the flow proceeds through steps 1026, 1028, and 1030, ultimately ending at step 1032, “set GPS Positioning mode” (red line). At step 1032, GPS is powered on.

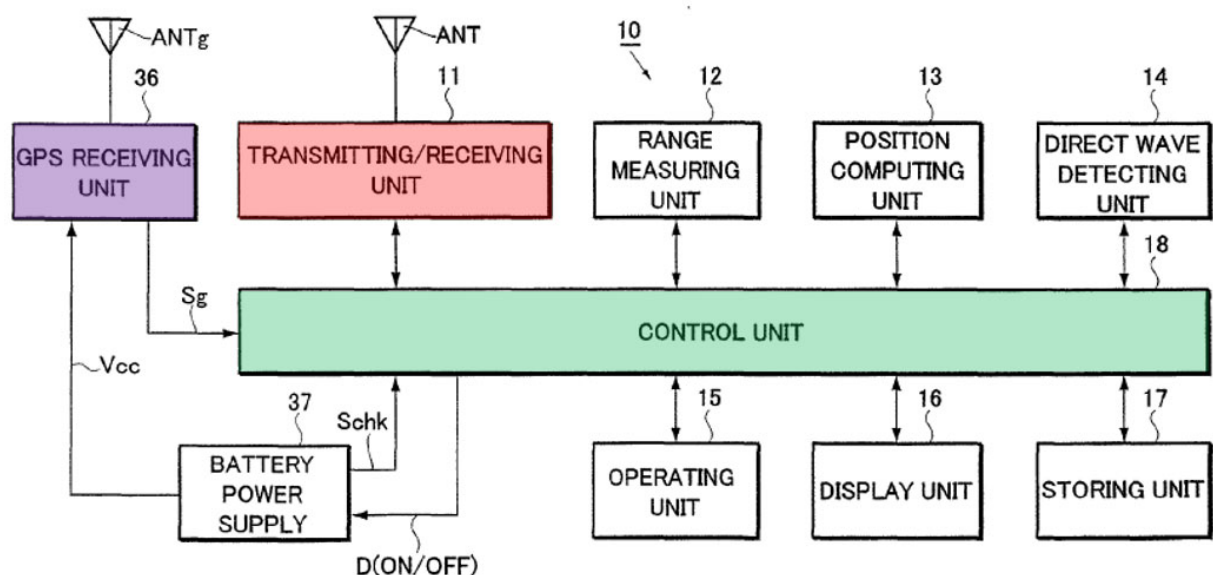


Ex-1006, Fig. 23.

135. At step 1032, the GPS is powered on. Nohara teaches that “when the GPS positioning mode is set at step 1032 [above, red] the control unit 18 supplies the battery power supply 37 . . . and thereby instructs that the supply voltage V_{cc} of the battery power supply 37 be supplied to the GPS receiving unit 36,” as shown in Figure 22 below. As further shown, Nohara teaches that “[t]he battery power supply 37 also outputs a predetermined supply voltage V_{cc} to operate the GPS

receiving unit 36.” Ex-1006 ¶298. Because the battery power supply is being supplied to the GPS after step 1032, the GPS will be powered on using that supplied battery power.

FIG.22



136. Claim 40 requires a “means for determining” which I have applied as described above in ¶74 and equivalents. Nohara teaches at least the equivalent structure and algorithm because it includes a control unit 18 (green, above) that is capable of “exercising central control over the entire mobile station 10.” This control includes determining when the HDOP error exceeds a threshold, at step 1024 in Figure 23 (above, blue), and then instructing the battery to supply power to the GPS to turn it on when necessary, through the red path to step 1032 (above Fig. 23, red) and as I describe further in ¶¶139-147, below. Ex-1006 ¶297.

137. Finally, Claim 43 requires a “second portion designed to determine when said embedded GPS module should be powered on.” For the same reason as I discussed above, a POSITA would have included programming logic (the second portion) to evaluate Figure 23, step 1024, at the control unit 18. As I explained previously, the first portion interfaces with the GPS receiving unit, while the second portion at control unit 18 evaluates at step 1024 in Figure 23 (which receives position information from the cellular system in step 1022).

d. 37[B]: said when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

40[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

43[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

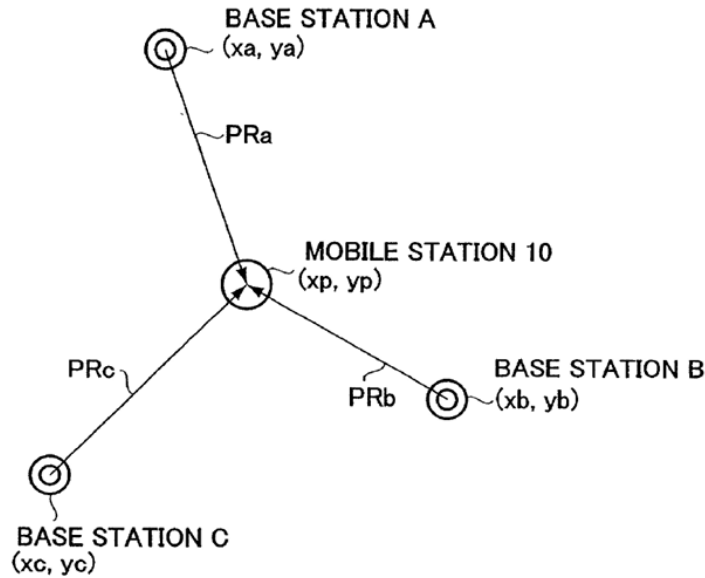
138. In my opinion, Nohara teaches elements 37[B], 40[C], and 43[C].

139. Nohara teaches the claims under the “disjunctive” view set out in ¶76, above, because it uses a “position error” to determine when to switch from cellular based positioning and power on GPS-based positioning.

140. As I discussed above in ¶¶134-137, Nohara teaches that the determination of turning on the GPS receiver of the mobile device is based on a “position error” or “HDOP,” determined from the wireless communications network. Specifically, Nohara discloses a mobile device that has the capability to “determine the present position (xp,yp) of the positioning apparatus 10 based on the radio waves coming from the base stations.” Ex-1006 ¶300. Nohara explains that at the start position, “the GPS receiving unit 36 is not supplied with the supply voltage Vcc for activation.” *Id.* ¶303. A POSITA would have understood that the supply voltage Vcc is the basic source of power (i.e., voltage and current) for the unit, and thus the GPS is powered off when it is not supplied with a power supply voltage. Nohara teaches that the first step is the “base-station positioning mode,” where “the control unit 18 sets a positioning mode of using incoming waves from base stations for positioning.” *Id.* ¶304. Nohara teaches that at this first step, “the present position(xp, yp) of the positioning apparatus 10” is determined using “the pseudo ranges of the incoming waves and the positions (xa, ya), (xb, yb), and (xc, yc) of the respective base stations A, B, and C.” *Id.* ¶306. This cellular-based positioning technique is shown, for example, in Figure 6. As depicted, the signals

are from the wireless communication network base stations, which are different than GPS.

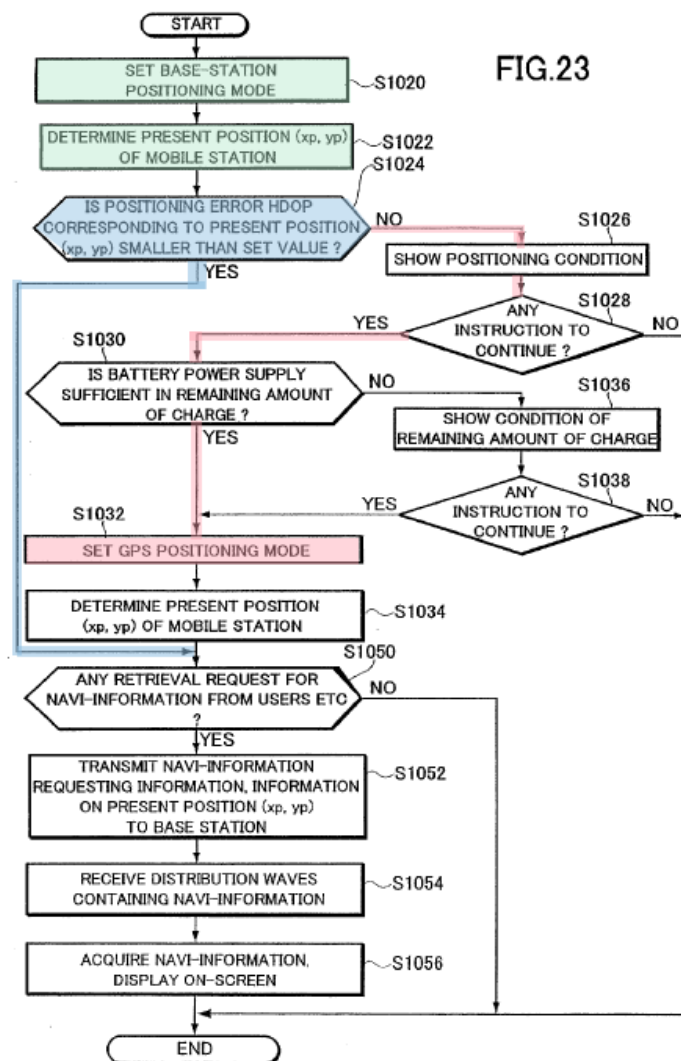
FIG.6



141. Nohara also teaches a mathematical expression to quantify position errors associated with this cellular positioning technique. Specifically “as shown in the following equation (11), a root-sum-square value HDOP (Horizontal Dilution of Precision) of the terms σ_{xx}^2 and σ_{yy}^2 is determined. The value HDOP shall be regarded as the positioning error quantified on the plane in the horizon system of coordinates.” Ex-1006 ¶144.

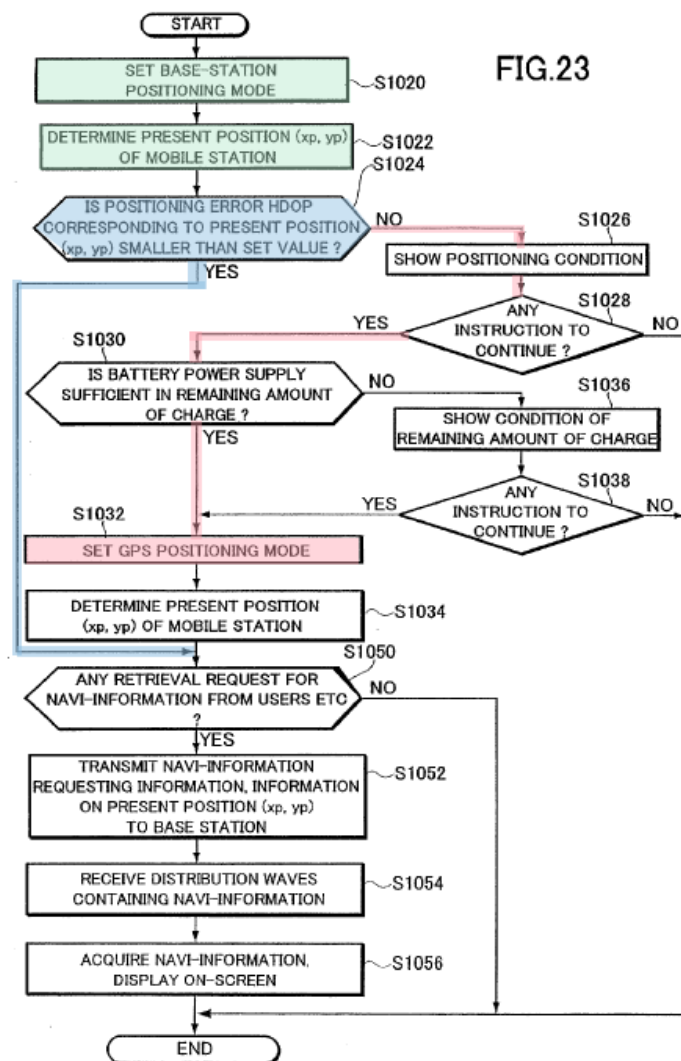
$$HDOP = \sqrt{\sigma_{xx}^2 + \sigma_{yy}^2} \quad (11)$$

142. As described in Figure 23, in one scenario, Nohara teaches that in the next step, “S1024, it is determined if the positioning error HDOP obtained upon the determination of the present position (xp, yp) of the positioning apparatus 10 is smaller than a predetermined set value.” Ex-1006 ¶307. In this step, Nohara teaches that “[i]f the positioning error HDOP is smaller than the set value (if ‘YES’), the present position (xp, yp) is decided to have high positioning precision, and the positioning operation in the base-station positioning mode is ended.” *Id.* Therefore, Nohara teaches that if the current position error determined from the wireless communications network is below a certain threshold, the power of the GPS receiver is not turned on. As I explained above in my technical background regarding known power conservation techniques, ¶¶50-52, there are systems where the GPS is turned off when positioning information is not required. *See* Ex-1026, 3:52-54, 18:19-19:19. In this scenario, as shown below in Figure 23, the process bypasses step 1032 (red) that would have turned on the GPS (blue arrow), and thus the GPS remains turned off.



143. In another scenario, Nohara teaches that “[a]t step S1024 above, if the positioning error HDOP corresponding to the present position (xp, yp) determined in the base-station positioning mode is greater than the predetermined set value (if ‘NO’), go to step S1026. Here, . . . favorable positioning precision has not been obtained . . .” Ex-1006 ¶310. In this step, Nohara further teaches that “an instruction to continue the positioning operations is given, . . . go to step 1030,” at step 1028 (*id.*, ¶311), and then a battery check for the remaining amount of charge

is determined at step 1030 (*id.*, ¶312). Once these steps are completed, Nohara teaches that, “[i]f the remaining amount of charge is sufficient (if ‘YES’), [it] enter[s] step S1032 [“GPS positioning mode”,] to set a positioning mode of using the GPS for positioning.” *Id.* Nohara teaches that while in the GPS positioning mode, “the control unit 18 supplies the battery power supply . . . to the GPS receiving unit 36.” *Id.* ¶315. Therefore, Nohara teaches that if the current position error, HDOP, determined from the wireless communications network is above a certain threshold (step 1024), power the GPS receiver is turned on (step 1030).



144. As shown in the figure above, (1) if the HDOP value determined using the cellular positioning approach is lower than the above mentioned value or threshold, the power of the GPS receiver is not turned on (blue highlighted path), and (2) if the HDOP value determined using the cellular positioning approach is higher than the above mentioned value or threshold, the power of the GPS receiver is turned on. (red highlighted path). This is based at least on a “position error” as claimed because the step that turns on the GPA is specifically executed when

“position error HDOP” threshold is exceeded (steps S1030 through S1032 as indicated by the red highlighting above). As I discuss below, the current position determined without GPS contains an error component that must also be factored into the distance moved threshold. However, for purposes of determining whether distance moved exceeds a threshold, a POSITA would assume the distance moved equivalent current radio position – starting position (previously acquired with GPS).

145. Thus, Nohara teaches turning on the GPS receiver when the error (HDOP) of the cellular determined position exceeds a “set value” (i.e., “a position error of said mobile device determined from the wireless communications network”).

146. Regarding Claim 40’s “means” term, a POSITA would have understood that Nohara discloses the recited algorithm because the control unit 18 in the mobile positioning apparatus determines that the position error (HDOP) is above a predetermined value. Specifically, Nohara discloses that “it is determined” (1) whether the HDOP error associated with the present position determination can be “smaller than a predetermined set value,” and therefore, not turning on the power of Nohara’s GPS receiver (*see* Ex-1006 ¶307), or (2) whether the HDOP error associated with the present position determination can be “greater than a predetermined set value,” and therefore, turning on the power of Nohara’s GPS

receiver (*see id.*, 310). Thus, a POSITA would have understood that Nohara's evaluation criteria for a predetermined set value is the threshold used to evaluate when to turn on the GPS receiver or not.

147. A POSITA would have also understood that Nohara's control unit would operate by executing the program that determines that the position error (HDOP) is above a predetermined value. Specifically, in step S1022, the cellular based position is determined and in step S1024 the error of that position measurement is estimated. If that error exceeds a set value or threshold, then the program logic directs processor to execute steps S1026, S1028, S1030, and finally to turn on the GPS receiver at step S1032 ("Set GPS positioning mode"). Once turned on the GPS receiver then determines the position using the GPS signals. Nohara also explains that when the system is in cellular positioning mode the power to the GPS receiver is turned off (*see e.g.*, Ex-1006 ¶305 "That is, when the base-station positioning mode is set, the transmitting/receiving unit 11 for conducting communications with base stations is activated at step S1022, while the GPS receiving unit 36 is not supplied with the Supply Voltage Vcc."), and when the logic reaches step S1030, if sufficient battery power is available the logic switches over to GPS positioning mode by applying voltage (i.e., power) to the GPS receiver. For example "[n]ext, at step S1030, the battery power supply 37 undergoes battery check for the remaining amount of charge, to determine if the

remaining amount of charge is sufficient as compared to a predetermined set value.

If the remaining amount of charge is sufficient (if ‘YES’), enter step S103 to set a positioning mode of using the GPS for positioning (hereinafter, referred to as ‘GPS positioning mode’).” *Id.* at ¶312.

C. Ground 3: Claims 38, 41, and 44 are obvious over Watters in view of Lau (Ex-1007)

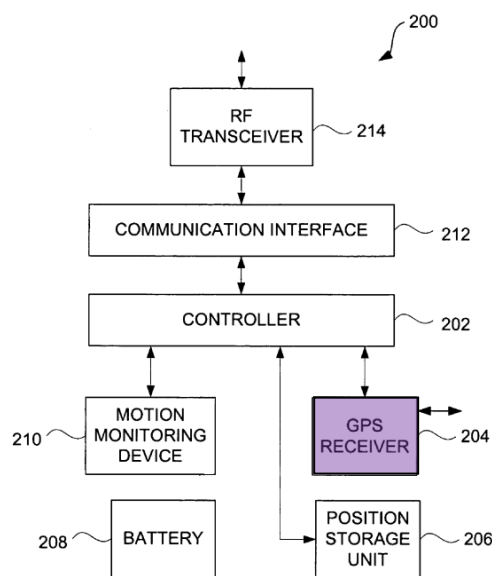
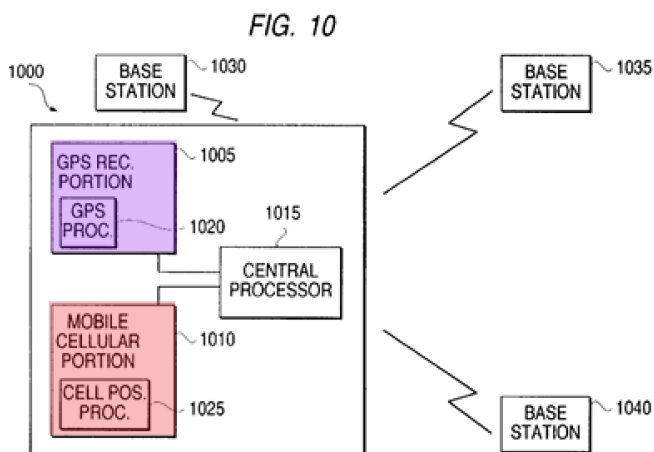
1. A POSITA would have been motivated to combine the teachings of Watters and Lau, and would have had a reasonable expectation of doing so

148. In my opinion, a POSITA would have been motivated to combine the teachings of Watters and Lau. Both references relate to global positioning satellite systems and addressing the need to optimize battery life. Ex-1005, 1:6-10; Ex-1007, 4:40-46. Watters discloses a GPS receiver that calculates position and a mobile cellular portion that computes position using a cellular network. Ex-1005, 19:54-58, 20:8-12 (using TDOA). Watters explains that in order to reduce power consumption, “it may be desirable to rely on the cellular network infrastructure to calculate position.” *Id.*, 22:38-40. Similarly, Lau discloses a location monitoring system, which monitors the location of mobile devices using a GPS. Ex-1007, 4:41-44. Lau explains the ability to save power and battery life by reducing the use of the GPS, which also reduces “the demands on wireless network band width in transmitting and managing such location information.” *Id.*, 6:19-26. Lau expressly teaches the use of low GPS power states such as sleep or hibernate. *Id.*, 9:65-10:2.

Lau al states “low power maintenance of the GPS receiver allow[s] the mobile device to significantly reduce its power consumption while still providing location monitoring. *Id.*, 8:66-9:2. A POSITA would have been motivated to apply the teachings of both Watters and Lau and reduce power consumption by allowing the GPS to remain in a no-power or low-power state mode to conserve power, because this was a common goal of both systems. As I explained in my technical background discussion of known power conservation techniques, ¶¶50-52, it is common to keep the GPS in a low-power state mode because turning off the GPS receiver entirely is not a viable approach. *See* Ex-1028, 3:31-37; Ex-1029 ¶15. Specifically because, in a cold start state, “the GPS receiver has no GPS almanac, or it has no approximate knowledge of current time and location.” *See* Ex-1033, 0010.

149. Specifically, in the Watters-Lau combination, a POSITA would have recognized the benefit of using Lau’s teachings regarding GPS receiver 204 maintaining a “low power state,” such as sleep mode in the comparable Watters GPS receiver 1005, which is able to be substantially turned off. As I further explained in in my technical background discussion, ¶¶50-52, turning the GPS off would result in a “cold start.” *See* Ex-1023; Ex-1026, 3:52-54, 18:19-19:19. A cold start takes about 12 minutes to obtain a position. A POSITA would have recognized the benefit of using Lau’s teaching to enable Watters’s GPS receiver

1005 to use recent GPS state data such as the current satellites in view, and their approximate code offsets, as well as almanac and ephemeris data that would have still been reasonably fresh. The GPS receiver holds in memory the last received ranging information and position calculations such as almanac and ephemeris data. *See* Ex-1028, 3:31-37. By holding the prior GPS information in memory, the system can avoid the delays associated with a cold start. These, and comparable, GPS receivers were routine at the time, and implementing power saving teachings on either of them would have been routine design choices.



2. Dependent Claims 38, 41, 44

- a. **Claim 38:** The method according to claim 37, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 41: The mobile device according to claim 40, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 44: The computer program product according to claim 43, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

150. In my opinion, Watters in view of Lau teaches Claims 38, 41, and 44.

151. As I discussed in ¶¶116-121, Watters teaches powering up the GPS receiver from a low-power mode such as a TricklePower power-down mode. A POSITA would have understood that a TricklePower power-done mode is the same as a “tricklestate.” For example, “[a] GPS receiver consumes substantially more power when in active mode (i.e., actively acquiring satellite or other ranging signals and recalculating position information)” than when the GPS is “not in active mode, i.e., is in standby (during which the GPS receiver simply holds in memory the last received ranging information and position calculations).” Ex-1028, 3:31-37. U.S. Patent Publication No. 2005/0083230 to Harvey et al., (Ex-1029) also refers to this standby mode or low-power mode as a “tricklestate” mode. Ex-1029 ¶15. To the extent that a POSITA would have desired additional implementation details for low-power GPS modes, a POSITA would have turned to an additional reference, such as Lau, which teaches those routine details. As I set out in my technical background discussion, ¶¶50-52, it was common to place the

GPS in a low-power state mode to conserve power. *See* Ex-1028, 3:31-37; Ex-1029 ¶15. A POSITA would recognized that a cold start (no GPS information available) requires a lengthy TTFF (about 12 minutes), while a warm start, where recent GPS information is available, can obtain a TTFF in about 30 seconds. *See* Ex-1033, 0010.

152. For example, Lau teaches that after its GPS receiver obtains the GPS position of the mobile device, the “GPS receiver is returned to a low-power state so as to conserve power.” Ex-1007, 7:40-44, 7:46-47. Lau explains that “the low-power state (or powered-down state) can be a sleep mode or it can be a disabled mode.” *Id.*, 7:47-49, 9:65-10:2 (“powered-off, disabled, sleep, hibernate, or other low power mode”). As I described in my technical background discussion, ¶¶50-52, maintaining some of the GPS state data, such as the most recent satellites in view, their approximate code offsets and the current ephemeris data avoids the long “cold start” process. *See* Ex-1023; Ex-1026, 3:52-54, 18:19-19:19.

153. A POSITA would have been motivated to implement these teachings in Watters, as I explained in ¶¶148-149. For example, Watters’s Claim 6 states that the GPS should be “substantially” turned off when a requisite number of cellular signals are being received. Ex-1005, Cl. 6. A POSITA would have applied the specific teachings of Lau such that when the GPS was “substantially” turned off as described in Watters’s Claims 6, the GPS would be “returned to a low-power state

so as to conserve power” rather than being fully turned off, as described by Lau.

This is because, as I discussed above, ¶¶50-52, turning off the GPS receiver entirely is not viable because the GPS receiver must then perform a “cold start.”

See Ex-1023; Ex-1026, 3:52-54, 18:19-19:19. Examples of low power states would include sleep, whereby GPS variables are maintained in memory under minimal power.²² When the GPS was powered up after having previously placed in such a low-power mode, it would be “powering up from a low-power mode” as claimed.

This would have conserved power and also allowed the GPS to maintain its ephemeris data and avoid cold start complications caused by long TTFF periods, as I explained in ¶¶116-121.

D. Ground 4: Claims 37-45 are obvious over Watters and Nohara

²² As with battery powered personal computers, sleep generally refers to maintaining state information in volatile memory (e.g., RAM), where a small amount of power is drawn to keep the memory state refreshed, but which can be quickly accessed when “awakened.” I explained these details in my technical background discussion, ¶¶50-52. For example, in a cold start state, “the GPS receiver has no GPS almanac, or it has no approximate knowledge of current time and location.” Ex-1033, 0010. “The GPS almanac gives an approximate satellite ephemeris” and “[i]t takes the receiver 12.5 min to download the almanac of the entire GPS constellation.” *Id.* To avoid this, many systems place the receiver in a standby mode wherein the GPS signals are still received, and tracked for time offset, but the actual position calculations, which can be computationally intensive and thus power consuming, are not performed. Another approach to conserving power is to maintain a record of the last known positions of the observed satellites when the receiver is powered down, and to then extrapolate the positions, and thus the time offsets of the satellite based on their orbital data. Thus, “a GPS receiver that starts in this state will be able to determine a position in about 30 s.” *Id.*, 0011.

1. A POSITA would have been motivated to combine the teachings of Watters and Nohara, and would have had a reasonable expectation of doing so

154. In my opinion, Watters and Nohara teach all the limitations of Claims 37-45. Nohara, similar to Watters, relates to global positioning satellite systems and addresses the need to optimize battery life. Ex-1006 ¶38. Watters and Nohara also both address the need to resolve multi-path errors, which could lead to the deterioration of the positioning accuracy. Ex-1005, 5:65-6:1; Ex-1006 ¶14. Nohara teaches a “system for determining the present position of a mobile station by using radio waves coming from the mobile station to a plurality of base stations” and a “positioning means for determining the present position of the mobile station by using the GPS.” Ex-1006 ¶36. Nohara also explicitly discloses determining Horizontal Dilution of Precision (HDOP), which is a well-known quantification of errors caused by multi-path and geometric effects, among others. *Id.* ¶307. Thus, a POSITA would have been motivated to combine the teachings of Watters and Nohara’s express teaching to use HDOP calculations as a routine approach for quantifying the “inherent errors” that Watters acknowledges. As I discussed above regarding GPS and cellular position errors, ¶¶60-63, HDOP provides an estimate of the error in a horizontal position estimate. These implementation details from Nohara would have been applied in Watters for determining whether to power on the GPS and determine a more accurate position of the mobile device to address

multi-path and geometry-based errors. This was a common goal of both Watters's and Nohara's systems.

155. Specifically, Watters teaches that multi-path errors result from changes in the transmission path of the signal that the mobile terminal receives from the base station. Ex-1005, 5:65-6:1. As I described in my technical background section regarding positioning errors, ¶¶60-63, multi-path occurs when a satellite signal reflects off some terrestrial object, causing a second version of the GPS signal to be received at a slightly later time. This results in ambiguity as to the exact value of the pseudorange, and this translates to an uncertainty or error in the position (i.e., higher HDOP). In the combination, Nohara's teaching regarding powering on the GPS when a calculated Horizontal Dilution of Precision (HDOP) value (also called a "positioning error") for "base-station positioning mode" is too high would have been implemented with Watters's base stations calculations to address these same problems. Each of these systems describe, acknowledge, and address problems of multi-path errors in routine and complimentary ways. And implementing these teachings on either of them would have involved routine design choices to overcome multi-path effects that they each recognize as associated with the use of the cellular-positioning technology.

156. Nohara explains that HDOP is a mathematical quantification of "position error." Nohara explains that HDOP is used as a quantitative measure of

whether there is too much error in the signal to reliably use that signal. Ex-1006

¶144. If there is too much error, then Nohara teaches to use GPS. *Id.*, Fig. 23.

Watters teaches to use a positional threshold, e.g., traveling more than 100 meters from the last GPS fix, to decide whether to turn the GPS back on. Watters continues and teaches that these GPS updates may be more or less frequent, depending on whether the cellular signal received is of “good accuracy.” Ex-1005, 22:61-66. Watters leaves implementation details to a POSITA on the best way to determine whether a signal is of sufficiently “good accuracy” (which details would have been obvious, as I explained in ¶¶99-114). To the extent further teachings would have been necessary, Nohara expressly teaches an objective measure that a POSITA would have known to use to quantify how good the position error is (HDOP).

157. A POSITA would have been motivated to implement Nohara’s quantitative measure in Watters because it would allow a POSITA to place a concrete number on how “good” the “accuracy” is exactly. Nohara’s HDOP algorithm and evaluation would be implemented in Watters Figure 12, at step 1230, which determines whether or not the “requisite cellular signals” are good enough. In the Watters-Nohara combination if, for example, the HDOP value is consistently too high, the cell reception is not of “good accuracy” so the GPS updates will have to be more frequent, so a POSITA would have reduced the

update distance threshold of 100 meters from last fix. For example, a POSITA would have set a smaller distance update threshold to update when the device moves 80 meters, instead of 100 meters. If the device had already moved, for example, 90 meters from the position of the last fix, then the system would immediately turn on GPS, since the modified threshold has already been exceeded. But if the device had only moved 60 meters, for example, then the GPS would not turn on again until the modified 80 meter threshold is exceeded at a later time. The choice of the specific distance threshold values for use in an given error conditions would have been a matter of routine design choice. The optimization of distance threshold versus battery power would have been performed by straightforward testing of various conditions to achieve the best results in a process that a POSITA would have found obvious to try.

158. Moreover, a POSITA would have been motivated to implement the teachings of Nohara and Watters together as a routine design choice for addressing the switch from cellular base station positioning to GPS because each reference compliments and addresses potential shortcomings in the other.

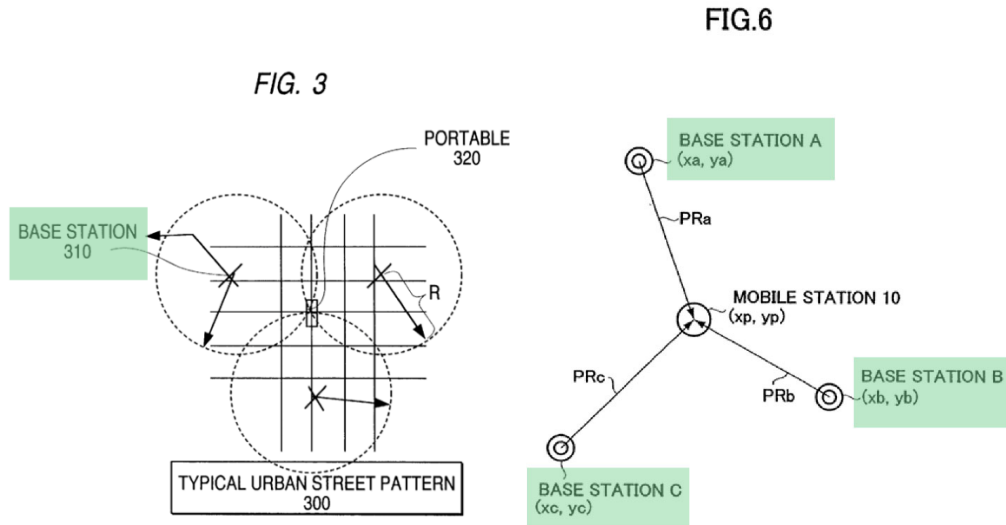
159. For example, in Nohara, the switch to GPS is made based on evaluation of position error, as quantified with an HDOP value. But an HDOP value requires receipt of signals from multiple different base stations in order to be calculated properly. Nohara does not explain what to do in the event that multiple

cellular signals cannot be received, which would have been a routine occurrence that a POSITA would have expected to occur. If multiple cellular signals cannot be received, Nohara's HDOP value cannot be calculated. But Watters explains what to do when the "requisite cellular signals" cannot be received in Figure 12's step 1230. Specifically, the GPS should simply be turned on to get a position fix. This Watters teaching thus directly addresses a potential shortcoming in Nohara that a POSITA would have recognized.

160. Additionally, Watters teaches to address errors that may be caused by multi-path propagation in the incoming signals. Ex-1005, 23:37-55. However, this is not the only source of potential errors in a TDOA measurement that a POSITA would have recognized. Additional errors may be caused by base station geometry as I discussed in in my technical background discussion, ¶¶60-63. For example, when base stations effectively form a right triangle with the tracked object, positioning error is significantly reduced. But when base stations are closer together, such that the angles made between them are smaller, the resulting position error from the TOA measurements can increase significantly. This is a source of position error separate and apart from multi-path errors that a POSITA would have been well aware of when considering Watters. Nohara's approach provides a mechanism to account for and address these errors. Thus, Nohara's HDOP calculation would have been used by a POSITA as a means to quantify this

additional error source, so that it could be properly dealt with in the combined Watters-Nohara system.

161. Each of these systems describe, acknowledge, and address problems of multi-path errors in routine and complimentary ways. And implementing these teachings on either of them would have involved routine design choices to overcome multi-path deficiencies that they each recognize as associated with the use of the cellular-positioning technology.



2. Independent Claims 37, 40, and 43

a. 37[Pre]: A method of acquiring a position on a mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said method comprising:

40[Pre]: A mobile wireless communication device for a wireless communications network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said mobile wireless communication device comprising:

43[Pre]: A computer program product for a mobile wireless communication device for a wireless communication network, said mobile wireless communication device possessing wireless communications capability for said wireless communications network and an embedded GPS module for GPS capability, said GPS referring to GPS-based techniques, said computer program product embodied on computer readable storage medium, said computer program product for acquiring a GPS position on said mobile wireless communication device, comprising:

162. In my opinion, Watters and Nohara teach the preambles of Claims 37, 40, and 43, to the extent they are limiting.

163. As I discussed in ¶¶91-94 and ¶¶126-129, each of Watters and Nohara teach “an embedded GPS module for GPS capability, said GPS referring to GPS-

based techniques” and a mobile wireless communication device that possesses wireless communications capability for said wireless communications network. These systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings from Nohara into the system of Watters.

b. 40[A]: an embedded GPS module providing a GPS capability for said mobile wireless communication device;

43[A]: a first portion designed to interface with the GPS capability of said mobile wireless communication device;

164. In my opinion, Watters and Nohara teach elements 40[A] and 43[A], as I discussed with respect to 40[A] and 43[A], in ¶¶95-99 and ¶¶130-132.

165. As I discussed in ¶¶95-99, Watters teaches a central processor that contains programming logic (a “first portion”) to interface with GPS capability. Further, as I discussed in ¶¶130-132, Nohara teaches a control unit, which contains a programming logic (a “first portion”) to interface with the GPS capability of the GPS receiving unit. These systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings, such as the teaching regarding powering on the GPS when a calculated Horizontal Dilution of Precision (HDOP) value (also called a

“positioning error”) for “base-station positioning mode” is too high from Nohara, into the system of Watters.

c. **37[A]: determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on,**

40[B]: and means for determining when said embedded GPS module should be powered on, said embedded GPS module then being powered on

43[B]: and a second portion designed to determine when said embedded GPS module should be powered on, said embedded GPS module then being powered on,

166. In my opinion, Watters and Nohara teach elements 37[A], 40[B], and 43[B].

167. As I discussed in ¶¶99-102 and ¶¶133-137, each of Watters and Nohara both teach “determining when said embedded GPS module should be powered on and said embedded GPS module then being powered on,” “means for determining when said embedded GPS module should be powered on,” and “a second portion designed to determine when said embedded GPS module should be powered on.” These systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings, such as the teaching regarding powering on the GPS when a calculated Horizontal Dilution of Precision (HDOP) value (also called a

“positioning error”) for “base-station positioning mode” is too high from Nohara, into the system of Watters.

- d. **37[B]: said when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.**

40[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

43[C]: said determining when said embedded GPS module should be powered on being dependent on at least one of a current radio position and a position error of said mobile device determined from the wireless communications network, said wireless communications network being different from said GPS.

168. In my opinion, Watters and Nohara teach elements 37[B], 40[C], and 43[C].

169. As I discussed in Section ¶¶103-114, Watters teaches to use both a “current radio position” and a “position error” to determine when to switch from cellular based positioning and power on GPS-based positioning. Watters explains that because there is unreliability in cellular-based techniques based on the quality of the signal, the “rate at which GPS updates are needed [in block 1240] will

depend on conditions under which the mobile is operating.” Ex-1006, 22:64-66.

For example, Watters teaches that if “the mobile terminal has moved a predetermined distance, such as 100 meters, then a GPS update would be called for and the process proceeds to block 1240.” *Id.*, 22:60-64. Watters discloses that the “100 meters” distance threshold described should vary based on signal quality with “less frequent updates needed if ... cellular network infrastructure signals are known to be of good accuracy,” *id.*, 22:61-66, and, by contrast, more frequent updates needed if the signal quality is low, such as when multi-path propagation is present. *Id.*, 23:41-44 (GPS updates reduce multi-path problems).

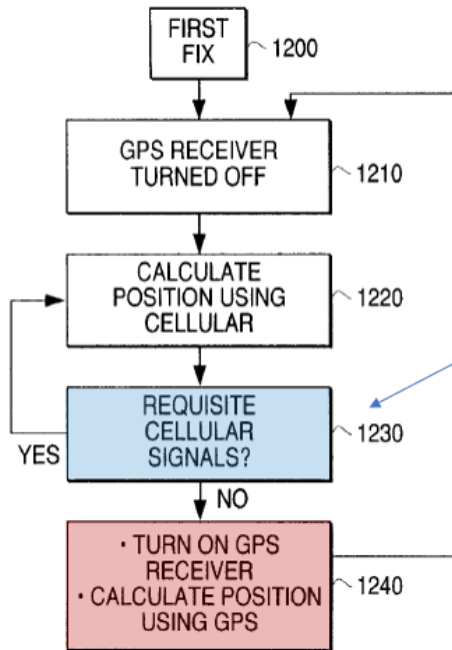
170. To the extent that a POSITA would have desired additional implementation details for determining or quantifying position errors, a POSITA would have turned to an additional reference, such as Nohara, which teaches those routine details. Specifically, as I discussed in Section ¶¶137-147, Nohara teaches that the determination of turning on the GPS receiver of the mobile device is based on a “position error,” or “HDOP,” determined from the wireless communications network.

171. A POSITA would have been motivated to implement Nohara’s technique of quantifying “position error HDOP” with Watters’s use of errors (as related to time or distance since previous GPS fix) in determining when to power on GPS. As I explained above, in ¶¶154-161, this would have allowed for

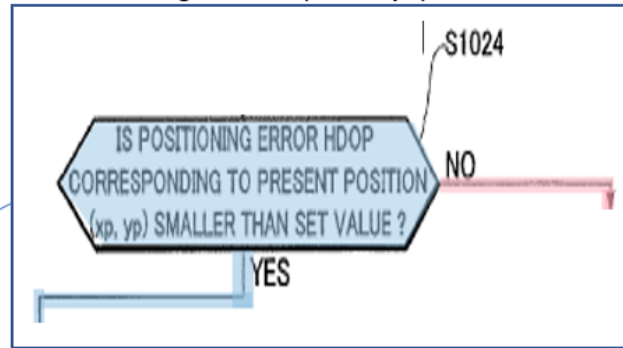
Watters's system to more precisely quantify and address "inherent errors" caused by multi-path or other effects. Because both Watters and Nohara recognize multi-path as a potential error source, a POSITA would have understood that Nohara's technique would have been applicable to solve the same problems identified by Watters, which uses errors to determine when to turn on GPS, as I explained in ¶¶103-114. Therefore, a POSITA would have been motivated to quantify that error as accurately as possible, to ensure the best operation of Watters's algorithm to save power. In the combined Watters-Nohara implementation, Watters's current radio position is used to evaluate whether the distance threshold is crossed, and Nohara's position error (HDOP) is used to determine whether the threshold should be altered (thus GPS update more or less frequent).

172. Specifically, Nohara's HDOP calculation would have been implemented in Watters's step 1230, which determines whether the "requisite" signal is sufficient for positioning purposes. And if the answer is "no" (e.g., because an HDOP value is too high and accuracy is too low) GPS is used at Watters's step 1240. As I explained above in Section ¶¶154-161, too high of an HDOP value would have been used to lower the positional threshold. If that lowered positional threshold was already exceeded, then the GPS would turn on immediately. If that lowered positional threshold was not yet exceeded, it would be turned on sooner, because the threshold is a smaller distance away.

FIG. 12



Nohara Figure 23 (excerpt)



173. This combination is consistent with, and indeed suggested by, Watters itself. Watters explains that, in its simplest form, step 1230 simply determines whether the requisite number of signals is available. Ex-1005, 23:50-55 (“At block 1230, a determination is made whether the requisite number of signals in the cellular network infrastructure are available for calculating position (e.g., three signals in the TDOA approach)”). However, Watters suggests that additional functionality (e.g., additional “inquiries”) can also be included in step 1230. Ex-1005, 23:57-62 (“inquiries at block 1230 include determining how long (in time) it has been since the last GPS update and/or how far (in space) the mobile terminal has moved since the last GPS update.”). A POSITA would have implemented Nohara’s position error (HDOP) determination as a routine design choice for one

of the additional “inquiries” conducted in Watters step 1230. As I explained in further detail in ¶¶154-161, above, a POSITA would have been motivated to do so for a number of reasons, including that: the combination would provide for an improved capability to quantify and address position errors in Watters; the combination would have improved Nohara’s algorithm because it would address what to do when three base station signals are not received; and the combination would have improved Watters’s ability to address errors caused by base-station geometry rather than signal characteristics (such as multi-path and other signal noise or attenuation).

3. Dependent Claims 38, 41, 44

- a. Claim 38: The method according to claim 37, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.**

Claim 41: The mobile device according to claim 40, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 44: The computer program product according to claim 43, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

174. In my opinion, Watters and Nohara teach Claims 38, 41, and 44.

175. As I discussed in Section ¶¶115-121, Watters teaches powering up the GPS receiver from a low-power mode such as a TricklePower power-down mode,

e.g., as exemplified by its Claim 6. Watters and Nohara's GPS systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings from Watters and Nohara, including for the reasons I discussed in ¶¶154-161.

- b. Claim 39: The method according to claim 37, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.**

Claim 42: The mobile device according to claim 40, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.

Claim 45: The computer program product according to claim 43, wherein said determining when said embedded GPS module should be powered on is also dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.

176. In my opinion, Watters and Nohara teach Claims 39, 42, and 45.

177. As I discussed in ¶¶122-125, Watters teaches determining when the GPS receiver should be powered on “dependent on at least one of; a last satellite position; a last position determined by the GPS; and a last time determined by the GPS.” As I explained in connection with Watters, a POSITA would have been motivated to also include either or both spatial and temporal measures in using this

determination. Ex-1005, 22:61-63, These systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings, such as the teaching regarding powering on the GPS when a calculated Horizontal Dilution of Precision (HDOP) value (also called a “positioning error”) for “base-station positioning mode” is too high from Nohara, into the system of Watters.

E. Ground 5: Claims 38, 41, and 44 Are Obvious Over Watters and Nohara in further view of Lau

1. A POSITA would have been motivated to combine the teachings of Watters, Nohara, and Lau, and would have had a reasonable expectation of doing so

178. In my opinion, Watters and Nohara teach all the limitations of Claims 37-45, as I explained above in ¶¶154-176. And they would have been combined as I explained in ¶¶154-161. Watters and Lau teach all of the limitations of Claims 38, 41, and 44, as I explained above in Sections ¶¶115-121 and ¶¶150-153. And they would have been combined for the reasons I explained in ¶¶148-149. Still further, each of Watters, Nohara, and Lau relate to systems and methods of turning on and off GPS in ways that balance power consumption with positional accuracy. In the combination, and to address these particular claims, no specific teaching of Nohara is necessary, since the applicable teachings are found in Watters and Lau. As such, none of the motivations or expectations of success analysis differs from what is recited in ¶¶148-149 due to the addition of Nohara. For all of these

reasons, a POSITA addressing these problems would have known of and consulted each of Watters Nohara and Lau, including because they are each representative of well-known design choices at the time to address these well-known problems.

2. Claim 38: The method according to claim 37, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 41: The mobile device according to claim 40, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

Claim 44: The computer program product according to claim 43, wherein said powered on comprises said module powering up from a low-power mode such as a TricklePower power-down mode.

179. In my opinion, Watters and Nohara in view of Lau teaches Claims 38, 41, and 44.

180. As I discussed in Section ¶¶115-121, Watters teaches powering up the GPS receiver from a low-power mode such as a TricklePower power-down mode e.g., as exemplified by its Claim 6. Further, as I discussed in ¶¶150-153, Lau's GPS receiver is returned to a low-power state, such as sleep, so as to conserve power. Further, as I discussed in ¶¶126-147, Nohara implements routine GPS systems applied for their routine purposes of providing GPS position information. These systems are each routine and complimentary, and a POSITA would have had a reasonable expectation of success in incorporating the comparable teachings from Lau with Watters and Nohara.

XIV. CONCLUSION

181. For at least these reasons, in my opinion, Claims 37-45 are invalid over the prior art.

182. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

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

184. I declare under penalty of perjury that the foregoing is true and correct.

Respectfully Submitted,

/s/ 
Scott Andrews