

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

GEOSCOPE TECHNOLOGIES PTE. LTD,

Patent Owner.

Case IPR2024-00255
U.S. Patent No. 7,561,104

EXHIBIT 2018

DECLARATION OF MR. MARK ALAN STURZA

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I, Mark Alan Sturza, declare as follows:

I. INTRODUCTION

1. My name is Mark Alan Sturza. I have been retained by Patent Owner Geoscope Technologies Pte. Ltd. (“Patent Owner” or “Geoscope”) as an independent expert consultant in this proceeding, and asked to submit this declaration in connection with U.S. Patent No. 7,561,104 (“the ’104 Patent”). I understand the ’104 Patent is the subject of an *inter partes* review and petition (“the Petition”) in front of the Patent Trial and Appeal Board of the United States Patent and Trademark Office, filed by Petitioner Apple Inc. (“Apple” or “Petitioner”).

2. I am being compensated at my standard consulting rate of \$500 per hour. My compensation is not contingent on the substance of my opinions or testimony, nor is it contingent on the outcome of this proceeding. I have no other financial interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

3. 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, and researching the technology referenced in this declaration.

4. I am over eighteen 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. A detailed list of my qualifications and experiences is contained in my curriculum vitae, which I understand is being submitted as EX2019. The following provides a brief overview of my qualifications relevant to the matters set forth herein. I am familiar with all aspects of position, location, and navigation technology.

5. I earned a Bachelor of Science (BS) degree in Applied Mathematics from the California Institute of Technology (Caltech) in 1977, a Master of Science in Electrical Engineering (MSEE) degree from the University of Southern California (USC) in 1979, and a Master of Business Administration (MBA) degree from Pepperdine University in 1985.

6. I am a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), as well as a Senior Member of the American Institute of Aeronautics and Astronautics (AIAA). I hold memberships in the Institute of Navigation (ION), the Pacific Telecommunications Council (PTC), the Society of Satellite Professionals International (SSPI), and the International Association for the Advancement of Space Safety (IAASS). I also hold a General Radiotelephone Operator License from the Federal Communications Commission (FCC).

7. I am the President of 3C Systems Company, a company I founded in 1989 to provide consulting expertise in the design, development, analysis, and

regulation of communications systems. My industry experience includes senior engineering management and technical positions at LinQuest, Litton, Magnavox, and Teledyne.

8. I have over 45 years of experience in the design, development, and application of position, location, and navigation systems, including with respect to iOS and Android location-based services. Examples of my experience are provided below.

9. I designed and implemented an improved graphics capability for the St. Mary's Loran-C navigation system.

10. I developed the first Global Positioning System (GPS) navigation set for commercial aviation applications, the LTN-700, in the early 1980's. I also architected 2nd and 3rd generation aviation products, the LTN-710 and the μ NAV.

11. I have participated in the design of numerous radio frequency (RF) devices. These included a TT&C (Telemetry, Tracking, and Control) transceiver operating from 70 MHz through S-Band, a 5.8-GHz Sensor Receiver for an RF Motion Capture system, a DVB-T/H receiver chipset, a Ka-band/5-GHz transverter (upconverter/downconverter unit used to change the frequency band over which a transceiver operates), an S-Band/L-Band transverter, miniaturized low-power J-Band transceiver for Trajectory Controlled Munitions, wideband (1-

GHz bandwidth) modem, 60-GHz transceiver, several GPS receivers from cards to modules to chipsets to single chip solutions, an amplifier module for Globalstar's multi-channel active antenna subscriber units, and several miniaturized low-power S-Band, L-Band, and VHF frequency synthesizers.

12. I was Principal Investigator for four Department of Defense (DoD) Small Business Innovative Research (SBIR) contracts:

- QPSK and MPSK Transmission and Receiving Equipment
- RPV Range Surveillance and Radio Relay Via Satellite
- Miniature GPS Digital Translator Development
- ECM Resistant GPS Receiver

13. I developed one of the first GPS software receivers, in the early 1990's. A software receiver is a computer program that processes digitized GPS signal samples generating pseudo-range and delta-range measurements and computes a navigation solution. This was part of the work I performed for NAVSYS Corporation supporting an Air Force contract.

14. I developed a differential GPS (DGPS) navigation filter with autonomous fault detection and conducted studies of receiver autonomous integrity monitoring (RAIM). DGPS is a technique used to improve location accuracy, and RAIM is a technique used to verify the location estimate was obtained from valid measurement data.

15. I was a member of the tiger team formed to review contract performance of the vendor developing Sirius Satellite Radio's receiver chipset.

16. I developed the system architecture for the Leo One USA store-and-forward satellite system including radio frequency plan, multiple access techniques, link budgets, satellite constellation orbits, network protocols, and satellite and user terminals.

17. I was technical lead for the Eagle River due diligence leading to ICO Global Communication's (ICO) emergence from bankruptcy. I worked closely with the ICO and Boeing Space Systems teams to identify and mitigate technical risks and continued to provide technical and regulatory support following the restructuring.

18. I was a member of the Teledesic (Gates-McCaw "internet in the sky") founding team. I developed the communications systems architecture for this low-Earth orbit (LEO) Ka-band satellite communications system, including developing the radio frequency plan, multiple access techniques, and link budgets.

19. I developed an RF Tag motion capture system for the entertainment industry allowing the capture of actor's performances in robust environments.

20. I was Chief Technology Officer (CTO) for SkyVault, a digital rights management and secure content distribution startup. I also developed a

demo system showcasing SkyVault's UltraSecure™ digital content protection.

21. I was a member of the team that developed the SiRFstar I, SiRFstar II, and SiRFstar IV GPS chipsets, including between 2006 and 2009. I developed high performance signal acquisition algorithms and moding, investigated positioning and geolocation techniques for GSM and UMTS mobile devices, and analyzed hybrid positioning techniques for mobile devices.

22. I was a member of the FCC's LightSquared/GPS Industry technical working group (TWG). The TWG was established to evaluate the potential for interference to GPS and conducted extensive testing of all types of GPS devices and use cases, including iOS and Android devices.

23. I was a member of an online dating startup's team where I worked on apps utilizing iOS location services.

24. I was a member of the Pascal's Pocket team developing remote control applications for smartphones. I developed an ultra-secure virtual private network (VPN) for gaming machine applications. I also worked on apps utilizing iOS and Android location services.

25. I was a member of the founding team of sfara, a mobile app telematics startup that uses data science and sensor fusion technology on smartphones to provide a "Sphere of Safety." My support included developing extensive expertise with the iOS and Android location services, and underlying

technologies.

26. I developed a product line of web service tools for link budget analysis, capacity planning, and performance monitoring.

27. I led a team conducting an Independent Technical Evaluation of Panasonic's eXConnect service.

28. I was a senior advisor to OneWeb in position, location, and navigation technology.

29. I have served as a senior advisor to Microsoft, Google, SpaceX, Facebook, and Viasat in matters of spectrum policy and radio technology.

30. I hold thirty U.S. patents in communications system design, eleven of which specifically cover position, location, and navigation technology. I have authored over thirty technical papers, twenty-one of which focused on position, location, and navigation technology. Two of these papers were published in Navigation: Journal of the Institute of Navigation.

31. I was an instructor at University of California Los Angeles (UCLA) Extension teaching short courses (one-week courses intended for industry professionals) on "Integrated Communications, Precision Positioning Determination and Navigation, and Identification Systems," and on "NAVSTAR Global Positioning System (GPS): Operation, Implementation, and Applications." I also presented a similar short course for the University

Consortium for Continuing Education. Additionally, I was an instructor at California State University Northridge, teaching a class in Linear Systems.

III. MATERIALS CONSIDERED

32. In forming my opinions regarding the '104 Patent, I reviewed all materials referenced in this declaration and the exhibits filed to date in this IPR. In addition, I have reviewed the Petition, Preliminary Response, and Institution Decision in this IPR. My opinions are also based on my education, training, experience, and knowledge in the field.

IV. LEGAL STANDARDS

33. I am not an attorney and do not intend to offer my opinion on the law. In forming my opinions in this case, I used the following legal standards that were explained to me by counsel.

A. Claim Construction

34. I have been informed that claim terms are to be construed from the perspective of a person of ordinary skill in the art at the time the application was filed. I have been informed that a claim term is generally given the plain and ordinary meaning that a person of ordinary skill in the art would ascribe to it when viewed in the context of the patent's claims, specification, and prosecution history.

35. I have been informed that "intrinsic evidence," including the patent

claims, specification, and prosecution history are the most important sources for interpreting claim language in a patent. I have been informed that related patents and their prosecution histories may also be relevant to interpreting claim terms in another patent.

36. I have been informed that “extrinsic evidence,” such as dictionary definitions and technical publications, may also be used to help interpret the claim language, but that such extrinsic evidence is secondary to the intrinsic evidence and cannot be used to contradict the meaning of the claim language that is evident from the intrinsic evidence.

B. Level of Ordinary Skill in the Art

37. I have been informed that a patent and its claims are to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). I have been informed that a POSITA is considered to possess normal skills and knowledge in the relevant technical field.

C. Anticipation

38. I have been informed that for prior art to anticipate a patent claim, each and every element of a claim, as properly construed, must be disclosed either explicitly or inherently in a single prior art reference or embodied in a single prior art device. I have been informed that inherent anticipation may be found only if the prior art necessarily includes the claimed limitations.

39. I have been informed that, once a challenged claim has been properly construed, the step in determining whether the challenged claim is anticipated by the prior art requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

D. Obviousness

40. I have been informed that a claim may be invalid as obvious if the differences between the claimed subject matter and one or more prior art references are such that the subject matter would have been obvious to a POSITA at the time of invention.

41. I have been informed that in assessing whether a claimed invention would have been obvious to a POSITA, the following factors are considered: (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 art, and (4) objective indicia of non-obviousness.

42. I have been informed that a claim is not proved obvious merely by demonstrating that each of the claim elements was known in the prior art. Rather, there must be a showing that a POSITA would have reason to attempt to either combine two or more references or modify a reference to achieve the claimed invention, and that a POSITA would have had a reasonable expectation of success in doing so. I have been informed that obviousness should not be evaluated using

the benefit of hindsight or what is known today.

43. I have been informed that the motivation to combine inquiry does not merely require showing that a POSITA could have combined references, but rather a POSITA would have been motivated to combine references to arrive at the claimed invention. I have been informed that whether a POSITA would be motivated to make a combination includes whether the POSITA would select particular references in order to combine their elements. I have been informed that fundamental differences between references may help show that a POSITA would not be motivated to combine them to achieve the claimed invention. I have been informed that when the prior art teaches away from a particular combination, the discovery of a successful means of combining said prior art is more likely to be non-obvious. I have been informed that a reference may be said to teach away when a person of ordinary skill in the art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path taken by the patentee.

44. I have been informed that in evaluating whether patent claims are invalid as obvious, “objective indicia of non-obviousness” should be considered. I have been informed that objective indicia of non-obviousness include commercial success, long-felt but unsolved needs, copying, praise, unexpected results, industry acceptance, failure of others, and industry skepticism. I have been

informed that there must be a nexus between the objective indicia and the claimed invention's novel features.

V. LEVEL OF ORDINARY SKILL IN THE ART

45. I understand that Dr. Sundaresan was informed that a POSITA would have had at least “a Bachelor’s degree in electrical engineering, computer science, or a similar discipline, and at least two years of experience in the field working with navigation and/or geolocation systems.” EX1003 [Sundaresan Decl.], ¶8. I also understand that Dr. Sundaresan was informed that “superior education could compensate for a deficiency in work experience, and *vice-versa*.” *Id.*

46. I do not agree with the definition of level of ordinary skill Dr. Sundaresan was provided. The ’104 Patent and the asserted references in this IPR are all from the field of wireless telecommunications—specifically, cellular technology. Accordingly, I believe the definition proposed by Petitioner in the related IPR2024-01209 involving the ’104 Patent is more appropriate:

A POSITA would have been (1) someone knowledgeable in wireless networks, cellular radio systems, mobile communication devices and radio navigation systems, (2) having at least a bachelor’s degree in electrical engineering, with a background in radio frequency communications and/or navigation system technology as well as approximately two years of industry experience working on radio communication and/or navigation

systems.

See Google LLC v. Geoscope Technologies Pte. Ltd., IPR2024-01209, Paper 2 (Petition), at 13-14. I do agree with Petitioner here, however, that a bachelor's degree in computer science or a similar discipline would be acceptable as an alternative to electrical engineering, and that superior education could compensate for a deficiency in work experience, and *vice-versa*.

47. Consistent with the '104 Patent, this definition requires a POSITA to be knowledgeable in cellular radio systems and mobile communication devices. While cellular technologies have some overlap in the field of geolocation, and both fields are relevant in the context of the '104 Patent, the two fields are distinct. Implementing geolocation inventions in the context of cellular technologies would require someone with significant cellular background.

48. For example, the Bhattacharya reference used in this IPR adds geolocation to existing cellular technologies. *See, e.g.*, EX1005 [Bhattacharya], [0001] (“The present invention relates to telecommunications in general, and, more particularly, to a technique for estimating the location of a wireless terminal.”). Specifically, Bhattacharya adds a “location system 212” to an existing wireless telecommunications system. Compare EX1005 [Bhattacharya], Fig. 1 (existing wireless telecommunication system labelled “prior art”) to Fig. 2 (adding location system 212 to Fig. 1’s wireless telecommunication system.).

That is, Bhattacharya simply adds a location system 212 to existing wireless telecommunication systems (such as GSM, in Bhattacharya's preferred embodiments). *Id.*, [0051]-[0052]. This location system 212 performs the geolocation irrespective of the underlying GSM network. *See, e.g.*, EX1005 [Bhattacharya], [0059], [0064], [0065], Figs. 2-18.

49. Cellular technology often does not involve geolocation and geolocation often has nothing to do with cellular technology. I discuss this distinction further in section X.A.1 below.

50. Based on my background and experience, I am (and was as of 2007) at least a person of at least ordinary skill in the relevant art for the '104 Patent under either the definition Dr. Sundaresan was provided or the definition I propose above and was so at the time of the invention. As detailed further above, I have decades of experience in wireless networks, cellular radio systems, mobile communication devices and radio navigation systems.

VI. BACKGROUND OF THE TECHNOLOGY

51. The '104 Patent relates to the geolocation of mobile devices using RF signals and cellular technologies. EX1001, Abstract. Location-based services utilize geographic data to provide information to a user, or perform another function for a user, based on the user's location. EX2022 [Business News Daily]. Location-based services include, among other things, maps (e.g., pinpointing a

user's current location or the location of another individual for applications such as a driver for a rideshare application), navigation (e.g., driving directions), local search (e.g., looking for nearby restaurants or providing relevant search results for requests with local intent), social networking, and targeted advertising. *See, e.g.,* EX2022 [Business News Daily]. The '104 Patent's mention of "public safety groups" (EX1001 at 1:17) indicates one possible application for emergency services.

52. Location-based services for mobile devices generally rely on the mobile devices being able to determine their location through a process called "geolocation." EX1001 at 1:17-20. Geolocation is simply attempting to determine the location of a person or object. EX2023 [Dictionary.com] ("Geolocation: The process of determining the location of an electronic device, as a computer, cell phone, satellite, etc."). As of February 2007 (the filing date of the '379 Provisional), there were many methods for geolocation. The best-known method was, and still is, GPS, but many other methods are available, including using IP addresses, Bluetooth, cell phone towers, and Wi-Fi access points. EX2024 [Investopedia].

53. At the time of the invention, "there [was] a longstanding problem of providing high accuracy location data for mobile devices, such as mobile telephones." EX2027 [Shkedi], 1:19-21. One way a mobile device can be

geolocated is by using a GPS receiver. EX2024 [Investopedia]. This GPS-based location could then be transmitted to a base station or used locally on the device. However, GPS usually requires a line of sight between several GPS satellites and the mobile device. EX2025 [Leverage], 4-5. There are many situations (e.g., indoors) where GPS information may not be available or reliable. In those situations, the mobile device can still use other information to assist in determining the mobile device's location. For example, RF signals (e.g., cellular signals) will, to an extent, propagate indoors. This allows the mobile device to identify nearby base stations and the strength of the signals received from each nearby base station. This information can be used to help determine location.

54. At the time of the invention, geolocation using RF signals (e.g., cellular data, as opposed to, for example, GPS information) was of interest in the field. Many methods attempted to use RF signals to geolocate mobile devices, but generally had problems, including limited accuracy. *See* EX2026 [Spain '735], [0003] (“A second solution is to compute the location of the mobile unit based on the cellular network signaling parameters This information is typically accurate to hundreds of meters.”); *see also* EX2027 [Shkedi], 1:39-57; EX2028 [Laitinen], 2504 (angle of arrival techniques are “expensive to implement” and “impractical in microcell sites” while existing GSM methods “do not allow highly accurate signal timing measurements.”). In general, a mobile phone monitors

which cell site it is connected to, meaning that the mobile phone is usually somewhere near the active cell site, but accuracy might be on the order of several miles or more.

55. Some systems, like the '104 Patent, attempted to use cellular signals to provide more accurate geolocation. The '104 Patent relies on collecting “calibration data” from the relevant geographic region and saving this information into a “calibration database” where it is associated with a specific location. EX1001 ['104 Patent], 1:21-24, 1:36-40. Once the calibration data is available, mobile devices seeking their location can retrieve and use the calibration data to determine their location. At a high level, a mobile device at an unknown location can “observe” and measure nearby network signals and compare that observed data to the previously-collected calibration data in a database to determine its location. When the measured data matches calibration data, that indicates the location of the mobile device. Various methods can be used for this comparison which involves comparing the calibration data and the observed data. *See, e.g.*, EX1001 ['104 Patent], Figs 7-10.

56. For example, drive testing is performed whereby mobile devices travel through a region and record information such as the received signal strength from various nearby base stations associated with specific coordinates (e.g., through simultaneous GPS measurements). This information is saved into the

calibration database. Then, when a new mobile device passes through the region, it can “observe” data such as the received signal strength from nearby base stations and compare that observed data to the stored calibration data that is associated with coordinates. This allows the mobile device to determine its location even without GPS.

57. There are a number of reasons calibration data may not correspond to the data observed by a mobile device at the time it is seeking its location, even where the same base stations are involved. For example, variations in the environment (e.g., weather) can affect the observed data. Clouds or precipitation can reduce signal strength. As another example, during summer months, foliage can interfere with signals. One potential reason for discrepancies is that the mobile device was indoors—where the signal is weaker—when it collected the observed data.

VII. OVERVIEW OF THE ’104 PATENT

58. The Petition challenged claims 1-4 and 6-11 of the ’104 Patent. Pet., 1. I understand that PO has filed a statutory disclaimer of claims 1, 3, and 11. Ex2021. Accordingly, I understand these claims are no longer at issue and my opinions in this declaration are limited to claims 2, 4 and 6-10 of the ’104 Patent

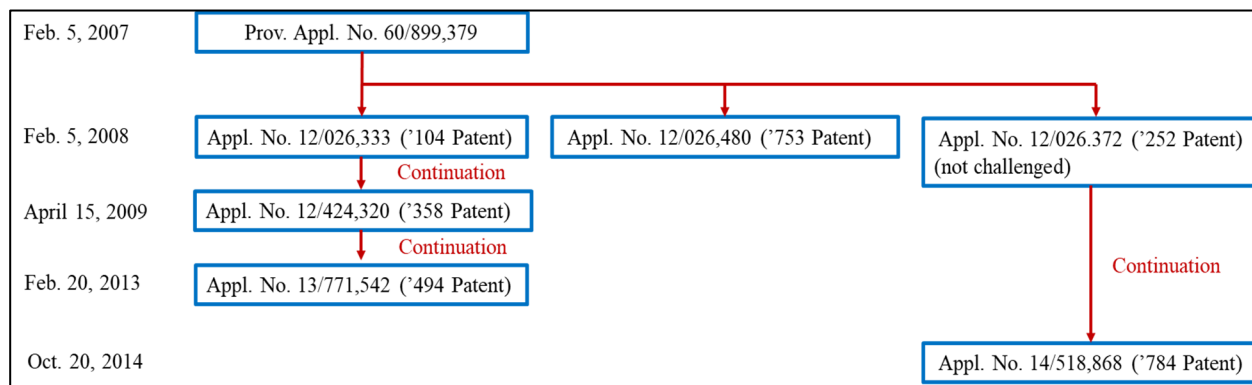
59. As discussed above, the ’104 Patent is directed to an invention for determining the location of a mobile device (or “geolocating”) using signal

information from wireless communications networks (*e.g.*, cellular signals). EX1001 at 1:46-54. To accomplish this, the claimed inventions recite providing a database of “calibration data” and collecting “network measurement data” observed by the mobile device. *Id.* at cl. 1. The observed network measurement data (*i.e.*, the data measurements made at the mobile device) is then modified to account for varying conditions and other variables that may be caused by, for example, environmental factors or signals propagating indoors. *Id.* at 3:43-49. Once modified, the observed network measurement data is compared with the database of calibration data to determine the location of the mobile device. EX1001 at 3:43-49.

60. The invention of the ’104 Patent addresses a particular problem in geolocation involving disparities between calibration data and observed data caused by “varying conditions and other operational variables” affecting how signals propagate in different environments, resulting in “poor estimated location accuracy.” EX1001 at 1:33-40, 9:35-39. One common reason for this disparity is that calibration data is “typically collected in an outdoor environment” because it is “time-consuming to perform calibration procedures indoors.” *Id.* at 1:24-32. However, geolocation within a building—using observed data collected indoors—is often desirable. *Id.* at 1:24-32. The differences in signal propagation outdoors versus indoors can make it difficult to perform an appropriate

comparison of calibration data (collected outdoors) to observed data for geolocation, especially where that observed data is collected indoors. EX1001 at 1:24-32. To solve this problem, the '104 Patent independent claims are directed to modifying the observed data measured by a mobile device to eliminate disparities with previously-gathered (outdoor) calibration data. *See id.* at cl. 1. The specification describes at length what these modifications may entail and how they are performed. *Id.* at 5:5-45, 5:58-6:52, 6:53-7:19.

61. I understand that the '104 Patent is part of a family of patents currently being challenged in several IPRs. The family relationship between these patents is shown below. As seen below, each patent in the family claims priority to, and incorporates by reference, the '379 Provisional:



A. Non-Uniform Grid Points

62. Dependent claim 2 of the '104 Patent further recites the use of what the patent refers to as “non-uniform grid points.” As explained below, the claimed

grid points of the '104 Patent are data structures that are generated from and associated with signal information based on evaluation of the similarities between calibration data that has been collected in a region. Because the grid points are generated based on the calibration data—rather than being predefined—their geographical boundaries, location, and associated signal information are not defined until determined from evaluation of the calibration data. The grid points serve as additional known locations associated with signal information, creating a denser “map” for mobile devices to compare observed data for the purpose of determining their location.

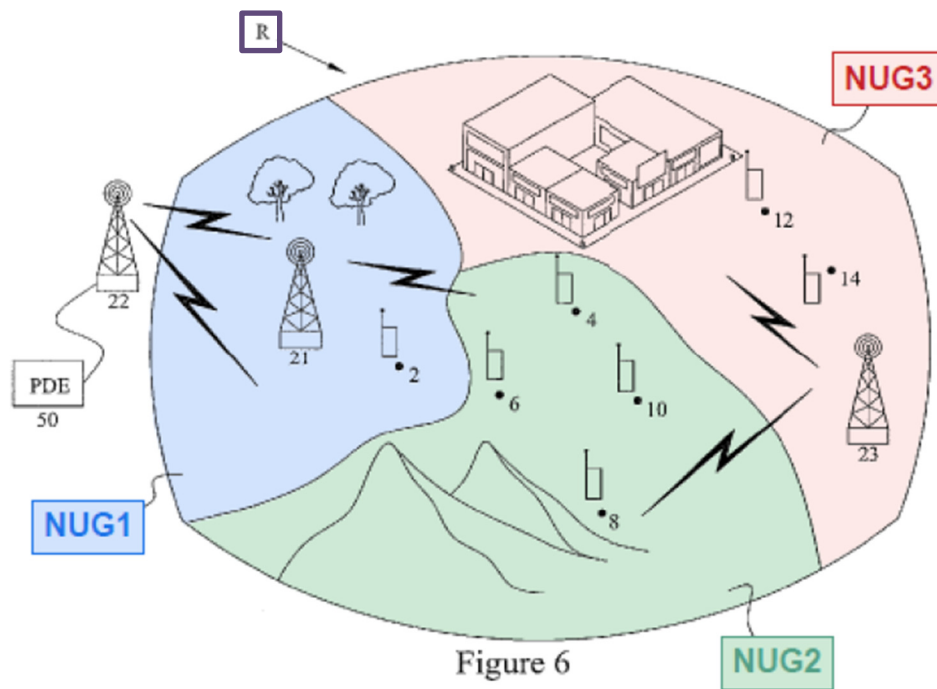
63. The grid points of the '104 Patent “usually will not be uniformly distributed throughout the geographic region.” EX2016 ['753 Patent] at 2:43-50; *see also* EX1001 at 3:50-60; EX2030 ['620 Patent].¹ Thus, the '104 Patent (and

¹ U.S. Patent No. 8,406,753 (EX2016, “'753 Patent”) and U.S. Patent No. 9,097,784 (EX2017, “'784 Patent”) claim priority to the same provisional application (U.S. Provisional Application No. 60/899,379 (EX2029; “'379 Provisional”) as the '104 Patent, and also describe “grid points” as the term is used in this patent family. The '379 Provisional is incorporated by reference in the '104 Patent (EX1001 at 1:6-9) and includes disclosures regarding “grid points” that are

related patents) uses the term “non-uniform grid points” or “NUGs” when describing grid points because the grid points are clusters of similar calibration data that do not have uniform geographic shapes. *Id.* That is, the claimed grid points “represent an area of collected calibration data” and “represent the signal characteristics and/or calibration data over a given region.” EX1001 at 3:50-60.

64. This is depicted in the related '784 Patent, which shows “a geographical region (R) having NUGs represented by NUG1, NUG2, and NUG3,” and explains “[a] NUG may be generated to represent the signal characteristics and calibration data over a given region.” EX2017 ['784 Patent] at 6:21-34.

also found in the '753 and '784 Patents. *See* EX2029 ['379 Provisional] at 5-7. Thus, in the Related Litigation, the district court relied on disclosures in the '753 Patent and '784 Patent in construing the term “grid point.” *See* EX2012 [Markman Order] at 19-20 (citing '753 Patent (as “Ex. E”) and '784 Patent (as “Ex. F”)).



Id. at Fig. 6 (annotated to show each NUG in geographical region R in a different color).

65. As seen in the figure, each NUG corresponds to a particular area within the entire “geographical region (R).” EX2017 [’784 patent] at Fig. 6, 6:21-34 (“A NUG may be generated to represent the signal characteristics and calibration data over a given region.”). And the calibration data associated with a particular NUG is representative of that area. For example, the subset of calibration data gathered in the region that is associated with NUG1 is representative of the area delineated by the boundaries of NUG1. EX2017 [’784 patent] at Fig. 6, 6:21-34.

66. Additionally, as seen in the figure, the boundaries for each NUG

differ, resulting in each NUG having a different shape and size. Consequently, the grid points are not uniform and look nothing like any conventional notion of a “grid.” This is because the boundaries of each grid point are defined by the calibration data itself. EX2029 [’379 Provisional] at 7; EX2016 [’753 patent] at 12:7-14. Calibration data associated with a grid point must represent the area encompassed by that grid point—*e.g.*, the calibration data associated with NUG1 represents the area within the boundaries of NUG1. EX2017 [’784 patent] at Fig. 6. Until that evaluation, the boundaries are undefined and the claimed grid point does not exist. As a result, the shape of each NUG is variable because it is based on evaluation of the calibration data—which itself varies throughout a region—rather than being predefined. This is stated explicitly in the ’379 Provisional incorporated by reference in the ’104 Patent as well as in the related ’753 Patent:

The NUGs fully cover the region R and each NUG has statistically similar data accumulated into itself. *The geometrical shape and the amount of data accumulated into such NUGs is seen to be variable since these are determined by the statistical similarity of the data allocated to a NUG.*

EX2029 [’379 Provisional] at 7 (emphasis added); *see also* EX1001 at 1:6-9 (stating that the ’379 Provisional is “incorporated by reference in its entirety” in the ’104 Patent).

The NUGs may fully cover the region R and each NUG may have statistically similar data accumulated into itself. *The geometrical*

shape (i.e., the shape defined by the union of locations of calibration points assigned to the NUG) and the amount of data accumulated into such NUGs is seen to be variable since these are determined by the statistical similarity of the data allocated to a NUG.

EX2016 [’753 Patent] at 12:7-14 (emphasis added).

67. Thus, a fundamental characteristic of a claimed grid point is that the geographical boundaries of the area it represents must be determined by evaluating the calibration data collected in a region. The related ’753 Patent further confirms this central aspect of the claimed grid points, explaining they are generated based on evaluation of measured calibration data:

The location of a wireless mobile device may be estimated using, at least in part, one or more pre-existing Network Measurement Reports (“NMRs”) which include calibration data for a number of locations within a geographic region. *The calibration data for these locations is gathered and analyzed so that particular grid points within the geographic region can be determined* and associated with a particular set or sets of calibration data from, for example, one or more NMRs.

EX2016 [’753 Patent] at Abstract, 9:34-39 (emphasis added).

68. This evaluation of calibration data involves determining which data are “statistically very similar” using “increasingly stringent tests of statistical sufficiency” such that they can be associated with (or “allocated to”) a particular grid point. EX2029 [’379 Provisional] at 6-7; EX2016 [’753 Patent] at 10:44-59.

The “[s]tatistical similarity” of the gathered calibration data can be evaluated to determine where a grid point should be generated, if one should be generated at all, and what subset of gathered calibration data should be allocated to it. EX2029 [’379 Provisional] at 6-7; EX2016 at 10:66-11:6. This “[s]tatistical similarity” in the calibration data can be evaluated using different types of statistical analyses including clustering tests, a probability density function, the mean and variance of the data, or other functions of the calibration data. EX2029 [’379 Provisional] at 6; EX2016 [’753 Patent] at 10:66-11:6, 12:4-14.

69. The way measured calibration data is evaluated and allocated to each grid point further shows why the boundaries of the grid points are variable and dependent on the calibration data. For example, the calibration data is evaluated to determine whether it “exhibit[s] clustering” and, based on that evaluation, is allocated to different grid points. EX2029 [’379 Provisional] at 6; EX2016 [’753 Patent] at 10:46-47. If clusters of data collected at different locations (referred to as “calibration points”) are “statistically very similar,” then the data for those calibration points is allocated to the same grid point. EX2029 [’379 Provisional] at 6; EX2016 [’753 patent], 10:55-59. If, however, these clusters of data are determined to be “sufficiently different,” then they are allocated to different grid points. EX2029 [’379 Provisional], 6; EX2016 [’753 patent], 10:50-55; EX2030 [’620 Patent], 6:22-27. Because the “geometrical

shape” of the area represented by a grid point is “defined by the union of locations of calibration points” allocated to it, this process of evaluating the calibration data to allocate it to different grid points defines the boundaries of that area. EX2029 [’379 provisional], 7; EX2016 [’753 Patent], 12:9-14.

VIII. SUMMARY OF ASSERTED REFERENCES

A. Bhattacharya

70. Bhattacharya is in the field of “telecommunications in general.” EX1005, [0001]. Bhattacharya describes a “process and machine for estimating the location of a wireless terminal” by “comparing the signal strength [the wireless terminal] currently observes against a map or database that correlates locations to signal strengths.” *Id.*, Abstract. Bhattacharya adds a “location system 212” to an existing cellular network to use signal strength measurements performed as part of preexisting cellular protocols to attempt to estimate the location of the wireless terminal. EX1005 [Bhattacharya], [00051]; EX2020 [Sundaresan Dep. Tr.], 69:5-9 (“Q ... So what Figure 2 [of Bhattacharya] is adding that differentiates it over the prior art according to Bhattacharya is location system 212, correct? A Correct.”). This estimation is performed by location system 212. EX1005 [Bhattacharya], [0059], [0064], [0065], Figs. 2-18; EX2020 [Sundaresan Dep. Tr.], 69:10-12 (“Q Location system 212 estimates the location of the wireless terminal 201, correct? A Correct.”).

71. In the estimation process performed by Bhattacharya's location system 212, an "Expected Signal-Strength Database" is first populated by overlaying "a rectangular grid of X by Y tessellated squares [] onto geographic region" with the "center of each square represent[ing] a location." *Id.* at [0105]-[0106]. Expected signal strength functions are "generated based on a combination of: (i) a plurality of theoretical radio-frequency propagation models, and (ii) a plurality of empirical signal-strength measurements" for locations in the geographic region. *Id.* at [0115]-[0117]. To estimate the location of a wireless terminal, Bhattacharya describes a process of comparing signal-strength measurements against the database of expected signal strengths through a series of "computationally intense" subtasks (i.e., Bhattacharya's subtasks 1702-1705) relating to generating a "current probability distribution" and "cumulative probability distribution." *Id.* at [0172]-[0173], [0179], [0189], [0195]. In the final step, the location of the wireless terminal is estimated "based on the normalized cumulative probability distribution." *Id.* at [0207].

B. Spain

72. Spain is in the field of "telecommunications in general." EX1007, [0001]. Spain describes a "technique for estimating the location of a wireless terminal at an unknown location in a geographic region" that is "based on the recognition that there are traits of electromagnetic signals that are dependent on

topography, the receiver, the location of the transmitter, and other factors.” EX1007 at Abstract. Spain describes a process of creating a “Trait-Correction Database” comprising information needed by the location server “to be aware of systemic measurement errors and to correct them,” such as the make and model of the wireless terminal. *Id.* at [0148]. Spain explains that “[f]or example, one make and model of wireless terminal is known to erroneously measure and report the signal strength of signals by -2 dB” and therefore, if the location server “adds 2 dB to the measurements from that make and model of wireless terminal, the likelihood that location server [] would erroneously estimate the location of the wireless terminal would be reduced.” *Id.* at [0147]. Spain then describes generating probability distributions for the location of a given wireless terminal based on “comparing the measurements of traits associated with [a] wireless terminal.” *Id.* at [0181], [0208]-[0214]. As shown below, Spain also describes partitioning a “geographic region 220” into different locations based on a number of factors such as “natural and man-made physical attributes” of the region, “legal laws governing” the region, and “patterns of the location and movement of people and vehicles” within the region:

[0086] In accordance with the illustrative embodiment, the boundaries of each location are based, at least in part, on:

[0087] i. natural and man-made physical attributes of geographic region 220 (e.g., buildings, sidewalks, roads, tunnels, bridges, hills, walls, water, cliffs, rivers, etc.),

[0088] ii. legal laws governing geographic region 220 (e.g., laws that pertain to the location and movement of people and vehicles, etc.),

[0089] iii. theoretical predictions and empirical data regarding the location and movement of individuals and groups of people and vehicles in geographic region 220,

[0090] iv. the desired accuracy of the estimates made by location server 214, and

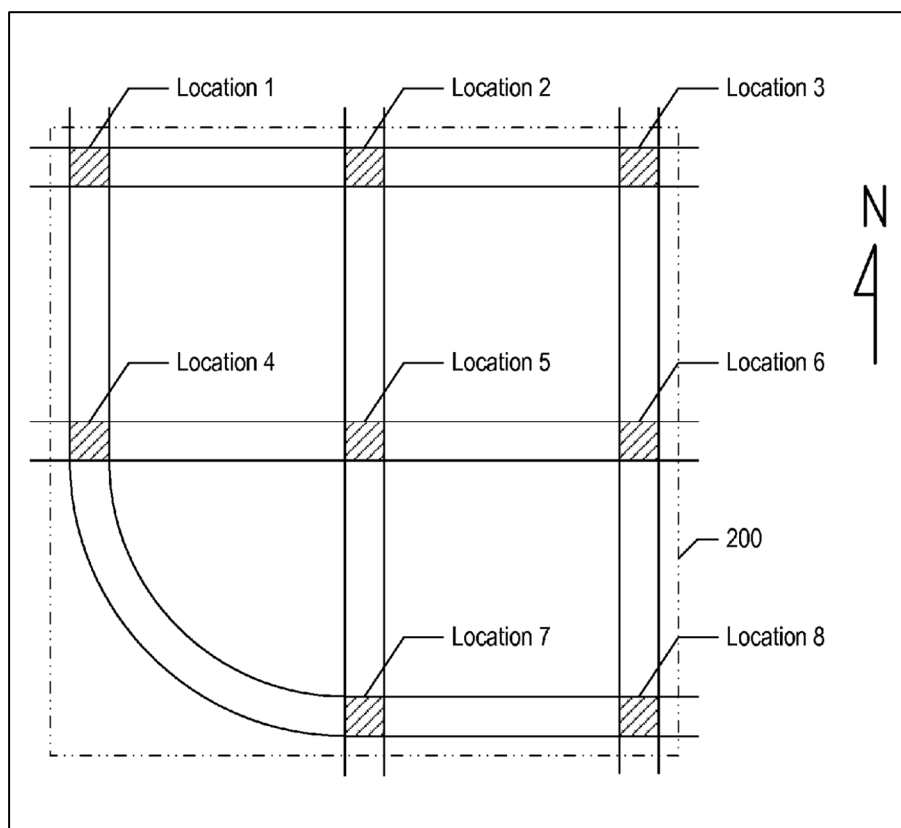
[0091] v. patterns of the location and movement of people and vehicles within geographic region 220,

[0092] vi. the calendrical time T, and

[0093] vii. the environmental conditions N,

Id. at [0072], [0086]-[0093]; see also *id.* at [0094]-[0099].

73. Thus, the partitioning in Spain is not based on calibration data such as measured strengths of network signals. Rather, as is apparent from this disclosure, the partitioning is based on environmental conditions that are independent of any calibration data. This is consistent with the partitioning merely being an overlay on a geographic region independent of any calibration data, as shown in Spain's figures:



Id. at Fig. 6c; see also *id.* at Figs. 6a, 6b, 6d-6k.

74. Spain also emphasizes that the partitioning is a function of the desired accuracy and “computational burden,” further demonstrating that the partitioning is also based on factors determined by the operator of the system, but not based on measured calibration data. *Id.* at [0094]-[0097].

C. Zeng

75. Zeng is an excerpted chapter from the Handbook of Wireless Networks and Mobile Computing. EX1006 at 1. Zeng explains the concept of handoffs in wireless mobile networks. EX1006 at 1. Zeng explains that a “handoff” in this context is “the process of changing the channel (frequency, time

slot, spreading code, or combination of them) associated with the current connection while a call is in progress.” *Id.* Zeng further describes various “handoff schemes” that can be used in cellular technologies. *Id.* at 4-5. Zeng is an overview document that is not tied to any specific cellular standard and does not discuss navigation or geolocation.

IX. CLAIM CONSTRUCTION

76. I understand PO is proposing the following terms for construction in its POR:

Term	Proposed Construction
“calibration data”	“modified or unmodified network measurement data associated with a geographic location”
“Grid Point” or (alternately) “Non-Uniform Grid Point” (claim 2)	“a point associated with representative calibration data for an area whose boundaries are determined from evaluation of the calibration data.”

77. As discussed in more detail below, I agree with PO’s constructions.

78. I understand the Petition listed the district court’s constructions for the terms “calibration data,” “observed network measurement data” and “grid point.” Pet., 2-3. The Institution Decision construed the term “grid point” but declined to construe any other term “because doing so would have no effect on our analyses below.” D.I., 9. For purposes of this declaration, I have not opined on “observed network measurement data.”

A. “Calibration Data”

79. I understand that PO proposes the following construction for “calibration data”:

Term	Proposed Construction
“calibration data”	“modified or unmodified network measurement data associated with a geographic location”

80. This is the same construction adopted by the district court and adopted in the Petition. Pet., 2; EX2012 [Markman Order], 6-8. The construction is consistent with my understanding of “calibration data” in view of the intrinsic record. The ’104 Patent improves the location accuracy of a mobile device by collecting “calibration data” at defined, known locations, which are then stored in a database for further use. See EX1001 [’104 Patent] at 1:21–3:11, 11:65–12:15. “Calibration data” includes network measurement data such as “signal strength, round trip time, time difference of arrival (TDOA), etc.” *Id.*, 1:21-24. The ’104 Patent similarly describes the calibration database as “a collection of data from . . . grids that contain network measurements with associated location estimates.” EX1001 [’104 Patent] at 10:55–58. *See, e.g., id.*, 1:47-50.

81. This construction is consistent with my understanding that calibration data is essentially mobile optimization data that measures network signal characteristics by, for example, driving a mobile device to different

locations served by a cell and recording the network data at those various locations. EX2031 [Applus]. There can be other methods of performing calibration data, such as crowd sourcing the calibration data. These tests are performed as part of network design and optimization—that is, wireless providers perform this testing to ensure their wireless networks provide the best possible service for customers. *Id.* Network measurement data such as signal strength, round trip time and TDOA are some of the types of data that would be measured and recorded by a drive test. Thus, in my opinion, “calibration data” is “network measurement data associated with a geographic location.”

B. “Non-Uniform Grid Point”

82. I understand that PO proposes the following constructions for “grid point” or, alternately, “non-uniform grid point”:

Term	Proposed Construction
“Grid Point” or (alternately) “Non-Uniform Grid Point” (claim 2)	“a point associated with representative calibration data for an area whose boundaries are determined from evaluation of the calibration data.”

83. I understand that in the Institution Decision, the Board construed “grid point” as “a point associated with representative calibration data for an area,” which is nominally the same construction adopted by the district court in the Related Litigation. D.I. at 9; EX2012 [Markman Order]. I also understand that

the Institution Decision preliminarily construed “non-uniform grid points” as “grid points that are non-uniformly spaced throughout a geographic region.” *Id.* at 28.

84. In my opinion, the district court’s use of the phrase “representative calibration data for an area” requires that the claimed grid points be generated based on evaluating the measured calibration data. *Infra* § IX.B.1. That is, the ’104 Patent starts with a calibration database and then forms grid points based on that calibration data.

85. The claim term “*non-uniform* grid point” also requires this construction. A fundamental aspect of the claimed non-uniform grid points is that they represent a particular area, within a broader region, that is determined by evaluating calibration data that has been previously gathered in that region and grouping similar clusters of calibration data together to form non-uniform grid points. *Infra* § IX.B.2.

1. The District Court’s Construction of “Grid Point” Requires Evaluation of Calibration Data to Determine the Boundaries of the Area Represented by a “Grid Point”

86. The district court construed “grid point” as “a point associated with representative calibration data for an area.” Ex2012 [Markman Order] at 18-20. In its *Markman* Order, the district court expanded on what this construction means in the context of the ’104 Patent and related patents that use the same term.

87. The district court adopted the phrase “representative calibration data for an area” in its construction of “grid point.” In doing so, the district court explained that “Defendants’ [Petitioner’s] use of ‘representative calibration data’ is intended to reflect that *the defining characteristic of a NUG region*—as explained in the specifications of the ’753 Patent, ’104 Patent, and [’784] Patent—*is that the data points within an area are all ‘statistically very similar’* such that each of the grid points within the NUG region can represent the overall NUG.” EX2012 [Markman Order] at 20 (emphasis added) (citing EX1001 at 3:56-60; EX2016 [’753 Patent] at 10:29-11:7; EX2017 [’784 Patent] at 6:22-28). Thus, the district court explained that it selected Petitioner’s construction because the “defining characteristic” of a NUG is that the calibration data associated with a grid point are “statistically very similar” such that the calibration data are representative of the area encompassed by the NUG. As discussed below, the data points within a NUG are statistically very similar because the NUG is formed by grouping similar data points together to form a larger area. Thus, the NUGs are a conglomeration of a number of data points with similar calibration data.

88. Further, the district court construction requires that a “grid point” must be associated with calibration data that is *representative for an area*. This requires that the boundaries of the area represented by a given grid point be determined by evaluating the calibration data so that the subset of data associated

with that grid point is representative of that area. That is, the boundaries and shape of the NUG (i.e., the area) are formed by grouping data points with similar calibration data together.

89. The '379 Provisional—which is incorporated by reference in the '104 Patent (EX1001 at 1:6-9)—and the related '753 Patent describe this as involving the evaluation of statistical similarities across the set of calibration data gathered within a region, and teach examples of the statistical analyses used to generate the claimed grid points from this calibration data. EX2029 ['379 Provisional] at 6 (“If the aggregated cluster is statistically very similar to either of the first clusters, the data for the two calibration points are allocated to the same NUG”), 7 (“The NUGs fully cover the region R and each NUG has statistically similar data accumulated into itself”); EX2016 ['753 Patent] at 10:39-65, 12:4-14. Similarly, the '379 Provisional and '753 Patent teach examples of the statistical analyses used to generate the claimed grid points from this calibration data. EX2029 ['379 Provisional] at 6; EX2016 ['753 Patent] at 10:66-11:6. This is done in the '379 Provisional by evaluating “data vectors at a particular calibration point.” EX2029 ['379 Provisional] at 6. This calibration point becomes “the root of the NUG.” *Id.* Then, the data vector is compared against data vectors of other calibration points. *Id.* If the two data vectors “exhibit tight clustering, the data for the next candidate calibration point is aggregated to the

former.” *Id.* Thus, the NUG consists of a number of calibration points that are “statistically very similar.” *Id.* The representative calibration data for an area is a subset of the calibration data that is collected through a broader region. EX2017 [’784 Patent] at Fig. 6, 6:21-34 (depicting geographical region (R), where calibration data is collected, divided into different areas each associated with a different grid point (NUG1, NUG2, and NUG3)); EX1001 at 3:50-60 (describing same).

90. Thus, in my opinion, the district court’s construction requires evaluating the calibration data to determine the boundaries of the area represented by a grid point so that “representative calibration data for [the] area” can be associated with particular grid points. If the calibration data is not evaluated, the “representative calibration data for an area” cannot be defined, and thus cannot be associated with a point.

91. The district court also stated that the ’753 Patent’s explanation that “calibration data for a number of locations” is “gathered and analyzed so that particular grid points within the geographic region can be determined and associated with a particular set or sets of calibration data” demonstrates “what *must be done* to arrive at a grid point or set of grid points.” EX2012 [Markman Order] at 19 (quoting ’753 Patent at Abstract) (emphasis in original). This further demonstrates the district court’s recognition that generating a grid point involves

evaluating calibration data, as reflected in its use of the phrase “representative calibration data for an area” in its adopted construction.

92. In my opinion, how the claimed grid points are generated is fundamental to what they are—they consist of aggregated data points with calibration data containing similar statistical properties. Thus, they must be generated based on evaluation of the calibration data so that they are representative of a particular area. The boundaries of the area represented by a given grid point—and thus, the shape of that area—are not defined until the calibration data is evaluated. EX2029 [’379 Provisional] at 7 (“The *geometrical shape* and the amount of data accumulated into such NUGs *is seen to be variable since these are determined by the statistical similarity of the [calibration] data allocated to a NUG.*”) (emphasis added).

93. In my opinion, the intrinsic evidence confirms that how the claimed grid points are generated is an essential characteristic of what they are. *See infra* § IX.B.2. For example, the ’379 Provisional extensively describes the generation of grid points, explaining that “[t]he evaluation of data vectors is of great importance since it is fundamental to the method.” EX2029 [’379 Provisional] at 6. Similarly, the related ’753 Patent describes in detail how grid points are generated so that they can serve their purpose of representing a given area. EX2016 [’753 Patent] at 10:39-11:6, 12:4-14.

94. For these reasons, the district court’s construction of “grid point,” which Petitioner has proposed and the Board adopted for purposes of institution, requires that a grid point—including the boundaries of the area represented by that grid point—be determined from evaluation of calibration data. Thus, the “non-uniform grid points” claimed in the ’104 Patent have this same requirement.² As explained further below, this requirement is also supported by the intrinsic evidence. *Infra* § IX.B.2.

2. In the Alternative, the Board Should Adopt a Construction of “Non-Uniform Grid Point” that is Supported by the Intrinsic Evidence

95. For the reasons set forth above, the district court’s construction of “grid point” necessarily requires that the calibration data be evaluated to determine the boundaries of the area represented by a “grid point” so “representative calibration data for [the] area” can be associated with the “grid point.” *Supra* § IX.B.1. And this requirement is similarly applicable to “non-uniform grid points.” *Id.*

96. To the extent the Board disagrees with PO’s construction of “grid

² The Institution Decision construed “non-uniform grid points” as “grid points that are non-uniformly spaced throughout a geographic region,” recognizing that “non-uniform grid points” incorporate the requirements of “grid points.” D.I. at 28.

point,” the claim term “non-uniform” in front of “grid point” clarifies that “non-uniform grid point” should be construed as “a point associated with representative calibration data for an area whose boundaries are determined from evaluation of the calibration data.”

97. In my opinion, the claim language supports this construction. The use of the claim term “non-uniform” means that the area covered by each grid point is not uniform—*i.e.*, the shapes, sizes and boundaries of the non-uniform grid points are different. EX1001 at cl. 2. Further, claim 2 requires that the “[calibration] database” comprises “previously-gathered calibration data for one or more non-uniform grid points within said region.” *Id.* Thus, the claim language, consistent with PO’s construction, requires assigning the calibration data gathered over a predetermined region to “one or more non-uniform” grid points. *Id.* at cls. 1, 2.

98. The specification also supports this construction. The ’104 Patent explains that a “non-uniform grid point (NUG) may represent the signal characteristics and/or calibration data over a given region” such that each NUG “represent[s] an area of collected calibration data.” EX1001 at 3:50-56. The boundaries of the area represented by a non-uniform grid point—which define the shape of that area—are variable because they are based on evaluation of statistical similarities across the gathered calibration data.

99. The '379 Provisional explains this fundamental aspect of the claimed non-uniform grid points (or NUGs):

The NUGs fully cover the region R and each NUG has statistically similar data accumulated into itself. *The geometrical shape and the amount of data accumulated into such NUGs is seen to be variable since these are determined by the statistical similarity of the data allocated to a NUG.*

EX2029 ['379 Provisional] at 7 (emphasis added); *see also* EX1001 at 1:6-9 (stating that the '379 Provisional is “incorporated by reference in its entirety” in the '104 Patent).

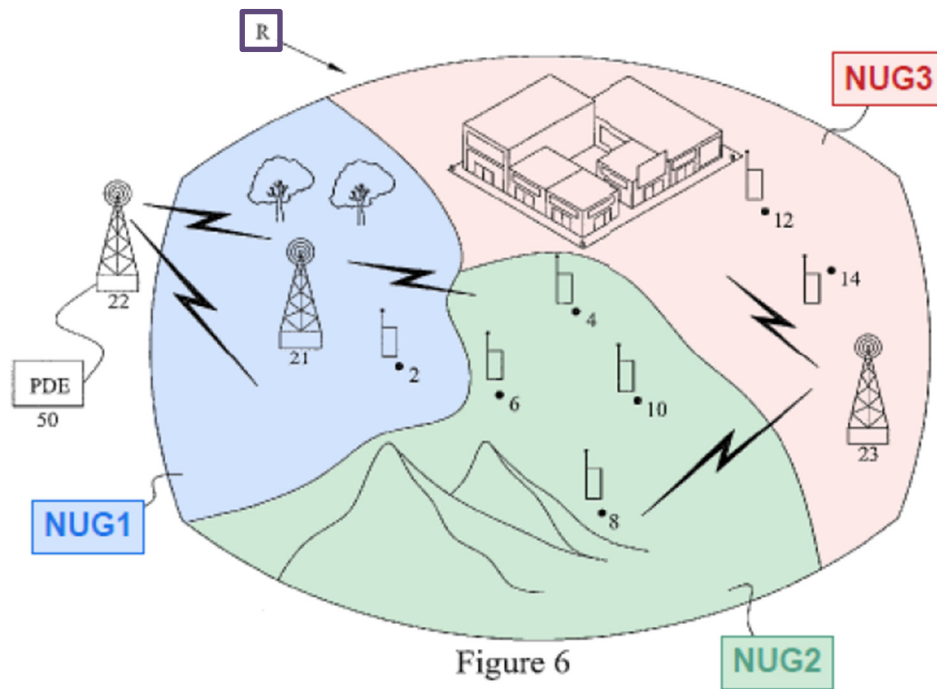
100. The related '753 Patent also describes this critical aspect of the claimed non-uniform grid points (or NUGs):

The NUGs may fully cover the region R and each NUG may have statistically similar data accumulated into itself. *The geometrical shape (i.e., the shape defined by the union of locations of calibration points assigned to the NUG) and the amount of data accumulated into such NUGs is seen to be variable since these are determined by the statistical similarity of the data allocated to a NUG.*

EX2016 ['753 Patent] at 12:7-14 (emphasis added). Thus, a NUG's shape and size are determined by the “statistical similarity of the data allocated to a NUG.” *Id.*

101. NUGs are similarly depicted in Figure 6 of the related '784 Patent, which shows “a geographical region (R) having NUGs represented by NUG1,

NUG2, and NUG3.”



EX2017 [’784 Patent] at Fig. 6 (annotated to show each NUG in geographical region R in a different color), 6:14-15 (“Grid points (e.g., NUGs) are another way to organize and/or realize information related to a wireless networking environment”); 6:21-34 (“A NUG may be generated to represent the signal characteristics and calibration data over a given region.”); EX2030 [’620 Patent].

102. As shown in the annotated figure, each NUG corresponds to an area that is part of a broader region (R). EX2017 [’784 Patent] at Fig. 6; *see also supra* § VII.A (further describing the claimed grid points of the ’104 Patent). Calibration data is gathered at different locations in this broader region and then analyzed to define grid points that divide the region into different areas represented by each

grid point. EX2016 ['753 Patent] at 2:31-35 (“The calibration data for these locations [within a geographic region] must be gathered and analyzed so that particular points (e.g., ‘grid points’) within the geographic region can be determined and associated with a particular set or sets of calibration data from, for example, one or more NMRs.”). Thus, each NUG has a different shape and size and represents a different set of calibration data.

103. Because non-uniform grid points “represent an area of collected calibration data” (EX1001 at 3:56-60)—and thus are associated with representative calibration data for an area—the boundaries of this area must be defined. As discussed above, the NUG boundaries are determined based on evaluation of the calibration data. EX2029 ['379 Provisional] at 7 (“The geometrical shape and the amount of data accumulated into such NUGs is seen to be variable since these are determined by the statistical similarity of the data allocated to a NUG.”); *see also supra* § VII.A. This allows the size and shape of each non-uniform grid point to be tailored to the broader region where the calibration data is collected so that the region can be divided into areas represented by such grid points.

104. The specification similarly describes the evaluation of calibration data that occurs to generate a non-uniform grid point. The '379 Provisional states that “[t]he evaluation of the [calibration] data vectors is of great importance since

it is fundamental to the method” of generating the claimed grid points. EX2029 [’379 Provisional] at 6; *see also* EX1001 at 1:6-9. The ’379 Provisional further explains that the data is evaluated “using increasingly stringent tests of statistical sufficiency.” EX2029 [’379 Provisional] at 6; *see also* EX1001 at 1:6-9. The “[s]tatistical similarity” of the gathered calibration data is evaluated to generate a grid point, which includes defining the area it represents and associating it with calibration data that is representative of that area. EX2029 [’379 Provisional] at 6-7; *see also* EX1001 at 1:6-9. Multiple methods of evaluating statistical similarities across the calibration data may be used to allocate calibration data to different grid points. EX2029 [’379 Provisional] at 6 (referring to “clustering tests” and “K-means algorithm”); *see also* EX1001 at 1:6-9. For example, calibration data is evaluated to determine whether it “exhibit[s] clustering.” EX2029 [’379 Provisional] at 6. Clusters of data collected at different “calibration points” that are determined, based on this evaluation, to be “statistically very similar” are allocated to the same grid point while clusters of data that are “sufficiently different” are allocated to different grid points. EX2029 [’379 Provisional] at 6; *see also* EX1001 at 1:6-9. Thus, the intrinsic record is teaching that NUGs are formed by aggregating statistically similar calibration data into larger clusters.

105. The result of this evaluation and allocation of data to each non-

uniform grid point is that each grid point has “statistically similar data accumulated into itself”—*i.e.*, each claimed grid point is associated with representative calibration data for an area. EX2029 [’379 Provisional] at 7; *see also* EX1001 at 1:6-9. Additionally, the allocation of subsets of calibration data collected at various locations within a region to different non-uniform grid points defines the areas represented by each grid point. Consequently, the “geometrical shape” (*i.e.*, boundaries) of the area represented by a particular non-uniform grid point is “determined by the statistical similarity of the data” allocated to a grid point, which is based on evaluation of the calibration data. EX2029 [’379 Provisional] at 7; *see also* EX1001 at 1:6-9. The related ’753 Patent reiterates this as well. EX2016 [’753 Patent] at 10:66-11:6, 12:7-14.

106. For these reasons, in my opinion, a POSITA would understand, in view of the intrinsic evidence, that the term “non-uniform grid point” as used in the ’104 Patent means “a point associated with representative calibration data for an area whose boundaries are determined from evaluation of the calibration data.” As explained above, the district court’s construction of “grid point” requires that the boundaries of the area represented by a grid point be determined from evaluation of the calibration data. *Supra* § IX.B.1. Nonetheless, if the Board concludes otherwise, it should adopt this proposed construction for “non-uniform grid point.”

X. PETITIONER FAILS TO MEET ITS BURDEN TO PROVE THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE

107. As discussed above, Dr. Sundaresan states “*I have been informed* that a person of ordinary skill in the art (‘POSITA’) had at least a Bachelor’s degree in electrical engineering, computer science, or a similar discipline, and at least two years of experience in the field working with navigation and/or geolocation systems”:

IV. LEVEL OF ORDINARY SKILL IN THE ART

8. I have been informed that a person of ordinary skill in the art (“POSITA”) had at least a Bachelor’s degree in electrical engineering, computer science, or a similar discipline, and at least two years of experience in the field working with working with navigation and/or geolocation systems. Superior education could compensate for a deficiency in work experience, and *vice-versa*. Based on my experiences, I have a good understanding of the capabilities of a POSITA. I have taught, mentored, advised, and collaborated closely with many such individuals over the course of my career.

EX1003 [Sundaresan Decl.], ¶8.

108. Dr. Sundaresan does not indicate that he has analyzed the definition he was provided or adopted it as his own. Thus, Dr. Sundaresan does not provide his *opinion* on level of ordinary skill.

109. Nor is it clear from Dr. Sundaresan’s declaration what he believes the alleged field of pertinent art is. The field here broadly defined is telecommunications and more narrowly defined could be described as using cellular or wireless networks to perform geolocation.

A. Petitioner’s Rationales For Combining Fail

**1. Petitioner’s POSITA lacks the background to combine
Bhattacharya with Zeng**

110. In my opinion, a POSITA as defined at paragraph 8 of the Sundaresan Declaration does not necessarily have the requisite level of skill to combine the asserted references.

111. Paragraph 8 of the Sundaresan Declaration defines a POSITA as a person with “at least a Bachelor’s degree in electrical engineering, computer science, or a similar discipline, and at least two years of experience in the field working with navigation and/or geolocation systems.” EX1003 [Sundaresan Decl.], ¶8.

112. The ’104 Patent and asserted references are directed to telecommunications and cellular technology. EX2029 [’379 Provisional], [0001] (“The present invention relates to telecommunications in general”); EX1006, Title (“Handoff in Wireless Mobile Networks”); EX1007, [0001] (“The present invention relates to telecommunications in general”). Bhattacharya and Spain are telecommunications patents that disclose cellular systems that can be used for

geolocation applications. EX 1005 [Bhattacharya], Title (“Estimating the location of a wireless terminal based on calibrated signal-strength measurements”); EX1007 [Spain], Title (“Estimating the location of a wireless terminal based on non-uniform locations”). Zeng is strictly a cellular reference that does not involve geolocation or navigation. EX1006 [Zeng], Title (“Handoff in Wireless Mobile Networks”). As such, someone seeking to combine these references would need significant experience working with cellular technologies.

113. A POSITA with experience in navigation and geolocation does not necessarily have experience in cellular technologies or telecommunications. EX1003 [Sundaresan Decl.], ¶8. Such a person may not have a background with cellular technologies and may not be familiar with concepts such as handoffs and signal strength measurement reports in wireless mobile networks. These are not trivial concepts; wireless standards are very complex and are debated and revised by experts in the field for years before being adopted. *See, e.g.*, <https://www.etsi.org/technologies/mobile/mobile>.

114. Petitioner argues that “[w]hile lacking specific handoff operations performed by the wireless switching center 211, Bhattacharya acknowledges that such operations are performed in a ‘well known fashion.’” Pet., 24. But Bhattacharya is referring to handoff operations that would be “well known as part of the GSM protocol and the mobile-assisted hand-off process.” EX1005

[Bhattacharya], [0095]. The “GSM protocol” is a cellular standard, and the “mobile-assisted hand-off process” is part of cellular technologies. EX2032 [Techtarget]; EX1006 [Zeng]. Thus, Bhattacharya is referring to technology that would be “well-known” to a POSITA with a background in cellular technologies, not necessarily a POSITA with a background in navigation and geolocation technologies. A POSITA with a background in navigation and geolocation may not be familiar with the mobile-assisted hand-off process of the GSM protocol and if that were the case would not understand how to perform specific handoff operations.

115. Similarly, Petitioner argues that “Bhattacharya itself provides the motivation to a POSITA to seek well-known handoff functionality beyond its disclosure given recognition that such functionality enables location estimation ‘when a wireless terminal is near the boundary of one or more systems.’” Pet., 24 [quoting EX1005, [0054]]. But Bhattacharya paragraph 54 is not talking about handoff functionality between two base stations; it is discussing obtaining signal strength measurements from two adjacent systems. EX1005 [Bhattacharya], [0054] (“The illustrative embodiment comprises one wireless switching system, but after reading this disclosure it will be clear to those skilled in the art how to make and use alternative embodiments of the present invention that use two or more systems.”). Bhattacharya goes on to provide an example using signals from

the IS-41 cellular telecommunications systems protocol. *Id.* IS-41, also known as ANSI-41, is “an Inter Cellular Network Communication Protocol which was developed to support interoperability between differing networks for mobile telephony.” EX2033 [Telecom ABC]. A POSITA who is not “skilled in the art” of cellular telecommunications systems and would not be familiar with IS-41 or understand its messaging structure.

116. Petitioner argues that “A POSITA would have perceived this teaching to be relevant to Bhattacharya’s wireless switching center 211, which is ‘capable of relaying [] packet data’ and implements the mobile-assisted hand-off process.” Pet., 25 (quoting EX1005 [Bhattacharya], [0095]). Again, Bhattacharya [0095] is discussing the GSM protocol. A POSITA with expertise in “navigation and/or geolocation systems” (EX1003 [Sundaresan Decl.], ¶8) and no experience in cellular technologies would not be familiar with “wireless switching” or “mobile-assisted hand-off process[es]” of the GSM protocol.

117. Petitioner states that “a POSITA would have incorporated handoff functionality into the improved wireless switching center in a manner that preserves other functionality described in Bhattacharya, such as ‘forward[ing] the [Signal-Strength Measurement Reports (SSMR)] to location system 212.’” Pet., 26 (quoting EX1005 [Bhattacharya], [0095]). Again, a POSITA with a background limited to navigation and geolocation would not have the background

to understand handoff functionality in wireless switching, let alone understanding concepts such as preserving SSMR forwarding.

118. The Petition goes on to state “Since Bhattacharya teaches transmitting signal-strength measurements in the form of SSMRs, a POSITA would have leveraged the use of SSMRs in configuring handoff functionality and location estimation functionality in the improved wireless switching center.” Pet., 26. SSMRs and handoff functionality are cellular technology concepts that have nothing to do with “navigation and/or geolocation systems.” EX1003 [Sundaresan Decl.], ¶8. Thus, a POSITA under this definition does not necessarily have a basis for “leveraging the use of SSMRs in configuring handoff functionality.”

2. Petitioner’s proposed combination misinterprets Bhattacharya and Zeng

119. Petitioner seeks to combine the handoff functionality described in Zeng into Bhattacharya to “enable[] an improved wireless switching center ... to thereby improve service ‘when a wireless terminal is near the boundary of one or more systems’ (as described in Bhattacharya).” Pet., 25 (citing EX1005 [Bhattacharya], [0054]). But Petitioner misinterprets Bhattacharya [0054]. Bhattacharya paragraph [0054] is not concerned with improving service or handing off within a cellular system. Instead, it is concerned with obtaining signal-strength measurements from two or more nearby wireless telecommunications systems to help estimate the location of the wireless terminal.

120. That is, Bhattacharya [0054] discloses that Bhattacharya's wireless switching center 211 can send "the IS-41 protocol messages HandoffMeasurementRequest and Handoff MeasurementRequest2 to a second wireless switching center in an adjacent system to request a response from the second wireless switching center. But the wireless switching center is not requesting a handoff; it is requesting a measurement signal from the second system. EX2020 [Sundaresan Dep. Tr.], 73:11-15. ("Q [] the wireless switching center in [Bhattacharya [0054]] isn't concerned about the hand-over for purposes of the Bhattacharya. It's concerned with getting the signal strength measurements, correct? A Correct."). The mobile station then performs a signal strength measurement on the response message from the second system. Thus, Bhattacharya [0054] is teaching how to get additional signal strength information from neighboring systems.

121. While the HandoffMeasurementRequest and HandoffMeasurementRequest2 messages could potentially be used to help determine whether to initiate a handoff to another system in the cellular system, that is not what Bhattacharya is using them for. EX2020 [Sundaresan Dep. Tr.], 73:8-10 ("A Yeah. You don't have to execute a hand-over but these messages facilitate a hand-over process."). Instead, Bhattacharya is using the signal strength of these messages to assist in location determination. Thus, Bhattacharya is not

concerned with improving handoffs in wireless mobile networks. A POSITA would have no reason to look to Zeng to solve a cellular network issue that Bhattacharya does not address.

122. Moreover, the Zeng reference does not discuss adjacent cellular systems. EX1006 [Zeng]. Instead, it discusses handoff between base stations that appear to be in the same network or system. Zeng Fig. 1.1 below illustrates this:

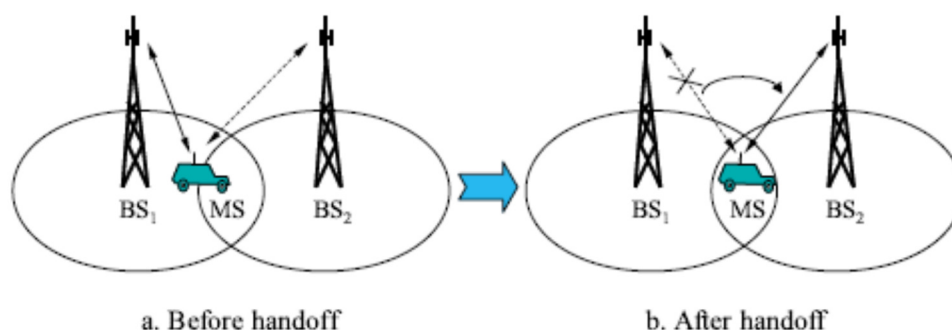


Figure 1.1 Hard handoff between the MS and BSs.

123. Thus, a POSITA would not look to Zeng to improve the functionality described at Bhattacharya [0054] because Zeng is directed to cellular handoffs between two base stations in the same system. Bhattacharya [0054] is directed to measuring signal strengths from two different systems for the purposes of estimating location.

124. Petitioner provides two examples of its hypothetical “Bhattacharya-Zeng” combination. Pet., 27, 28. These examples use Zeng to perform handoff in a cellular system and have nothing to do with determining location. *Id.* While Petitioner’s examples forward the received SSMR to location system 212 in what

Petitioner notes as step (4), there is no explanation of how Zeng's handoff determination is involved with or relevant to location system 212, which performs Bhattacharya's location estimation.

125. Indeed, "handoff is the process of changing the channel (frequency, time slot, spreading code, or combination of them) associated with the current connection while a call is in progress." EX1006 [Zeng], 1. Bhattacharya's "location system 212 is a data processing system that is capable of estimating the location of wireless terminal 201." EX1005 [Bhattacharya], [0059]. Nothing in Bhattacharya indicates location system 212 has anything to do with handoffs. Nor does Bhattacharya discuss changing channels while a call is in progress. Further, nothing in Zeng or Bhattacharya explains why Zeng's handoff process would be relevant to Bhattacharya's location estimation. Not only would a POSITA with experience in navigation and geolocation not necessarily understand how to implement cellular handoffs, there is no explanation other than hindsight as to why Zeng's handoff procedures would be useful for location determination. Thus, Petitioner's combination fails.

3. Petitioner fails to show a reasonable expectation of success

126. Petitioner argues that "a POSITA would have reasonably expected to succeed in configuring Bhattacharya-Zeng to leverage Zeng's handoff functionality since its implementation would have required only routine

knowledge well within the skill of a POSITA...” Pet., 29. A POSITA with a background in navigation and geolocation and no experience with cellular technology would not have this knowledge. Even if Zeng’s handoff functionality were routine knowledge in cellular technologies, a person with experience limited to navigation and geolocation does not have knowledge of cellular technologies or how handoffs function in cellular technologies.

127. In reality, handoff functionality in cellular networks is specified by complex standards that must be closely followed. *See, e.g.*, EX1010 [GSM Mobile Radio Interface Level 3 Specification]; EX1005 [Bhattacharya], [0052] (noting that “the illustrative embodiment operates in accordance with the [GSM protocol]” but that “other protocols, such as, for example, [UMTS], CDMA-2000, IS-136 TDMA, Short Message Service [or] Circuit Switched Data” could be used). Different protocols have different methods for performing handoffs to ensure interoperability and efficiency. A person with no background in the relevant cellular protocol cannot be expected to implement different handoff methods ad hoc within an existing network using one of these protocols and expect the network to function. Bhattacharya, for example, is directed to GSM. *Id.* GSM has specific rules for performing handoffs (or handovers, as known in GSM). *See, e.g.*, EX1010 [GSM Mobile Radio Interface Level 3 Specification]. As can be seen, the rules for GSM handovers are complex. They are very specific

and hardware will not work in a GSM system unless it follows the specification exactly. Further, hardware will not be certified as GSM unless it not only complies with the specification, but is also tested to verify compliance. Accordingly, Petitioner has not shown a reasonable expectation of success.

**B. Claim 2 Is Not Rendered Obvious By The Combination of
Bhattacharya, Zeng, and Spain**

128. Claim 2 of the '104 Patent, which depends from claim 1, further recites “wherein said database comprises previously-gathered calibration data for one or more *non-uniform grid points* within said region.” EX1001 at cl. 2 (emphasis added). Claim 2 is challenged only in Ground 2 and only based on disclosure in the Spain reference (EX1007). Pet., 1, 68-70. Because, as explained below, Spain has no teaching or suggestion of this limitation under the proper construction, Petitioner fails to show that this combination renders obvious claim 2 of the '104 Patent.

129. As explained above in Section IX.B, the proper construction for “[non-uniform] grid point” is “a point associated with representative calibration data for an area whose boundaries are determined from evaluation of the calibration data.” Petitioner points to Spain’s disclosure of “partitioning a geographic region” as purportedly teaching this limitation, corresponding the partitioned locations to “one or more non-uniform grid points within said region.” Pet. at 68-71 (citing EX1007 at [0076]-[0082], [0099]).

130. The partitioned locations of Spain are fundamentally different from the non-uniform grid points of the '104 Patent because they are not based on analysis of calibration data. “Calibration data,” as correctly construed by the district court, is “modified or unmodified network measurement data associated with a geographic location.” EX2012 [Markman Order], 8; *see supra*, §IX.A.

131. Spain determines the boundaries of its locations without evaluation of calibration data. Spain makes this clear in several ways. *First*, Spain explains that “the boundaries of each location are based, at least in part, on” factors that are *not* calibration data (i.e., not network measurement data). EX1007 at [0086]-[0093]. These include “natural and man-made physical attributes of geographic region 220,” “legal laws governing geographic region 220,” “data regarding the location and movement of individuals ... and vehicles in geographic region 220,” and other similar factors:

[0086] In accordance with the illustrative embodiment, the boundaries of each location are based, at least in part, on:

[0087] i. natural and man-made physical attributes of geographic region **220** (e.g., buildings, sidewalks, roads, tunnels, bridges, hills, walls, water, cliffs, rivers, etc.),

[0088] ii. legal laws governing geographic region **220** (e.g., laws that pertain to the location and movement of people and vehicles, etc.),

[0089] iii. theoretical predictions and empirical data regarding the location and movement of individuals and groups of people and vehicles in geographic region **220**,

[0090] iv. the desired accuracy of the estimates made by location server **214**, and

[0091] v. patterns of the location and movement of people and vehicles within geographic region **220**,

[0092] vi. the calendrical time T, and

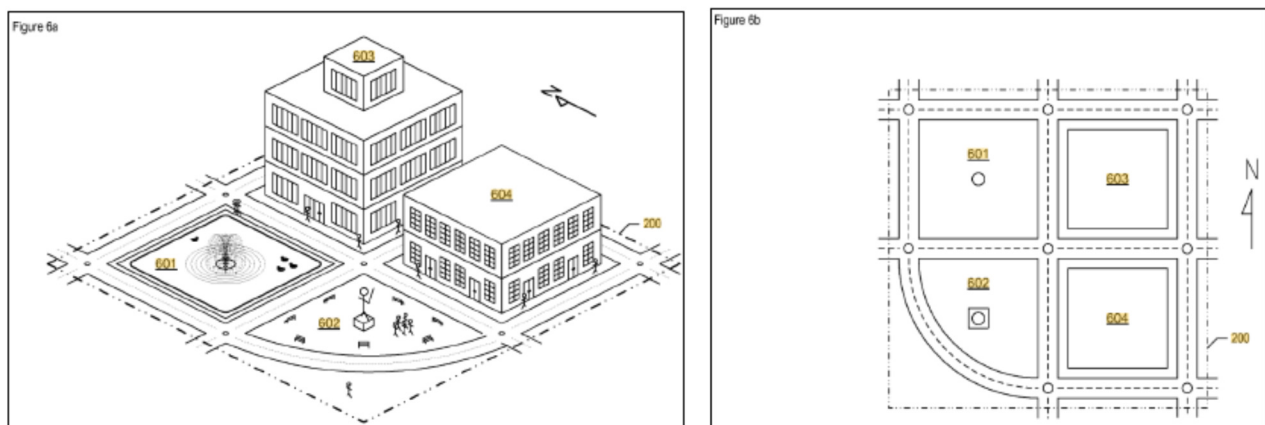
[0093] vii. the environmental conditions N,

EX1007 at [0086]-[0093]. None of these factors are network measurement data, and thus they are not calibration data.

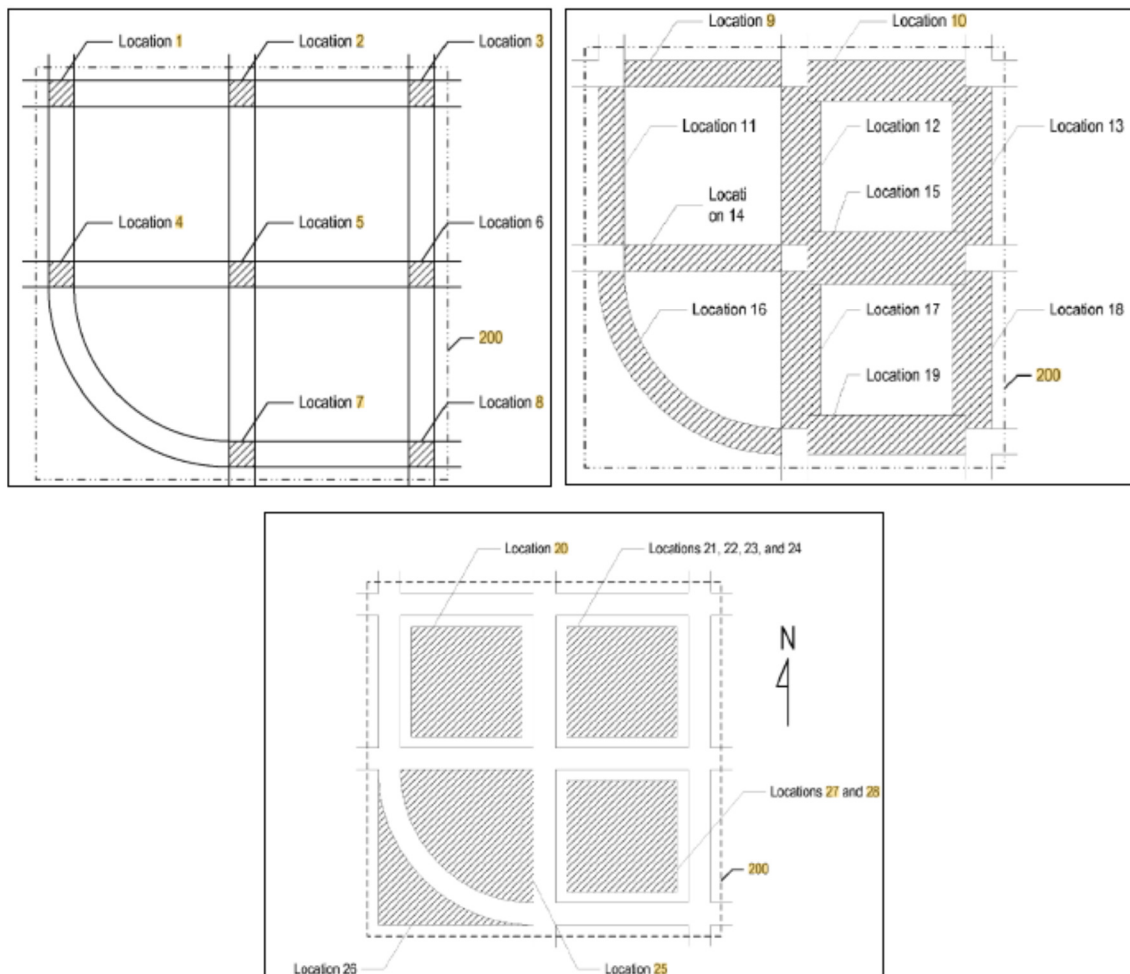
132. Spain also teaches that the partitioning may be based on considerations such as accuracy (*id.* at [0094]), computational burden (*id.* at [0095]) and “the ability of location server 214 to correctly determine when wireless terminal 201 is in one location or another.” *Id.* at [0096]. Again, the operator’s desired accuracy level (i.e., smaller or larger location size) and tolerance level for computational complexity (i.e., the tradeoff between

computational burden increases as location sizes get smaller) are also not calibration data because they do not relate to network measurement data. Petitioner identifies nothing in Spain that teaches partitioning a region into locations based on any form of calibration data, or analysis of such data.

133. *Second*, Spain's figures show that the partitioning is merely an overlay on a geographic region that is independent of any calibration data. Figures 6a-6k "depict geographic regions and their deconstruction into a plurality of locations." EX1007 at [0020]. Petitioner relies on these figures as purportedly depicting non-uniform grid points. *See* Pet. at 69-70 (citing EX1007 at Figs. 6a, 6e). These figures, however, further demonstrate that the partitioning is not based on an analysis of calibration data. For example, Figures 6c-6e show how the same region depicted in Figures 6a and 6b can be partitioned into a number of different locations without relying on calibration data:



(region depicted in Figs. 6a and 6b)

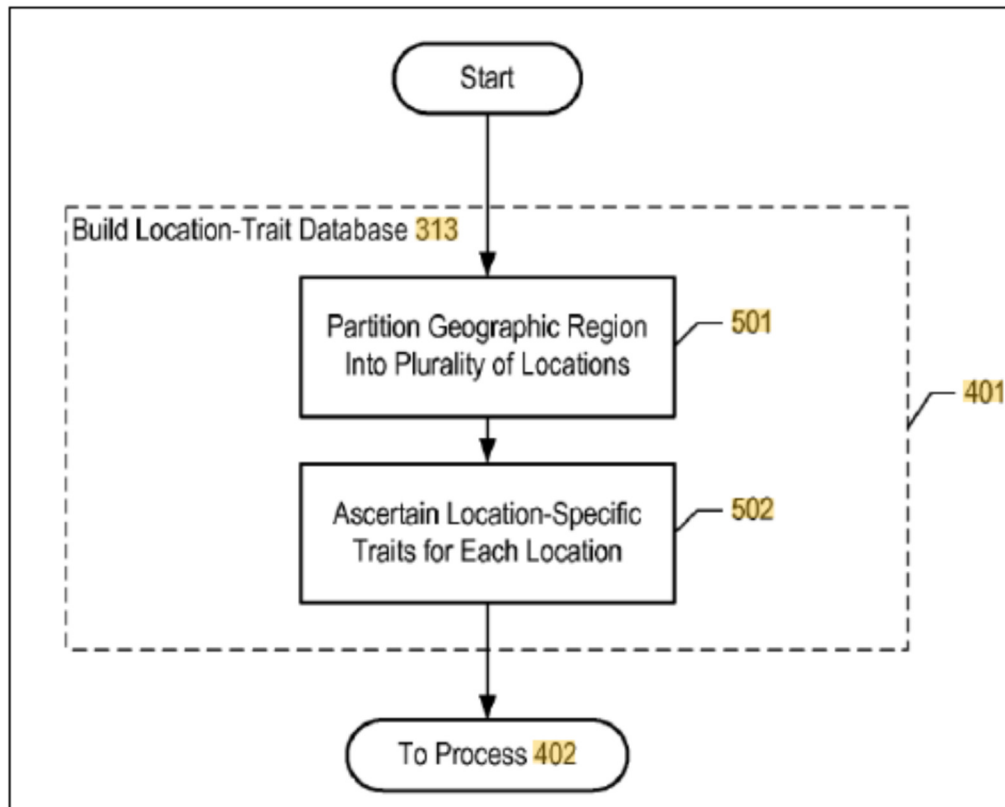


(partitioning depicted in Figs. 6c-6e)

134. Spain explains that these figures show that “eight road intersections are partitioned into Locations 1 through 8” (Fig. 6c), “the street sections and their adjacent sidewalks up to the edge of [the] buildings ... are partitioned into Locations 9 through 19” (Fig. 6d), and various other parts of the region such as the “water fountain,” “park,” “and each floor of [a] building” are partitioned into additional locations (Fig. 6d). EX1007 at [0098]-[0099]. Thus, Spain’s partitioning is shown and described as merely assigning location identifiers to

different physical attributes or characteristics of a region (*e.g.*, streets or intersections), amounting to no more than an overlay of identifiers onto a region. There is no analysis of calibration data being used to assign these identifiers. This is consistent with Spain’s teaching, discussed above, of partitioning a region into locations based on, *e.g.*, “natural and man-made physical attributes” rather than based on measured network signal data. *Id.* at [0086]-[0093].

135. *Third*, the flowchart in Figure 5 of Spain confirms that the partitioning is not based on analysis of calibration data (*i.e.*, network measurement data), and thus the partitioned locations are not non-uniform grid points. Figure 5, reproduced below, “depicts a flowchart of the salient processes performed in accordance with ... building Location-Trait Database 313.” EX1007 at [0019], Fig. 5.



136. As seen in the figure, the partitioning of a geographic region into different locations occurs first at step 501 *before* location-specific “traits” are ascertained for each location in step 502. Even if these traits constituted calibration data, Spain teaches that the traits are ascertained for each location in step 502 *after* the partitioning has already occurred in step 501. *Id.* at Fig. 5. This confirms that the partitioning taught by Spain is not based on any analysis of these traits (or anything else that could constitute calibration data). That is, Spain’s Location-Trait Database 313 teaches to partition regions into locations and then assign them location-specific traits. Non-uniform grid points under the proper construction are created by first evaluating calibration data and then partitioning

the NUGs based on that evaluation. Therefore, Petitioner's assertion that Spain's partitioned locations are a disclosure of "one or more non-uniform grid points within said region" is incorrect and should be rejected.

137. Petitioner relies on the "Bhattacharya-Zeng-Spain" combination for providing a "database representing expected signal-strength measurement" (Pet., 71) but, as discussed above, Petitioner relies on Spain's Location-Trait Database 313 for assigning traits. Spain only assigns traits to locations after the geographic location's shape and size has been determined. *See, e.g.*, EX1007 [Spain], Fig. 5, [0072]. The '104 Patent, on the other hand, starts with calibration data first and creates grid points of different shapes and sizes based on similarities in that calibration data. EX1001 ['104 Patent], 3:56-60.

138. Petitioner does not point to anything in Spain teaching evaluating calibration data to determine non-uniform grid points. Accordingly, Petitioner fails to show that the combination of Bhattacharya, Zeng, and Spain renders obvious claim 2 of the '104 Patent.

XI. CONCLUSION

139. I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are 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 and that any such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Respectfully submitted,



Mark Alan Sturza

Dated: 8/23/2024