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. 8,032,153

Title: MULTIPLE LOCATION ESTIMATORS FOR WIRELESS LOCATION

PETITION FOR *INTER PARTES* REVIEW

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EXHIBITS

Number	Description
1001	U.S. Patent No. 7,764,231 (the "'231 Patent")
1002	U.S. Patent No. 7,525,484 (the "'484 Patent")
1003	U.S. Patent No. 8,032,153 (the "'153 Patent") **(PATENT CHALLENGED IN THIS PETITION)**
1004	U.S. Patent No. 7,298,327 (the "'327 Patent")
1005	*Curriculum Vitae* of Dr. William Michalson
1006	Expert Declaration of Dr. William Michalson
1007	U.S. Patent No. 5,724,660 to Kauser ("*Kauser*")
1008	U.S. Patent No. 5,936,572 to Loomis ("*Loomis*")
1009	U.S. Patent No. 6,748,226 to Wortham ("*Wortham*")
1010	International PCT Application No. PCT/US93/12179 to Schuchman ("*Schuchman*")
1011	U.S. Patent No. 5,327,144 to Stilp ("*Stilp*")
1012	FAA Advisory Circular 20-101C, *Airworthiness Approval of Omega/VLF Navigation Systems For Use in the U.S. National Airspace System (NAS) and Alaska* (Sep. 12, 1988) ("*FAA Advisory Circular 1*")
1013	FAA Advisory Circular 20-130A, *Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors* (Jun. 14, 1995) ("*FAA Advisory Circular 2*")
1014	*FCC Notice of Proposed Rulemaking for Locating Wireless 911 Callers* (Released Oct. 19, 1994)
1015	TR45 Joint Experts Meeting (JEM) for Emergency Services (Aug. 18, 1994)

1016	C.J. Driscoll & Associates, *Survey of Location Technologies to Support Mobile 9-1-1*, July 1994 ("*Driscoll*")
1017	Claim Construction Order (MetroPCS and TCS lawsuits)

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 1, 3, 15, 16, 20, 21, 23, 27, and 29 of U.S. Patent No. 8,032,153 (the "'153 Patent" attached as Ex. 1003 (the '153 Patent) 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.

B. Related Matters

The ’153 Patent is involved in the lawsuit *TracBeam, LLC v. T-Mobile US, Inc.*, No. 6:14-cv-00678 (E.D. Tex.). In addition to this lawsuit, related patents 7,525,484 and 7,764,231 are or were involved in the following additional lawsuits: (1) *TracBeam, LLC v. Apple Inc.*, No. 6:14-cv-00680 (E.D. Tex.); (2) *TracBeam, LLC. v. Google, Inc.*, No. 6:13-cv-00093 (E.D. Tex.); (3) *TeleComm. Sys., Inc. v. TracBeam, LLC*, Nos. 6:12-cv-00058 (E.D. Tex.), 1:11-cv-02519 (D. Colo.); and (4) *TracBeam, LLC v. MetroPCS Commc’ns, Inc. et al.*, No. 6:11-cv-00096 (E.D. Tex.).

Patent Owner TracBeam is currently asserting the ’153 Patent and three other related patents (attached as Exs. 1001 – 1004) against Petitioner T-Mobile in the first lawsuit identified above. In addition to the present Petition for the ’153 Patent, Petitioner is concurrently filing additional *inter partes* review petitions for the three other asserted patents (U.S. Patent Nos. 7,525,484; 7,764,231; 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, doug.kubehl@bakerbotts.com, chad.walters@bakerbotts.com, and 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

Pursuant to 37 C.F.R. § 42.104(a), Petitioners hereby certify that the '153 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 '153 Patent.

Petitioners T-Mobile, TCS, and Ericsson have not filed a civil action challenging the validity of any claims of the '153 Patent, and the complaint served on T-Mobile in the litigation referenced above in Section II.B was served within the last 12 months. Petitioners TCS and Ericsson have not been served with a complaint for infringement of the '153 Patent.

Further, Petitioners are not barred based on the prior TracBeam lawsuits involving MetroPCS and TCS (*see* Section II.B (Related Matters)) because the '153 Patent was not involved in these prior lawsuits, and thus neither MetroPCS nor TCS were served with a complaint for infringement of the '153 Patent, nor did they file an action challenging the validity of the '153 Patent. Thus, Petitioners cannot be barred under 35 U.S.C. § 315(a)(1) or § 315(b).

V. IDENTIFICATION OF CHALLENGE

Petitioners challenge the following claims of the '153 Patent on the following grounds:

Challenged Claims	Statutory Basis	Prior Art References
1, 3, 15, 16, 21, 23, 27, 29	35 U.S.C. § 103	*Loomis*
20	35 U.S.C. § 103	*Loomis* and *Kauser*

Section VII identifies how the challenged claims are to be construed. Section IX 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.

VI. THE '153 PATENT

A. Overview

The '153 Patent issued from an application filed January 14, 2008, which was a continuation of application 09/194,367, filed as the U.S. national stage application of International PCT Application No. PCT/US97/15892 (the "PCT

Application"). The PCT Application claims priority to U.S. Provisional Application Nos. 60/025,855 (filed Sep. 9, 1996), 60/044,821 (filed Apr. 25, 1997), and 60/056,590 (filed Aug. 20, 1997).

The '153 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. 1003 (the '153 Patent) at Abs., 9:38-52, and 11:3-17.) 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. 1003 (the '153 Patent) at 169:6–55).)

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

B. Prosecution History

No substantive prior art rejections were issued by the USPTO during the prosecution of the '153 Patent. Instead, in the first response from the USPTO was a Notice of Allowance on October 13, 2010 allowing the two pending claims. Despite the notice of allowance as of October 2010, prosecution of the '153 Patent

lasted an additional year due to the strategic filing of RCEs, IDSs, and repetition claim/specification amendments. This same pattern of delay was seen during prosecution of Patent Owner's other related patents, including in the 12-year prosecution of the parent '231 Patent (which is discussed in Petitioners' *inter partes* review petitions for the '231 Patent). Accordingly, the prosecution histories of the '153 Patent and other related patents in the same family (*e.g.*, the '231 Patent) provide limited guidance as to the understanding and interpretation of the claims for the 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 '153 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 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.*)

VII. CLAIM CONSTRUCTION

Certain claims of two patents that are related to the '153 Patent (*i.e.*, the '231 Patent and '484 Patent, attached as Exs. 1001 and 1002) were previously 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*" and "*computational machinery*"

The terms "*mobile station*" and "*computational machinery*" are recited by certain challenged claims. While the '153 Patent has never been construed, the prior district court construed various claim terms of the related '231 and '484 Patents that also appear in the challenged claims of the '153 Patent: (1) *mobile station*: "*a mobile wireless device that is at least a transmitting device and may include a receiving device*"; and (2) "*computational machinery*: "*one or more machines (such as a computer or hardware device) that performs computations*." (Ex. 1017 (Claim Construction) at 37-38.)

VIII. PRIOR ART

A. State of the Art

As acknowledged by the '153 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 '153 Patent. (*See, e.g.*, Ex. 1003 (the '153 Patent) at 1:46–2:32.) 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

(TOA), and time-difference-of-arrival (TDOA) 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 1) at 1.)

Various GPS improvements were also known at the time, including Differential GPS (D-GPS) and Assisted GPS (A-GPS). (Expert Decl. § VII.C.4.) Differential GPS is a variation of GPS that adjusts and improves the accuracy of GPS estimates using differential correction data that is wirelessly transmitted from a GPS reference station to a GPS receiver. (Ex. 1009 (Wortham) at 3:48-59; Ex. 1010 (Schuchman) at 20:21-28; Ex. 1008 (Loomis) at 11:20-48.) Assisted GPS is another variation of GPS that leverages wireless communications to assist a GPS receiver in determining its location. An implementation often referred to as "mobile-based A-GPS" enables a GPS receiver to generate position estimates significantly faster by providing the GPS receiver with GPS assistance data over a wireless communications link. (Ex. 1010 (Schuchman) at 6:11-33.) Another implementation often referred to as "mobile-assisted A-GPS" involves wirelessly transmitting GPS satellite measurements from a GPS receiver to a remote network component and/or server, which then performs the GPS calculations for the GPS receiver. (Ex. 1008 (Loomis) at 8:29-35, 20:29-36, Abs.)

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.) In fact, the FAA began experimenting with a hybrid solution in its flight management systems in the 1980s and early 1990s. (Ex. 1012 (FAA Advisory Circular 1) at 1, 3; Ex. 1013 (FAA Advisory Circular 2) at 1.) Similarly, the automotive industry began incorporating hybrid solutions in vehicle navigation and fleet management systems in the early 1990s. (*See, e.g.*, Ex. 1010 (Schuchman) at 1:1–2:23.) As the use of cellular technology increased, systems were also developed that used existing cellular telephone infrastructure to provide wireless location capabilities. (*See, e.g.*, Ex. 1009 (Wortham) at 1:46–2:12; Ex. 1007 (Kauser) at 2:62-66; Ex. 1011 (Stilp) at Abs., 5:5-26.) Various hybrid location technologies were also utilized in these cellular systems. (*See, e.g.*, Ex. Ex. 1007 (Kauser) at 2:62-66; Ex. Ex. 1010 (Schuchman) at 1:1-12, 5:22-33, 7:19-26; Ex. 1016 (Driscoll E911 Survey) at stamped pp. 9, 38-39.)

B. *Loomis*

U.S. Patent No. 5,936,572 to Loomis et al. ("*Loomis*") (Ex. 1008), entitled "Portable Hybrid Location Determination System," 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).

Loomis discloses a method and apparatus for determining and outputting a

resulting location estimate for a mobile user carrying a hybrid location determination ("LD") device (*e.g.*, a mobile station) using multiple location techniques that generate location estimates using wireless signal measurements. (Ex. 1008 (Loomis) 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 include satellite-based techniques (*e.g.*, GPS) and terrestrial-based techniques (*e.g.*, a radio technique). (*Id.*) *Loomis*' location function can be initiated in response to a request from a person or facility. (*Id.* at 12:34-40.)

Loomis' location functionality can be performed by a variety of computational machinery, including a central station, controller, GPS signal receiver/processor, and/or radio signal receiver/processor. (*See, e.g.*, *id.* at 4:51–56, 5:4–22, 6:22–29, 6:41–55, 7:9–22, 11:50–12:29, 12:47–13:4, FIG. 6.) The location function can determine the specific geographic location of a mobile user using the techniques identified above (*e.g.*, GPS and a radio technique). (*Id.* at Abs., 5:14–38, 12:21–27, 12:47–13:4, 19:3–63, FIG. 9; *see also id.* at 4:39–42, 14:52–55, 15:39–42, 16:39–51.) For example, *Loomis* discloses an embodiment whereby the location function obtains location estimates for the mobile user from each technique. (*Id.* at 12:21–27, FIG. 9.) The location function then determines a resulting location estimate using the respective estimates from the various techniques (*i.e.*, the satellite-based technique and the terrestrial-based technique).

(*Id.* at 12:47–13:4, FIG. 9; *see also id.* at 5:14-22, 31:33-67.) The resulting location estimate is then provided to a person or facility. (*Id.* at 12:30–40.)

C. *Kauser*

U.S. Patent No. 5,724,660 to Kauser et al. ("*Kauser*") (Ex. 1007), titled "Method and Apparatus for Locating a Mobile Station by Comparing Calculated Location Area with GPS Coordinates," was filed February 20, 1996 and issued March 3, 1998, and thus qualifies as prior art under 35 U.S.C. § 102(e).[1]

Kauser discloses a method and apparatus for determining and outputting a resulting location estimate for a mobile telephone using multiple location techniques that generate location estimates using wireless signal measurements. (Ex. 1007 (Kauser) at Abs., 2:62-3:15, 6:12-34, 11:35-12:21.) The location techniques include satellite-based techniques (*e.g.*, GPS) and terrestrial-based techniques (*e.g.*, cell-site geometric and coverage area techniques). (*Id.*) *Kauser's* location function can be initiated for a variety of services, including emergency response services, fleet management, navigation for mobile station users who are lost, etc. (*Id.* at 1:46-60, 5:33-67, 12:22-35.)

Kauser's location functionality can be implemented by a mobile location

[1] Petitioners believe that the invention described in *Kauser* was actually invented in 1995 and thus qualifies as prior art as of that date under 102(g)(2). Petitioners, however, cannot rely on 102(g) prior art in an IPR proceeding.

module (MLM), which is a component with a processor and memory that is connected to the mobile telephone system via a mobile switching center (MSC). (*Id.* at 5:23-32.) The MLM can determine the specific geographic location of a mobile station using the techniques identified above (*e.g.*, GPS, a cell-site geometric technique, and a cell-site coverage area technique). (*Id.* at 5:23-32, 6:1-23, 11:35-12:21.) For example, *Kauser* discloses an embodiment whereby the MLM obtains location estimates for the mobile station from each location technique. (*Id.* at 6:1-23, 11:35-12:21.) The MLM then determines a resulting location estimate using the respective estimates from the various techniques (*i.e.*, the satellite-based technique and the terrestrial-based technique). (*Id.* at 11:35-12:21.) The resulting location estimate (and associated confidence value) is then routed to the appropriate end user destination. (*Id.* at 12:22-35.)

D. Obviousness based on *Loomis* and *Kauser*

1. Overview

The grounds of invalidity presented in Section IX demonstrate that the challenged claims are obvious in view of *Loomis* either alone or in combination with *Kauser* (depending on the particular challenge). This section describes 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") using multiple location techniques that generate location estimates using wireless signal measurements. (Ex. 1008 (Loomis) at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5; *see also id.* at 18:27–32, FIG. 1; *see also id.* at 2:7-25, 3:63-4:4, 11:24-29.) 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.*

2. Satellite GPS Technique

This section addresses claim elements relating to a satellite (*i.e.*, "*not attached to the Earth*") location technique.

Satellite (non-terrestrial) technique:

Loomis' location system includes a GPS technique, 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.) 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. 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:

> The hybrid LD system . . . includes a satellite-based outdoor LD unit [], carried or transported by or attached to the user. This outdoor LD unit [] includes an outdoor LD signal antenna [] and associated outdoor LD signal receiver/processor [] that receive outdoor LD signals from three or more satellites [] whose locations at any time are known with acceptable accuracy. The antenna [] receives the outdoor LD signals and the receiver/processor [] determines the present location of this antenna, using well known techniques. The Global Positioning System (GPS) and the Global Orbiting Navigation Satellite System (GLONASS) are two suitable examples of satellite-based outdoor LD systems.

(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 '153 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. § IX.B.2; Ex. 1003 (the '153 Patent) at 1:61–2:5.) 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, 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. § VII.C.2.)

Satellite location information:

In *Loomis*' location system, the GPS location information generated by *Loomis*' GPS technique satisfies the claim elements that require "*first and second information related to likely geographical approximations for a location of said one wireless mobile station*" (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.) For example, *Loomis*' GPS technique (when supplied with GPS signal measurements) provides the following GPS location information: (1) the present GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station, and (2) 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.)

3. 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, 8:61-64; *see also id.* at 4:44-56, 6:25-29, 8:53-60, 21:36-38, FIG. 1.) *Loomis* explains that "[t]he 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; *see also id.* at 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.)

Terrestrial location technique:

Loomis' location system includes a radio location technique, which satisfies the claim elements that require a terrestrial location technique used to determine/obtain the location of the mobile station. (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. (Ex. 1008 (Loomis) at 6:20–29, 6:41–52, 11:52–65.)

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. 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:

> [A] hybrid LD system [] is carried or transported by or attached to a user [] and includes a radio LD unit []. The radio LD unit [] preferably includes an FM carrier or subcarrier signal antenna [] and FM subcarrier signal receiver/processor []. The *radio LD unit* [] *receives radio LD signals* from three or more radio LD signal sources [] that have fixed locations with known location coordinates.
>
> . . . .
>
> The *relative phases of the radio signals transmitted by the sources* [] may change from time to time. When the *radio LD unit* [] is provided with a recent *measurement of these relative phases*, the radio LD unit can determine the *location* of its antenna.

(Ex. 1008 (Loomis) at 6:20-29, 6:46-55; *see also id.* at 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.* at 6:25–29, 6:41–55, 11:55–65. Alternatively, the mobile station can transmit the signal phase measurements to a central station (either 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.

Signal time delay measurements

As explained by *Loomis*, "[w]hen the radio LD unit [] is provided with a recent measurement of these relative phases, the radio LD unit can determine the location of its antenna [], using intersections of three or more hyperboloids that are defined by the relative times of arrival of the three radio LD signals at the antenna." (Ex. 1008 (Loomis) at 6:47–52 (emphasis added).) Thus, the relative signal phase measurements in *Loomis* correspond to the relative "times of arrival" of each signal. (*Id.*) As explained by Dr. Michalson, one of ordinary skill in the art would understand that the relative signal "times of arrival" are based on the relative delay in the arrival of each signal, and thus the phase measurements used by *Loomis*' radio technique constitute the "*time difference of arrival*" measurements required by certain claims). (Expert Decl. §§ VII.C.3, IX.C.3)

4. 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.) 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 and should not be used, or should be used with caution.

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.) In another embodiment, 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.)

Loomis' location system then outputs/transmits the resulting location estimate to the appropriate person or facility. (*See* Section VIII.D.5 (Output Resulting Location); *see also* Ex. 1008 (Loomis) at 5:14–22, 12:30–40.)

Correctness 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 as the resulting location. (*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 "correctness" of the location estimate of the mobile station.

5. Output Resulting Location Information

In *Loomis*' location system, after the location of a mobile user carrying a mobile station has been determined, *Loomis* discloses that the location estimate may be provided to an interested person or facility. (Ex. 1008 (Loomis) at 5:14-22, 12:30-40; *see also id.* at 12:62-13:1.) As one example, *Loomis* discloses:

> At one or more selected times, or upon receipt by the controller module [] of a command by radiowave signals or telecommunication signals, the controller module causes the cellular communication means [] to send information on the present or recent location of the LD unit [] to a person or facility spaced apart from this LD unit.

(*Id.* at 12:34-40.) The controller and/or central station can transmit, store, and/or "visually or audibly" display the location of the mobile station. (*Id.* at 19:63-65, 20:40-42.)

6. Combinations of Prior Art

This section presents obviousness reasons that apply globally to the various combinations and/or modifications discussed in this Petition. As explained below, those of ordinary skill in the art would have been motivated to modify *Loomis* based on market forces, to comply with FCC-imposed rules, and for improvement to yield predictable results.

One of ordinary skill in the art would have been motivated to combine *Loomis* and *Kauser*. (Expert Decl. § IX.G.) 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 mobile station using satellite-based techniques (*e.g.*, GPS) and terrestrial-based techniques (*e.g.*, a radio technique). (Ex. 1008 (Loomis) at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5; *see also id.* at 18:27-32, FIG. 1.) Similarly, *Kauser's* mobile telephone location system includes a method and apparatus for determining and outputting a resulting location estimate (and associated confidence value) for a mobile telephone using multiple location techniques, including satellite-based techniques (i.e., GPS) and terrestrial-based techniques (*i.e.*, cell-site geometric and coverage area techniques). (Ex. 1007 (Kauser) at Abs., 2:62-3:15, 6:12-34, 9:19-29, 11:35-12:21.)

As described throughout this section, a person of ordinary skill in the art would have been motivated to modify and/or combine *Loomis'* radio technique with aspects of the techniques disclosed in *Kauser*. (Expert Decl. § IX.G.) As one example, *Loomis'* radio technique may be substituted for a coverage area technique, as described in *Kauser*. (Expert Decl. § IX.F.4.) A person of ordinary skill in the art would have been motivated to modify and/or combine *Loomis'* hybrid location system by using *Kauser's* coverage area technique (*e.g.*, a terrestrial-based technique) in place of *Loomis'* radio technique (*e.g.*, a terrestrial-

based technique) because it merely involves substituting one terrestrial-based technique for another. (Expert Decl. § IX.F.4.)

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. (Ex. 1014 (FCC E911 Proposal) at ¶¶ 2, 9-10, 37, 39.) "When a work is available in one field, design incentives and other market forces can prompt variations of it, either in the same field or in another. If a person of ordinary skill in the art can implement a predictable variation, and would see the benefit of doing so, § 103 likely bars its patentability." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007).

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 E911 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 explore combinations of existing location systems, such as that of *Loomis* and *Kauser*, and thereby to respond to market forces. (Expert Decl. § IX.G.) This is particularly true in light of the fact that *Loomis'* location system would comply with the third implementation phase of the rules, which requires that the location information include three-dimensional location coordinates of the mobile station. (Ex. 1014 (FCC E911 Proposal) at ¶ 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 E911 Survey) at stamped pp. 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 combination with concepts from other cellular location systems, such as that of *Kauser* (*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; Ex. 1007 (Kauser) at Abs., 2:62-3:15, 6:12-34, 9:19-29, 11:35-12:21; Expert Decl. § IX.G.)

Those of ordinary skill in the art would have also been motivated to modify *Loomis'* location system with concepts from *Kauser* based on the extremely similar nature of the problem solved: they both provide solutions for locating mobile devices using satellite and terrestrial location techniques. (Ex. 1008 (Loomis) at Abs., 19:32-37; Ex. 1007 (Kauser) at Abs., 2:62-3:15, 6:12-34, 9:19-29, 11:35-12:21.) 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." *See KSR*, 550 U.S. at 416.

IX. GROUNDS OF UNPATENTABILITY

The grounds of invalidity are set forth in detail throughout this section.

A. Claims 1, 3, 15, 16, 21, 23, 27, and 29, are obvious under 35 U.S.C. § 103 in view of *Loomis*

As demonstrated below, Claims 1, 3, 15, 16, 21, 23, 27, and 29, are rendered obvious by *Loomis*.

CLAIM 1

1.1 A method for locating, from a plurality of wireless mobile stations, one of the wireless mobile stations

Loomis' location system provides a process for determining a resulting

location estimate for a hybrid LD device carried by a mobile user (*i.e.*, "*a method for locating . . . one of the wireless mobile stations*") using multiple location techniques. (*See* Section VIII.D.1 (Obviousness 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.)

1.2 using measurements of wireless signals, wherein at least one of: (i) said measurements and (ii) said wireless signals are transmitted between said one wireless mobile station and at least one of a plurality of fixed location communication stations,

Loomis' location system includes a radio location technique (*i.e.*, the radio LD module) and a GPS technique (*i.e.*, the outdoor LD module) that each generate location estimates using measurements of wireless signals as input (*i.e.*, *Loomis'* method is performed "*using measurements of wireless signals*"). (*See* Section VIII.D.1 (Obviousness Overview); *see also* Ex. 1008 (Loomis) at Abs., 4:39-5:13, 11:49-13:4, 19:32-20:5.) For example, *Loomis'* radio and GPS techniques locate mobile stations using radio source signal measurements and GPS satellite signal measurements, respectively. (Ex. 1008 (Loomis) at 11:49-12:15, 19:32-47.)

This claim further requires wherein "*at least one of*" "*said measurements*"

and "*said wireless signals*" are transmitted, and thus the prior art need only disclose one of those functions to satisfy this claim element. *Loomis*, however, discloses both of the recited limitations. As explained in Section VIII.D.3, 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.*, "*fixed location communication stations*"). (Section VIII.D.3 (Radio Technique); Ex. 1008 (Loomis) at 4:44-56, 6:25-29, 6:35-37, 8:53-64, 21:36-38, FIG. 1; Expert Decl. § IX.C.) The radio signals are sent from the terrestrial radio sources and are received by a radio receiver/processor in the mobile station (*i.e.*, "*said wireless signals are transmitted between said one wireless mobile station and at least one of a plurality of fixed location communication stations*"). (Section VIII.D.3 (Radio Technique); Ex. 1008 (Loomis) at 6:20-29, 6:41-55, 11:52-65; *see also* 4:51-56, 6:25-29, 11:50-61, 21:36-38, FIG. 1.) Because *Loomis* discloses the "*wireless signals*" claim element, it is not necessary that it also disclose the "*said measurements*" claim element. However, *Loomis* further discloses the "*said measurements*" claim element, as explained below.

As explained in Section VIII.D.3, a mobile station can transmit the signal phase measurements, which are obtained from signals sent between the mobile station and the terrestrial radio sources (*i.e.*, "*said measurements*"), to a central station to allow the radio technique to be performed by the central station (*i.e.*,

"*said measurements . . . are transmitted between said one wireless mobile station and at least one of a plurality of fixed location communication stations*). (Section VIII.D.3 (Radio Technique); Ex. 1008 (Loomis) at 8:26-35, 20:29-42.) One of ordinary skill in the art would understand that a "central station" is "*one of a plurality of fixed location communication stations*." (Expert Decl. § IX.C.2.) Thus, although the prior art need only disclose either "*said measurements*" or "*said wireless signals*" being transmitted, *Loomis* discloses both.

1.3 each communication station capable of at least one of receiving wireless signals from, and transmitting wireless signals to said one wireless mobile station,

This claim element recites "*at least one of*," and thus the prior art need only disclose communication stations that are capable of either (1) "*receiving wireless signals*" or (2) "*transmitting wireless signals*." As explained with respect to Claim Element 1.2 and Section VIII.D.3, *Loomis'* radio sources (*i.e.*, "*communication station*") transmits radio signals to the mobile station, which are received by a radio receiver/processor in the mobile station (*i.e.*, "*transmitting wireless signals to said one wireless mobile station*"). (Section VIII.D.3 (Radio Technique); Ex. 1008 (Loomis) at 6:20-29, 6:41-55, 11:52-65.) Although not required to satisfy this claim element, *Loomis* also discloses "*each communication station capable of . . . receiving wireless signals from . . . said one wireless mobile station*." Specifically, when *Loomis'* mobile station transmits the signal phase measurements to a central

station, the central station (*i.e.*, "*communication station*") is receiving the signal phase measurements (*i.e.*, *receiving wireless signals from . . . said one wireless mobile station*). Further, one of ordinary skill in the art would understand that, in order to send the signal phase measurements—which are obtained from signals sent from the terrestrial radio sources to the mobile station—the mobile station would have to send this information in the form of an additional "*wireless signal*." (Expert Decl. § IX.C.2.)

1.4 comprising the following steps at A and B which are performed by computational machinery:

Loomis' location system performs the following steps in Claim Elements 1.5 through 1.9 using various hardware components, including a controller, GPS signal receiver/processor, radio signal receiver/processor, and/or a central station (*i.e.*, "*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.)

1.5 (A) receiving, from each of at least first and second mobile station location estimators, corresponding first and second information related to likely geographical approximations for a location of said one wireless mobile station,

As explained with respect to Claim Element 1.2, *Loomis'* location system includes radio and GPS (outdoor) location techniques (*i.e.*, "*first and second mobile station location estimators*"). (*See* Analysis for Claim Element 1.2.) The

location estimates from these respective techniques can be computed by the mobile station itself, or the respective signals can be transmitted from the mobile station to a central station to allow the central station to compute the location estimate (*i.e.*, the "*receiving*" of first and second information related to likely geographical locations can be performed by either the mobile station or the central station). (Ex. 1008 (Loomis) at 8:26-42.) Although explained below as the first mobile station location estimator using the GPS technique and the second location estimator using the radio technique, both "*the first*" and "*the second mobile station location estimator*" can be satisfied by either *Loomis'* GPS technique or radio technique to determine the likely geographic approximation of a location. (Expert Decl. § IX.G.2) For example, *Loomis'* radio technique can satisfy either "*the first mobile station location estimator*" or "*the second mobile station location estimator*." Similarly *Loomis'* GPS technique can satisfy either "*the first mobile station location estimator*" or "*the second mobile station location estimator*."

first mobile station location estimator

Section VIII.D.2 explains how *Loomis'* GPS technique satisfies these claims elements. For example, in *Loomis*, the mobile station also includes a GPS receiver/processor that obtains GPS location information (*i.e.*, "*receiving . . . corresponding first . . . information related to likely geographical approximations for a location*") when supplied with GPS satellite signal measurements.

(Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at 7-9:22, 11:66-12:15; Expert Decl. § IX.B.3.) Alternatively, *Loomis* discloses that a central station can receive GPS signal measurements and perform the GPS technique to provide GPS location information. (Ex. 1008 (Loomis) at 8:29-24, 20:29-42.) The GPS location information (*i.e.*, "*first . . . information related to likely geographical approximations for a location*") includes the present GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station and associated GPS signal indicium I_{out}. (Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.)

second mobile station location estimator

Section VIII.D.3 explains how *Loomis'* radio technique 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 information related to likely geographical approximations for a location*") when supplied the signal phase measurements. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 6:25-29, 6:41-55, 11:55-65.) The radio location information (*i.e.*, "*second information related to likely geographical approximations for a location*") includes the present radio location coordinates $(x_u,y_u,z_u)_{rad}$ of the mobile station and associated radio signal indicium I_{rad}. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 11:55-65,

12:21-27.)

1.6 wherein (a) and (b) following are satisfied:

(a) for determining a likely geographical approximation, GA_A, for a location, L_A, of a second of the wireless mobile stations at a time T_A, said first mobile station location estimator generates GA_A without requiring a prior likely geographical location approximation generated by said second mobile station location estimator for locating the second wireless mobile station at substantially the location L_A at substantially the time T_A, and,

(b) for estimating a likely geographical approximation, GA_B, for a location, L_B, of a third one of the wireless mobile stations at a time T_B, said second mobile station location estimator generates GA_B without requiring a prior likely geographical location approximation generated by said first mobile station location estimator for locating the third wireless mobile station at the location L_B at substantially the time T_B;

This claim element essentially requires, in a very roundabout way, that the "*first and second mobile station location estimators*" operate independently of one another. Specifically, this claim element requires each "*location estimator*" to independently determine its own respective location estimate (*i.e.*, "*a likely geographical approximation*") without needing an estimate or other output from the other "*location estimator*" (*i.e.*, "*without requiring a prior likely geographical approximation generated by [another] mobile station location estimator*"). As an example, under this claim element, the location estimate generated from the first "*location estimator*" cannot be used by the second "*location estimator*" as a starting point when generating its own location estimate.

To delineate the above requirement for the "*location estimators*" to operate independently, this claim element recites how the "*location estimators*" would

operate in the context of locating two hypothetical mobile stations (*i.e.*, the "*second mobile station*" and the "*third mobile station*"), which are different from the mobile station that is actually located by Claim 1 (*i.e.*, "*said one wireless mobile station*"). As explained by Dr. Michalson, one of ordinary skill in the art would understand that *Loomis'* location system could be used to locate multiple mobile stations. (Expert Decl. § IX.F.1.) For example, when *Loomis'* mobile station communicates with a central processing station, it includes "a label, tag or other indicium that identifies the transmitting LD unit," which allows the central station to distinguish between hybrid LD devices. (Ex. 1008 (Loomis) at 20:29-34.) Thus, the following discussion regarding the "*second mobile station*" and the "*third mobile station*" refers to these other multiple mobile stations disclosed by *Loomis*.

Loomis discloses that the GPS technique "operates independently" of the radio technique and that each of these techniques provides "a separate determination of user location" (*i.e.*, the various techniques generate "*likely geographical approximation,* GA_A" and estimate "*likely geographical approximation,* GA_B" "*without requiring a prior likely geographical location approximation generated by said [first/second] mobile station location estimator*"). (Ex. 1008 (Loomis) at 5:7-10, 5:63-6:4.) For example, as explained above, *Loomis'* radio technique provides radio location coordinates $(x_u,y_u,z_u)_{rad}$ of

the mobile station when supplied with radio input data. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 11:55-65, 12:21-27.) Similarly, *Loomis'* GPS technique provides GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station when supplied with GPS input data. (Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.) Additionally, *Loomis* explains that "the outdoor LD unit 31 also complements the radio LD unit 13 by providing an independent determination of location of the hybrid LD unit 11." (Ex. 1008 (Loomis) at 7:41-44, 5:7-9.) One of ordinary skill in the art would understand that the GPS and radio coordinates are determined "*without requiring a prior likely geographic location approximation generated by said [first/second] mobile station location estimator*." (Expert Decl. § IX.F.2.)

The following analysis presents the mapping of *Loomis* against each distinct requirement of Claim Element 1.6.

> (a) for determining a likely geographical approximation, GA_A, for a location, L_A, of a second of the wireless mobile stations at a time T_A,

This element of the claim merely specifies how the "*geographical approximations*" of "*first and second information related to likely geographical approximations for a location*" received in step (A) should be "*determined*." The beginning phrase "*for determining a likely geographical approximation*," indicates

that this claim element (a) explains how the first mobile station location estimator generates $GA_{\underline{A}}$. The terms GA_A, L_A, T_A, and "*a second of the wireless mobile stations*" are used to distinguish between different claim elements, and thus should not be construed as requiring any particular order.

Specifically, these terms are used to show an association with "*the first mobile station location estimator*" and to distinguish between, for example, the geographical approximation estimated by "*the second mobile station location estimator*." Because the "*mobile station location estimators*" use different techniques, their individual geographical approximations may be different. Thus, this beginning part of claim element (a) indicates that this element will explain how the first mobile station location estimator generates $GA_{\underline{A}}$.

> said first mobile station location estimator generates $GA_{\underline{A}}$ without requiring a prior likely geographical location approximation generated by said second mobile station location estimator for locating the second wireless mobile station at substantially the location $L_{\underline{A}}$ at substantially the time $T_{\underline{A}}$,

This second part of claim element (a) merely specifies how the first mobile station location estimator generates the geographical approximation for a location. Specifically, the claim indicates that the "*first mobile station location estimator*" does not use (*i.e.*, "*without requiring*") a geographical approximation from any other location estimator (*i.e.*, "*a prior likely geographical approximation*

generated by said second mobile station location estimator") in order generate GA_A and locate the wireless mobile station (*i.e.*, "*for locating the second wireless mobile station at substantially the location* L_A *at substantially the time* T_A"). In other words, the "first mobile station location estimator" operates independently from any other mobile station location estimator to generate its own geographical approximation. This is further supported by the specification that explains: "*The present disclosure* describes a system and method that . . . can utilize a plurality of wireless location estimators based on different wireless location technologies . . . wherein each such estimator may be *activated independently* of one another, whenever suitable data is provided thereto and/or certain conditions, e.g., *specific to the estimator* are met." (1003 (the '153 Patent) 10:48-49, 11:3-4, 11:14-17 (emphasis added).)

As explained above, *Loomis'* GPS technique and radio technique each provide an independent determination of the location of the hybrid LD unit. (Ex. 1008 (Loomis) at 7:41-44, 5:7-9.) A person of skill in the art would understand that when locating a "*second wireless mobile station*," *Loomis* would operate similarly as it does when locating the "*one wireless mobile station*." (Expert Decl. § IX.F.1.) Specifically, in using the satellite technique, a second mobile station would include a GPS signal receiver/processor that receives wireless signals from satellites and uses those signals to estimate a location of the second mobile station.

(Section VIII.D.2 (Satellite / Non-Terrestrial GPS Technique); 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.) In using the radio technique, the second mobile station receives FM subcarrier signals from radio signal sources and calculates the location estimates using measurements of the wireless signals. (Section VIII.D.3 (Terrestrial Radio Technique); Ex. 1008 (Loomis) at 6:20–29, 6:41–52, 11:52–65.) The location function then determines a resulting location estimate using the respective estimates from the various techniques (*i.e.*, the satellite-based technique and the radio technique). (VIII.D.4 (Resulting Location Determination); Ex. 1008 (Loomis) at 12:47–13:4, FIG. 9; *see also id.* at 5:14-22, 31:33-67.)

> (b) for estimating a likely geographical approximation, GA_B, for a location, L_B, of a third one of the wireless mobile stations at a time T_B,

Similar to the first part of claim element (a), this first part of claim element (b) indicates that claim element (b) will explain how the second mobile station location estimator generates GA_B. (*See* analysis for Claim Element 1.5(a)).

> said second mobile station location estimator generates GA_B without requiring a prior likely geographical location approximation generated by said first mobile station location estimator for locating the third wireless mobile station at the location L_B at substantially the time T_B

Similar to the second part of claim element (a), this second part of claim element (b) indicates how the second mobile station location estimator estimates

the geographical approximation for a location. Specifically, the claim indicates that the "*second mobile station location estimator*" does not use (*i.e.*, "*without requiring*") a geographical approximation from any other location estimator (*i.e.*, "*a prior likely geographical approximation generated by said first mobile station location estimator*") in order to locate the wireless mobile station (*i.e.*, "*for locating the third wireless mobile station at substantially the location* L_A *at substantially the time* T_A"). In other words, the "*second mobile station location estimator*" operates independently from any other mobile station location estimator to generate its own geographical approximation. As explained above, *Loomis'* GPS technique and radio technique each provide an independent determination of the location of the mobile station. (Ex. 1008 (Loomis) at 7:41-44, 5:7-9.)

Further, a person of skill in the art would understand that when locating a "*third wireless mobile station*," *Loomis* would operate similarly as it does when locating the "*one wireless mobile station*." (Expert Decl. § IX.F.1.) As explained above, a third mobile station could use wireless signals from satellites and FM subcarrier signals from radio signal sources to calculate two separate location estimates, and then use those two location estimates to determine a resulting location estimate. (Section VIII.D.2 (Satellite / Non-Terrestrial GPS Technique); 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; Section VIII.D.3 (Terrestrial Radio Technique); Ex. 1008 (Loomis) at

6:20-29, 6:41-52, 11:52-65; Section VIII.D.4 (Resulting Location Determination); Ex. 1008 (Loomis) at 12:47-13:4, FIG. 9; *see also id.* at 5:14-22, 31:33-67.)

1.7 (B) determining a resulting location estimate of said one wireless mobile station, wherein said step of determining includes at least one of the substeps (B1) through (B2) following:

Section VIII.D.4 explains how *Loomis'* location system performs an algorithm for "*determining a resulting location estimate*" using the respective estimates from the GPS and radio techniques. (Section VIII.D.4 (Resulting Location Determination); *see also* 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.) For example, 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. (*Id.* at 12:21-27, 12:47-13:1.) As explained below, although this element requires "*determining a resulting location estimate*" using either substep (B1) or (B2) (*i.e.*, due to the "*at least one of the substeps*" language), *Loomis* discloses both substeps.

1.8 (B1) when said first and second information include, respectively, first and second likely geographical approximations, combining said first and second likely geographical approximations so that said resulting location estimate is dependent on each of said first and second location likely geographical approximations; and

As explained above, the claim only requires either substep (B1) or substep (B2) to be satisfied. Because *Loomis* discloses the elements of substep (B2) (*see*

Claim Element 1.9), satisfying the elements of substep (B1) is not required. However, *Loomis* discloses that the signals from both the radio technique and the GPS technique are optimally blended together using an estimator such as a Kalman filter (*i.e.*, *combining said first and second likely geographical approximations so that said resulting location estimate is dependent on each of said first and second location likely geographical approximations*). (Ex. 1008 (Loomis) at 15:39–42.) Further, *Loomis* discloses using the signals from both the GPS technique and radio technique, and optionally processing the signals to determine the location. (Ex. 1008 (Loomis) at 19:63-65.) Thus, although not required, *Loomis* discloses the elements of substep (B1) as well.

1.9 (B2) selecting one of said first and second information for receiving preference in determining said resulting location estimate, wherein said selecting is dependent upon location related data in at least one of said first and second information.

Section VIII.D.4 explains how *Loomis'* location system determines the "*resulting location estimate*" by "*selecting one of said first and second information*." First, *Loomis* explains that its system allows a choice of which location information to use (*i.e.*, "*selecting one of said first and second information for receiving preference*") by comparing the signal indicia for each location technique (*i.e.*, "*location related data in at least one of said first and second information*"). (Ex. 1008 (Loomis) at 4:27-33.) For example, *Loomis* first determines which of the geographical approximations—the one determined by the

GPS technique or the one determined by the radio technique—likely provides the most accurate location estimate, by comparing the signal indicia from each technique to threshold indicia and/or comparing the location estimates themselves. (Section VIII.D.4 (Resulting Location Determination); *see also* 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* selects either the radio location estimate or GPS location estimate as the resulting location estimate (collectively, "*selecting one of said first and second information for receiving preference in determining said resulting location estimate*"). (Ex. 1008 (Loomis) at FIG. 9, 12:47-13:1, 19:48-63.) By comparing the signal indicia and/or location estimates (*i.e.*, "*location related data*") of either the GPS technique and/or the radio technique (*i.e.*, "*said first and second information*"), this selection of the location estimate is based on the signal indicia (*i.e.*, "*selecting is dependent upon location related data in at least one of said first and second information*").

CLAIM 3

3. The method of claim 1, wherein the first and second mobile station location estimators comprise hardware and software that perform different location determining computational techniques for locating the one wireless mobile station.

This claim depends from Claim 1, and as explained above, *Loomis* discloses all elements of Claim 1. (*See* Analysis for Claim 1.) As explained above in Sections VIII.D.2 and VIII.D.3, *Loomis* discloses at least two techniques (*i.e.*,

"*different location determining computational techniques"*) for locating a wireless mobile station, including the GPS technique and the radio technique. (Section VIII.D.2 (Satellite/Non-Terrestrial GPS Technique); Section VIII.D.3 (Terrestrial Radio Technique); Expert Decl. § IX.F.2.) *Loomis* discloses that each of these techniques provides "a separate determination of user location" (*i.e.*, "*perform different location determining computational techniques for locating the one wireless mobile station*"). (Ex. 1008 (Loomis) at 5:7-10, 5:63-6:4.) For example, as explained above, *Loomis'* radio technique provides radio location coordinates $(x_u,y_u,z_u)_{rad}$ of the mobile station when supplied with radio input data. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 11:55-65, 12:21-27.) Similarly, *Loomis'* GPS technique provides GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station when supplied with GPS input data. (Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.) Additionally, *Loomis* explains that "the outdoor LD unit 31 also complements the radio LD unit 13 by providing an independent determination of location of the hybrid LD unit 11." (Ex. 1008 (Loomis) at 7:41-44, 5:7-9.)

CLAIM 15

15.1 The method of claim 1, wherein the first mobile station location estimator is a collection of one or more computational machinery modules that include, or are operationally dependent upon, a signal processing technique, provided by computational machinery,

As explained in Claim Element 1.4, *Loomis'* location system uses various hardware components, including a controller, GPS signal receiver/processor, radio signal receiver/processor, and/or a central station (*i.e.*, "*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.) Further, both *Loomis'* radio technique and GPS technique generate location estimates by receiving and processing signals at the "radio signal receive/processor" and the "outdoor LD signal receiver/processor," respectively (*i.e.*, "*signal processing technique[s]*"). (*See* Section VIII.D.1 (Obviousness Overview); Section VIII.B (*Loomis*); *see also* Ex. 1008 (Loomis) at 8:1-15, 8:26-42, 10:65-67, 16:24-29, 19:63-65.)

15.2 the first mobile station location estimator for estimating a location of the one wireless mobile station when computational machinery for the signal processing technique is supplied with data obtained from wireless signals (S) received by the one mobile station from one or more transmitting stations not attached to the Earth, wherein said wireless signals S provide time values, and the computational machinery for the signal processing technique uses at least one differential between a time of transmission and a time of arrival for the wireless signals S transmitted by a plurality of the transmitting stations;

As explained in Section VIII.D.2, *Loomis'* GPS technique determines the present GPS location coordinates of the mobile station (*i.e.*, "*for estimating the location of the one wireless mobile station*") by receiving wireless signals (*i.e.*, "*wireless signals (S) received by the one mobile station*") from satellites. (*See*

Section VIII.D.3 (GPS Technique); Ex. 1008 (Loomis) at 22:57-23:13.) The GPS technique uses the signal travel time of GPS satellite signals (*i.e.*, "*data obtained from the wireless signals . . .wherein said wireless signals S provide time values*") to determine the location of the mobile station. (*See* Section VIII.D.3 (GPS Technique); Ex. 1008 (Loomis) at 22:57-23:13; Expert Decl. § IX.B.2.) As would be understood by one of ordinary skill in the art, when using a GPS technique, the mobile station determines the difference between when the signal was transmitted from the satellite and when it is received by the mobile station (*i.e.*, "*the computational machinery for the signal processing technique uses at least one differential between a time of transmission and a time of arrival for the wireless signals S transmitted by a plurality of the transmitting stations*") to determine the mobile station's location. (Expert Decl. § IX.B.2; Section VIII.D.3 (GPS Technique); Ex. 1003 ('153 Patent) 1:61-2:5.) Further, as would be understood by one of ordinary skill in the art, each GPS satellite is a "*transmitting station[] not attached to the Earth*." (Expert Decl. § IX.B.1.)

15.3 wherein the first information is dependent upon an output from the signal processing technique.

As explained above in Section VIII.D.2, *Loomis'* GPS technique calculates location estimates (*i.e.*, "*the first information*") using measurements of wireless signals (*i.e.*, "*dependent upon an output from the signal processing technique*") transmitted between the mobile station and GPS satellites.

CLAIM 16

16. The method of claim 15, wherein the second mobile station location estimator is dependent upon a time difference of arrival of a wireless signal between the one wireless mobile station and at least one of the communication stations.

This claim depends from Claim 15, and as explained above, *Loomis* discloses all elements of Claim 15. (*See* Analysis for Claim 15.) First, *Loomis'* FM radio technique implements TDOA techniques in order to determine a location for the mobile station. As explained in Section VIII.D.3, *Loomis* discloses its radio LD unit receiving FM subcarrier signals (*i.e.*, "*wireless signal*") from three radio LG signal sources (*i.e.*, "*at least one of the communication stations*"). (Section VIII.D.3 (Terrestrial Radio Technique); Ex. 1008 (Loomis) at 6:41-45.) *Loomis* further discloses that its radio technique "use[s] the common 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. (Ex. 1008 (Loomis) at 6:47-55, 9:61-67, 10:24-39, 11:61-65.) Those of ordinary skill in the art would understand that the "relative times of arrival" of the signals in *Loomis* refers to the difference in arrival times of a signal from multiple radio towers (*i.e.*, "*time difference of arrival of a wireless signal*"), which are used in *Loomis* to generate hyperboloids whose intersection serves as the location estimate for the mobile station. (*Id.* at 6:47-52, 10:24-39, 11:61-65; Expert Decl. §§ VII.C.3, IX.C.3.) Thus, *Loomis'* radio technique operates as a TDOA technique such that "*the*

second mobile station location estimator is dependent upon a time difference of arrival of a wireless signal."

Loomis discloses that these types of "*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" and "differences in arrival times of the range tones received from the radio station." (Ex. 1008 (Loomis) at 2:18-21, 2:51-53, 3:28-33 (emphasis added); Expert Decl. §§ VII.C.3, IX.C.3.)

CLAIM 21

21. The method of claim 15, wherein when the first location information is unavailable at a location, L, for the one wireless mobile station, the location estimate for the second information is used for determining the resulting location estimate.

This claim depends from Claim 15, and as explained above, *Loomis* discloses all elements of Claim 15. (*See* Analysis for Claim 15.) *Loomis* discloses that the mobile station determines whether the signals from either the GPS satellites or the FM radio towers are adequate, and thus available, to locate the mobile station. Specifically, after the mobile station receives the signals from the GPS satellite (*e.g.*, the "outdoor LD signals") and the signals from the radio tower (*e.g.*, the "radio LD signals"), *Loomis* discloses:

> determin[ing] whether the outdoor LD signals, or the radio LD

signals, or both, or neither, is adequate to allow determination of the location of the associated LD unit antenna, relying in part on the indicium or indicia associated with that signal or signals. 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. In step 185, the controller uses the selected LD signals to determine the location of the hybrid LD system 11, or of the radio LD unit, and thus of the user 12.

(Ex. 1008 (Loomis) 19:48-60 (emphasis added).) One of ordinary skill in the art would understand that if one of the signals (either outdoor LD signals or radio LD signals) were not "adequate," then those signals would be "*unavailable*" for "*determining the resulting location estimate*" and would use the other type of signals that are adequate and thus available. (Expert Decl. § IX.F.3.) For example, if the mobile station determines that the outdoor LD signals (*e.g.*, GPS signals) were not adequate, for example due to an obstruction of the satellite signals, (*i.e.*, "*the first location information is unavailable*") and that the radio LD signals are adequate, then the mobile station would use the radio LD signals (*i.e.*, "*the location estimate for the second information is used*") to determine the location of the mobile station *i.e.*, "*for determining the resulting location estimate*"). (Expert

Decl. § IX.F.3; Ex. 1008 (Loomis) 19:48-60.)

CLAIM 23

23. The method as claimed in claim 1, further including, for a geographical indication, GI, of one of the first and second information, a step of obtaining data indicative of a correctness that the at least one geographical indication GI represents a location that includes the one wireless mobile station.

This claim depends from Claim 1, and as explained above, *Loomis* discloses all elements of Claim 1. (*See* Analysis for Claim 1.) Further, as explained above in Section VIII.D.2, *Loomis* compares the signal indicium (*e.g.*, uncertainty) of the estimates from each of the techniques (*e.g.*, radio technique and GPS technique) and selects the location estimate having the least amount of uncertainty. (Expert Decl. § IX.D.2; Section VIII.D.4 (Resulting Location Determination); Ex. 1008 (Loomis) at 12:21-27, 12:47-13:1; *see also id.* at 5:14-21, 14:52-55, 16:39-51, 19:48-63.) Specifically, the controller receives the indicia I_{rad} and I_{out} (*i.e.*, "*obtaining data indicative of a correctness*") and compares them against respective indicia thresholds $I_{rad,thr}$ and $I_{out,thr}$ in order to select the location estimate (*e.g.*, the estimate provided by the radio technique or the estimate provided by the GPS technique) with the higher accuracy (*i.e.*, "*a correctness that the at least one geographical indication GI represents a location that includes the one wireless mobile station*"). (*Id.*)

CLAIM 27

27. The method of claim 1, wherein the first and second mobile station location estimators use different wireless signal location related data for determining the resulting location estimate.

This claim depends from Claim 1, and as explained above, *Loomis* discloses all elements of Claim 1. (*See* Analysis for Claim 1.) *Loomis* discloses that the GPS technique "operates independently" of the radio technique and that each of these techniques provides "a separate determination of user location." (Ex. 1008 (Loomis) at 5:7-10, 5:63-6:4.) *Loomis* further discloses that each technique (*e.g.*, radio technique and GPS technique) is supplied with data specific to the technique being used (*i.e.*, "*different wireless signal location related data*") in order to determine the location of the mobile station. For example, as explained above, *Loomis'* radio technique provides radio location coordinates $(x_u,y_u,z_u)_{rad}$ of the mobile station when supplied with radio input data. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 11:55-65, 12:21-27.) Similarly, *Loomis'* GPS technique provides GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station when supplied with GPS input data. (Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.) One of ordinary skill in the art would understand that the GPS technique cannot use the radio input to determine a location of a mobile station and the radio technique cannot use the GPS input data to determine a location of a mobile station. (Expert Decl. § IX.F.2.) Because the GPS technique

uses the GPS input data and the radio technique uses the radio input data, *Loomis* discloses "*the first and second mobile station location estimators use different wireless signal location related data for determining the resulting location estimate*."

CLAIM 29

29.1 The method of claim 27, wherein for determining the resulting location estimate: (A) the first mobile station location estimator uses data indicative of a time difference of arrival of wireless signal communications between: (1) the one wireless mobile station, and (2) a plurality of the communication stations attached to the Earth;

This claim depends from Claim 27, and as explained above, *Loomis* discloses all elements of Claim 27. (*See* Analysis for Claim 27.)

The mapping of Claim 1 above identifies *Loomis'* GPS technique as the "*first mobile station location estimator*" and *Loomis'* radio technique as the "*second mobile station location estimator*." As explained in Claim Element 1.5, however, *Loomis'* GPS and radio techniques can each satisfy either the "*first mobile station location estimator*" or "*second mobile station location estimator*" in Claim 1. This claim (Claim 29), however, requires the "*first mobile station location estimator*" to be a terrestrial-based technique (*i.e.*, because it requires signals to/from "*communication stations attached to the Earth*"), while dependent Claim 15 requires the "*first mobile station location estimator*" to be a satellite-based technique (*i.e.*, because it requires signals from "*transmitting stations not attached to the Earth*"). (*See* Claim Element 15.2.) Thus, due to the inconsistent

requirements of Claims 15 and 29, the mapping of *Loomis'* location techniques to the "*first mobile station location estimator*" and "*second mobile station location estimator*" is reversed for Claims 15 and 29. For example, in this claim (Claim 29), *Loomis'* radio technique is mapped against the "*first mobile station location estimator*" and *Loomis'* GPS technique is mapped against the "*second mobile station location estimator*," while the opposite mapping is used in Claim 15.

The following analysis presents the mapping of *Loomis* against each distinct requirement of Claim 29.

As explained above in the analysis for Claim 16, *Loomis* discloses that its radio techniques uses TDOA in order to determine location of a mobile station and further that time difference of arrival (TDOA) techniques were well known in the art. (*See* Analysis for Claim 16; Section VIII.D.3 (Terrestrial Radio Technique); Ex. 1008 (Loomis) at 2:13-21, 6:41-45, 6:48-52; Expert Decl. §§ VII.C.3, IX.C.3).

Further, the radio LD unit (*i.e.*, "*wireless mobile station*") receives FM subcarrier signals (*i.e.*, "*wireless signal communications*") from three or more radio signal sources with fixed, known locations," (*i.e.*, "*a plurality of the communication stations attached to the Earth*"), which include "transmitting antennas" (*i.e.*, "*wireless signal communications <u>between</u> (1) the one wireless mobile station, and (2) a plurality of the communication stations attached to the Earth*"). (*See* Section VIII.D.3 (Terrestrial Radio Technique); Ex. 1008 (Loomis)

at 5:32-36, 8:61-64; *see also id.* at 4:44-56, 6:25-29, 8:53-60, 21:36-38, FIG. 1.)

29.2 (B) the second mobile station location estimator does not use the data indicative of the time difference of arrival, and

As explained in Section VIII.D.2, *Loomis* discloses a satellite location technique. *Loomis'* GPS technique calculates location estimates using measurements of wireless signals transmitted between a mobile station and three or more satellites. The mobile station receives wireless signals from satellites and uses those signals to estimate the location of the mobile station by measuring the signal travel time delay of the received GPS signals. (Section VIII.D.2; Expert Decl. § IX.B.2; 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.) Rather than comparing the arrival time of one received signal to the arrival time of the other two received signals (which is how time difference of arrival techniques operate), the GPS technique merely looks at the travel time required for each of the individual satellite signal to be received by the mobile station. (*Id.*) Thus, by using a GPS technique, the "*second mobile station location estimator does not use the data indicative of the time difference of arrival*". (Expert Decl. § IX.B.2.)

29.3 (C) each of the first and second information includes a location estimate of the one wireless mobile station.

As explained in Sections VIII.E.4 and Section VIII.D.2, *Loomis* discloses that both the radio technique and the GPS technique each provide "a separate determination of user location" (*i.e.*, "*a location estimate of the one wireless*

mobile station"). (Section VIII.D.3 (Radio Technique); Section VIII.D.2 (GPS Technique); Ex. 1008 (Loomis) at 5:7-10, 5:63-6:4.) For example, as explained above, *Loomis'* radio technique provides radio location coordinates $(x_u,y_u,z_u)_{rad}$ of the mobile station when supplied with radio input data. (Section VIII.D.3 (Radio Technique); *see also* Ex. 1008 (Loomis) at 11:55-65, 12:21-27.) Similarly, *Loomis'* GPS technique provides GPS location coordinates $(x_u,y_u,z_u)_{out}$ of the mobile station when supplied with GPS input data. (Section VIII.D.2 (GPS Technique); *see also* Ex. 1008 (Loomis) at FIG. 9, Abs., 12:21-27, 19:42-47, 20:14-16, 21:48-57.)

B. Claim 20 is obvious under 35 U.S.C. § 103 in view of the *Loomis-Kauser* combination

As demonstrated below, Claim 20 is rendered obvious by the *Loomis-Kauser* combination.

CLAIM 20

20. The method of claim 15, wherein the second mobile station location estimator is dependent upon location data indicative of a coverage area of at least one of the communication stations, wherein the location data is used as a location estimate for the second information.

This claim depends from Claim 15, and as explained above, *Loomis* discloses all elements of Claim 15. (*See* Analysis for Claim 15.) *Kauser's* location system includes a coverage area technique, which uses the known geographic coverage area (*i.e.*, "*dependent upon location data indicative of a coverage area*) of the serving cell site (*i.e.*, "*of at least one of the communication*

stations") to estimate the location of the mobile telephone (*wherein the location data is used as a location estimate for the second information*). (Ex. 1007 (*Kauser*) at FIG. 2, 4:42-56, 6:1-22.) For example, because the mobile telephone is connected to the serving cell site and thus must be within its coverage area, the location estimate of the mobile telephone simply corresponds to the known coverage area of the serving cell site. (Ex. 1007 (*Kauser*) at FIG. 2, 4:42-56, 6:1-22.) One of ordinary skill in the art would have been motivated to combine *Loomis* and *Kauser* such that *Loomis'* system utilizes *Kauser's* coverage area technique. (Expert Decl. § IX.G.)

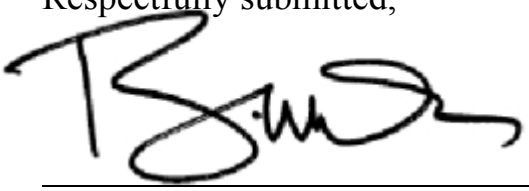
Section VIII.D.6 further presents reasons why it would have been obvious to modify and/or combine the prior art in this manner.

X. CONCLUSION

For the reasons set forth above, there is a reasonable likelihood that Petitioners will prevail as to the invalidity of Claims 1, 3, 15, 16, 20, 21, 23, 27, and 29 of the '153 Patent. Accordingly, Petitioners request that the Board institute *inter partes* review and subsequently invalidate the challenged claims.

DATED: August 11, 2015

Respectfully submitted,



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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 '153 Patent:

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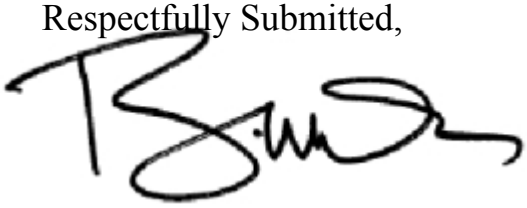
Respectfully Submitted,



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