

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

T-Mobile US, Inc., T-Mobile USA, Inc., TeleCommunication Systems, Inc.,
Ericsson Inc., and Telefonaktiebolaget LM Ericsson,
Petitioners

v.

TracBeam, LLC,
Patent Owner.

U.S. Patent No. 7,764,231

Title: WIRELESS LOCATION USING MULTIPLE MOBILE STATION
LOCATION TECHNIQUES

PETITION FOR *INTER PARTES* REVIEW

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EXHIBITS¹

Number	Description
1001	U.S. Patent No. 7,764,231 (the “’231 Patent”) (PATENT CHALLENGED IN THIS PETITION)
1002	U.S. Patent No. 7,525,484 (the “’484 Patent”)
1003	U.S. Patent No. 8,032,153 (the “’153 Patent”)
1004	U.S. Patent No. 7,298,327 (the “’327 Patent”)
1005	<i>Curriculum Vitae</i> of Dr. William Michalson
1006	Expert Declaration of Dr. William Michalson
1007	U.S. Patent No. 5,724,660 to Kauser (“ <i>Kauser</i> ”)
1008	U.S. Patent No. 5,936,572 to Loomis (“ <i>Loomis</i> ”)
1009	U.S. Patent No. 6,748,226 to Wortham (“ <i>Wortham</i> ”)
1010	International PCT Application No. PCT/US93/12179 to Schuchman (“ <i>Schuchman</i> ”)
1011	U.S. Patent No. 5,327,144 to Stilp (“ <i>Stilp</i> ”)
1012	FAA Advisory Circular 20-101C, <i>Airworthiness Approval of Omega/VLF Navigation Systems For Use in the U.S. National Airspace System (NAS) and Alaska</i> (Sep. 12, 1988)
1013	FAA Advisory Circular 20-130A, <i>Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors</i> (Jun. 14, 1995)

¹ For the Board’s convenience, the same set of exhibits and exhibit numbering are provided for each of Petitioner’s concurrently filed petitions for the ’231 Patent.

1014	<i>FCC Notice of Proposed Rulemaking for Locating Wireless 911 Callers</i> (Released Oct. 19, 1994)
1015	TR45 Joint Experts Meeting (JEM) for Emergency Services (Aug. 18, 1994)
1016	C.J. Driscoll & Associates, <i>Survey of Location Technologies to Support Mobile 9-1-1</i> , July 1994 (“ <i>Driscoll Survey</i> ”)
1017	Claim Construction Order (MetroPCS and TCS lawsuits)
1018	Supplemental Claim Construction Order
1019	Complaint against MetroPCS
1020	Complaint filed by TCS
1021	Dismissal Request (MetroPCS and TCS lawsuits)
1022	Dismissal Order (MetroPCS and TCS lawsuits)
1023	MetroPCS Corporate Disclosure Statement (MetroPCS lawsuit)
1024	American Heritage Dictionary, Houghton Mifflin Company (4th ed. 2000) (definition of “locus”)

I. INTRODUCTION

Petitioners T-Mobile US, Inc., T-Mobile USA, Inc., TeleCommunication Systems, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson (collectively “Petitioners”) respectfully request *inter partes* review of Claims 17, 20, 25, and 26 of U.S. Patent No. 7,764,231 (the “’231 Patent,” attached as Ex. 1001) in accordance with 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq.* The expert declaration of Dr. William Michalson (attached as Ex. 1006), is provided in support of this Petition and is cited throughout as “Expert Decl.”

II. MANDATORY NOTICES

A. Real Party-In-Interest

The real parties-in-interest are Petitioners T-Mobile US, Inc. and T-Mobile USA, Inc. (collectively “T-Mobile”), Petitioner TeleCommunication Systems, Inc. (“TCS”), and Petitioners Ericsson Inc. and Telefonaktiebolaget LM Ericsson (collectively, “Ericsson”).

For disclosure purposes, the following entities own more than 10% of the publicly traded shares (either directly or indirectly) of Petitioner T-Mobile: Deutsche Telekom AG, T-Mobile Global Holding GmbH, T-Mobile Global Zwischenholding GmbH, and Deutsche Telekom Holding B.V.

Finally, Petitioner T-Mobile acquired MetroPCS Wireless, Inc. and MetroPCS Communications, Inc. (collectively “MetroPCS”) in April 2013, and thus the MetroPCS entities no longer exist. (Ex. 1023 (MetroPCS Corporate

Disclosure Statement).)

B. Related Matters

The '231 Patent is or was involved in the following lawsuits: (1) *TracBeam, LLC v. T-Mobile US, Inc.*, No. 6:14-cv-00678 (E.D. Tex.); (2) *TracBeam, LLC v. Apple Inc.*, No. 6:14-cv-00680 (E.D. Tex.); (3) *TracBeam, LLC v. Google, Inc.*, No. 6:13-cv-00093 (E.D. Tex.); (4) *TeleComm. Sys., Inc. v. TracBeam, LLC*, Nos. 6:12-cv-00058 (E.D. Tex.), 1:11-cv-02519 (D. Colo.); and (5) *TracBeam, LLC v. MetroPCS Commc'ns, Inc. et al.*, No. 6:11-cv-00096 (E.D. Tex.).

Patent Owner TracBeam is currently asserting the '231 Patent and three other related patents (attached as Ex. 1001 – Ex. 1004) against Petitioner T-Mobile in the first lawsuit identified above. In addition to the present Petition for the '231 Patent, Petitioner is concurrently filing additional *inter partes* review petitions for the '231 Patent (*see* Section V) and for the three other asserted patents (U.S. Patent Nos. 7,525,484; 8,032,153; and 7,298,327).

C. Counsel and Service Information

Lead Counsel is Brian W. Oaks (Reg. No. 44,981) of Baker Botts LLP; Back-up Counsel is Douglas M. Kubehl (Reg. No. 41,915), Chad C. Walters (Reg. No. 48,022), and Ross G. Culpepper (Reg. No. 69,339) of Baker Botts LLP. A Power of Attorney is filed concurrently herewith under 37 C.F.R. § 42.10(b).

Service information is as follows: Baker Botts LLP, 98 San Jacinto Blvd.,

Suite 1500, Austin, TX 78701; Phone: (512) 322-5470; Fax: (512) 322-3621.

Petitioners consent to service by electronic mail at brian.oaks@bakerbotts.com,
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ross.culpepper@bakerbotts.com.

III. PAYMENT OF FEES

The undersigned authorizes the Office to charge the fee required by 37 C.F.R. § 42.15(a) for this Petition to Deposit Account No. 02-0384, as well as any additional fees that might be due in connection with this Petition.

IV. GROUNDS FOR STANDING

A. Petitioners have standing to bring this Petition

Pursuant to 37 C.F.R. § 42.104(a), Petitioners hereby certify that the '231 Patent is available for *inter partes* review and that the Petitioners are not barred or estopped from requesting *inter partes* review of the challenged claims of the '231 Patent.

Petitioner T-Mobile has not filed a civil action challenging the validity of any claims of the '231 Patent, and the complaint served on T-Mobile in the litigation referenced above in Section II.B was served within the last 12 months. Petitioner Ericsson has not filed a civil action challenging the validity of any claims of the '231 Patent, nor has it been served with a complaint for infringement of the '231 Patent.

Further, as explained below, Petitioners are not barred based on the prior TracBeam lawsuits involving MetroPCS and TCS (*see* Section II.B (Related Matters)) because those lawsuits were dismissed without prejudice.

B. Petitioners are not barred by the prior litigation

Petitioner T-Mobile (which acquired MetroPCS in 2013) is not barred by Patent Owner TracBeam’s prior litigation against MetroPCS, and Petitioner TCS is not barred by its prior litigation with Patent Owner TracBeam. (*See* Section II.B (Related Matters).) Those lawsuits were dismissed without prejudice, and thus are treated as if they had never been filed.

Specifically, on February 25, 2011, TracBeam filed a civil action against MetroPCS alleging infringement of the ’231 Patent. (Ex. 1019 (Complaint against MetroPCS).) On September 27, 2011, TCS filed a declaratory judgment action against TracBeam with respect to the ’231 Patent (in response to TracBeam’s lawsuit against TCS’s customers, including MetroPCS). (Ex. 1020 (Complaint filed by TCS).) The TCS lawsuit and the MetroPCS lawsuit were eventually consolidated. On June 17, 2013, both the MetroPCS and TCS lawsuits were dismissed without prejudice after the parties filed an agreed dismissal request. (Ex. 1021 (Dismissal Request); Ex. 1022 (Dismissal Order).) The Board has held that a civil action—including a declaratory judgment action—dismissed without prejudice does not bar a petition for *inter partes* review (“IPR”), as such dismissals

are treated as if the lawsuit had never been brought. “[A] prior action that is voluntarily dismissed without prejudice does not give rise to 35 U.S.C. §§ 315 (a)(1) or (b) statutory bars.” *Microsoft Corp. v. Parallel Networks Licensing LLC*, IPR2015-00486, Paper 10 at 14 (PTAB Jul. 15, 2015). Thus, Petitioners cannot be barred from bringing this Petition based on the prior litigation.

V. NON-REDUNDANCY OF CONCURRENT PETITIONS

Due to the many lengthy asserted claims, and page limits for IPR petitions, Petitioners are concurrently filing the following petitions for the ’231 Patent:

<u>PETITIONS FOR ’231 PATENT</u>		
Petition #	Challenged Claims	Primary Prior Art Reference
1	25, 26, 36, 82	<i>Kauser</i> (Ex. 1007)
2	10, 47, 185	<i>Kauser</i> (Ex. 1007)
3	155, 162, 165	<i>Kauser</i> (Ex. 1007)
4	1, 41, 155, 162, 215	<i>Loomis</i> (Ex. 1008)
5 (THIS PETITION)	17, 20, 25, 26	<i>Loomis</i> (Ex. 1008)

The grounds of invalidity in these respective petitions for the ’231 Patent are not redundant and should each be instituted by the Board.

First, the *Loomis* grounds in petition no. 5 (**this Petition**) are not redundant to the *Loomis* grounds in petition no. 4 because each petition addresses different claims.

Second, the *Loomis* grounds in petition no. 4 and petition no. 5 (**this**

Petition) are not redundant to the *Kauser* grounds in petition nos. 1, 2, and 3 because most claims (11 of the 15 total claims) are only challenged under either the *Kauser* grounds or the *Loomis* grounds (but not both).

Third, for the claims that are challenged under both the *Kauser* grounds and the *Loomis* grounds (Claims 25, 26, 155, and 162), the respective *Kauser* and *Loomis* grounds each provide distinct benefits. For example, the primary embodiments in *Kauser* are substantially similar to those in the '231 Patent, and thus *Kauser* maps very clearly to the challenged claims. While the *Loomis* mapping is also very strong, many claims require the location functionality to be implemented in a two-way communications network, but the primary embodiment in *Loomis* is implemented using FM radio towers (which are typically one-way transmitters). Thus, the *Loomis* grounds are based on combinations with other prior art location systems that are implemented in two-way cellular networks. Those combinations are unnecessary in the *Kauser* grounds because the location system in *Kauser's* primary embodiment is implemented in a cellular network.

Loomis, on the other hand, is less susceptible to being antedated by the Patent Owner than *Kauser* because *Loomis* has an earlier priority date. While the earliest provisional application for the '231 Patent was filed in September 1996, Patent Owner has alleged in the district court litigation against Petitioner T-Mobile

that certain claims are entitled to an earlier invention date in 1995. *Loomis* has a priority date of February 1994 and thus predates both the parent provisional of the '231 Patent *and* the earlier 1995 invention date alleged by Patent Owner. *Kauser* was filed in February 1996 and thus predates the parent provisional of the '231 Patent by approximately six months, but post-dates the Patent Owner's alleged 1995 invention date. While it remains to be seen whether Patent Owner can provide suitable evidence of conception, diligence, and reduction to practice to establish its earlier invention date for any claims, if it is able to meet this burden then *Kauser* could be disqualified as prior art but *Loomis* would not.

Thus, while the disclosure of *Kauser* aligns the closest with the '231 Patent, *Loomis* is less susceptible to being antedated by the Patent Owner. Accordingly, the respective *Kauser* and *Loomis* grounds are not redundant and should each be instituted.

Finally, while certain prior art relied on in this Petition was disclosed to the Patent Office during prosecution, that prior art was buried within 400+ prior art references disclosed by the applicants during prosecution and was never addressed substantively by the Examiner. *See, e.g., Microsoft Corp. v. Parallel Networks Licensing LLC*, IPR2015-00486, Paper 10 at 15 (PTAB Jul. 15, 2015) (declining to exercise discretion to deny petition under 35 U.S.C. § 325(d) for prior art disclosed during prosecution but never applied to the claims by the Examiner).

VI. IDENTIFICATION OF CHALLENGE

Petitioners challenge Claims 17, 20, 25, and 26 of the '231 Patent on the following grounds:

Challenged Claims	Statutory Basis	Prior Art References
17, 20, 25, 26	35 U.S.C. § 103	<i>Loomis and Wortham</i>

Section VIII identifies how the challenged claims are to be construed. Section X identifies (1) the specific statutory grounds on which the challenge to each claim is based and how each challenged claim is unpatentable for each ground, and (2) the exhibit numbers of the supporting evidence and the relevance of that evidence.

VII. THE '231 PATENT

A. Overview

The '231 Patent was filed September 8, 1997, and claims priority to various provisional applications, the earliest of which was filed September 9, 1996.

The '231 Patent relates to a system and method for locating mobile stations using a combination of wireless location techniques, including satellite-based techniques (*e.g.*, GPS) and terrestrial-based techniques (*e.g.*, cell tower time-of-arrival (TOA) techniques). (Ex. 1001 ('231 Patent) at Abs., 9:5-9, 10:40-43.) For example, certain claims require (1) using multiple location techniques to obtain location information and/or estimates for a mobile station, and (2) determining a resulting estimate using the location information from each technique (*e.g.*, by either combining location estimates from each location technique or selecting a

location estimate from one of the location techniques). (*See, e.g.*, Claim 1 (Ex. 1001 ('231 Patent) at 170:62-171:35).)

A more detailed description of the patented technology is provided in Dr. Michalson's expert declaration. (Expert Decl. § III.)

B. Prosecution History

The '231 Patent was prosecuted for over 12 years. Notably, despite the extraordinary length of prosecution, there were no substantive rejections based on prior art. Accordingly, the prosecution history of the '231 Patent provides limited guidance as to the understanding and interpretation of the claims for purposes of this proceeding.

C. Level of ordinary skill in the art

A person of ordinary skill in the art in the field of the '231 Patent would typically have (1) a degree in electrical engineering, computer engineering, computer science, or a related field, and (2) one to four years of experience and/or postgraduate study relating to wireless communication systems and/or wireless location and navigation technologies. (Expert Decl. § V.) However, someone with less technical education but more practical experience, or vice versa, could also meet that standard. (*Id.*)

VIII. CLAIM CONSTRUCTION

Some of the challenged claims were construed in connection with a prior lawsuit filed by Patent Owner TracBeam, using the applicable claim construction

standards for district court proceedings. (Ex. 1017 (Claim Construction Order).) The following claim construction analysis in this Petition, however, is based on the broadest reasonable interpretation of the claims in light of the specification. See 37 C.F.R. § 42.100(b).

A. “*mobile station*,” “*computational machinery*,” “*location technique(s)*,” and “*geographical extent*”

The terms “*mobile station*,” “*computational machinery*,” “*location technique(s)*,” “*geographical extent*,” and/or variations thereof are recited by certain challenged claims. The prior district court proceeding adopted the following constructions: (1) *mobile station*: “*a mobile wireless device that is at least a transmitting device and may include a receiving device*”; (2) *computational machinery*: “*one or more machines (such as a computer or hardware device) that performs computations*”; (3) *mobile station location technique*: “*technique for determining mobile station locations*”; and (4) *geographical extent*: “*geographical area or range*.” (Ex. 1017 (Claim Construction Order) at 37-38.)

Petitioners do not believe that these terms require construction in this *inter partes* review proceeding, but nonetheless Petitioners do not otherwise object to the prior district court constructions for purposes of this proceeding.

B. “*location information*” and related terms

The challenged claims recite the term “*location information*” and/or variations thereof. The context of the challenged claims requires the “*location*

information” terms to contain information that identifies or indicates a location (as opposed to, for example, solely containing an error or failure message). For example, Claim 20 requires “*instances of location information having one or more location estimates of the mobile station.*” Thus, the requirement for the “*location information*” terms to identify or indicate a location can be found in the surrounding claim language. Consequently, for purposes of this proceeding Petitioners do not object to interpreting the “*location information*” terms according to their plain and ordinary meaning under the broadest reasonable interpretation.

C. “*locus of locations*”

Claims 17 and 25 recite the term “*locus of locations.*” For example, Claim 25 recites determining “*a location estimate of the mobile station by determining a locus of locations from at least one of the fixed location terrestrial stations.*” The specification uses the term “locus” only once, stating that “an intersection of each area locus defined by the base station offsets may provide an estimate of the location of the target MS.” (Ex. 1001 (’231 Patent) at 51:1-7 (emphasis added).) The American Heritage Dictionary defines “locus” as “the set or configuration of all points whose coordinates satisfy a single equation or one or more algebraic conditions.” (Ex. 1024 (Definition of Locus).) Thus, under its broadest reasonable interpretation in view of the claims and specification, those of ordinary skill in the art would understand a “*locus of locations*” to be “*a collection of points or*

locations.” (Expert Decl. § VI.C.)

D. order of claim elements

Certain challenged claims use numeric modifiers, such as “*first*” and “*second*,” to refer to various claim elements associated with the recited location techniques and/or location information provided from those techniques. The challenged claims simply use these modifiers to distinguish between different claim elements, and thus should not be construed as requiring any particular order. “The use of the terms ‘first’ and ‘second’ is a common patent-law convention to distinguish between repeated instances of an element or limitation” and “should not in and of itself impose a serial or temporal limitation.” *3M Innovative Props. Co. v. Avery Dennison Corp.*, 350 F.3d 1365, 1371 (Fed. Cir. 2003) (holding that the terms “first pattern,” “second pattern,” “first embossing step,” and “second embossing step” did not impose an order).

For example, Claims 17, 20, and 25 each recite the steps of “*first obtaining*” and “*second obtaining*” (and/or variations thereof), which relate to obtaining location information from a satellite technique and a terrestrial technique. These numeric modifiers, however, are simply used to distinguish between the two different “*obtaining*” steps rather than to impose an order on the satellite and terrestrial location techniques. *Unwired Planet, LLC v. Google Inc.*, No. 3:12-CV-00504-MMD, 2014 WL 7012497, at *27 (D. Nev. Dec. 12, 2014) (holding that the

steps of “first transmitting” and “second transmitting” are merely “two separate transmission steps” and do not require an order).

In the prior litigation, Patent Owner argued that these numeric modifiers imposed an order on the location techniques in certain claims. That argument, however, was simply a last resort attempt to distinguish the prior art, raised for the first time in Patent Owner’s expert reports (rather than during claim construction). Patent Owner’s interpretation is unsupported (and contradicted) by the specification, and is also inconsistent with a ruling from the prior district court, which determined that both “*obtaining*” steps of Claim 25 are not always required. (Ex. 1018 (Supplemental Claim Construction Order).)

The specification explicitly confirms that the location techniques are not performed in any particular order. For example, the “Field of the Invention” states that “[t]he present invention is directed ... to a system and method for locating a wireless mobile station using a plurality of simultaneously activated mobile station location estimators.” (Ex. 1001 (’231 Patent) at 1:14-20 (emphasis added); *see also id.* at 53:7-11, 54:26-30.) Location techniques that are “simultaneously activated” are performed at the same time: they do not have an order. Patent Owner will surely argue that not all embodiments require the techniques to be activated simultaneously. Even if the techniques can be performed serially, however, it is clear from the specification that no particular order is required,

because the outputs from all the location techniques are “*synergistically used for deriving therefrom an enhanced location estimate.*” (Ex. 1001 (’231 Patent) at 12:7-16, 68:2-8 (emphasis added); *see also id.* at 9:5-11, 66:9-14, 87:44-58.)

Thus, under the broadest reasonable interpretation of these claims in view of the specification, the numeric modifiers do not require any particular order for the associated claim elements.

IX. PRIOR ART

A. State of the Art

As acknowledged by the ’231 Patent, various location determining technologies were widely known, understood, and implemented by those of skill in the art at the time of the alleged invention of the ’231 Patent. (*See, e.g.*, Ex. 1001 (’231 Patent) at 1:43-2:29.) Examples of preexisting location determining technologies include GPS, GLONASS, Loran-C, Omega, and various other ground-based positioning technologies, such as signal strength, time-of-arrival, and time-difference-of-arrival techniques. (*See, e.g.*, Ex. 1009 (Wortham) at 2:63-3:5; Ex. 1007 (Kauser) at 1:61-2:40, 2:62-66; Ex. 1011 (Stilp) at Abs., 5:5-26, 6:41-55, 14:31-39; Ex. 1012 (FAA Advisory Circular 20-101C) at 1.)

Hybrid location systems that used multiple location techniques were also widely known and understood by those of skill in the art at the time of the alleged invention. (*See, e.g.*, Ex. 1008 (Loomis) at Abs.; Ex. 1007 (Kauser) at 2:62-66;

Ex. 1010 (Schuchman) at 1:1-12, 5:22-33, 7:19-26; Ex. 1012 (FAA Advisory Circular 20-101C) at 1, 3; Ex. 1013 (FAA Advisory Circular 20-130A) at 1.)

A more detailed description of the state of the art is provided in Dr. Michalson's expert declaration. (Expert Decl. § VII.)

B. *Loomis*

U.S. Patent No. 5,936,572 to Loomis et al. ("*Loomis*") issued August 10, 1999 as a continuation of an application filed February 4, 1994, and thus qualifies as prior art under 35 U.S.C. § 102(e). (Ex. 1008.) *Loomis* is described in Section IX.D, and in Dr. Michalson's expert declaration (Expert Decl. § VIII.B).

C. *Wortham*

U.S. Patent No. 6,748,226 to Wortham ("*Wortham*") issued June 8, 2004 as a continuation of an application filed November 16, 1994, and thus qualifies as prior art under 35 U.S.C. § 102(e). (Ex. 1009.) *Wortham* is described in Section IX.D, and in Dr. Michalson's expert declaration (Expert Decl. § VIII.C).

D. Combinations of Prior Art

1. Overview

The grounds of invalidity presented in Section X demonstrate that the challenged claims are obvious in view of *Loomis* in combination with *Wortham*. This section describes the relevant features disclosed by these prior art references and explains how these references could be combined and/or modified to invalidate the challenged claims.

For example, *Loomis*' hybrid location system includes a method and apparatus for determining and outputting a resulting location estimate for a mobile user carrying a hybrid LD device (also referred to in *Loomis* as a "mobile station" (Ex. 1008 (*Loomis*) at 2:7-25, 3:63-4:4, 11:24-29)) using multiple location techniques that generate location estimates using wireless signal measurements. (*Id.* at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5; *see also id.* at 18:27-32, FIG. 1.) The location techniques in *Loomis*' hybrid location system include satellite-based techniques (*e.g.*, GPS) and terrestrial-based techniques (*e.g.*, a radio technique). (*Id.*) As described throughout this section, a person of ordinary skill in the art would have been motivated to modify and/or combine *Loomis*' hybrid location system with aspects of the positioning systems disclosed in *Wortham*. (Expert Decl. § X.B.) As one example, *Loomis*' location system can be integrated into an existing mobile communications infrastructure, such as a cellular telephone network, as described in *Wortham*. (Section IX.D.2 (Two-Way Communication); Ex. 1009 (*Wortham*) at 1:46-2:12; Expert Decl. § X.B.) Section IX.D.7 presents reasons why these prior art combinations and/or modifications would have been obvious to those of ordinary skill in the art.

2. Two-Way Wireless Communication for Location Functionality

Certain claim elements require the mobile station to be in two-way communication with terrestrial transmitters that provide location functionality.

Loomis' hybrid LD device (*i.e.*, mobile station) includes an FM radio receiver/processor for locating the mobile station using FM radio signal measurements, and a cellular communications transmitter/receiver ("transceiver") for communicating with another person or facility using telecommunication signals. (Ex. 1008 (*Loomis*) at 6:20-29, 6:46-55, 11:52-65, 12:16-20, 12:27-40, FIG. 6.) It would have been obvious to modify *Loomis*' hybrid LD device to use the cellular transceiver to provide both the location capabilities (*i.e.*, instead of the FM radio transceiver) and the communications capabilities, as described in *Wortham*. (Ex. 1009 (*Wortham*) at 1:46-2:12, 7:48-55, 7:67-8:4; Expert Decl. § X.B.) For example, under the proposed combination, *Loomis*' hybrid LD device would use its cellular transceiver and associated cellular towers (which would be present for use with any cellular communications transmitter/receiver) for both locating the mobile station and wirelessly communicating with another person or facility. In particular, *Loomis*' hybrid location system could be modified to implement its terrestrial location capabilities using (1) the same cell towers of *Loomis* that provide cellular communication capabilities (as described in *Wortham*), instead of *Loomis*' FM radio towers, and (2) *Loomis*' cellular transceiver, instead of its FM radio transceiver. (Expert Decl. § X.B; *see also* Ex. 1009 (*Wortham*) at 1:46-2:12, 7:48-55, 7:67-8:4.)

Under this proposed combination, the mobile station in *Loomis* would be

capable of two-way communication with the same terrestrial transmitters that are used to provide the location capabilities (*i.e.*, receiving signals from and transmitting signals to the cell towers). (*Id.*) For example, *Loomis*' mobile station could obtain wireless signal measurements using signals transmitted from the cell towers and/or transmit wireless signal measurements (such as satellite signal measurements and/or cell tower signal measurements) to the network of cell towers to provide location information of the mobile station to a person or facility. (Expert Decl. § X.B; *see also* Ex. 1008 (*Loomis*) at 8:29-34, 12:27-40, 20:29-42; Ex. 1009 (*Wortham*) at 1:46-2:12, 7:48-55, 7:67-8:4.) Section IX.D.7 (Reasons to Modify/Combine) explains why it would have been obvious to combine the prior art in this manner.

3. Satellite / Non-Terrestrial GPS Technique

This section addresses claim elements relating to a satellite or non-terrestrial location technique.

Satellite (non-terrestrial) technique:

Loomis' location system includes a GPS technique (*i.e.*, the outdoor LD module), which satisfies the claim elements that require a satellite or non-terrestrial location technique. (Ex. 1008 (*Loomis*) at Abs., 7:9-22; *see also id.* at 4:66-5:9, 6:55-58, 11:66-12:15; *see also* Expert Decl. § X.C.1.) In *Loomis*, the GPS technique can be implemented using differential GPS (D-GPS). (*Id.* at 11:20-48;

Expert Decl. § VII.C.4.) As explained in the following paragraphs, *Loomis*' GPS technique calculates location estimates using measurements of wireless signals transmitted between a hybrid LD device (*i.e.*, a mobile station) carried by a mobile user and three or more satellites.

Satellite signal time delay measurements:

In *Loomis*' location system, the satellite signal measurements used by *Loomis*' GPS technique satisfy the claim elements that require satellite signal time delay measurements. (Expert Decl. § X.C.2.) For example, *Loomis* discloses that the mobile station includes a GPS signal receiver/processor (referred to in *Loomis* as the "outdoor LD unit") that receives wireless signals from satellites and uses those signals to estimate a location of the mobile station. (Ex. 1008 (*Loomis*) at 7:9-22; *see also id.* at Abs., 4:66-5:9, 6:55-58, 11:66-12:15, 12:21-27.) As explained by Dr. Michalson and acknowledged by the '231 Patent, one of ordinary skill in the art would understand that the present location is determined from the GPS signals by measuring the signal travel time delay of the received GPS signals. (Expert Decl. § X.C.2; Ex. 1001 ('231 Patent) at 1:54-2:2.) This is also confirmed by *Wortham*, which explains that GPS calculations involve "pseudorange" measurements corresponding to the range of the GPS receiver from each satellite in space (*i.e.*, the "*spatial range*" required by some claims), which are determined using the travel/propagation time, or time of arrival, of the satellite signals. (Ex.

1009 (Wortham) at 3:21-25, 5:18-23; *see also* Ex. 1008 (Loomis) at 22:57-23:13.) Thus, while these satellite signal time delay measurements are inherently used by any GPS receiver (including that of *Loomis*), they are also explicitly disclosed by *Wortham*. (Ex. 1009 (Wortham) at 3:21-25, 5:18-23; *see also* Ex. 1008 (Loomis) at 22:57-23:13; Expert Decl. § X.C.2.)

Satellite location information:

In *Loomis*' location system, the GPS location information generated by *Loomis*' GPS technique satisfies the claim elements that require "location information" (and variations thereof) obtained from a satellite technique. (Ex. 1008 (Loomis) at 15:54-59, 19:42-47, FIG. 9; *see also id.* at Abs., 12:21-27, 21:48-57; Expert Decl. § X.C.3.) For example, *Loomis*' GPS technique determines the present GPS coordinates $(x_u, y_u, z_u)_{out}$ and GPS signal indicium I_{out} (*i.e.*, a measure of signal quality and/or signal strength). (*Id.* at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.)

4. Terrestrial Radio Technique

This section addresses claim elements relating to terrestrial location techniques.

Terrestrial communication stations at fixed locations:

Loomis' location system is implemented using radio towers, such as FM radio towers. For example, *Loomis* discloses that the mobile station receives FM

subcarrier signals “from three or more radio signal sources with fixed, known locations,” which include “transmitting antennas.” (Ex. 1008 (Loomis) at 5:32-36, 8:53-64; *see also id.* at 4:44-56, 6:25-29, 21:36-38, FIG. 1.) *Loomis* explains, “The sources of these FM subcarrier signals may be a plurality of FM broadcasting stations located in or near the user.” (*Id.* at 6:35-37, 4:44-56.) Thus, each radio source in *Loomis* (*i.e.*, an FM broadcasting station and associated transmitting antenna) is a fixed or stationary radio transmission structure with a known location on earth. (*Id.* at 4:44-56, 5:32:36, 6:25-29, 6:35-37, 8:53-64, 21:36-38, FIG. 1; *see also* Expert Decl. § X.D.1.)

Terrestrial location technique:

Loomis’ location system includes a radio location technique (*i.e.*, the radio LD module), which satisfies the claim elements that require a terrestrial location technique used to determine/obtain “location information” (or some variation of that term). (Ex. 1008 (Loomis) at Abs., 4:51-56, 6:20-29, 6:41-52, 11:52-65.) As explained in the following paragraphs, *Loomis*’ radio location technique calculates location estimates using measurements of wireless signals transmitted between a mobile station and the surrounding radio sources. (*Id.* at 6:20-29, 6:41-52, 11:52-65.) Under the proposed combination with *Wortham* mentioned above, those radio sources would be cell towers. (Expert Decl. § X.D.2; *see also* Ex. 1009 (Wortham) at 1:46-2:12; Section IX.D.2 (Two-Way Communication).)

Wireless signal measurements:

The radio signal measurements used by *Loomis*' radio technique satisfy the claim elements that require the terrestrial technique to use wireless signal measurements obtained from transmissions with the terrestrial stations. (Expert Decl. § X.D.3.) Specifically, *Loomis*' radio technique calculates the location of a hybrid LD device (*i.e.*, a mobile station) using signal phase measurements from the transmissions between the radio sources and the mobile station. (*Id.*; Ex. 1008 (*Loomis*) at 6:20-29, 6:41-55, 7:23-29, 11:52-65.) For example, in *Loomis*, the radio receiver/processor of the mobile station performs signal phase measurements using radio signals transmitted from the radio sources, and then uses those signal phase measurements to determine radio location information of the mobile station. (*Id.*) Alternatively, the mobile station can transmit the signal phase measurements to a central station (unprocessed, partially processed, or fully processed) to allow the radio technique to be performed by the central station. (*Id.* at 8:26-35, 20:29-42; Expert Decl. § X.D.3.)

Signal time delay measurements:

The radio location technique in *Loomis*' main embodiment uses signal timing measurements (*i.e.*, the “*signal time delay*” or “*signal timing*” data required by certain claims). (Ex. 1008 (*Loomis*) at 6:46-55; Expert Decl. § X.D.4.) For example, *Loomis*' radio technique generates location estimates using signal phase

measurements to determine “the intersections of three or more hyperboloids that are defined by the relative times of arrival of the three radio LD signals.” (Ex. 1008 (Loomis) at 6:46-55, 11:61-65 (emphasis added).) Thus, the relative signal phase measurements in *Loomis* correspond to the relative “times of arrival” of each signal. (*Id.*; see also Expert Decl. § X.D.4.) As explained by Dr. Michalson, those of ordinary skill in the art would understand that the “relative times of arrival” of the three radio signals refers to the differences in their respective arrival times, and thus constitutes the “*signal time delay*” or “*signal timing*” data required by certain claims. (Expert Decl. § X.D.4.)

Loomis discloses that these types of location techniques based on signal timing measurements (*i.e.*, the claimed “*signal time delay*” or “*signal timing*” data) were well known in the prior art. (*Id.*) For example, in the Background of the Invention, *Loomis* discloses various known prior art location techniques that determine locations using “differences in time of arrival...of the pulse transmitted by the roving station,” “differences in arrival times of the range tones received from the radio station,” or by “comparing times of arrival of the transmitted signal.” (Ex. 1008 (Loomis) at 2:18-21, 2:51-53, 3:28-33 (emphasis added).)

5. Resulting Location Determination

This section addresses claim elements relating to a resulting location determination.

Determining resulting location information:

Loomis' location system performs an algorithm for determining a resulting location estimate using the respective estimates from the GPS and radio techniques. (Ex. 1008 (*Loomis*) at FIG. 9, Abs., 5:14-22, 12:21-27, 12:47-13:4, 19:48-63; *see also id.* at 5:63-6:4, 18:19-33; Expert Decl. § X.E.1.) Specifically, after obtaining estimates from each technique, the ultimate location of the mobile station can be determined by comparing the signal indicium (*i.e.*, uncertainty) of the estimates from each technique, and selecting the location estimate having the least amount of uncertainty as the resulting location:

The controller [] receives the present location coordinates $(x_u, y_u, z_u)_{rad}$ of the user [] from the radio LD signal receiver/processor [], receives the present location coordinates $(x_u, y_u, z_u)_{out}$ of the user [] from the outdoor LD signal receiver/processor [], and receives the indicia I_{rad} and I_{out} , for comparison with the respective indicia thresholds $I_{rad,thr}$ and $I_{out,thr}$.

. . .

If $I_{rad} \geq I_{rad,thr}$ and $I_{out} \geq I_{out,thr}$, the controller module [] is free to choose the coordinates $(x_u, y_u, z_u)_{rad}$ or the coordinates $(x_u, y_u, z_u)_{out}$ as the present location of the user []. Differences in accuracy between these two determinations of present location would lead the controller to choose one of these triples as the coordinates of the user's present location. For example, if the outdoor LD system is GPS . . . whose inaccuracies are much lower than the inaccuracies of a radio LD system such as the FM subcarrier system, the controller module []

would probably choose $(x_u, y_u, z_u)_{out}$ as the present location coordinates of the user []. If $I_{rad} \geq I_{rad,thr}$ and $I_{out} < I_{out,thr}$, the controller chooses the coordinates $(x_u, y_u, z_u)_{rad}$ as the present location coordinates of the user. If $I_{rad} < I_{rad,thr}$ and $I_{out} \geq I_{out,thr}$, the controller module [] chooses the coordinates $(x_u, y_u, z_u)_{out}$ as the present location coordinates of the user. If $I_{rad} < I_{rad,thr}$ and $I_{out} < I_{out,thr}$, the controller module [] chooses neither set of coordinates as the present location coordinates of the user, and the controller module notifies any interested person or facility that the methods used for location determination have an unacceptably high errors associated with them.

(*Id.* at 12:21-27, 12:47-13:1; *see also id.* at 5:14-21, 14:52-55, 16:39-51, 19:48-63.)

Thus, *Loomis* determines a more accurate location estimate using the respective estimates from the GPS and radio techniques. (*See, e.g., id.* at 4:17-42, 5:23-27.)

In one embodiment of *Loomis*, the signals from both the radio technique and the GPS technique are optimally blended together using an estimator such as a Kalman filter. (*Id.* at 15:39-42.)

Finally, *Loomis* also discloses embodiments where the signals from the radio technique and/or the GPS technique are transmitted to a central processing station for the determination of the mobile station location. (*Id.* at 8:29-39.)

Likelihood indication:

As described in the preceding paragraphs, *Loomis*' location determining algorithm (1) uses signal indicia I_{rad} and I_{out} and indicia thresholds $I_{rad,thr}$ and $I_{out,thr}$

to determine which of the respective location estimates from the GPS and radio techniques are likely to be the most accurate (Ex. 1008 (Loomis) at 12:47-13:1, 16:39-51, 19:48-52, 20:6-20), and (2) provides a resulting location estimate based on the comparison of the respective estimates and/or associated signal indicia from each location technique (*id.* at FIG. 9, Abs., 5:19-21, 12:47-64, 16:40-51, 19:48-60). For example, *Loomis*' location determining algorithm may first determine whether the signals received by the GPS and/or radio techniques are adequate for location determination by comparing signal indicia I_{rad} and I_{out} with the respective threshold values $I_{rad,thr}$ and $I_{out,thr}$. (*Id.* at Abs., 12:47-64, 16:40-51.) If they are both within the indicia threshold values (*i.e.*, $I_{rad} \geq I_{rad,thr}$ and $I_{out} \geq I_{out,thr}$), the location algorithm may then compare radio signal indicia I_{rad} with GPS signal indicia I_{out} and/or the radio coordinates $(x_u, y_u, z_u)_{rad}$ with the GPS coordinates $(x_u, y_u, z_u)_{out}$ to determine which estimate is likely to be the most accurate location of the mobile station and is ultimately used as the resulting location. (*Id.* at 5:15-21, 5:65-6:4, 12:47-58, 16:40-51.) If $I_{rad} \geq I_{rad,thr}$ and $I_{out} < I_{out,thr}$, then the radio coordinates $(x_u, y_u, z_u)_{rad}$ are used as the resulting location; but if $I_{rad} < I_{rad,thr}$ and $I_{out} \geq I_{out,thr}$, then the GPS coordinates $(x_u, y_u, z_u)_{out}$ are used. (*Id.* at 12:58-62.) Thus, the signal indicia from *Loomis*' location determining algorithm satisfies the claim elements that require using or obtaining an indication of the "likelihood" of the mobile station being at or within a particular estimate. (Expert Decl. § X.E.2.)

6. Order of Location Techniques

As explained in Section VIII (Claim Construction), Petitioners do not believe the broadest reasonable interpretation of the challenged claims requires the satellite location technique and the terrestrial location technique to be performed in any particular order. (Expert Decl. § X.G.) Nonetheless, to the extent the Board determines that certain challenged claims require obtaining location information from the satellite technique before the terrestrial technique, *Loomis* discloses both orders, and regardless, it would have been obvious to obtain location information from *Loomis*' GPS technique before the radio technique. (*Id.*)

First, *Loomis* discloses multiple embodiments where the GPS satellite technique can be performed either before the FM radio technique or after the FM radio technique. (Ex. 1008 (*Loomis*) at Abs., 19:52-60; Expert Decl. § X.G.) Thus, in some embodiments of *Loomis*, location information is in fact obtained from the GPS technique before the radio technique. (*Id.* at 19:52-60.) For example, *Loomis* teaches embodiments that use the GPS technique first, but if the GPS signals are not adequate to allow for determination of the present location of the mobile station, then subsequently use the radio technique:

If the outdoor LD signals are adequate and the outdoor LD unit is selected, in step 181, to determine the location, the system (or controller) uses the outdoor LD unit information to determine the present location of the user. If the radio LD signals are adequate and

the radio LD unit is selected, in step 183, to determine the location, the system (or controller) uses the radio LD unit information to determine the present location of the user.

(*Id.*; *see also id.* at FIG. 9.) Accordingly, *Loomis*' location system does indeed obtain location information from the GPS technique before the radio technique.

Second, the order of the location techniques does not matter in *Loomis*' location system. (Expert Decl. § X.G.) Specifically, in one embodiment, *Loomis*' resulting location determination algorithm simply obtains estimates from both location techniques and compares their associated signal indicia to determine which to return as the resulting estimate. (*Id.* at 12:21-27, 12:47-13:1, FIG. 9; *see also* Section IX.D.5 (Resulting Location Determination).) Thus, while the GPS and radio location techniques must both be performed (or at least attempted) before the resulting location determination can be performed, it does not matter what order those techniques are performed. Given that the order is immaterial, those of ordinary skill in the art would understand that it would be trivial to request and obtain location information using *Loomis*' GPS technique before the radio technique, or vice versa. (Expert Decl. § X.G.) Thus, at a minimum it would have been obvious to implement *Loomis*' location system to perform the location techniques in any order. (*Id.*) Section IX.D.7 (Reasons to Modify/Combine) explains why it would have been obvious to modify the prior art in this manner.

7. Reasons to Modify and/or Combine

As noted in Section IX.D.2 (Two-Way Communication), the proposed *Loomis-Wortham* combination involves modifying *Loomis* to provide its terrestrial location capabilities using its cellular-based system (as taught by *Wortham*), instead of its FM-based system. As explained below, those of ordinary skill in the art would have been motivated to modify *Loomis* in this manner based on market forces, to comply with FCC-imposed rules, and for improvement to yield predictable results.

For example, design incentives and other market forces, such as the increased popularity and use of cellular phones in the 1990s, and the FCC's proposed rules for locating wireless callers, would have prompted those of skill in the art to modify and implement existing location technologies into cellular telephone networks to comply with the FCC-imposed rules. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007). (*See also* Ex. 1014 (FCC E911 Proposal) ¶¶ 2, 9-10, 37, 39.) Specifically, in 1994, the rapid increase in the use of cellular telephones prompted the FCC to propose rules requiring cellular service providers to locate wireless 911 callers both inside and outside of buildings. (*Id.* ¶¶ 2, 9-10, 45-46.) To provide the requisite location capabilities, the FCC suggested incorporating existing location technologies into cellular telephone systems, such as GPS and terrestrial radio location systems. (*Id.* ¶¶ 39, 45-46.) As a result, those of ordinary skill in the art were actively looking to modify existing location

systems in a predictable manner (*i.e.*, combine and implement existing location technologies into cellular networks). (*Id.* ¶¶ 46-47; *see also* Ex. 1016 (Driscoll Survey) at stamped pp. 4-5, 12; Ex. 1015 (TR45 Joint Experts Meeting) at 2 (Background), 5 (Identify Caller’s Initial Location).) Thus, one of skill in the art would have been motivated to combine an existing location system, such as that of *Loomis*, with a cellular telephone network to comply with the FCC-imposed rules, and thereby to respond to market forces. (Expert Decl. § X.I.) This is particularly true in light of the fact that *Loomis*’ location system complies with the third implementation phase of the FCC proposal, which requires that the location information include 3-dimensional location coordinates of the mobile station. (Ex. 1014 (FCC E911 Proposal) ¶ 51; Ex. 1008 (*Loomis*) at 12:21-25.)

Moreover, the industry recognized that, “[o]n the whole, GPS is well suited for in-vehicle 9-1-1 location, but it would need to be used in combination with other technologies to cover in-building emergency calls from portable cellular or PCS phones.” (Ex. 1016 (Driscoll Survey) at stamped p. 12.) Given that *Loomis*’ solution uses GPS in combination with an FM radio location technique to provide location functionality both inside and outside of buildings (as the Driscoll Survey taught would be needed for 911 location-compliant solutions), those of ordinary skill in the art would appreciate that *Loomis*’ location system is an ideal candidate for integration with a cellular network to locate 911 callers (*i.e.*, using a known

system to improve a similar system to yield predictable results). (Ex. 1008 (Loomis) at 5:23-31, 18:27-32; *see also id.* at Abs., 19:32-37; Expert Decl. § X.I.) In addition, because cellular 911 callers would have to be in the vicinity of cell towers in order to make a 911 call, *Loomis*' FM radio towers and FM receiver would be unnecessary, as the cell towers could be used to provide the location functionality (as taught by *Wortham*) instead of the FM radio towers. (Expert Decl. § X.B.) Therefore, it would have been obvious to incorporate *Loomis*' hybrid location system, which uses a combination of GPS and terrestrial techniques, into a cellular network. (*Id.*)

Those of ordinary skill in the art would have found this combination obvious for various reasons. First, the mobile station in *Loomis* already includes cellular capabilities, as *Loomis* discloses embodiments that include “cellular communication means” for communicating with “another transmitter or receiver” and/or “another person or facility by cellular telecommunications” (*i.e.*, via a cellular tower). (Ex. 1008 (Loomis) at Fig. 6, 11:49-52, 12:27-40.) Second, similar to the FM radio towers in *Loomis*, the cellular towers corresponding to the “cellular communication means” in *Loomis* also would be fixed or stationary radio transmission structures with known locations (as taught by *Wortham*). (Ex. 1009 (Wortham) 1:67-2:6, 3:3-5, 13:29-32, 13:39-44; Expert Decl. § X.B.) Under this proposed combination, *Loomis*' cellular transceiver and associated cell towers

would be modified to provide the terrestrial location capabilities (in addition to the cellular communication capabilities), as in *Wortham*, instead of *Loomis*' FM radio transceiver and associated FM radio towers. (Ex. 1009 (*Wortham*) at 1:46-2:12, 7:48-55, 7:67-8:4; Expert Decl. § X.B.) In other words, *Loomis*' mobile station would be capable of two-way communication with the same towers that are used to provide the location capabilities (*i.e.*, cell towers), which would have been predictable to one of ordinary skill in the art. (*Id.*) As explained by Dr. Michalson, it would be easy to implement *Loomis*' location capabilities using cell towers instead of FM towers: *Loomis*' radio location technique would simply be performed using signals transmitted at cellular frequencies instead of FM radio frequencies. (Expert Decl. § X.B.) Thus, *Loomis*' location system would simply be modified to provide both the location and cellular communication capabilities using cell towers (as taught by *Wortham*). (*Id.*)

Those of ordinary skill in the art would have been motivated to modify *Loomis*' location system to use cellular towers, as in *Wortham*, based on the extremely similar nature of the problem solved: both references provide solutions for locating mobile devices using satellite and terrestrial location techniques. (Expert Decl. § X.I; *see also* Ex. 1008 (*Loomis*) at Abs., 19:32-37; Ex. 1009 (*Wortham*) at 1:46-53, 3:57-59.) *See also KSR*, 550 U.S. at 416 (Where “a patent claims a structure already known in the prior art that is altered by the mere

substitution of one element for another known in the field, the combination must do more than yield a predictable result.”). The extremely similar nature of the problem solved by *Loomis* and *Wortham*, and the similar manner in which they each solve that problem, would have motivated those of ordinary skill in the art to modify *Loomis*’ location system to provide its terrestrial location capabilities using *Loomis*’ cellular transceiver and associated cell towers, as described in *Wortham*, as a substitute for *Loomis*’ FM towers, to yield predictable results. As noted above, those of ordinary skill in the art would recognize that it would be easy to implement *Loomis*’ location capabilities using cell towers instead of FM towers: *Loomis*’ radio location technique would simply be performed using signals transmitted at cellular frequencies instead of FM radio frequencies. (Expert Decl. § X.B.)

As noted in Section IX.D.6 (Order of Techniques), it would have also been obvious to modify *Loomis*’ location system to perform the location techniques in any order, including performing *Loomis*’ GPS technique before its radio technique. (Expert Decl. § X.G.) For example, as explained in Section IX.D.6, the order of the location techniques does not matter in *Loomis*’ location system: both techniques simply need to be performed prior to performing the resulting location determination. Thus, those of ordinary skill in the art would recognize that implementing *Loomis*’ location techniques in a particular order would be obvious

to try given that there is only a finite number of identified, predictable solutions, all with a reasonable expectation for success. (Expert Decl. § X.G.) For example, the potential solutions for the order of techniques in *Loomis* include performing the GPS technique before, after, or concurrently with the radio technique. Given that the order of techniques is immaterial in *Loomis*' location system, all of these solutions are predictable and have an extremely strong expectation of success. (Expert Decl. § X.G.) Moreover, performing a satellite technique either before or after a terrestrial technique was a concept that was well known in the art. For example, *Kauser* discloses obtaining location information from a GPS technique before a cell-site geometric technique. (Ex. 1007 (Kauser) at Abs., 5:57-59, 6:12-24, 9:12-18, 9:40-46, 10:14-16, 11:23-34.) In addition, *Schuchman* discloses embodiments that perform GPS before an AM radio terrestrial technique. (Ex. 1010 (Schuchman) at 22:19-26.)

X. GROUNDS OF UNPATENTABILITY

The grounds of invalidity are set forth in detail throughout this section. As demonstrated below, Claims 17, 20, 25, and 26 are rendered obvious under 35 U.S.C. § 103 in view of the *Loomis-Wortham* combination.

CLAIM 17

17.0 A method for locating a wireless mobile station,

Loomis' location system provides a process for determining a location of a hybrid LD device carried by a mobile user (*i.e.*, “*a method for locating a wireless*

mobile station”) using multiple location techniques. (See Section IX.D.1 (Overview); see also Ex. 1008 (Loomis) at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5.) Each hybrid LD device in *Loomis* is capable of transmitting and receiving information (*i.e.*, satisfying the prior district court’s construction of “*mobile station*” as “*a mobile wireless device that is at least a transmitting device and may include a receiving device*”). (Ex. 1008 (Loomis) at 4:44-56, 12:27-46, FIG. 1.)

17.1 comprising performing the following steps by computational equipment:

Loomis’ location system performs the following steps in Claim Elements 17.2 through 17.10 using various hardware components, including a controller, GPS signal receiver/processor, radio signal receiver/processor, and/or a central station (*i.e.*, “*computational equipment*,” a variation of “*computational machinery*,” construed in the prior district court as “*one or more machines (such as a computer or hardware device) that performs computations*”). (Ex. 1008 (Loomis) at FIGS. 1, 6, 4:51-56, 4:66-5:22, 8:29-34, 11:50-12:29, 12:47-13:4.)

17.2 (A1) receiving location information for the mobile station by the steps (a) and (b) following:

As explained in Section IX.D.1, *Loomis*’ location system includes GPS and radio location techniques that provide location information of the mobile station using wireless signal measurements. (See Section IX.D.1 (Overview); Ex. 1008 (Loomis) at 11:49-12:15, 19:32-47.) The required “*steps (a) and (b)*” are addressed in the following analysis for Claim Elements 17.3-17.9.

17.3 (a) first obtaining a first instance of the location information when supplied with signal time delay data obtained from wireless signal data received by the mobile station from a satellite, wherein a geographic range corresponding to the signal time delay data is used to determine the first instance;

Section IX.D.3 explains how *Loomis*' GPS technique (i.e., outdoor LD module) satisfies these claim elements. For example, in *Loomis*, the mobile station includes a GPS receiver/processor that obtains GPS location information of the mobile station (i.e., "*first obtaining a first instance of the location information*") when provided with GPS satellite signal measurements (i.e., "*when supplied with signal time delay data obtained from wireless signal data received by the mobile station from a satellite*"). (Ex. 1008 (*Loomis*) at 11:49-12:15, 19:32-47; *see also* (Section IX.D.3 (GPS Technique).) The GPS location information (i.e., "*first instance of the location information*") includes the present GPS location coordinates $(x_u, y_u, z_u)_{out}$ of the mobile station and associated GPS signal indicium I_{out} . (Ex. 1008 (*Loomis*) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.)

As explained in Section IX.D.3, GPS signal measurements relate to "*signal time delay data*" of wireless signals received by the mobile station from GPS satellites. (See Section IX.D.3 (GPS Technique); Ex. 1008 (*Loomis*) at 22:57-23:13; Ex. 1009 (*Wortham*) at 3:21-25, 5:18-23; Expert Decl. § X.C.2.)

Loomis' GPS technique determines the present GPS location coordinates of the mobile station using the signal travel time of GPS satellite signals (i.e., "*signal*

time delay data obtained from wireless signal data received by the mobile station from a satellite”) to determine pseudorange measurements corresponding to the range of the GPS receiver in the mobile station from each satellite (*i.e.*, “*a geographic range corresponding to the signal time delay data is used to determine the first instance*”). (Ex. 1008 (Loomis) at 12:8-12:15, 22:57-23:13; *see also* Section IX.D.3 (GPS Technique).)

Section IX.D.6 (Order of Techniques) explains that, if this claim requires an order for the steps, *Loomis* discloses the required order and also renders it obvious.

17.4 wherein communication between the mobile station and at least one terrestrial transceiver is used to improve said first instance; and

As noted in Section IX.D.3, *Loomis*’ GPS technique can be implemented using differential GPS (“D-GPS”). (Ex. 1008 (Loomis) at 11:20-48; *see also* Expert Decl. § X.C.1.) For example, *Loomis* discloses that a reference station with a known location (*i.e.*, the central station) can be used for “differential position computations for determining the present location” of the GPS receiver/processor in the mobile station. (Ex. 1008 (Loomis) at 11:20-24.) In those embodiments, the reference station (which performs the D-GPS calculations) determines differential GPS (“D-GPS”) correction data using GPS satellite signals, and then transmits the D-GPS correction data to the mobile station “so that the calculated present location . . . can be adjusted.” (*Id.* at 11:34-48 (emphasis added); *see also* Ex. 1009 (Wortham) at 3:48-59, 4:10-25.) As *Loomis* teaches, “[d]ifferential position

techniques use the known location of the reference station to remove some of the errors contained in signals received by a mobile station.” (Ex. 1008 (Loomis) at 11:24-29.) Moreover, when combined with *Wortham* as described in Section IX.D.2, the reference station would transmit the D-GPS correction data to the mobile station using the network of cell towers (*i.e.*, “*communication between the mobile station and at least one terrestrial transceiver is used to improve said first instance*”). (Section IX.D.2 (Two-Way Communication); Ex. 1009 (Wortham) at 1:46-2:12.)

17.5 (b) second obtaining a second instance of the location information of the mobile station when supplied with second data indicative of time delays of wireless signals transmitted between the mobile station and a plurality of terrestrial transceivers cooperatively linked together for use in two way communication with the mobile station,

Section IX.D.4 (under the discussion of signal time delay measurements) explains how *Loomis*’ radio technique (*i.e.*, the indoor LD module) satisfies these claim elements. For example, in *Loomis*, the mobile station includes a radio receiver/processor that obtains location information of the mobile station (*i.e.*, “*second obtaining a second instance of the location information*”) when supplied with the radio phase measurements (*i.e.*, “*when supplied with second data*”). (See Section IX.D.4 (Radio Technique); Ex. 1008 (Loomis) at 6:25-29, 6:41-55, 11:55-65.) The radio location information (*i.e.*, “*second instance of the location information*”) includes the present radio location coordinates $(x_u, y_u, z_u)_{rad}$ and

associated radio signal indicium I_{rad} . (Ex. 1008 (Loomis) at 11:55-65, 12:21-27.)

As explained in Section IX.D.4, each radio source in *Loomis* (which includes a transmitting antenna) is a fixed radio transmission structure with a known location on the Earth (*i.e.*, “*terrestrial transceivers*”). (Section IX.D.4 (Radio Technique); Ex. 1008 (Loomis) at 4:44-56, 6:25-29, 6:35-37, 8:53-64, 21:36-38.) When combined with *Wortham* as described in Section IX.D.2, those radio sources would be cell towers (*i.e.*, “*a plurality of terrestrial transceivers cooperatively linked together for use in two way communication with the mobile station*”). (Ex. 1009 (Wortham) at 1:46-2:12, 13:23-30; *see also* Section IX.D.2 (Two-Way Communication); Expert Decl. § X.B).

Loomis also discloses that location techniques based on signal timing measurements (*i.e.*, “*data indicative of time delays of wireless signals*”) were known in the prior art. For example, in the Background of the Invention, *Loomis* discloses various known prior art location techniques that determine locations using “differences in time of arrival...of the pulse transmitted by the roving station,” “differences in arrival times of the range tones received from the radio station,” or by “comparing times of arrival of the transmitted signal.” (Ex. 1008 (Loomis) at 2:18-21, 2:51-53, 3:28-33 (emphasis added).)

Moreover, the radio location technique in *Loomis*’ main embodiment uses signal timing measurements (*i.e.*, “*data indicative of time delays of wireless*

signals”). (Section IX.D.4 (under the discussion of signal time delay measurements); Expert Decl. § X.D.4; *see also* Ex. 1008 (Loomis) at 6:46-55.) For example, *Loomis*’ radio technique generates location estimates using signal phase measurements to determine “the intersections of three or more hyperboloids that are defined by the relative times of arrival of the three radio LD signals.” (Ex. 1008 (Loomis) at 6:46-55, 11:61-65 (emphasis added).) Those of ordinary skill in the art would understand that the “relative times of arrival” of the three radio signals refers to the differences in their respective arrival times (*i.e.*, the claimed “*data indicative of time delays of wireless signals*”). (Expert Decl. § X.D.4.)

Section IX.D.6 (Order of Techniques) explains that, if this claim requires an order for the steps, *Loomis* discloses the required order and also renders it obvious.

17.6 wherein at least one of (i) and (ii) following are used for obtaining the second instance:

This claim element requires that the second instance be obtained using one of the two recited elements (not both) identified below in Claim Elements 17.7 and 17.8 (*i.e.*, “at least one of the following”). As explained below, *Loomis*’ radio technique uses “(i)” in Claim Element 17.7, and thus is not required to use “(ii)” in Claim Element 17.8.

17.7 (i) a representation of a locus of locations having substantially a same time difference of arrival for wireless signals communicated between: the mobile station, and each of at least two of the transceivers, and

Loomis’ radio technique calculates location estimates using phase

measurements of signals received by the mobile station from the radio towers (*i.e.*, “wireless signals communicated between: the mobile station, and each of at least two of the transceivers”). (Ex. 1008 (Loomis) at 6:47-55, 9:61-10:4, 10:24-39, 11:61-65.)

Loomis also discloses that the claimed “*time difference of arrival*” (TDOA) techniques were known in the prior art. For example, in the Background of the Invention, *Loomis* discloses various known prior art location techniques that determine locations using “differences in time of arrival...of the pulse transmitted by the roving station,” “differences in arrival times of the range tones received from the radio station,” or by “comparing times of arrival of the transmitted signal.” (*Id.* at 2:18-21, 2:51-53, 3:28-33 (emphasis added).)

Moreover, the radio technique in *Loomis*’ main embodiment is implemented using a “*time difference of arrival*” technique. (Expert Decl. § X.H.1.) For example, *Loomis*’ radio technique generates location estimates “using intersections of three or more hyperboloids that are defined by the relative times of arrival of the three radio LD signals.” (Ex. 1008 (Loomis) at 6:47-55, 11:61-65.) Those of ordinary skill in the art would understand that the “relative times of arrival” of the three radio signals refers to the differences in their respective arrival times (*i.e.*, the claimed “*time difference of arrival for wireless signals*”). (Expert Decl. § X.H.1.) Moreover, *Loomis* explains that the intersection of the “hyperboloids or similar

quadratic surfaces” may be “two points” or “curve segments” (*i.e.*, satisfying the claimed “*locus of locations*,” proposed for construction as “*a collection of points or locations*”). (Ex. 1008 (Loomis) at 10:27-33; Expert Decl. § X.H.2.) Thus, the intersecting points or curve segments, which *Loomis* calculates using the difference in arrival times of the signals, represent “*a locus of locations having substantially a same time difference of arrival for wireless signals.*” (Expert Decl. § X.H.2; *see also* Ex. 1008 (Loomis) at 6:46-55, 10:24-33.)

17.8 (ii) *an area obtained by a correspondence between surveyed wireless signaling characteristics of the area, and wireless signals communicated between the mobile station and the transceivers;*

As explained for Claim Element 17.6, “(ii)” does not need to be used if “(i)” is used.

17.9 *wherein the second instance does not depend on a geographical location of the mobile station obtained from information indicative of a distance between the mobile station and at least one of the one or more satellites;*

Loomis discloses that the GPS technique “operates independently” of the radio technique and that each of these techniques “provid[es] an independent determination of location” (*i.e.*, “*the second instance*” obtained by the radio technique “*does not depend on a geographical location of the mobile station obtained [by the GPS technique] from information indicative of a distance between the mobile station and at least one of the one or more satellites*”). (Ex. 1008 (Loomis) at 5:7-9, 7:41-44.)

17.10 (A2) *determining resulting location information, for each of one or more*

locations of said mobile station, using at least one of: a first value obtained from the first instance, and a second value obtained from the second instance;

(A3) outputting said resulting location information for each of the one or more locations;

wherein: the first value is used to obtain the resulting information for one of the locations, and the second value is used to obtain the resulting information for one of the locations.

resulting location information

Section IX.D.5 explains how *Loomis*' location system determines the "resulting location information." For example, *Loomis*' resulting location determination first determines which of the GPS and radio techniques likely provided the most accurate location estimate, by comparing the signal indicia of the estimates from each technique with threshold indicia and/or comparing the estimates themselves. (See Section IX.D.5 (Resulting Location Determination); Ex. 1008 (*Loomis*) at 12:21-27, 12:47-13:1, 19:48-63.) Next, based on a comparison of the respective signal indicia and/or location estimates, *Loomis*' resulting location determination selects either the radio location estimate or GPS location estimate as the resulting location information (collectively, "*determining resulting location information, for each of one or more locations of said mobile station, using at least one of: a first value obtained from the first instance, and a second value obtained from the second instance*"). (Ex. 1008 (*Loomis*) at FIG. 9, 12:47-13:1, 19:48-63.)

In addition, *Loomis* teaches that its location system typically uses the GPS

location information as the resulting location information when the mobile station is outside of a building (*i.e.*, “*the first value is used to obtain the resulting information for one of the locations*”), and uses the radio location information as the resulting location information when the mobile station is inside of a building (*i.e.*, “*the second value is used to obtain the resulting information for one of the locations*”). (*Id.* at 18:27-32, 20:21-28.)

outputting resulting location information

Loomis’ location system transmits (*i.e.*, “*outputting*”) the selected location estimate (*i.e.*, “*resulting location information for each of the one or more locations*”) to an interested person/facility. (Ex. 1008 (*Loomis*) at 5:14-22, 12:30-40; *see also id.* at 12:62-13:1.)

CLAIM 20

20.0 A method for locating a terrestrial wireless mobile station capable of two way communication with a plurality of fixed location terrestrial stations,

For the reasons presented with respect to Claim Element 17.0, *Loomis* satisfies this claim element (including the prior district court construction of “*mobile station*”). (*See* Analysis for Claim Element 17.0; *see also* Ex. 1008 (*Loomis*) at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5.) In addition, one of skill in the art would understand that the mobile station in *Loomis* is “*terrestrial*,” or on the Earth. For example, *Loomis*’ method determines the location of a mobile user that carries the hybrid LD device (*i.e.*, “*terrestrial mobile station*”) “inside or

outside buildings and structures within a region R.” (Ex. 1008 (Loomis) at Abs.; *see also id.* at 19:32-37.)

Finally, when combined with *Wortham* as described in Section IX.D.2, *Loomis*’ mobile station would be capable of two-way communication with a network of cell towers (*i.e.*, “*a terrestrial wireless mobile station capable of two way communication with a plurality of fixed location terrestrial stations*”). (Section IX.D.2 (Two-Way Communication); *see also* Ex. 1009 (Wortham) at 1:46-2:12, 7:48-55, 7:67-8:4; Expert Decl. § X.B.) As Section IX.D.4 explains, the cell towers are fixed or stationary radio transmission structures with known locations (*i.e.*, “*fixed location terrestrial stations*”). (Ex. 1009 (Wortham) at 1:67-2:6, 3:3-5, 13:29-32, 13:39-44; *see also* Section IX.D.4 (Radio Technique).)

20.1 comprising performing the following steps by computational machinery:

See Analysis for Claim Element 17.1.

20.2 receiving, from computational machinery performing a plurality of mobile station location techniques, a plurality of instances of location information having one or more location estimates of the mobile station, wherein said location techniques generate the instances of location information when said location techniques are supplied with corresponding input information upon which their location information is dependent, and wherein the corresponding input information is at least partially derived from measurements of wireless signals transmitted from or received at the mobile station;

As explained in Section IX.D.1, *Loomis*’ hybrid location system provides location estimates for a mobile station using GPS and radio location techniques that require wireless signal measurements as input (*i.e.*, “*receiving, from*

computational machinery performing a plurality of mobile station location techniques, a plurality of instances of location information”). (See Section IX.D.1 (Overview); Ex. 1008 (Loomis) at Abs., 11:49-13:4, 19:32-20:5.)

As explained in Section IX.D.3, the mobile station includes a GPS receiver/processor (*i.e.*, “*computational machinery performing*” the GPS technique) that determines location coordinates $(x_u, y_u, z_u)_{out}$ of the mobile station (*i.e.*, “*location information having one or more location estimates of the mobile station*”) when supplied with the requisite GPS satellite signal measurements (*i.e.*, “*corresponding input information upon which their location information is dependent*”). (See Section IX.D.3(GPS Technique); Ex. 1008 (Loomis) at 7-9:22, 11:66-12:15.) The GPS signal measurements used by the GPS technique are obtained from signals received by the mobile station from GPS satellites (*i.e.*, “*the corresponding input data information is at least partially derived from measurements of wireless signals transmitted from or received at the mobile station*”). (Ex. 1008 (Loomis) 7:9-22, Abs., 12:8-12:15, 19:32-47.)

As explained in Section IX.D.4, *Loomis*’ mobile station also includes a radio receiver/processor (*i.e.*, “*computational machinery performing*” the radio technique) that obtains location coordinates $(x_u, y_u, z_u)_{rad}$ of the mobile station (*i.e.*, “*location information having one or more location estimates of the mobile station*”) when supplied with the requisite cell tower signal measurements (*i.e.*,

“corresponding input information upon which their location information is dependent”). (See Section IX.D.4 (Radio Technique); Ex. 1008 (Loomis) at 6:25-29, 6:41-55, 11:55-65.) In the Combination, the cell tower signal measurements used by *Loomis*’ radio technique are obtained from signals received by the mobile station from cell towers (i.e., *“the corresponding input data information is at least partially derived from measurements of wireless signals transmitted from or received at the mobile station”*). (See Section IX.D.2 (Two-Way Communication); Ex. 1009 (Wortham) at 1:46-2:12; *see also* Section IX.D.4 (Radio Technique).)

For these reasons, *Loomis*’ GPS and radio techniques would also satisfy the recited *“location techniques”* under the prior district court construction of *“mobile station location techniques”* as *“techniques for determining mobile station locations.”*

20.3 *wherein said steps of receiving includes steps (a) and (b) following:*

The requirements *“(a) and (b)”* are addressed in the following analysis for Claim Elements 20.4, 20.5, and 20.6.

20.4 *(a) first receiving, from a first of said location techniques, first location information for the mobile station, wherein said corresponding input information for said first location technique includes timing data from wireless signals transmitted from one or more global positioning satellites, and received by the mobile station,*

See Analysis for Claim Element 17.3.

20.5 *wherein said first location technique also uses information dependent upon a location of a terrestrial receiver, TS, that receives a wireless transmission from the mobile station, and resulting in the first location*

information being dependent on the location of TS and the timing data, wherein TS is remote from the mobile station;

Section IX.D.3 explains how *Loomis*' GPS technique satisfies these claims elements. First, *Loomis* discloses embodiments where the GPS receiver/processor in the mobile station performs the GPS signal timing measurements, and then transmits those measurements—unprocessed, partially processed, or fully processed—to a central station (*i.e.*, “a terrestrial receiver, TS, that receives a wireless transmission from the mobile station”). (Ex. 1008 (*Loomis*) at 8:26-35, 20:29-42.). The central station then performs the GPS technique (*i.e.*, “first location technique”) using the signal timing measurements. (*Id.*) *Loomis* teaches that the central station is a fixed or stationary structure with a known location on Earth and remote from the mobile station. (*Id.* at FIG. 1, 11:20-29.)

Second, as explained for Claim Element 17.4, *Loomis*' central station can also perform D-GPS to adjust and improve the accuracy of GPS location estimates by removing errors in GPS satellite signals. (*See id.* at 11:20-48; Analysis for Claim Element 17.4.) In those embodiments, the central station (*i.e.*, “a terrestrial receiver, TS”) uses its known location to determine D-GPS correction data (*i.e.*, “information dependent upon a location of a terrestrial receiver, TS”), and then adjusts the calculated location of the mobile station based on the D-GPS correction data. (Ex. 1008 (*Loomis*) at 11:34-48; *see also* Ex. 1009 (*Wortham*) at 3:48-59, 4:10-25.) Thus, when *Loomis*' central station performs the GPS technique (*i.e.*, the

“first location technique”) and D-GPS calculations, the resulting GPS location information is dependent on the GPS signal timing measurements received from the mobile station and the D-GPS correction data obtained using the known location of the central station (*i.e.*, *“resulting in the first location information being dependent on the location of TS and the timing data”*).

20.6 (b) *second receiving, from a second of said location techniques, second location information for the mobile station, wherein said corresponding input information for said second location technique includes data that is a function of a signal time delay of wireless signals transmitted between the wireless mobile station and one of said plurality of fixed location terrestrial stations during a plurality of transmissions between the mobile station and the one terrestrial station;*

See Analysis for Claim Element 17.5.

20.7 *wherein for obtaining the corresponding input information for the second location technique, there is at least one transmission from the mobile station to the one terrestrial station, and at least one transmission from the one terrestrial station to the mobile station, and*

wherein said second location information is determined by said second location technique at a site whose location is spaced apart from the mobile station;

Loomis’ mobile station performs the signal phase measurements (i.e., “corresponding input information”) using signals transmitted from the radio towers (i.e., “there is...at least one transmission from the one terrestrial station to the mobile station”), and in one embodiment, the mobile station then transmits those signal phase measurements (i.e., “corresponding input information”) to the central station to allow the central station to perform the radio technique (i.e., “wherein for obtaining the corresponding input information...there is at least one transmission

from the mobile station”). (Ex. 1008 (Loomis) at 8:29-34, 20:29-42.)

Moreover, when combined with *Wortham* as presented in Claim Element 20.0, *Loomis*’ transmission of the phase measurements (*i.e.*, “*corresponding input information*”) to the central station would be done using cellular communications via cell towers (*i.e.*, “*there is at least one transmission from the mobile station to the one terrestrial station*”). (*Id.* at 8:29-34, 20:29-42; Ex. 1009 (Wortham) at 1:46-2:12; *see also* Section IX.D.2 (Two-Way Communication); Expert Decl. § X.B.)

Loomis’ central station (which performs the radio technique using the measurements from the mobile station) is located at a site spaced apart from the mobile station (*i.e.*, “*said second location information is determined by said second location technique at a site whose location is spaced apart from the mobile station*”). (Ex. 1008 (Loomis) at FIG. 1, 11:20-29.)

20.8 determining, a plurality of resulting location estimates for the mobile station, wherein said step of determining includes steps (c) and (d) following: (c) obtaining at least one of said resulting location estimates using an instance (I_1) of said first location information for locating the mobile station; and (d) obtaining at least one of said resulting location estimates using an instance (I_2) of said second location information for locating the mobile station.

For the reasons presented with respect to Claim Element 17.10, *Loomis* satisfies this claim element. Moreover, *Loomis* discloses determining “the present location of the user [] at selected times (e.g., second-by-second, or more or less

often, if desired)” (*i.e.*, “*determining, a plurality of resulting location estimates*”).
(Ex. 1008 (Loomis) at 8:26-35.)

CLAIM 25

25.0 A method for providing a location estimate of a wireless mobile station dependent upon measurements of wireless signals

For the reasons presented with respect to Claim Element 17.0, *Loomis* satisfies this claim element (including the prior district court construction of “*mobile station*”). (See Analysis for Claim Element 17.0.) For example, *Loomis*’ location system provides a location estimate of a mobile station using multiple location techniques that require wireless signal measurements as input (*i.e.*, the method is “*dependent upon measurements of wireless signals*”). (See *id.*; Ex. 1008 (Loomis) at Abs., 11:49-13:4, 19:32-20:5.) Further, when combined with *Wortham*, each mobile station in *Loomis* is capable of two-way wireless communication with a cellular network (*i.e.*, “*wireless mobile station*”). (See Analysis for Claim Element 20.0.)

25.1 wherein for receiving a first collection of measurements related to signal time delay of wireless signals, the wireless signals received by said mobile station and transmitted from one or more satellites, there is a predetermined corresponding location technique for determining first location information of the mobile station

wherein when provided with the first collection, the predetermined corresponding location technique uses the first collection to determine a location for the mobile station

For the reasons presented with respect to Claim Elements 17.3 and 20.2, *Loomis*’ GPS technique satisfies these claim elements. (See Analysis for Claim

Elements 17.3, 20.2.) For example, in *Loomis*, the GPS receiver/processor in the mobile station receives and measures GPS satellite signals (*i.e.*, “*for receiving a first collection of measurements*”) and performs a GPS technique for determining GPS location information of the mobile station (*i.e.*, “*a predetermined corresponding location technique for determining first location information of the mobile station*”). (See Section IX.D.3 (GPS Technique); Ex. 1008 (*Loomis*) at 4:66-5:9, 7:9-22, 11:66-12:15.) The GPS location information (*i.e.*, “*first location information*”) includes the present GPS coordinates and associated signal indicia. (Ex. 1008 (*Loomis*) at 12:21-27, 19:42-47.)

As explained for Claim Element 17.3, GPS signal measurements relate to “*signal time delay of wireless signals*” received by the mobile station from GPS satellites. (See Analysis for Claim Element 17.3; *see also* Ex. 1008 (*Loomis*) at 22:57-23:13; Expert Decl. § X.C.2.)

When provided with the GPS signal measurements (*i.e.*, “*when provided with the first collection*”), *Loomis*’ GPS technique uses the measurements to estimate the location of the mobile station (*i.e.*, “*a location for the mobile station*”). (See Section IX.D.3 (GPS Technique); Ex. 1008 (*Loomis*) at 7:9-22, 11:66-12:15.)

For these reasons, *Loomis*’ GPS technique would also satisfy the recited “*location technique*” under the prior district court construction of “*mobile station location technique*” as “*technique for determining mobile station locations.*”

25.2 wherein for receiving a second collection of measurements obtained from wireless signals transmitted between said mobile station and one or more fixed location terrestrial stations, at least when said first collection is not available, there is a predetermined corresponding location technique for determining second location information of the mobile station

For the reasons presented with respect to Claim Elements 17.5 and 20.2, *Loomis*' radio technique satisfies this claim element. (See Analysis for Claim Elements 17.5, 20.2.) For example, in *Loomis*, the radio receiver/processor in the mobile station obtains signal phase measurements from signals transmitted between the mobile station and surrounding radio towers (i.e., “for receiving a second collection of measurements obtained from wireless signals transmitted between said mobile station and one or more fixed location terrestrial stations”), and then uses a radio technique to determine radio location information of the mobile station (i.e., “a predetermined corresponding location technique for determining second location information of the mobile station”). (See Section IX.D.4 (Radio Technique); see also Ex. 1008 (*Loomis*) at 6:25-29, 6:41-55, 11:55-65.) As explained for Claim Element 17.5, the radio towers are fixed or stationary radio transmission structures with known locations (i.e., “fixed location terrestrial stations”). (See Analysis for Claim Element 17.5.)

For these reasons, *Loomis*' radio technique would also satisfy the recited “location technique” under the prior district court construction of “mobile station location technique” as “technique for determining mobile station locations.”

Finally, those of ordinary skill in the art would understand that, in *Loomis*' location system, the radio technique and associated signal measurements are used to generate a location estimate even when the GPS satellite signal measurements are unavailable, for example, due to an obstruction (*i.e.*, "*at least when said first collection is not available*"). (Ex. 1008 (*Loomis*) at 18:27-32, 20:21-28; Expert Decl. § X.H.4.) For example, *Loomis* explains that GPS systems "do not work well where some of the signal sources are obscured by structures outdoors, or when the object to be located is positioned indoors." (Ex. 1008 (*Loomis*) at 1:20-35.) *Loomis* teaches that it addresses this problem by using the GPS coordinates provided by the GPS technique when the mobile station is outside of buildings and the radio coordinates provided by the radio technique when the mobile station is inside of buildings. (*Id.* at 18:27-32, 20:21-28.) In addition, *Loomis* teaches selecting either the GPS or radio technique based on the adequacy of their respective signals, and therefore if the GPS signals are inadequate, the radio signals would be used. (*Id.* at 19:48-60.)

Thus, when the GPS coordinates are either unavailable or unreliable, *Loomis*' resulting location determination is simply performed using the radio technique. (*Id.*) Those of ordinary skill in the art would understand that, in any GPS-based system such as *Loomis*', GPS signals will not always be available, either because they are completely obstructed or at least sufficiently obstructed that

they do not produce a reliable estimate. In either situation, the collection of GPS signal measurements would be considered unavailable (*i.e.*, “*at least when said first collection is not available*”). Thus, those of ordinary skill in the art would find it both inherent and obvious that *Loomis*’ radio technique would still be used even when there is a blockage or outage of GPS signals. (Expert Decl. § X.H.4.)

25.3 *wherein said second collection includes signal time delay data of wireless signals transmitted between the mobile station and the fixed location terrestrial stations*

For the reasons presented with respect to Claim Element 17.5, *Loomis* satisfies this claim element. (See Analysis for Claim Element 17.5; see also Section IX.D.4 (discussing signal time delay measurements).) For example, the phase measurements (*i.e.*, “*said second collection*”) used by *Loomis*’ radio technique indicate the “relative times of arrival” (*i.e.*, “*signal time delay data*”) of signals between the mobile station and radio towers. (Ex. 1008 (*Loomis*) at 6:46-55; Section IX.D.4 (Radio Technique); Expert Decl. § X.D.4.)

25.4 *there being at least one wireless transmission from the mobile station to the one or more fixed location terrestrial stations in order to provide the predetermined corresponding location technique for receiving the second collection with the second collection*

Loomis’ mobile station performs the signal phase measurements (*i.e.*, “*second collection*”) using signals transmitted from the radio towers (*i.e.*, “*fixed location terrestrial stations*”), and in one embodiment, the mobile station then transmits those signal phase measurements to the central station to allow the

central station to perform the radio technique (*i.e.*, “*there being at least one wireless transmission from the mobile station...in order to provide the predetermined corresponding location technique for receiving the second collection with the second collection*”). (Ex. 1008 (Loomis) at 8:29-34, 20:29-42.)

Moreover, when combined with *Wortham* as described in Section IX.D.2, *Loomis*’ transmission of the phase measurements (*i.e.*, “*second collection*”) to the central station would be done using cellular communications via cell towers (*i.e.*, “*from the mobile station to the one or more fixed location terrestrial stations*”). (Ex. 1008 (Loomis) at 8:29-34, 20:29-42; Ex. 1009 (Wortham) at 1:46-2:12; *see also* Section IX.D.2 (Two-Way Communication); Expert Decl. § X.B.)

25.5 *wherein said second collection of measurements is used by the corresponding location technique for receiving the second collection to determine a location estimate of the mobile station by determining a locus of locations from at least one of the fixed location terrestrial stations, wherein for locations identified by said locus of locations, a signal time delay dependent condition is satisfied using the signal time delay data*

Loomis’ radio technique (*i.e.*, “*the corresponding location technique*”) uses signal phase measurements (*i.e.*, “*second collection of measurements*”) to calculate a location estimate of the mobile station. (Ex. 1008 (Loomis) at 6:47-55, 9:61-10:4, 10:24-39, 11:61-65.) As explained for Claim Element 17.7, the radio technique in *Loomis*’ main embodiment is implemented using a time difference of arrival technique. (Expert Decl. § X.H.1.) For example, *Loomis*’ radio technique generates location estimates “using intersections of three or more hyperboloids that

are defined by the relative times of arrival of the three radio LD signals” at the mobile station’s antenna from the radio towers (*i.e.*, “*a signal time delay dependent condition is satisfied using the signal time delay data*”). (Ex. 1008 (Loomis) at 6:47-55, 9:61-67, 10:24-39, 11:61-65.)

Moreover, *Loomis* explains that the intersection of the “hyperboloids or similar quadratic surfaces” may be “two points” or “curve segments” (*i.e.*, satisfying the claimed “*locus of locations*,” proposed for construction as “*a collection of points or locations*”). (*Id.*; Expert Decl. § X.H.2.) Thus, the intersecting points or curve segments, which *Loomis* calculates using the difference in arrival times of the signals, satisfy the following claim element: “*for locations identified by said locus of locations, a signal time delay dependent condition is satisfied using the signal time delay data.*” (*Id.*; see also Ex. 1008 (Loomis) at 6:46-55, 10:24-33.)

Finally, by measuring the difference in arrival times of a signal at three radio towers to form three or more hyperboloids, the location of the mobile station can be estimated as the intersection of those hyperboloids (*i.e.*, “*determine a location estimate of the mobile station by determining a locus of locations from at least one of the fixed location terrestrial stations*”). (Ex. 1008 (Loomis) at 6:46-52, 10:24-39, 11:61-65; Expert Decl. § X.H.1.)

25.6 comprising performing the following steps by computational equipment:

See Analysis for Claim Element 17.1.

25.7 *first obtaining the first location information of said mobile station, the first location information determined by computational machinery when said corresponding location technique for using the first collection is supplied with an instance of said first collection;*

See Claim Element 17.3 Analysis (and 17.1 for “computational machinery”).

25.8 *second obtaining the second location information of said mobile station, the second location information determined by computational machinery when said corresponding location technique for receiving the second collection is supplied with an instance of said second collection*

See Claim Element 17.5 Analysis (and 17.1 for “computational machinery”).

25.9 *outputting, to a source for accessing location data for said mobile station, resulting location information that is dependent upon: at least one of said first and second location information, and also dependent upon data for indicating a likelihood of the mobile station being in a geographical extent represented by of at least one of said first location information and said second location information.*

resulting location information

Section IX.D.5 (Resulting Location Determination) explains how *Loomis*’ location system determines the “*resulting location information.*” For example, *Loomis*’ resulting location determination first determines which of the GPS and radio techniques likely provided the most accurate location estimate, by comparing the signal indicia of the estimates from each technique with threshold indicia and/or comparing the estimates themselves. (Ex. 1008 (*Loomis*) at 12:21-27, 12:47-13:1, 19:48-63.) Next, based on a comparison of the respective signal indicia and/or location estimates to determine which is more accurate, *Loomis*’ resulting location determination selects either the radio location estimate or GPS

location estimate as the resulting location estimate (collectively, “*resulting location information that is dependent upon: at least one of said first and second location information*”). (Ex. 1008 (Loomis) at FIG. 9, 12:47-13:1, 19:48-63.)

As explained in Section IX.D.5, the claimed “*data for indicating a likelihood*” is satisfied by the signal indicium for the estimates from each technique, which are used to indicate the “accuracy” or likelihood of the mobile station being at the respective GPS and radio location estimates (*i.e.*, “*resulting location information that is...dependent upon a likelihood of the mobile station being in a geographical extent represented by of at least one of said first location information and said second location information*”). (*Id.* at Abs., 5:15-21, 5:65-6:4, 12:47-64, 16:40-51.)

Additionally, the claimed “*geographical extent*” (previously construed as “*geographical area or range*”) is satisfied by either the GPS location coordinates (*i.e.*, “*first location information*”) determined by *Loomis*’ GPS technique or the radio location coordinates (*i.e.*, “*second location information*”) determined by *Loomis*’ radio technique (each of which represent an “area” defined by the precision and accuracy of the coordinates, as explained by Dr. Michalson). (Expert Decl. § X.H.3.)

outputting resulting location information to a source for accessing location data

Loomis’ location system transmits (*i.e.*, “*outputting*”) the selected location

estimate (*i.e.*, “*resulting location information*”) to an interested person or facility (*i.e.*, “*a source for accessing location data for said mobile station*”). (Ex. 1008 (Loomis) at 5:14-22, 12:30-40; *see also id.* at 12:62-13:1.)

CLAIM 26

26. *The method as claimed in claim 25, wherein the data for indicating a likelihood includes first data indicative of a likelihood of the mobile station being in a geographical extent represented by the said first location information, and includes second data indicative of a likelihood of the mobile station being in a geographical extent represented by the second location information.*

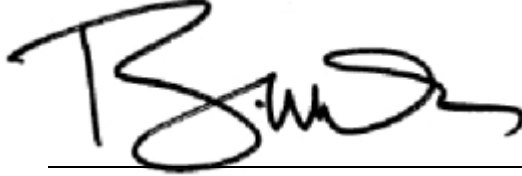
This claim depends from Claim 25, and as explained above, *Loomis* and *Wortham* disclose all elements of Claim 25. In addition, for the reasons presented in Claim 25.9 (including the “*geographical extent*” discussion), the GPS signal indicia (*i.e.*, “*first data indicative of a likelihood*”) and radio signal indicia (*i.e.*, “*second data indicative of a likelihood*”) each identify the accuracy/reliability (*i.e.*, “*likelihood*”) of the respective GPS estimate (*i.e.*, “*first location information*”) and radio estimate (*i.e.*, “*second location information*”). (Ex. 1008 (Loomis) at Abs., 5:15-21, 5:65-6:4, 12:47-64, 16:40-51.)

XI. CONCLUSION

For the reasons set forth above, there is a reasonable likelihood that Petitioners will prevail as to the invalidity of Claims 17, 20, 25, and 26 of the '231 Patent. Accordingly, Petitioners request that the Board institute *inter partes* review and subsequently invalidate the challenged claims.

DATED: August 7, 2015

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'B. W. Oaks', written over a horizontal line.

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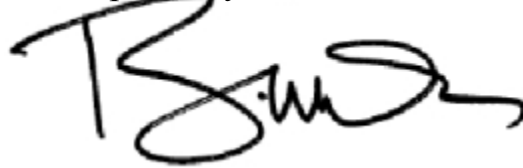
Counsel for Petitioners

CERTIFICATE OF SERVICE

The undersigned certifies that, pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the Patent Owner has been served with a copy of this Petition for *Inter Partes* Review and supporting materials at the correspondence address of record for the '231 Patent:

Dennis Dupray
1801 Belvedere Dr.
Golden, CO 80401

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'B. W. Oaks', written over a horizontal line.

DATED: August 7, 2015

Brian W. Oaks
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