No. _____

In The
Supreme Court of the United States

COMMIL USA, LLC,

Petitioner,

v.

CISCO SYSTEMS, INC.,

Respondent.

ON PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

PETITION FOR WRIT OF CERTIORARI

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QUESTIONS PRESENTED

Commil holds a patent teaching a method to implement short-range wireless networks. At trial, the jury returned a verdict that Commil's patent was valid, that Cisco directly infringed but did not induce infringement, and awarded damages. Because Cisco's counsel invoked stereotypes about Commil's Jewish owner and inventors during trial, the district court found the verdict "inconsistent with substantial justice" and ordered a new trial on inducement and damages only. At the second trial, the jury returned a verdict that Cisco induced infringement and awarded damages. The Federal Circuit reversed and remanded for a third trial on two grounds. First, although Commil's patent is valid, the Federal Circuit held that Cisco's "good faith belief" that the patent was invalid is a defense to induced infringement. Second, although Cisco had actual knowledge of Commil's patent, the Federal Circuit held that this Court's opinion in *Global-Tech Appliances*, *Inc. v. SEB S.A.*, 131 S. Ct. 2060 (2011) rendered erroneous and prejudicial the jury instruction based on *DSU Medical Corp. v. JMS Co.*, 471 F.3d 1293 (Fed. Cir. 2006). The questions presented are:

1. Whether the Federal Circuit erred in holding that a defendant's belief that a patent is invalid is a defense to induced infringement under 35 U.S.C. § 271(b).

2. Whether the Federal Circuit erred in holding that *Global-Tech Appliances*, *Inc. v. SEB S.A.*, 131 S. Ct. 2060 (2011) required retrial on the

issue of intent under 35 U.S.C. § 271(b) where the jury (1) found the defendant had actual knowledge of the patent and (2) was instructed that "[i]nducing third-party infringement cannot occur unintentionally."

PARTIES TO THE PROCEEDING

The petitioner here, and plaintiff-appellee in the Federal Circuit, is Commil USA, LLC ("Commil"). The respondent here, and the defendant-appellant in the Federal Circuit, is Cisco Systems, Inc. ("Cisco").

CORPORATE DISCLOSURE STATEMENT

Pursuant to Rule 29.6 of the Rules of this Court, petitioner Commil USA, LLC states that it has no parent corporation and no publicly held company owns 10 percent or more its stock.

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Petitioner Commil USA, LLC, respectfully petitions for a writ of certiorari to review the judgment of the United States Court of Appeals for the Federal Circuit in this case.

OPINIONS BELOW

The Federal Circuit panel opinions, including a majority opinion and two opinions concurring-in-part and dissenting-in-part, are reported at 720 F.3d 1361 (App. 1a-39a)[1]. The Federal Circuit order denying Commil's petition for rehearing *en banc*, including opinions dissenting from the denial joined by five of the eleven participating Federal Circuit judges, is not yet reported (App. 50a-63a). The Memorandum Opinion and Order of the district court granting petitioner's motion for new trial is not reported. (App. 40a-44a). The Order of the district court granting petitioner's motion *in limine* is not reported. (App. 45a-47a). The Amended Final Judgment of the district court that is the subject of this appeal is not reported. (App. 48a-49a).

JURISDICTION

The Federal Circuit entered its judgment on June 25, 2013, and denied Commil's petition for rehearing *en banc* by an order entered on October 25, 2013. This Court has jurisdiction under 28 U.S.C. § 1254(1).

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[1] References to "App. __a" are to the appendix bound together with this petition; references to "A__" are to the appendix filed in the Federal Circuit.

STATUTORY PROVISIONS INVOLVED

The relevant portion of 35 U.S.C. § 271(b) provides:

(b) Whoever actively induces infringement of a patent shall be liable as an infringer.

The relevant portion of 35 U.S.C. § 282(a) provides:

> (a) In General. — A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

STATEMENT OF THE CASE

This petition raises two important issues relating to inducement of patent infringement that, as decided by a divided Federal Circuit, dramatically weaken the Patent Act's provision of liability for inducing infringement, 35 U.S.C. § 271(b). Through two trials and the successful resolution of an *ex parte* reexamination proceeding at the United States Patent & Trademark Office ("USPTO") requested by Cisco, Commil has proved that its patent is valid, that Cisco had actual knowledge of Commil's patent and its relevance to Cisco's products, and that Cisco caused its customers to directly infringe Commil's patent. Nevertheless, the Federal Circuit has ordered a third trial to permit Cisco to present a newly created defense to inducement—that Cisco had a "good faith belief" that Commil's patent was invalid. Cisco has obtained a new trial on this point even though the validity of Commil's patent was confirmed by both a jury (whose verdict of validity was then affirmed by Federal Circuit) and, separately, by the USPTO in a reexamination proceeding.

The Federal Circuit also found reversible error in the jury instruction on inducement intent, which required the jury to find that Cisco had knowledge of Commil's patent, "actually intended to cause the acts that constitute direct infringement," "actively and knowingly aided and abetted [its customers] direct infringement," and further instructed that inducement "cannot occur unintentionally." Misapplying this Court's opinion in *Global-Tech Appliances*, *Inc. v. SEB S.A.*, 131 S.

Ct. 2060 (2011), the Federal Circuit held that these instructions "plainly recite[d] a negligence standard" because they further required a finding that Cisco "knew or should have known that its actions would induce actual infringement." In context, the jury instruction reflected the correct level of culpability required for inducement. The Federal Circuit's interpretation of *Global-Tech* will generate substantial confusion because it raises doubt about when, if ever, a patentee can prove inducement without a "smoking gun" document in which a defendant expressly states its knowledge of the infringement. Moreover, the seemingly stringent standard adopted by the Federal Circuit in the present case cannot be reconciled with the outcome of *Global-Tech*, where this Court affirmed a verdict of inducement where the defendant did not (as here) even have actual knowledge of the patent.

Commil respectfully requests that this Court grant certiorari to correct the Federal Circuit's errors and provide clarity to the intent requirement for inducement.

A. The Patented Technology

Commil is the owner of U.S. Patent No. 6,430,395 ("the '395 Patent") (App. 77a-202a), which claims an improved way to implement a short-range wireless network such as a WiFi network. The invention is directed to wireless networks in areas that are too large to be covered by a single access point—for example, universities and large corporate buildings. The problem solved by the invention is how to manage "hand-offs" between multiple access

points (also referred to as base stations) that together provide wireless coverage over a large area. With a novel way to manage handoffs, the invention teaches a way to implement a wireless network that minimizes interference with the user's activities as the user moves throughout the network coverage area.

In wireless networks pre-dating Commil's invention, each base station independently handled the entire wireless communication protocol. A mobile device's transition from one base station to another in such a system resulted in disruptions to the communications and could negatively affect the user's experience. The inventors of the '395 patent devised a new way to implement short-range wireless networks to provide coordination between base stations and improve the speed and reliability of handoffs. Rather than using the old base stations that handle the entire communication protocol, the '395 invention provides a novel architecture that includes a new device called a "switch," which is connected to and supports multiple base stations. Based on this architecture, the communication protocol is divided into two parts, with certain functionality (including functionality that is time-sensitive) performed at the base station and other functionality (including functionality that is not time-sensitive) performed at the switch, as shown in Fig. 2 of the patent. App. 80a.

B. Cisco's Knowledge of Commil's Patent

Commil's CEO spoke with a Cisco mergers and acquisitions manager several times in late 2004

or early 2005. App. 221a-223a. During these discussions, Commil's CEO told Cisco about Commil's technology and patents and explained that they "line[d] the core" of the products presently accused of infringement, which Cisco was then acquiring from a company called Airespace. App. 224a-228a. Airespace, which was founded more than a year after the priority date of the '395 Patent, described the infringing access points and switches (collectively, "the Accused Products") with language that is strikingly similar to Commil's patent:

> Split-MAC WLAN systems ... split[] the processing of the 802.11 data and management protocols, as well as the AP [access point, a/k/a base station] functionality, between the AP and the WLAN switch or controller .... In the split-MAC approach, the AP handles the portions of the protocol that have real-time requirements .... All other functionality is handled in the WLAN switch/appliance, where time-sensitivity is not a concern ....

A15113. At trial, one of the founders of Airespace (who joined Cisco after the acquisition) admitted that Cisco knew about Commil's asserted patent. App. 233a-234a. Shortly after acquiring Airespace and with knowledge of both Commil's patent and the assertion by Commil's CEO that the patent "line[d] the core" of the Accused Products, Cisco implemented a "migration plan" to move all customers from the older and non-infringing access

points to the Accused Products "as quickly as possible." A15239.

C. Proceedings at the District Court

Commil filed the present lawsuit against Cisco in 2007. The district court had jurisdiction under 28 U.S.C. §§ 1331 and 1338(a). Because the claims of the '395 Patent recite a method that will be performed when the Accused Products are used, Commil asserted that Cisco directly infringed the asserted claims under 35 U.S.C. § 271(a) when it used the Accused Products itself and induced its customers' infringement under 35 U.S.C. § 271(b) by selling the Accused Products and encouraging their use (which necessarily results in direct infringement of the claimed method).

A first trial was held in May 2010, and the jury returned a verdict that Commil's patent was not invalid, that Cisco directly infringed, that Cisco was not liable for inducement, and that Commil's damages were $3,726,207 (the exact amount presented by Cisco's damages expert). App. 4a-5a. Throughout this trial, however, Cisco's counsel used religious references and played on stereotypes about Commil's owner and inventors, who are Jewish and reside in Israel. App. 13a-17a. In response to Commil's motion for a new trial, the district court found that Cisco's conduct "impliedly align[ed] Cisco's counsel's religious preference with that of the jurors and employ[ed] an 'us v. them' mentality—i.e., 'we are Christian and they are Jewish.'" App. 43a. The district court concluded that the verdict was

"inconsistent with substantial justice" and ordered a new trial on inducement and damages. App. 44a.

Although the validity of the '395 Patent had been resolved in Commil's favor in the first trial and was no longer at issue, Cisco sought to introduce evidence challenging validity in the second trial under the theory that it allegedly showed Cisco's belief in the invalidity of the '395 Patent. Cisco argued that this alleged belief prevented it from having the intent required for inducing infringement. The district court granted Commil's motion *in limine* to exclude evidence challenging validity. App. 46a, 206a.

At the close of the second trial, the jury was given instructions on inducement intent that were based on the instructions approved by the *en banc* Federal Circuit in *DSU Medical Corp. v. JMS Co.*, 471 F.3d 1293 (Fed. Cir. 2006). The instructions included the following:

> (1) ". . . Commil must prove by a preponderance of the evidence that Cisco actively and knowingly aided and abetted [its customers] direct infringement." App. 238a.
>
> (2) ". . . Commil must show that Cisco actually intended to cause the acts that constitute direct infringement and that Cisco knew or should have known that its actions would induce actual infringement." App. 238a-239a.

> (3) "Inducing third-party infringement cannot occur unintentionally." App. 239a.
>
> (4) "Cisco ... cannot be liable for inducing infringement if it was not aware of the existence of the patent." App. 239a.

These instructions were given seven weeks before this Court issued its *Global-Tech* opinion. The jury returned a verdict that Cisco was liable for inducing infringement and awarded damages of $63,791,153. App. 48a.

D. Proceedings at the Federal Circuit

On appeal to the Federal Circuit (which had jurisdiction under 28 U.S.C. § 1295(a)(1)), Cisco challenged two aspects of the proceedings relating to inducement (among other issues not relevant to this petition). First, Cisco argued that the district court improperly prevented Cisco from presenting evidence that allegedly demonstrated the invalidity of the '395 Patent in order to argue, as a defense to inducement, that it had a good faith belief that the asserted patent was invalid. Second, Cisco argued that the jury instructions were erroneous because they make use of certain "knew or should have known" language that, according to Cisco, was declared improper by this Court's opinion in *Global-Tech Appliances*, *Inc. v. SEB S.A.*, 131 S. Ct. 2060 (2011).

The panel vacated the jury's infringement and damages determinations, affirmed the validity determinations, and remanded for a new trial on inducement and damages. The basis for vacating the infringement determination was two-fold. First, the panel concluded that the jury instructions on inducement were erroneous because they were inconsistent with *Global-Tech*. App. 7a-8a. The panel further explained that to the extent the instructions would have been proper under pre-*Global-Tech* Federal Circuit law (such as *DSU*), such law was no longer good law. *Id.*

Second, and over a dissent by Judge Newman, the panel concluded that the district court erred by excluding Cisco's evidence relating to the validity of Commil's patent in the second trial. The panel majority acknowledged that its holding that "a good-faith belief of invalidity may negate the requisite intent for induced infringement" was new substantive law. App. 10a. The majority explained that it "s[aw] no principled distinction between a good-faith belief of invalidity and a good faith belief of non-infringement for the purpose of whether a defendant possessed the specific intent to induce infringement of a patent." App. 11a. This was so, according to the majority, because "[i]t is axiomatic that one cannot infringe an invalid patent." *Id.*

Commil filed a petition for rehearing *en banc*, which was denied over the dissent of five of the eleven participating judges. App. 50a-63a. Two dissenting opinions accompanied the denial—the first authored by Judge Reyna (joined by Chief Judge Rader, Judge Newman, Judge Lourie, and

Judge Wallach), and the second written by Judge Newman (joined by Chief Judge Rader, Judge Newman, and Judge Wallach). These dissenting opinions explained that neither the statute, nor Federal Circuit precedent, nor *Global-Tech* provided a foundation for the majority's new means of absolving inducers of liability for their infringement of valid patents. App. 54a, 61a-62a.

REASON FOR GRANTING THE PETITION

I. THE COURT SHOULD DETERMINE WHETHER A PARTY'S BELIEF THAT A PATENT IS INVALID IS A DEFENSE TO INDUCING INFRINGEMENT UNDER 35 U.S.C. § 271(b)

Issued patents are entitled to a statutory presumption of validity and the defense of invalidity must be proved by clear and convincing evidence. *See* 35 U.S.C. § 282(a)-(b); *Microsoft Corp. v. i4i Ltd. P'ship*, 131 S. Ct. 2238 (2011). The Federal Circuit's new defense to inducement, however, "fundamentally changes the operating landscape" and "strikes at the very heart of the presumption of validity by eroding patent rights that have been duly granted by the PTO based solely on an erroneous—albeit good faith—belief that the PTO erred in granting the patent." App. 58a-60a.

Where a defendant has a mistaken belief of invalidity, the patentee will now be deprived of any remedy for infringement under § 271(b) even if, for example, (1) the patent is valid; (2) the defendant knew about the patent; (3) the defendant

intentionally took actions that caused a third party to infringe the patent; and (4) the defendant intended to cause that infringement. Indeed, inequitable fact patterns such as this are the only occasion under which the Federal Circuit's new defense will come into play, as the absence of any one of the preceding four facts would mean no liability for the defendant under previously existing law. *See* App. 54a, 56a, 61a-62a.

Neither the Patent Act, nor this Court's precedent, nor Federal Circuit precedent justifies the panel majority's new invalidity-based defense to infringement. Title 35, Section 271(b) provides that "[w]hoever actively induces infringement of a patent shall be liable as an infringer" (emphasis added). As noted in Judge Reyna's dissent, "[t]he legislative history explains that the language of § 271(b) 'recites in broad terms that one who aids and abets an infringement is likewise an infringer.'" App. 55a. (quoting H.R. Rep. No. 82-1923, at 9) (emphasis added). This Court has held that "[t]he addition of the adverb 'actively' suggests that the inducement must involve the taking of affirmative steps to bring about the desired result." *Global-Tech*, 131 S. Ct. at 2065. The statute and legislative history make clear that the relevant result is infringement. This Court's case law is equally clear. *Id.* at 2068 ("Accordingly, we now hold that induced infringement under § 271(b) requires knowledge that the induced acts constitute patent infringement." (emphasis added)); *see also* App. 55a-56a.

It is well-established that "[a]n act of infringement occurs when all the elements of a

claimed product or method are met by the accused device or process." App. 55a. (quoting *TecSec, Inc. v. Int'l Bus. Mach. Corp.*, — F.3d —, No. 2012-1415, 2013 WL 5452049, at *13 (Fed. Cir. 2013) (emphasis added)). As recognized by Federal Circuit precedent, the determination of infringement is distinct from validity:

> [T]his court has long recognized that patent infringement and invalidity are separate and distinct issues. "Though an invalid claim cannot give rise to liability for infringement, whether it is infringed is an entirely separate question capable of determination without regard to its validity."

Pandrol USA, LP v. Airboss Railway Prods., Inc., 320 F.3d 1354, 1365 (Fed. Cir. 2003) (quoting *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 721 F.2d 1563, 1383 (Fed. Cir. 1983)).

The crux of the Federal Circuit panel majority's reasoning in support of its new defense to a charge of inducing infringement is that "[i]t is axiomatic that one cannot infringe an invalid patent." App. 11a. But, as noted by the dissenting opinions, this proposition can hardly be "axiomatic" because it is directly contrary to *Pandrol* and *Medtronic*. App. 56a-57a, 61a-62a. The only cases relied upon by the panel majority may appear relevant at first blush, but upon closer review do not support its conclusion. App. 23a. In both opinions cited by the *Commil* majority for this "axiom," the panels decided that they did not need to address the

infringement issues raised on appeal because their invalidity determinations resolved all liability issues. *Id.*; *see also Prima Tek II*, *L.L.C. v. Polypap*, *S.A.R.L.*, 412 F.3d 1284, 1291 (Fed. Cir. 2005); *Richdel*, *Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983).

As explained in Judge Reyna's dissenting opinion (App. 57a-58a) and by the Federal Circuit 30 years ago in *Medtronic*, a determination of invalidity may dispose of liability, but infringement of a claim is "an entirely separate question capable of determination without regard to its validity" and the "better practice" is to address each issue separately. *Medtronic*, 721 F.2d at 1583 (emphasis added). The panel majority's pronouncement that "it can hardly be said that the alleged inducer intended to induce infringement" if it erroneously believes the patent is invalid cannot be reconciled with *Medtronic*. App. 12a. Correcting the confusion that will be generated by conflicting Federal Circuit panel opinions is itself a reason for this Court to grant certiorari. *See* App. 62a. (noting that "[i]nvestors, competitors, and trial courts cannot be confident as to the law that will be applied by the Federal Circuit").

The Federal Circuit panel majority also reasoned that it "s[aw] no principled distinction between a good-faith belief of invalidity and a good-faith belief of non-infringement for the purpose of whether a defendant possessed the specific intent to induce infringement of a patent." App. 11a. In addition to the statutory presumption of validity, the statutory language defining inducement and corresponding legislative history, this Court's

precedent, and the Federal Circuit precedent discussed above, there are additional reasons that weigh against the panel majority's new defense to inducement.

First, as described in Judge Newman's dissent to the panel opinion, the panel's new defense is at odds with common principles of tort liability. "Patent infringement is a tort." *Mars, Inc. v. Coin Acceptors, Inc.*, 527 F.3d 1359, 1365 (Fed. Cir. 2008). As Judge Newman adeptly explained in her dissent to the panel opinion:

> The majority's view that a belief in invalidity can negate infringement is contrary to the principles of tort liability, codified in the inducement statute. Liability for induced infringement is akin to "liability . . . under a theory of joint tortfeasance, wherein one who intentionally caused, or aided and abetted, the commission of a tort by another was jointly and severally liable with the primary tortfeasor." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990)[.]
>
> ***
>
> A mistake of law, even if made in good faith, does not absolve a tortfeasor. "Our law is . . . no stranger to the possibility that an act may be 'intentional' for purposes of civil liability, even if the actor lacked actual knowledge that her conduct violated the

> slaw." *Jerman v. Carlisle, McNellie, Rini, Kramer & Ulrich LPA*, 130 S. Ct. 1605, 1612 (2010). "If one intentionally interferes with the interests of others, he is often subject to liability notwithstanding the invasion was made under an erroneous belief as to some legal matter that would have justified the conduct." *Id.* (quoting W. Keeton, D. Dobbs, R. Keeton & D. Owen, Prosser and Keeton on Law of Torts 110 (5th ed. 1984)). A trespass "can be committed despite the actor's mistaken belief that she has a legal right to enter the property." *Id.* (citing Restatement (Second) of Torts § 164, & cmt. e (1963-1964)). "[P]atent validity is a question of law," *CSIRO v. Buffalo Technology (USA), Inc.*, 542 F.3d 1363, 1375 (Fed. Cir. 2008), and an "erroneous belief" of the "legal matter" of validity does not excuse the violation. *Jerman*, 130 S. Ct. at 1612.

App. 24a-25a.

Second, as Judge Reyna explained in his dissent to the denial of Commil's petition for rehearing *en banc*, "[c]onflating infringement and invalidity also unnecessarily complicates the induced infringement inquiry." App. 58a. Judge Reyna continued:

> [I]nfringement and non-infringement are opposite sides of the same coin

> whereas infringement and invalidity are altogether entirely different coins. The intent element of § 271(b) is met when the accused infringer acts with actual knowledge of the patent claim and was "actively inducing" conduct that it knew to be within the scope of an asserted claim. Whether the accused infringer held a good faith belief that it was inducing conduct that fell outside the scope of the claims is directly relevant to this intent inquiry. But whether the accused infringer held a good faith belief in invalidity—e.g., an erroneous belief regarding obviousness—is wholly unrelated to the accused infringer's conduct vis-à-vis the limitations of a presumptively valid patent claim.

App. 58a-59a. (citation omitted).

Third, the relative intent requirements for willfulness and inducement counsel against this new "good faith belief in invalidity" defense to inducement. For willfulness—unlike inducement—the defendant's subjective belief about validity is a factor. *Compare In re Seagate Tech.*, 497 F.3d 1360, 1371 (Fed. Cir. 2007) ("[T]o establish willful infringement, a patentee must show . . . that the infringer acted despite an objectively high likelihood that its actions constituted infringement of a valid patent." (en banc; emphasis added)), *with DSU*, 471 F.3d at 1306 ("[I]nducement requires that an alleged infringer knowingly induced infringement and possessed specific intent to encourage another's

infringement.") (en banc; emphasis added)); *see also* App. 23a. ("A good-faith belief of patent invalidity may be raised as a defense to willfulness of the infringement, but it is not a defense to the fact of infringement.").

Because willfulness permits enhanced damages, a higher level of culpability should be required. *See In re Seagate*, 497 F.3d at 1368 (en banc); *Broadcom Corp. v. Qualcomm, Inc.*, 543 F.3d 683, 699 (Fed. Cir. 2008) ("[A] lack of culpability for willful infringement does not compel a finding of non-infringement under an inducement theory."). Under *Broadcom*, for example, a plaintiff can rely on the defendant's failure to obtain an opinion of counsel to prove inducement even though such evidence cannot be used to prove willfulness. 543 F.3d at 699-700. The same principle should apply here—a defendant has more defenses to a willfulness allegation (*e.g.*, a good faith belief in invalidity) than to an inducement charge. *See LadaTech, LLC v. Illumina, Inc.*, No. 09-627-SLR, 2012 WL 1188266, at *2 (D. Del. Feb. 14, 2012) ("While defendants' beliefs regarding patent validity may be a relevant defense to willfulness, such beliefs are not a relevant defense to inducement of infringement.").

Finally, the panel majority's opinion creates more questions than it answers, which will inevitably spawn extensive (and expensive) litigation about the bounds of this new defense. *See* App. 58a-60a. For example, the panel majority opinion's response to Judge Newman's panel dissent is a puzzling attempt to temper or disavow what one would have otherwise thought was the holding of the

case. The majority first writes: "We now hold that evidence of an accused inducer's good-faith belief of invalidity may negate the requisite intent for induced infringement." App. 12a. In a footnote accompanying this sentence, the majority then says that it "certainly [do]es not hold 'that if the inducer of infringement believes in good faith that the patent is invalid, there can be no liability for induced infringement.'" App. 13a. If "an accused inducer's good-faith belief of invalidity may negate the requisite intent for inducement," it is unclear how a patentee could ever succeed in establishing liability for induced infringement where "the inducer of infringement believes in good faith that the patent is invalid." *Id.*

The new defense created by the Federal Circuit panel majority is at odds with the Patent Act and its legislative history, the statutory presumption of validity, the precedent of this Court or the Federal Circuit, principles of tort liability, and the relationship between willful and non-willful infringement. It is an unwarranted and unnecessary escape hatch that will serve only to increase the expense of litigation and release defendants who are inducing infringement of valid patents from all liability. Commil respectfully requests that this Court grant certiorari to restore the import of the statutory presumption of validity and return force to 35 U.S.C. § 271(b).

II. THE COURT SHOULD DETERMINE WHETHER *GLOBAL-TECH* OVERRULED *EN BANC* FEDERAL CIRCUIT LAW GOVERNING JURY INSTRUCTIONS ON INDUCEMENT INTENT WHERE THE DEFENDANT HAD ACTUAL KNOWLEDGE OF THE PATENT

A. The Federal Circuit Incorrectly Held That The Jury Was Given An Instruction That "Plainly Recites a Negligence Standard"

The jury was given the following instructions pertaining to inducement:

> If you find that a third party has directly infringed Claim 1, 4, or 6 of the '395 patent, then Commil must prove by a preponderance of the evidence that Cisco actively and knowingly aided and abetted that direct infringement.
>
> Furthermore, Commil must show that Cisco actually intended to cause the acts that constitute direct infringement and that Cisco knew or should have known that its actions would induce actual infringement.
>
> Inducing third-party infringement cannot occur unintentionally. This is different from direct infringement, which can occur unintentionally. Cisco also cannot be liable for inducing

> infringement if it was not aware of the existence of the patent.
>
> If you find that a third party has directly infringed Claim 1, 4, or 6 of the '395 patent and that Cisco knew or should have known that its actions would induce direct infringement, you may find that Cisco induced another to infringe Commil's patent if it provided instructions and directions to perform the infringing act through labels, advertising, or other sales methods.
>
> You may also find that Cisco induced infringement by supplying the components that are used in an infringing manner with the knowledge and intent that its customer would directly infringe by using the components to perform every step of the claimed method

App. 238a-239a. (emphasis added).

Focusing solely on the "knew or should have known" language, the Federal Circuit held that "the present jury instruction plainly recites a negligence standard, which taken literally, would allow the jury to find the defendant liable based on mere negligence where knowledge is required." App. 8a. But the jury could not have found inducement based on mere negligence, because the instruction required the jury to find that Cisco knew about the patent, that Cisco "actually intended to cause the acts that

constitute direct infringement," and that "actively and knowingly aided and abetted [its customers] direct infringement." Moreover, the instruction expressly precluded a finding of inducement if the jury found Cisco had not intentionally caused its customers infringement. *Cf. Sykes v. United States*, 131 S. Ct. 2267, 2285 (2011) (Scalia, J., dissenting) (describing "strict liability, negligence, and recklessness crimes" as "unintentional crimes").[2]

B. The Federal Circuit's Error Resulted From The Incorrect Premise That *Global-Tech* Overruled *DSU*

The Federal Circuit's error stemmed from a misapplication of this Court's opinion in *Global-Tech*. Prior to *Global-Tech*, the *en banc* Federal Circuit in *DSU* had recognized that "knew or should have known" language could properly be used in a jury instruction on inducement intent so long as the jury is also required to find culpable conduct, knowledge of the patent (which was not disputed in

[2] Even if the mere use of the "knew or should have known" language was error, it was harmless. It is a "well-established proposition that a single instruction to a jury may not be judged in artificial isolation, but must be viewed in the context of the overall charge." *Cupp v. Naughten*, 414 U.S. 141, 146-47 (1973). Lay jurors would not confuse these instructions with a negligence standard. *See Boyde v. California*, 494 U.S. 370, 380-81 (1990) ("Jurors do not sit in solitary isolation booths parsing instructions for subtle shades of meaning in the same way that lawyers might.").

DSU), and intent to cause the infringing acts.[3] *See DSU Medical Corp. v. JMS Co.*, 471 F.3d 1293, 1305-06 (Fed. Cir. 2006). Although *DSU* and *Global-Tech* rely on the same precedent and set forth the same substantive standard, confusion abounds about if (and if so, how) *Global-Tech* altered *DSU*. In the present case, the Federal Circuit panel acknowledged that the challenged language in the present instructions was approved in *DSU*, but went on to hold it was erroneous and required a new trial in light of *Global-Tech*. App. 7a-8a. The instructions given were consistent with both *DSU* and *Global-Tech*, and this Court should grant certiorari to correct misconceptions about the relationship between *DSU* and *Global-Tech*.

In *DSU*, the *en banc* Federal Circuit addressed the intent requirement for inducement. Relying heavily on this Court's opinion in *Metro-Goldwyn-Mayer Studios Inc. v. Grokster*, 545 U.S. 913 (2005), the Federal Circuit held that "inducement requires that the alleged infringer knowingly induced infringement and possessed

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[3] In the context of a proper instruction, the "knew or should have known" language serves the important purpose of recognizing that direct evidence of wrongful intent will rarely, if ever, be available. *Cf. Digital Control, Inc. v. Charles Mach. Works*, 437 F.3d 1309, 1317 (Fed. Cir. 2006) ("Direct evidence of intent is rare, such that a court must often infer intent from the surrounding circumstances."); *see also Farmer v. Brennan*, 511 U.S. 825, 1981 (1994) ("[I]f the risk is obvious, so that a reasonable man would realize it, we might well infer that [the defendant] did in fact realize it . . ." (quoting LaFave & Scott § 3.7, p. 335)); *Everson v. Leis*, 412 Fed. Appx. 771, 782 (6th Cir. 2011) ("[A]n inference can be drawn from the fact that he should have known, and that inference is circumstantial evidence of Wittich's actual knowledge.").

specific intent to encourage another's infringement." 471 F.3d at 1306 (quotation marks omitted). In 2011, this Court issued its opinion in *Global-Tech*, which also addressed the intent requirement for inducement. Much like *DSU*, this Court's opinion relied on *Grokster* and held that "induced infringement under § 271(b) requires knowledge that the induced acts constitute patent infringement." *Global-Tech*, 131 S. Ct. at 1067-68.

Although *DSU* and *Global-Tech* announced substantively the same standard, in the present case the Federal Circuit found in *Global-Tech* a significant change in the law. A careful reading of *Global-Tech* shows that it overruled the Federal Circuit's opinion in that particular case, but not *DSU*. *Global-Tech* addressed a specific and narrow question: Can a defendant be liable for inducement if it did not have actual knowledge of the patent? The Court answered this question in two steps. First, the Court held that inducement requires intent to cause a third party to infringe, not just intent to cause the third party to act in a manner that happens to be infringing. 131 S. Ct. at 2065-68. This is the same conclusion that the *en banc* Federal Circuit reached in *DSU*. *Compare Global-Tech*, 131 S. Ct. at 2067 (quoting *Metro-Goldwyn-Mayer Studios Inc. v. Grokster*, 545 U.S. 913 (2005)), *with DSU*, 471 F.3d at 1306 (same).

The second step of the Court's answer addressed an issue that *DSU* did not speak to (and that is irrelevant to the present case): What if the defendant indisputably did <u>not</u> have actual knowledge of the patent? In *DSU*, it was undisputed

that the defendant knew about the asserted patent. 471 F.3d at 1311 (Michel, C.J., concurring) ("There is no dispute that [the defendant] had actual knowledge of [the patent]. Accordingly, the 'knowledge of the patent' issue is not before us."). On this point, this Court disagreed with the Federal Circuit panel opinion in the *Global-Tech* case, but this disagreement did not overrule *DSU*, which did not present this issue.

In *Global-Tech*, it was undisputed that the defendant did not have actual knowledge of the asserted patent. 131 S. Ct. at 2064. The evidence showed that the defendant intentionally copied a version of the plaintiff's product, hired a patent attorney to perform a right-to-use study, declined to tell the attorney that it had copied the plaintiff's product, and then began selling its product after the attorney failed to find the relevant patent. *SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1366 (Fed. Cir. 2010). At trial, the jury instructions provided that "Defendants cannot be liable for inducing infringement if they had no reason to be aware of the existence of the '312 patent." Respondents' Br., *Global-Tech Appliances Inc. v. SEB*, 2010 WL 5488407, at *26a (emphasis added).

On JMOL, at the Federal Circuit, and at the Supreme Court, the defendant consistently argued that a finding of inducement requires actual knowledge of the patent. *Id.* at 1367; *id.* at 1376; 131 S. Ct. at 2065 ("Pentalpha argues that active inducement liability under § 271(b) requires more than deliberate indifference to a known risk that the induced acts may violate an existing patent.

Instead, Pentalpha maintains, actual knowledge of the patent is needed."). At the Federal Circuit, the panel held that the "knowledge of the patent" requirement set forth in *DSU* could be satisfied by proof of a "deliberate[] disregard[of] a known risk" that there was a protective patent. 594 F.3d at 1376-77. This Court rejected the conclusion that knowledge of the patent could be shown by "deliberate indifference" and instead adopted the more rigorous "willful blindness" standard. *See* 131 S. Ct. at 2068 ("Returning to Pentalpha's principal challenge, we agree that deliberate indifference to a known risk that a patent exists is not the appropriate standard under § 271(b).").

Properly viewed, this Court's *Global-Tech* opinion endorsed the *DSU* intent standard for inducement and corrected a separate error relating to the "knowledge of the patent" requirement that was at issue in *Global-Tech* but not in *DSU* (or the present case). It did not, as the *Commil* panel held, overrule *DSU*. Indeed, prior to *Commil*, the Federal Circuit had repeatedly cited *DSU* and *Global-Tech* in tandem when describing the intent requirement for inducement. *See Akamai Techs., Inc. v. Limelight Networks, Inc.*, 692 F.3d 1301, 1308 (Fed. Cir. 2012) (en banc); *see also Merial Ltd. v. Cipla Ltd.*, 681 F.3d 1283, 1304 (Fed. Cir. 2012); *In re Bill of Lading Transmission & Processing Sys. Patent Litig.*, 681 F.3d 1323, 1339 (Fed. Cir. 2012).

C. The *Commil* Opinion Compounds The Confusion Created By *Global-Tech* About How A Plaintiff Can Prove That The Intent Requirement Is Satisfied

Since the *Global-Tech* opinion was issued, there has been confusion about how a plaintiff can prove that the intent requirement for inducement is satisfied.[4] The confusion generally relates to what evidence a plaintiff needs to present other than evidence that the defendant knew of the patent. The *Global-Tech* opinion strongly suggests that knowledge of the patent is sufficient to support an inducement verdict by repeatedly referring to knowledge of the patent nearly (if not entirely) synonymously with knowledge of infringement of that patent. For example:

- "Pentalpha argues that active inducement liability under § 271(b) requires more than deliberate indifference to a known risk that the induced acts may violate an existing patent. Instead, Pentalpha maintains, actual knowledge of the patent is needed." 131 S. Ct. at 2065 (emphasis added).

[4] There have been at least two other recent petitions for certiorari that relate to the intent requirement for inducement under *Global-Tech*. *See Artesyn Techs., Inc. v. Synqor, Inc.*, No. 13-375 (Sept. 23, 2013) (cert petition denied Nov. 18, 2013) (Federal Circuit affirmed inducement verdict where "knew or should have known" language was used in the jury instruction); *Arthrex, Inc. v. Smith & Nephew, Inc.*, No. 13-290 (Aug. 30, 2013) (cert petition denied Dec. 9, 2013).

- "On the other hand, this Court, in *Henry v. A. B. Dick Co.* . . . stated that 'if the defendants [who were accused of contributory infringement] knew of the patent and that [the direct infringer] had unlawfully made the patented article . . . with the intent and purpose that [the direct infringer] should use the infringing article . . . they would assist in her infringing use.'" *Id.* at 2066 (emphasis in original).

- "The phrase 'knowing [a component] to be especially made or especially adapted for use in an infringement' may be read to mean that a violator must know that the component is 'especially adapted for use' in a product that happens to infringe a patent. Or the phrase may be read to require, in addition, knowledge of the patent's existence." *Id.* at 2067 (emphasis added).

- "It would thus be strange to hold that knowledge of the relevant patent is needed under § 271(c) but not under § 271(b). Accordingly, we now hold that induced infringement under § 271(b) requires knowledge that the induced acts constitute patent infringement." *Id.* at 2068 (emphasis added).

- "Taken together, this evidence was more than sufficient for a jury to find

> that Pentalpha subjectively believed there was a high probability that SEB's fryer was patented, that Pentalpha took deliberate steps to avoid knowing that fact, and that it therefore willfully blinded itself to the infringing nature of Sunbeam's sales." *Id.* at 2063 (emphasis added).

The opinion ultimately concludes that evidence of willful blindness with respect to the existence of the patent was sufficient to prove inducement under the Court's holding that "induced infringement under § 271(b) requires knowledge that the induced acts constitute patent infringement." 131 S. Ct. at 2068, 2071 (emphasis added).

This approach makes sense, as it is extraordinarily unlikely that a defendant would create (and then produce during discovery) evidence that it analyzed the patent and concluded that it was valid and infringed. If such evidence were required, inducing infringement would be effectively removed from the Patent Act. By vacating an inducement verdict where the plaintiff proved that the defendant had actual knowledge of the patent (in addition to all of the other findings required by the instructions discussed above), the Federal Circuit's opinion in this case has created an anomalous situation where it appears easier to prove inducement intent where the defendant did not have actual knowledge of the patent (as in *Global-Tech*, where this Court affirmed the verdict) than it is to prove inducement where the defendant did have knowledge of the patent (as in the present case).

For example, a plaintiff who relies on a defendant's willful blindness with respect to the existence of the patent (as in *Global-Tech*) cannot be criticized for failing to present additional evidence of that defendant's more specific knowledge of the infringing nature of its customers' acts (*i.e.*, how the infringing acts map onto the particular claim language and whether that claim language may also encompasses the prior art). There obviously will be no such evidence if the defendant did not have actual knowledge of the patent. Yet in the present case, a new trial has been ordered because although Commil proved (and the jury found) that Cisco had actual knowledge of the patent and that Cisco intended to aid and abet its customers' infringement, the instructions also required the jury to find that Cisco "knew or should have known that its actions would induce actual infringement." The Court should take this opportunity to clarify that *Global-Tech* permits a jury to infer from a defendant's actual knowledge of the patent that the defendant also knew of the infringement, and that an additional finding that a party "should have known" of those actual infringements strengthens that inference. *See Farmer v. Brennan*, 511 U.S. 825, 1981 (1994) ("[I]f the risk is obvious, so that a reasonable man would realize it, we might well infer that [the defendant] did in fact realize it . . ." (quoting LaFave & Scott § 3.7, p. 335)).

CONCLUSION

For the reasons set forth above, Commil respectfully requests that the Court grant its petition for a writ of certiorari.

Respectfully Submitted,

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January 23, 1014

APPENDIX

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United States Court of Appeals for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

Decided: June 25, 2013

MARK S. WERBNER, Syles Werbner, P.C., of Dallas, Texas, argued for plaintiff-appellee. With him on the brief were RICHARD A. SAYLES and MARK D. STRACHAN. Of counsel on the brief were LESLIE V. PAYNE, NATHAN J. DAVIS and MIRANDA Y. JONES, Heim, Payne & Chorush, of Houston, Texas.

WILLIAM F. LEE, Wilmer Cutler Pickering Hale and Dorr LLP, of Boston, Massachusetts, argued for defendant-appellant. With him on the brief were MARK C. FLEMING, JONATHAN W. ANDRON and FELICIA H. ELLSWORTH; and WILLIAM G. MCELWAIN, of Washington, DC. Of counsel on the

brief were HENRY B. GUTMAN, Simpson Thacher & Bartlett LLP, of New York, New York; and JEFFREY E. OSTROW, HARRISON J. FRAHN, IV, PATRICK E. KING and JONATHAN SANDERS, of Palo Alto, California.

Before NEWMAN, PROST, and O'MALLEY, *Circuit Judges*.

Opinion for the court filed by *Circuit Judge* PROST.

Opinion concurring-in-part, dissenting-in-part filed by *Circuit Judge* NEWMAN.

Opinion concurring-in-part, dissenting-in-part filed by *Circuit Judge* O'MALLEY.

PROST, *Circuit Judge*.

Cisco Systems, Inc. appeals from the final judgment of the United States District Court for the Eastern District of Texas, which was based on the findings of two separate jury verdicts finding that: Cisco directly and indirectly infringed specified claims of Commil USA, LLC's U.S. Patent No. 6,430,395 ("'395 patent"); the specified claims of the '395 patent are not invalid as indefinite, for lack of enablement, or as lacking adequate written description; and that Cisco was liable for $63,791,153 in damages as well as pre-judgment interest and costs. We find that the district court gave the jury a legally erroneous instruction with respect to indirect infringement. Additionally, we find that Cisco's evidence of a good-faith belief of invalidity may negate the requisite intent for induced infringement. However, we find that the

district court did not err in granting a partial new trial. Thus, we affirm-in-part, vacate-in-part, and remand for further proceedings consistent with this opinion.

I. BACKGROUND

A. THE PATENT AND ACCUSED PRODUCTS

In a wireless system, mobile devices such as phones and laptop computers communicate with fixed "base stations" according to standardized procedures that govern the way in which data exchanged between devices is formatted, ordered, maintained, and transmitted. These procedures are referred to as "protocols." Effective wireless communication requires that the transmitting device and the receiving device follow the same protocol.

The '395 patent relates to a method of providing faster and more reliable handoffs of mobile devices from one base station to another as a mobile device moves throughout a network area. The '395 patent teaches that the communication protocol is divided based on time sensitivity. The portions of the protocol requiring accurate time synchronization—"real-time capabilities"—are performed at the base station. This part of the protocol is called the "low-level protocol." Other parts of the protocol that are not time-sensitive comprise the "high-level protocol, "which is performed on another device called a switch. The base station and switch cooperate to handle a connection with a mobile unit. To implement the full communications protocol, the base station runs an instance of the low-level

protocol for the connection and the switch runs a corresponding instance of the high-level protocol.

Cisco is a major supplier of WiFi access points and controllers. Commil alleges that certain Cisco access points and controllers infringe claims 1, 4, and 6 of the'395 patent. Claim 1, the patent's sole independent claim, provides:

> In a wireless communication system comprising at least two Base Stations, at least one Switch in communication with the Base Stations, a method of communicating between mobile units and the Base Stations comprising:
>
> dividing a short-range Communication protocol into a low-level protocol for performing tasks that require accurate time synchronization and a high-level protocol which does not require accurate time synchronization; and
>
> for each connection of a mobile unit with a Base Station, running an instance of the low-level protocol at the Base Station connected with the mobile unit and running an instance of the high-level protocol at the Switch.

B. THE DISTRICT COURT PROCEEDINGS

A jury trial commenced on May 10, 2010. On May 17, 2010, the jury returned a verdict rejecting Cisco's invalidity contentions, finding Cisco liable for direct infringement, and awarding Commil $3.7

million in damages. The jury also found that Cisco was not liable for induced infringement. Commil filed a motion for a new trial on the issues of induced infringement and damages, which the court granted on December 29, 2010.

On April 5, 2011, a second trial was held with respect to indirect infringement and damages. On April 8, 2011, the jury returned a verdict in favor of Commil on both issues and this time awarded $63.7 million in damages. On September 28, 2011, the district court entered an amended final judgment granting $63.7 million in actual damages, $10.3 million in prejudgment interest, and $17,738 in costs. This appeal followed.

II. DISCUSSION

Cisco appeals the district court decision on several grounds. First, Cisco contends that an erroneous instruction allowed the jury to find inducement based on mere negligence. Second, Cisco argues that the district court erroneously precluded Cisco from presenting evidence of its good-faith belief of invalidity to show that it lacked the requisite intent to induce infringement of the asserted claims. Third, Cisco argues that the district court abused its discretion in granting a new trial and that the district court violated the Seventh Amendment by granting a new trial on certain issues, but not others. Fourth, Cisco claims the court erred in construing the term "short-range communication protocol." Fifth, Cisco argues that there is not substantial evidence to sustain the jury verdict on infringement. Sixth, Cisco contends the claims are indefinite, not enabled, and lacking

adequate written description. Finally, Cisco objects to the damages award on the grounds that Commil's royalty base violates the entire market value rule. We take each of these issues in turn.

A. THE JURY INSTRUCTION

Before the district court and on appeal, Cisco challenged the second trial's jury instruction on induced infringement. The district court denied Cisco's motion for a new trial on the jury instruction issue. We review the denial of a motion for a new trial under the law of the regional circuit. *Riverwood Int'l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1352 (Fed. Cir. 2003). In the Fifth Circuit, the denial of a motion for a new trial "will not be disturbed absent an abuse of discretion or a misapprehension of the law." *Prytania Park Hotel v. Gen. Star Indem. Co.*, 179 F.3d 169, 173 (5th Cir. 1999). Whether a jury instruction on an issue of patent law is erroneous is a matter of Federal Circuit law that is reviewed de novo. *Sulzer Textil A.G. v. Picanol N.V.*, 358 F.3d 1356, 1363 (Fed. Cir. 2004) (citing *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000)).We will set aside the jury verdict, "if the movant can establish that 'those instructions were legally erroneous,' and that 'the errors had prejudicial effect.'" *Id.* (citations omitted). In reviewing jury instructions, we review the trial record and the jury instructions in their entirety. *Id.*

At the second trial, the court instructed the jury that it could find inducement if "Cisco actually intended to cause the acts that constitute direct infringement and that Cisco knew or should have known that its actions would induce actual

infringement." J.A. 6389 (98:2499:2). The "knew or should have known" language is a verbatim recitation of the standard for showing induced infringement we originally set forth in *Manville Sales Corp. v. Paramount Sys., Inc.*, 917 F.2d 544, 553 (Fed. Cir. 1990). This court, sitting en banc, again approved this language in *DSU Medical Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006) (en banc). Cisco alleges that this instruction allowed the jury to find inducement on the showing of mere negligence and, as such, is legally erroneous in view of the Supreme Court's recent decision in *Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060 (2011).

The *Global-Tech* Court held that induced infringement "requires knowledge that the induced acts constitute patent infringement." *Id.* at 2068. The knowledge requirement of *Global-Tech* may be satisfied by showing actual knowledge or willful blindness. *Id.* at 2072. In reaching this conclusion the Court expressly distinguished actual knowledge and willful blindness from recklessness and negligence explaining that:

> [A] willfully blind defendant is one who takes deliberate actions to avoid confirming a high probability of wrongdoing and who can almost be said to have actually known the critical facts. By contrast, a reckless defendant is one who merely knows of a substantial and unjustified risk of such wrongdoing and a negligent defendant is one who should have known of a similar risk but, in fact, did not.

Id. at 2070-71 (citations omitted). The Court acknowledged that the facts that must be adduced to find willful blindness prevent such a finding on facts that support only recklessness or negligence. *Id.* Moreover, the Court rejected the standard set forth by this court, in part, because it permitted "a finding of knowledge when there is merely a 'known risk' that the induced acts are infringing." *Id.* at 2071.

Commil contends that the jury instruction in this case merely allowed the jury to find knowledge based upon circumstantial evidence. Circumstantial evidence can, of course, support a finding of actual knowledge or willful blindness just as it did in *Global-Tech*. *Id.* at 2071-72. The jury instruction in this case, however, was not so limited. While the court did instruct the jury that certain circumstantial evidence could support a finding of inducement, the present jury instruction plainly recites a negligence standard, which taken literally, would allow the jury to find the defendant liable based on mere negligence where knowledge is required. J.A. 6389 (98:1999:15). Therefore, to the extent our prior case law allowed the finding of induced infringement based on recklessness or negligence, such case law is inconsistent with *Global-Tech* and no longer good law. It is, therefore, clear that the jury instruction in this case was erroneous as a matter of law. This finding, however, does not end our inquiry.

In order to set aside a jury verdict, we must find not only that the jury instruction was legally erroneous, but also that the instruction had a prejudicial effect. *Sulzer Textil*, 358 F.3d at 1364 ("[I]t is not enough to merely show that a jury

instruction is erroneous; [petitioner] also must show that the erroneous jury instruction was prejudicial."). If the erroneous jury instruction "could not have changed the result, the erroneous instruction is harmless." *Environ Prods., Inc. v. Furon Co.*, 215 F.3d 1261, 1266–67 (Fed. Cir. 2000). Commil contends that when viewed as a whole, the jury instruction required the jury to find facts that satisfy the *Global-Tech* standard and, therefore, there is no prejudicial effect. We cannot agree.

A finding of inducement requires both knowledge of the existence of the patent and "knowledge that the induced acts constitute patent infringement." *Global-Tech*, 131 S. Ct. at 2068; *see also DSU Med. Corp.*, 471 F.3d at 1306 (explaining that an "alleged infringer must be shown . . . to have *knowingly* induced infringement," not merely knowingly induced the acts that constitute direct infringement" (citation omitted)). Here, the jury was clearly instructed that Cisco could not be liable for induced infringement if it was not aware of the '395 patent. The jury was also instructed that Cisco must have actively and knowingly aided and abetted direct infringement. The jury, however, was not instructed that in order to be liable for induced infringement, Cisco must have had knowledge that the induced acts constitute patent infringement. On the contrary, the jury instruction allowed Cisco to be held liable if "Cisco knew or should have known that its actions would induce direct infringement." J.A. 6389 (99:10-11). With respect to whether the induced acts constitute patent infringement, it is clear that the jury was permitted to find induced infringement based on mere negligence where knowledge is required. This erroneous instruction certainly could

have changed the result. Facts sufficient to support a negligence finding are not necessarily sufficient to support a finding of knowledge. Accordingly, we vacate the jury's verdict on induced infringement and remand for a new trial. Because we vacate the induced infringement verdict upon which the damages award is based, we also vacate the damages award.

B. CISCO'S GOOD-FAITH BELIEF OF INVALIDITY

Cisco further contends that the district court erred in preventing Cisco from presenting evidence during the second trial of its good-faith belief of invalidity to rebut Commil's allegations of induced infringement. We agree.

Prior to the second trial, Cisco proffered evidence to support its good-faith belief that the '395 patent is invalid. Commil filed a motion in limine to exclude this evidence, which the district court granted without written opinion. It is not entirely clear from the record why the district court precluded Cisco from presenting its evidence. However, during a colloquy with Cisco's counsel at a pretrial hearing, the district court appeared to base its decision on the fact that our precedent indicates that such evidence is relevant where it relates to a good-faith belief of non-infringement, but is silent with respect to invalidity. J.A. 6061-63. It is true, as the district court noted, that we appear to have not previously determined whether a good-faith belief of invalidity may negate the requisite intent for induced infringement. We now hold that it may.

Under our case law, it is clear that a good-faith belief of non-infringement is relevant evidence that tends to show that an accused inducer lacked the intent required to be held liable for induced infringement. *See DSU Med. Corp.*, 471 F.3d at 1307 (finding a demonstrated belief of non-infringement sufficient to support a jury verdict that the defendant did not induce infringement); *Ecolab, Inc. v. FMC Corp.*, 569 F.3d 1335, 1351 *amended on reh'g in part*, 366 F. App'x 154 (Fed. Cir. 2009) (finding that a reasonable belief of non-infringement supported a jury verdict that the defendant lacked the intent required for induced infringement); *Kinetic Concepts, Inc. v. Blue Sky Med. Grp., Inc.*, 554 F.3d 1010, 1025 (Fed. Cir. 2009) (holding that defendant's "belief that it can freely practice inventions found in the public domain" supports "a jury's finding that the intent required for induced infringement was lacking"); *Bettcher Indus., Inc. v. Bunzl USA, Inc.*, 661 F.3d 629, 649 (Fed. Cir. 2011) (finding opinion of counsel regarding non-infringement "admissible, at least with respect to [defendant]'s state of mind and its bearing on indirect infringement"). We see no principled distinction between a good-faith belief of invalidity and a good-faith belief of non-infringement for the purpose of whether a defendant possessed the specific intent to induce infringement of a patent.

It is axiomatic that one cannot infringe an invalid patent. *See, e.g.*, *Prima Tek II, L.L.C. v. Polypap, S.A.R.L.*, 412 F.3d 1284, 1291 (Fed. Cir. 2005) ("there can be no . . .induced infringement of invalid patent claims"); *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983) ("The claim being invalid there is nothing to be

infringed."). Accordingly, one could be aware of a patent and induce another to perform the steps of the patent claim, but have a good-faith belief that the patent is not valid. Under those circumstances, it can hardly be said that the alleged inducer intended to induce infringement. Thus, a good-faith belief of invalidity is evidence that may negate the specific intent to encourage another's infringement, which is required for induced infringement. Several district courts have considered this question and come to the same conclusion. *See VNUS Med. Techs., Inc. v. Diomed Holdings, Inc.*, 2007 WL 2900532, at * 1 (N.D.Cal. Oct. 2, 2007) (denying plaintiff's motion for summary judgment on induced infringement based, in part, on an opinion of counsel that the patents-in-suit were invalid"); *Kolmes v. Worm Elastic Corp.*, 1995 WL 918081, at * 10 (M.D.N.C. Sept. 18, 1995) (finding, after a bench trial, no intent to induce infringement where defendants "had a good faith belief in the invalidity" of the patent-in-suit); *DataQuill Ltd. v. High Tech Computer Corp.*, 2011 WL 6013022, at *10 (S.D. Cal. Dec. 1,2011) (indicating that a belief of invalidity may present a triable issue of fact as to intent to induce infringement); *see also* Lemley, *Inducing Patent Infringement*, 39 U.C. Davis. L. Rev. 225,243 (2005) ("[I]t is not reasonable to assume that merely because a defendant is aware of the existence of a patent, he intended to infringe it. He may believe the patent invalid"); *but see Applera Corp. v. MJ Research Inc.*, 2004 WL 367616, at *1 (D. Conn. Feb. 24, 2004); *LadaTech, LLC v. Illumina, Inc.*, 2012 WL 1188266, at *2 (D. Del. Feb. 14, 2012).

We now hold that evidence of an accused inducer's good-faith belief of invalidity may negate

the requisite intent for induced infringement.[1] This is, of course, not to say that such evidence precludes a finding of induced infringement. Rather, it is evidence that should be considered by the fact-finder in determining whether an accused party knew "that the induced acts constitute patent infringement." *Global-Tech*, 131 S. Ct. at 2068.

C. THE GRANT OF A SECOND TRIAL

Cisco challenges the district court's grant of a new trial on two fronts. First, Cisco argues that there was no basis for granting a new trial. Second, Cisco argues that even if a new trial was proper, the partial new trial violated the Seventh Amendment. We discuss these issues seriatim.

1. THE FIRST TRIAL

The district court proceedings in this case were unusual. Commil is based in Israel and the inventors of the '395 patent are Israeli. Throughout the trial, according to the district court, Cisco's trial counsel attempted to play upon religious prejudices and ethnic stereotypes.

For instance, during the cross-examination of Jonathan David, a co-owner of Commil who is Jewish, Cisco's counsel attempted to perpetuate the

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[1] In dissent, Judge Newman does little more thanconstruct a straw man and set him ablaze. We certainly do not hold "that if the inducer of infringement believes in good faith that the patent is invalid, there can be noliability for induced infringement." J. Newman Op. concurring-in-part, dissenting-in-part 1. Nor do we "include a belief in patent validity as a criterion of infringement." *Id.* at 4.

stereotype of Jewish people as greedy opportunists by asking Mr. David if his cousin was a "bottom-feeder who swim[s] around on the bottom buying people's houses that they got kicked out of for next to nothing." J.A. 5823 (139:19-140:1). Later, when Mr. David mentioned dining at a local barbeque restaurant, Cisco's counsel quipped, "I bet not pork." J.A. 5825 (146:4-24). Following the pork comment, the court questioned counsel on the relevance of his statement and issued a curative instruction stating:

> Sometimes when a lawyer injects irrelevant information into a case it's because he perceives a weakness in the merits of his case. I don't know whether that's why it happened in this case, but you can consider that as you're evaluating the testimony and the evidence in this case.

J.A. 5838 (2:25-3:9).

Despite the potent curative instruction and the court's clear displeasure, in his closing, counsel again made several irrelevant and prejudicial remarks. Counsel's behavior reached a new low when he began his closing argument with a reference to the trial of Jesus Christ, stating:

> Ladies and Gentlemen of the Jury, you are, in this case, truth-seekers. You are charged with the most important job in this courtroom, and that's determining the truth. . . . And when you figure out what the truth is, you'll know how to answer that verdict form. You

> remember the most important trial in history, which we all read about as kids, in the Bible had that very question from the judge. What is truth?

J.A. 6038 (16:1-16).[2]

After discharging the jury, the court again expressed displeasure with Cisco's counsel and informed Commil that should they file it, a motion for a new trial would be entertained. Shortly thereafter, Commil filed a motion for a new trial on the issues of indirect infringement and damages. In ruling on the motion, the court found that when counsel's comments regarding the trial of Jesus were viewed in context with other comments regarding Mr. David and the inventors Jewish heritage, it was clear that counsel was attempting to align his "religious preference with that of the jurors and employs an 'us v. them' mentality–i.e., 'we are Christian and they are Jewish.'" *Commil USA, LLC v. Cisco Sys., Inc.*, No. 2:07-CV-341, slip op. at 3 (E.D. Tex. Dec. 29, 2010). The court granted the motion, finding that the comments prejudiced the jury with respect to indirect infringement and damages. Cisco filed a motion for reconsideration, which the court denied.

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[2] Cisco was not alone in its attempt to curry favor with the jury through the use of religious references. For instance, during the voir dire, Commil's counsel explained that the case began in Israel, "the Holy Land for many religions." J.A. 5686 (25:11-13). Later, during closing argument, Commil's counsel argued with respect to damages that Cisco wanted the jurors to "split the baby"and "[y]ou know, that wasn't wise at the time of King Solomon. It's not wise today." J.A. 6047 (52:3-9).

1. GRANT OF A NEW TRIAL

We review issues not unique to patent law, such as the grant of a new trial based on the prejudicial remarks of counsel, under regional circuit law. *Riverwood Int'l Corp.*, 324 F.3d at 1352. The Fifth Circuit reviews rulings on new trial motions for abuse of discretion, with more exacting review applied to orders granting a new trial than to those denying them. *Conway v. Chem. Leaman Tank Lines, Inc.*, 610 F.2d 360, 362-363 (5th Cir. 1980). "[A] new trial will not be granted, even if counsel's remarks are improper, unless after considering the record as a whole the court concludes that manifest injustice would result from letting the verdict stand." *Gautreaux v. Scurlock Marine, Inc.*, 84 F.3d 776, 783 (5th Cir. 1996).This is particularly the case where, as here, the statements drew no objection from the opposing party: "[I]mproper argument may be the basis for a new trial where no objection has been raised only 'where the interest of substantial justice is at stake.'" *Hall v. Freese*, 735 F.2d 956, 961 (5th Cir. 1984) (quoting *Edwards v. Sears, Roebuck & Co.*, 512 F.2d 276, 286 (5th Cir. 1975)).

As discussed *supra*, the district court granted a new trial based on what it viewed as the prejudicial effect of inflammatory statements made by Cisco's counsel during trial. Cisco claims that the statements do not warrant a new trial. Cisco asks us to review the cold record—substituting our judgment for the district court's—and find that there was no manifest injustice in this case. We decline.

In reviewing the district court's ruling, it is clear that the court did not abuse its discretion.

There is ample evidence from which the district court could conclude that the jury was biased by Cisco's actions. Throughout trial, Cisco attempted to instill in the jury, through irrelevant references to ethnicity and religion, an "us versus them" mentality. Cisco persisted in its course of conduct even after the court warned counsel and issued a curative instruction. And, in a case involving Jewish inventors and plaintiffs, Cisco's counsel began his closing argument with a reference to the trial of Jesus Christ.

Even if we were inclined to agree with Cisco that there is no manifest injustice in this case—and we are not—we refuse to substitute our judgment for that of a district court whose "on-the-scene assessment of the prejudicial effect, if any, carries considerable weight." *United States v. Munoz*, 150 F.3d 401, 415 (5th Cir. 1998).Accordingly, we find that the district court did not abuse its discretion in granting a new trial.

2. PARTIAL NEW TRIAL

The Federal Rules of Civil Procedure allow the courts to grant partial new trials so long as the issues are "distinct and separable." Fed. R. Civ. P. 59. A court's authority to grant a partial new trial is likewise constrained by the Seventh Amendment. *Gasoline Prod. Co. v. Champlin Refining Co.*, 283 U.S. 494, 500 (1931). "Where the practice permits a partial new trial, it may not properly be resorted to unless it clearly appears that the issue to be retried is so distinct and separable from the others that a trial of it alone may be had without injustice." *Id.* A partial new trial should not be granted where the

issues to be retried are "so interwoven" with other issues in the case "that the former cannot be submitted to the jury independently of the latter without confusion and uncertainty." *Id.* We have explained, however, that the Seventh Amendment "prohibition is not against having two juries review the same *evidence*, but rather against having two juries *decide* the same *essential issues*." *In re Innotron Diagnostics*, 800 F.2d 1077, 1086 (Fed. Cir. 1986) (citation omitted). Trying issues separately is appropriate where "separate trials would not constitute a 'clear and indisputable' infringement of the constitutional right to a fair trial. *Id.* (citing *Bankers Life & Casualty Co. v. Holland*, 346 U.S. 379, 384 (1953).

Cisco contends that the district court violated the Seventh Amendment by granting a new trial on the issues of induced infringement and damages, but not direct infringement and validity. Specifically, Cisco contends, under the circumstances of this case, indirect infringement is not distinct and separable from validity, but rather, they are inextricably intertwined. Cisco argues that where the plaintiff alleges induced infringement and the defendant has evidence of a good-faith belief of invalidity, the issues of validity and induced infringement are not distinct and separable. We disagree.

We note at the outset that "patent infringement and invalidity are separate and distinct issues." *Pandrol USA, LP v. Airboss Ry. Prod., Inc.*, 320 F.3d 1354, 1364-65 (Fed. Cir. 2003). Indeed, this court routinely orders a partial new trial on infringement, while upholding an earlier verdict on validity. *See, e.g., Cardiac Pacemakers, Inc. v. St.*

Jude Med., Inc., 381 F.3d 1371, 1374 (Fed. Cir. 2004); *Comaper Corp. v. Antec, Inc.*, 596 F.3d 1343, 1354-55 (Fed. Cir. 2010).

We previously rejected the "argument that, under the Seventh Amendment, a new trial on willfulness would require a new trial on infringement." *Voda v. Cordis Corp.*, 536 F.3d 1311, 1329 (Fed. Cir. 2008). In order to prove that infringement was willful, a plaintiff must show both that "an infringer acted despite an objectively high likelihood that its actions constituted infringement of a valid patent" and that the "objectively-defined risk (determined by the record developed in the infringement proceeding) was either known or so obvious that it should have been known to the accused infringer." *In re Seagate Tech., LLC*, 497 F.3d 1360, 1371 (Fed. Cir. 2007). "[T]he objective prong of *Seagate* tends not to be met where an accused infringer relies on a reasonable defense to a charge of infringement. Thus, the question on appeal often posed is whether a defense or non-infringement theory was reasonable." *Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.*, 682 F.3d 1003, 1005-06 (Fed. Cir. 2012) *cert. denied*, 133 S. Ct. 932 (2013). In such a case, in order to find that infringement was not willful, the defendant's non-infringement theory must be reasonable. The question of a non-infringement theory's reasonableness often requires looking at the merits of non-infringement. Yet, a new trial on willfulness does not require a new trial on infringement. *See Voda*, 536 F.3d at 1329. We believe the situation in the present case to be analogous.

We acknowledge that the current case presents a unique situation where a jury considering induced infringement, but not validity, may be asked to consider evidence of invalidity in order to decide whether Cisco possessed a good-faith belief of invalidity. Nonetheless, the fact that a second jury will consider evidence of invalidity that supports Cisco's position on the good-faith belief issue does not compel the conclusion that the second jury will decide the ultimate issue of invalidity. Indeed, the issue of whether Cisco possessed a good-faith belief of invalidity is distinct and separate from the issue of whether the patent claims are invalid. In order to determine that Cisco had a good-faith belief of invalidity, the jury must merely decide whether Cisco possessed that belief in good-faith. The jury need not decide whether the underlying position was meritorious. Thus, although the two juries will review the same evidence of invalidity, they will not decide the same essential issues. Therefore, we cannot say that separate trials on invalidity and induced infringement would constitute a clear and indisputable infringement of the constitutional right to a fair trial. Accordingly, we find that holding separate trials on the issues of invalidity and induced infringement does not violate the Seventh Amendment.

D. CLAIM CONSTRUCTION AND THE MERITS

Cisco challenges the district court's construction of the term "short-range communication protocol." The court construed this term to mean "a set of procedures required to initiate and maintain short-range communication between two or more devices." *Commil USA, LLC v. Cisco Sys., Inc.*, 2:07-

CV-341, slip op. at 1 (E.D. Tex. Nov. 6, 2009). Cisco's argument is without merit. Cisco does not contend that a "short-range communication protocol" is not "a set of procedures required to initiate and maintain short-range communication between two or more devices."Rather, Cisco asks this court, as it did the district court, to limit the term to only those specific short-range communication protocols listed in the patent. We decline. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1323-24 (Fed. Cir. 2005) (cautioning against importing limitations from the specification into the claims).

Cisco also appeals the district court's findings regarding validity, infringement, and damages. Cisco argues that the claims are invalid for reasons of indefiniteness, non-enablement, and lack of written description. We find these contentions without merit. Because we remand for a new trial, we do not reach the issues of infringement and damages. Rather, we leave them to be decided by the district court in first instance.

AFFIRM-IN-PART, VACATE-IN-PART, AND REMAND

United States Court of Appeals
for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

NEWMAN, *Circuit Judge*, concurring in part, dissenting in part.

I agree that remand is appropriate, and I agree that in this case a partial retrial was within the district court's discretion.

However, I respectfully dissent from the change of law set forth in Part II.B of the court's opinion. The court holds that if the inducer of infringement believes in good faith that the patent is invalid, there can be no liability for induced infringement, although the patent is held valid. The opinion makes clear that the court intends to adjust the law, as in statements including:

> *We now hold* that evidence of an accused inducer's good-faith belief of invalidity may negate the requisite intent for induced infringement. . .

Maj. op. at 11 (emphasis added). This change in the law of induced infringement is inappropriate.

A good-faith belief of patent invalidity may be raised as a defense to willfulness of the infringement, but it is not a defense to the fact of infringement. Patent invalidity, if proved, eliminates an invalid patent and thus is a total defense to infringement. However, a "good-faith belief" in invalidity does not avoid liability for infringement when the patent is valid.[1] No rule eliminates infringement of a valid patent, whether the infringement is direct or indirect.

The "inducement" statute, 35 U.S.C. §271(b), serves a different purpose. The inducement statute is designed to allow remedy against an entity that provides an infringing product or method to direct infringers, but is not itself a direct infringer. The inducement statute does not import a validity criterion, or a "good faith belief" about validity, into proof of the act of infringement. *See Akamai Techs., Inc. v. Limelight Networks, Inc.*, 692 F.3d 1301, 1308 n.1 (Fed. Cir. 2012) (en banc) ("Because liability for inducement, unlike liability for direct infringement,

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[1] The *Prima Tek* and *Richdel* cases cited in the court's opinion do not state otherwise. *See Prima Tek II, L.L.C. v. Polypap, S.A.R.L.*, 412 F.3d 1284, 1285 (Fed. Cir. 2005) (declining as "moot" to address liability for infringement of an invalid patent); *Richdel, Inc. v. Sun-spool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983) (same).

requires specific intent to cause infringement, using inducement to reach joint infringement does not present the risk of extending liability to persons who may be unaware of the existence of a patent or even unaware that others are practicing some of the steps claimed in the patent.").

The majority's view that a belief in invalidity can negate infringement is contrary to the principles of tort liability, codified in the inducement statute. Liability for induced infringement is akin to "liability . . . under a theory of joint tort feasance, wherein one who intentionally caused, or aided and abetted, the commission of a tort by another was jointly and severally liable with the primary tortfeasor." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990); *see also Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2067 (2011) (recognizing that §271(b) codified pre-1952 case law, wherein induced infringement "was treated as evidence of 'contributory infringement,' that is, the aiding and abetting of direct infringement by another party"); H.R. Rep. No. 82–1923, at 9 (1952) (explaining that the new subsection (b) "recites in broad terms that one who aids and abets an infringement is likewise an infringer.").

A mistake of law, even if made in good faith, does not absolve a tortfeasor. "Our law is . . . no stranger to the possibility that an act may be 'intentional' for purposes of civil liability, even if the actor lacked actual knowledge that her conduct violated the law." *Jerman v. Carlisle, McNellie, Rini, Kramer & Ulrich LPA*, 130 S. Ct. 1605, 1612 (2010). "If one intentionally interferes with the

interests of others, he is often subject to liability notwithstanding the invasion was made under an erroneous belief as to some legal matter that would have justified the conduct." *Id.* (quoting W. Keeton, D. Dobbs, R. Keeton& D. Owen, Prosser and Keeton on Law of Torts 110 (5thed. 1984)). A trespass "can be committed despite the actor's mistaken belief that she has a legal right to enter the property." *Id.* (citing Restatement (Second) of Torts §164, & cmt. e (1963–1964)). "[P]atent validity is a question of law," *CSIRO v. Buffalo Technology (USA), Inc.*, 542 F.3d 1363, 1375 (Fed. Cir. 2008), and an "erroneous belief" of the "legal matter" of validity does not excuse the violation. *Jerman*, 130 S. Ct. at 1612.

A defendant's ultimate liability for induced infringement, as for direct infringement, is subject to various defenses including patent invalidity and unenforceability. However, whether there is infringement in fact does not depend on the belief of the accused infringer that it might succeed in invalidating the patent. Such a belief, even if held in good faith, does not negate infringement of a valid and enforceable patent. This rule applies, whether the infringement is direct or indirect. My colleagues err in holding that "evidence of an accused inducer's good-faith belief of invalidity may negate the requisite intent for induced infringement." Maj. op. at 11.

The Court stated in *Global-Tech* that "induced infringement under section 271(b) requires knowledge that the induced acts constitute patent infringement." 131 S. Ct. at 2068. The Court did not include a belief in patent validity as a criterion of infringement. *Global-Tech* does not hold that if the

inducer "believed" that the patent is invalid, the inducer avoids infringement when, as here, validity is sustained.

Validity of the Commil patent was sustained by the jury, sustained by the district court, and sustained by this court. Whatever Cisco's "belief" as to invalidity of the patent, this belief is irrelevant to the fact and law of infringement. A belief of invalidity cannot avoid liability for infringement of a patent whose validity is sustained. The panel majority's contrary holding is devoid of support in law and precedent.

The district court applied the correct law, and excluded the issue of validity from its retrial of the issue of infringement. My colleagues now hold that although validity was found and sustained at trial, "the district court erred in preventing Cisco from presenting evidence during the second trial of its good-faith belief in invalidity to rebut Commil's allegations of induced infringement." Maj. op. at 8–9. The court mis-cites the *Global-Tech* ruling concerning the inducer's knowledge "that the induced acts constitute patent infringement," maj. op. at 11, for *Global-Tech* relates to knowledge of infringement, not knowledge of validity.

The fact of infringement does not depend on whether the inducer's view of patent validity is held in good faith or bad faith. Validity and infringement are distinct issues, bearing different burdens, different presumptions, and different evidence. Although the court now acknowledges that "patent infringement and invalidity are separate and distinct issues," maj. op. at 16, the court holds that

on this third infringement trial the jury "may be asked to consider evidence of invalidity." Maj. op. at 17. If the jury is required to consider evidence of invalidity, as the court holds, it strains fairness to deny Cisco's request for redetermination of the issue of validity.

I respectfully dissent from the court's incorrect statement of the law of induced infringement, and from the holding that a showing of a good faith belief in patent invalidity can avoid all liability for induced infringement of a valid patent.

United States Court of Appeals
for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

O'MALLEY, *Circuit Judge*, concurring in part and dissenting in part.

I agree in large measure with the majority's thoughtful opinion in this case. First, I agree that the induced infringement judgment and award must be vacated. Like Judge Prost, I believe this is so both because the trial court instructed the jury to apply an incorrect legal standard during its deliberations and because the court erred in excluding evidence regarding Cisco's alleged good faith belief in the invalidity of the asserted claims of the'395 patent. On the latter point, I agree that an accused inducer's good faith belief of invalidity of a patent claim is relevant to its intent to induce

infringement of that claim and is, thus, admissible for that purpose.

I also agree that Cisco's objections to the trial court's construction of the claim term "short range communication protocol" are not well taken. Contrary to Cisco's contentions, the '395 patent's written description does not limit the short-range communication protocol to Bluetooth and related protocols. Instead, the patent consistently refers to such protocols as exemplary. *See, e.g.*, '395 patent at col. 18, ll. 23–24 ("Bluetooth wireless technology is an example of such a short-range communication protocol."); col. 8, ll. 41–46. We have expressly stated that we do not limit the scope of the claims to the preferred embodiment described in the written description. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) ("[W]e have expressly rejected the contention that if a patent describes a single embodiment, the claims of the patent must be construed as being limited to that embodiment.").

Finally, I agree that the trial judge acted within his discretion in granting a new trial following the first trial involving these parties and these patent claims. Cisco does not deny that its local counsel's conduct was reprehensible, nor does it debate whether *some* curative action was appropriate. Cisco simply asks that we substitute our judgment for that of the trial court with respect to whether that curative action should have been a new trial. I agree with the majority that it is appropriate to defer to the trial court's first-hand assessment of whether counsel's conduct was sufficiently improper as to call into question the integrity of the jury's verdict. Accordingly, while it may be true that a

different jurist might have refused to set aside the jury's verdict in these circumstances, the decision to do so here should not be reversed.[1]

Having set out those places where I agree with the majority's resolution of this appeal, I turn to the two decisions over which I must part company with my colleagues. First, I cannot endorse the majority's refusal to address Cisco's potentially dispositive arguments regarding whether Commil did or ever could prove the third-party direct infringement which is a necessary predicate to Commil's induced infringement claim. Next, I disagree with the majority's conclusion that the trial court's decision to order only a partial retrial of the issues presented is defensible; I believe the partial retrial order deprived Cisco of its right to a jury trial as guaranteed by the Seventh Amendment to the United States Constitution and must be reversed. I believe, therefore, that we should not address the strength of Cisco's validity arguments based on the record from the first trial and should leave those questions to the third jury to visit this matter.

I address these disagreements in turn.

I

Cisco argues that the trial court erred in denying its request for judgment as a matter of law

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[1] Where, as here, counsel for both parties made improper comments during the trial, the trial court's curative instructions were—as the majority describes it—quite "potent," and Commil did not ask for a new trial until invited to do so by the trial court, it also would have beenwell within the bounds of the trial court's discretion to *not* order a retrial. On this record, either conclusion would be defensible.

on Commil's induced infringement claim because Commil failed to prove—and allegedly cannot prove—that any third-party practices all of the steps of the method claimed in claim 1of the '395 patent. Specifically, Cisco asserts that its customers do not perform (1) the step of "dividing" the communications protocol into two smaller protocols or, (2)the step of "running an instance" of the low-level protocol at the base station and "running an instance" of the high-level protocol at the switch. Cisco asserts that only it—and not its customers—practices the "dividing" step because the WiFi protocol is divided into high-and low-level protocols at the factory when the products are created. Because of this, Cisco asserts that its customers cannot perform this step and, thus, do not directly infringe claim 1. With respect to the "running an instance step," Cisco asserts that, in its WiFi system, the access points run only a single copy of the protocol that communicates with all of the connected devices, and do not run separate copies of the low-level protocols with respect to each mobile unit or device to which the access point is connected. If one or both of these steps of the claimed method are not, in fact, practiced by its customers, Cisco is correct that Commil's claims of induced infringement—predicated as they are on claims of single party direct infringement—must fail.[2]

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[2] Cisco correctly points out that Commil never asserted a divided infringement theory, that the parties jointly asked the court to omit any divided infringement discussion from its instructions to the jury, and that the jury was instructed, without objection, that it could find induced infringement by Cisco only if it first found that "a single party performs each and every step of the claimed method."

On appeal, Cisco asks that we reverse the trial court's denial of its motion for judgment as a matter of law on these grounds and enter judgment in its favor. It contends that we need not reach the propriety of the trial court's inducement instructions or evidentiary rulings, or the need for a new trial based on errors therein, because Commil failed to prove the direct infringement predicate for its induced infringement claim. Cisco contends that these questions are dispositive of the induced infringement claims and that the need for a new trial could be obviated by their resolution.

Whatever the merits of Cisco's argument regarding the direct infringement aspect of Commil's induced infringement claim, Cisco is correct that it is within the scope of our authority on this record to resolve them now. Indeed, I believe it is our obligation to do so. If we send this matter back for a new trial on induced infringement without resolving these issues, we likely will see the case return in much the same posture. If a new panel ultimately concludes Cisco is correct as to either one of the required steps of claim 1—and that no finding of induced infringement can stand on that ground—we will have forced the parties and the trial court to go through a new trial when none was necessary.

I do not purport to prejudge Cisco's arguments; Cisco may be wrong on both points.[3] I urge us, however, to judge them one way or another.

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[3] While I, of course, have formulated positions on these questions, because the majority insists that the next panel of this court to visit this case be relegated to resolving them, I will not say anything which might impact its independent ability to do so.

We do no one any favors by kicking these potentially dispositive cans down the road and may well be requiring undue expense and wasting scarce judicial resources in the process. I believe our appellate function requires that we avoid such inefficiency whenever possible. For these reasons, I dissent from the majority's refusal to resolve these properly preserved issues on appeal.

II

I turn next to the majority's conclusion that the partial new trial order entered by the district court in this case—one which we now effectively reinstate—did not violate the Seventh Amendment. I do not agree. Accepting the proposition, as I have, that the district court acted within its discretion to find a new trial warranted in this case, I believe that nothing other than a full retrial on all issues can be justified under the law.[4]

While partial retrials are permissible in appropriate circumstances, the Supreme Court has set forth a strict standard for determining when such circumstances exist. In *Gasoline Prods. Co. v. Champlin Refining Co.*, 283 U.S. 494, 500 (1931), the Supreme Court explained that a court's authority to order a new trial is constrained by the Seventh Amendment such that "a partial new trial . . . may not properly be resorted to unless it clearly appears

[4] Because it appears that Commil has abandoned its direct infringement claims against Cisco, the other issues I believe need to be tried in conjunction with Commil's induced infringement claim include only those relating to the alleged invalidity of the claims of the '395 patent—indefiniteness, lack of enablement, and lack of adequate written description.

that the issue to be retried is so distinct and separable from the others that a trial of it alone may be had without injustice." Applying that standard to the case before it, the Supreme Court concluded that a partial retrial on damages alone would violate the Seventh Amendment because the facts and issues relating to the merits of the contract action were not sufficiently separable from those relating to damages. *Gasoline Prods.*, 283 U.S. at 500; *see also Witco Chemical Corp. v. Peachtree Doors, Inc.*, 787 F.2d 1545, 1549 (Fed. Cir. 1986) (quoting standard from *Gasoline Products* and finding that "it is inappropriate . . .to have one jury return a verdict on the validity, enforceability, and contract questions while leaving the infringement questions to a second jury.").

The Fifth Circuit—the regional circuit from which this case arises and whose law we are to apply to this non-patent basic right—repeatedly has cautioned against resort to partial retrials, citing to the guidance from *Gasoline Products*. *See*, *e.g.*, *Nissho-Iwai Co. v. Occidental Crude Sales, Inc.*, 729 F.2d 1530, 1539 (5th Cir.1984) (approving refusal to order partial retrial of fraud claim alone because "the fraud claim arose out of the acts surrounding the breach of contract [claim]" and understanding of one required understanding of the other); *Davis v. Safeway Stores*, 532 F.2d 489, 491 n. 3 (5th Cir. 1976) (noting that granting of a partial new trial over particular issues requires those issues to be clearly separable from other issues in the case); *Vidrine v. Kansas City S. Ry. Co.*, 466 F.2d 1217, 1221 (5th Cir. 1972) (observing that a partial retrial is only appropriate where issues are "so distinct and separable" that there will be "no injustice or

prejudice" to either party); *Williams v. Slade*, 431 F.2d 605, 609–10 (5th Cir. 1970) (noting that if a verdict is a "product of passion or prejudice" a new trial on all issues must be ordered).

The requirement that issues in multiple trials be separable and distinct protects parties' rights under the Seventh Amendment by guarding against circumstances which threaten those rights. *See*, *e.g.*, *Pryer v. C.O. 3 Slavic*, 251 F.3d 448, 454-58 (3d Cir. 2001) (collecting cases disapproving of partial retrials and outlining factors counseling against such partial retrials). One such circumstance is where the issues relating to the separated claims overlap, causing the potential for "confusion" or "uncertainty" when one issue is submitted to the jury without the other. *Id.*; *See also, Nissho-Iwai Co.*, 729 F.2d at 1539 (where claims arise from same transactional facts, jury cannot understand one fully without understanding the other and having both presented jointly); *FIGA v. R.V.M.P. Corp.*, 874 F.2d 1528, 1534 (11th Cir.1989) (partial retrial just on damages is not appropriate where damages evidence was not fully separable from evidence of insured's alleged intent to cause fire); *United States ex rel. Miller v. Bill Harbert Int'l Constr., Inc.*, 865 F. Supp. 2d 1, 10 (D.D.C. 2011) (partial retrial inappropriate because jury needs thorough knowledge of underlying conspiracy in order to understand and assess whether particular defendants joined that conspiracy).

Partial retrials must also be avoided where it is possible that the very error that is deemed to warrant a new trial may have impacted the jury's determination of other issues. *Pryer*, 251 F.3d at 455

(3d Cir. 2001) (partial retrial is inappropriate whenever it is not clear that the error that crept into one element of the verdict "did not in any way affect the determination of any other") (additional citations omitted). This is especially so where a retrial is prompted by a finding that comments of counsel may have unduly "inflamed" the jury because such a finding "implies that the jury made its decision on an improper basis." *United States ex rel. Miller*, 865 F. Supp. 2d at 10 (D.D.C. 2011) (finding partial retrial inappropriate where new trial was based on prosecutor's improper comments on one issue because that error "might well have affected the jury's determination of other issues"). And, partial retrials should be avoided whenever circumstances indicate "there is reason to think that the verdict may represent a compromise among jurors with different views on whether defendant was liable." *Pryer*, 251 F.3d at 455 (additional citations omitted); *See also Stanton v. Astra Pharm. Products, Inc.,* 718 F.2d 553, 576 (3d Cir. Pa. 1983) (citing *Vizzini v. Ford Motor Co.*, 569 F.2d 754, 759–60 (3d Cir. Pa. 1977)) (finding that suggestion of possible compromise verdict was such that permitting retrial of damages alone, absent reconsideration of liability issues was inappropriate, noting "[i]s difficult to say that 'allowing a second jury to determine the issue of damages in isolation from the whole of the circumstances surrounding the case was not an injustice. . .'"). All of these circumstances are presented here.

As the majority explained, the trial court ordered are trial based on statements by Cisco's local counsel which the trial court believed were so insidious as to call into question the integrity of the

jury's verdict. *See Commil USA, LLC v. Cisco Sys., Inc.*, No. 2:07-cv-341 slip. op. at 3–4 (E.D. Tex. Dec. 29, 2010). If the trial court believed the verdict truly was compromised, how could he—and how can we—assume the misconduct infected only a *portion* of their deliberations? Indeed, it could be that the jury was so incensed by its counsel's conduct that they held it against Cisco by refusing to invalidate Commil's patent, despite a contrary view of the evidence.

Once the partial retrial began, moreover, the trial court's evidentiary rulings themselves reflect the awkward posture in which he had placed the case. Most pointedly, as the majority discusses, the trial court excluded—incorrectly—evidence of Cisco's alleged good faith belief in the invalidity of the claims of the '395 patent. What the majority fails to mention, however, is that Commil itself expressly argued that it would unduly confuse the jury to admit such evidence *without also submitting the validity determination to it* to decide. *See Commil USA, LLC v. Cisco Sys., Inc.*, No. 2:07-cv-341, Doc. No. 398 at 4–5 (April 1, 2011). And, it was in response to this argument that the evidence was excluded. Where the court closest to these matters saw the potential for confusion because of the interwoven nature of the invalidity claims and Cisco's good faith defense to induced infringement, how can we ignore that potential when we now order the excluded evidence to be admitted? I do not believe we can. I do not believe we can differentiate the circumstances here from the overlapping nature of the issues in *Gasoline Products* and the host of cases cited above finding a partial retrial improper based on the principles described therein.

The practical implications of the judgment we render today highlight the Seventh Amendment problems we create thereby. We unanimously agree not only that it was error to exclude proffered evidence of Cisco's good faith belief in the invalidity of the claims of the '395 patent, but that the error was not harmless. In other words, we find that Cisco was denied the right to a fair trial on Commil's induced infringement claim because it was denied the opportunity to pursue a valid defense. In the same breath, however, the majority concludes it is appropriate to retry the case in a posture that would dilute that defense.

When this case returns to Texas for a third trial, the trial court will need to craft instructions that tell the jury that, while Cisco *claims* it had a good faith belief in the invalidity of the claims of the '395 patent, *Cisco was wrong*. The jury will need to be told that it is not permitted to conclude it agrees with Cisco's belief. The jury will, thus, begin its deliberations already suspect about Cisco's beliefs and the good faith nature of the same. It is precisely these circumstances against which the Supreme Court insists we guard. Importantly, given the significance of the Seventh Amendment guarantees it is our job to protect, we are not to ask whether it is *conceivable* that a jury could fairly assess Cisco's case in these circumstances; we are to assume that, where it is not *clear* that "the issue to be retried is so distinct and separable from the others," it cannot. *See, e.g., Gasoline Prods. Co.*, 283 U.S. at 500; *Witco Chemical Corp.*, 787 F.2d at 1549

Finally, I do not believe we can discount the possibility that the first verdict may have

represented a series of compromises by the jury. How can we know that the jury did not agree not to invalidate the claims of the '395 patent only because it found no induced infringement and understood that its direct infringement finding carried with it a smaller damages award? We cannot.

I do not contend that issues in patent cases can never be tried to separate juries, particularly after an appeal reveals that only one issue was adjudicated erroneously. Whether and when a new trial on all issues is required must be determined "only after considering the totality of the circumstances and by answering: 'How may the ends of justice be served?'" *Witco Chemical Corp.*, 787 F.2d at 1549 (citations omitted). Here, *all* circumstances indicate that a partial retrial of Commil's induced infringement claim without retrial of the validity issues is not appropriate.[5]

While Cisco's counsel's conduct was reprehensible and warranted curative action, action which compromises Cisco's Seventh Amendment right to a jury goes too far. I believe the trial court abused its discretion by only ordering a partial retrial of the claims asserted in this case and that we perpetuate that error by ordering yet another partial retrial.

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[5] The cases upon which the majority relies do not really support its contrary conclusion. Those cases either fail to address the constitutional issue at all or do so in fundamentally different circumstances. I am not persuaded they either control or even counsel in in favor of the conclusion the majority reaches.

[ENTERED: December 29, 2010]

IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS MARSHALL DIVISION

COMMIL USA, LLC	§	
	§	
vs.	§	CASE NO. 2:07-CV-341
	§	
CISCO SYSTEMS, INC.	§	

MEMORANDUM OPINION AND ORDER

Pending before the court is the plaintiff Commil USA, LLC's ("Commil") motion for new trial on issues of indirect infringement and damages (Dkt. No. 353). Commil argues that, during the trial of this case, the defendant Cisco System, Inc.'s ("Cisco") counsel made various comments that served to engender prejudice against Commil's owner and the inventors of the patent-in-suit. Commil contends that these statements prejudiced its right to a fair trial. As such, Commil requests that the court grant a new trial on the issues of indirect infringement and damages. After carefully considering the parties' arguments, the court is of the opinion that Cisco's counsel's statements regarding religious preferences were improper, and as such, the court GRANTS Commil's motion for new trial.

I. Background

On May 11, 2010, a jury trial commenced in this case. On May 17, 2010, the case was submitted to the jury, and the jury returned a verdict finding

that U.S. Patent No. 6,430,395 ("'395 Patent") was valid and that Cisco had directly infringed the patent. The jury, however, did not find that Cisco had induced infringement of the '395 Patent. The jury awarded Commil $3,726,207 to compensate for Cisco's direct infringement. On June 21, 2010, Commil filed this motion for new trial on the issues of indirect infringement and damages.

II. Legal Standard

Pursuant to Federal Rule of Civil Procedure 59(a) the court "may, on motion, grant a new trial on all or some of the issues–and to any party . . . after a jury trial for any reason for which a new trial has heretofore been granted in an action at law in federal court . . ." FED. R. CIV. P. 59(a). The regional circuit law applies to motions for new trials. *See Riverwood Intern. Court v. R.A. Jones & Co., Inc.*, 324 F.3d 1346, 1352 (Fed. Cir. 2003). In the Fifth Circuit, "[t]he decision to grant or deny a motion for a new trial is within the discretion of the trial court and will not be disturbed absent an abuse of discretion or a misapprehension of the law." *Prytania Park Hotel, Ltd. v. General Star Indem. Co.*, 179 F.3d 169, 173 (5th Cir. 1999).

The Fifth Circuit has explained that "awards influenced by passion and prejudice are the antithesis of a fair trial." *Whitehead v. Food Max of Miss., Inc.*, 163 F.3d 265, 276 (5th Cir. 1998). In *Hall v. Freese*, the Fifth Circuit concluded that irrelevant attorney argument meant to appeal to the jury's biases and prejudices about a particular person's status justified a new trial. *Hall v. Freese*, 735 F.2d 956 (5th Cir. 1984). The court, however, warned that

when no objection is raised during trial, improper attorney argument may be the basis for a new trial only 'where the interest of substantial justice is at stake.'" *Id.* at 961 (quoting *Edwards v. Sears, Roebuck & Co.*, 512 F.2d 276, 286 (5th Cir. 1975)). In determining whether to grant a new trial based on improper attorney argument, the court must consider "the comments of counsel, the counsel's trial tactics as a whole, the evidence presented, and the ultimate verdict." *Alaniz v. Zamora-Quezada*, 591 F.3d 761, 776 (5th Cir. 2009) (quoting *Mills v. Beech Aircraft Corp.*, 886 F.2d 758, 765 (5th Cir. 1989)). The court need not find that each individual statement was so improper as to justify a new trial, but only that the totality of the remarks prejudiced the jury's findings. *Whitehead*, 163 F.3d at 278.

III. Analysis

Commil bases its motion for new trial on, among other things, inappropriate comments made by Cisco's counsel during trial. Jonathan David, one of the owners of Commil and its client representative, is Jewish. While cross-examining Mr. David, Cisco's counsel inquired whether Mr. David had met with Nitzan Arazi, one of the inventors on the '395 Patent, while in Marshall, Texas for the trial. Mr. David responded affirmatively, explaining that they had had dinner at a barbeque restaurant, to which Cisco's counsel inexplicably responded: "I bet not pork." Trial Transcript, May 12, 2010 (morning session), at 146:23. When the court asked Cisco's counsel to explain the relevance of his comment, Cisco's counsel admitted that it had no relevance to any issue in the case. *Id.* at 158:2-6.

Thereafter, Cisco's counsel apologized to the witness, and the court gave a curative instruction.

Although Cisco's counsel acknowledged that his pork comment was inappropriate, he nevertheless proceeded to make further remarks regarding religious practices. Cisco's counsel's closing argument began:

> Ladies and Gentlemen of the Jury, you are, in this case, truth-seekers. You are charged with the most important job in this courtroom, and that's determining the truth
>
> . . .
>
> And when you figure out what the truth is, you'll know how to answer that verdict form. You remember the most important trial in history, which we all read about as kids, in the Bible had that very question from the judge. What is truth?

Trial Transcript, May 17, 2010 (afternoon session), at p. 16:1-16. Cisco's counsel was referring to the trial of Jesus, which was presided over by Pontius Pilate. This argument, when read in context with Cisco's counsel's comment regarding Mr. David and Mr. Arazi's religious heritage, impliedly aligns Cisco's counsel's religious preference with that of the jurors and employs an "us v. them" mentality – i.e., "we are Christian and they are Jewish."

When these comments are considered as a whole, the court concludes that the comments prejudiced the jury's findings regarding indirect infringement and damages. These comments had a tendency to appeal to the prejudices of the jurors. *See Hall*, 735 F.2d at 960-61. As such, even though no objections were made to these remarks, the court is convinced that the jury's verdict is inconsistent with substantial justice, and Commil's motion for new trial is GRANTED.

IV. Conclusion

For the forgoing reasons, the court GRANTS Commil's motion for new trial on the issues of indirect infringement and damages (Dkt. No. 353). Jury selection for the new trial on indirect infringement and damages is set for April 4, 2011 at 9:00 a.m., and the pre-trial conference is set for March 24, 2011 at 9:30 a.m.

SIGNED this 29th day of December, 2010.

/s/
CHARLES EVERINGHAM IV
UNITED STATES MAGISTRATE JUDGE

[ENTERED April 1, 2011]

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA, LLC	§	
	§	
vs.	§	CASE NO. 2:07-CV-341
	§	
CISCO SYSTEMS, INC.	§	

ORDER

Pending before the court are the parties' motions in limine (Dkt. Nos. 383 and 384) and Commil's motion for leave to exceed the fifteen page limit imposed on its motion in limine (Dkt. No. 385). The court GRANTS Commil's motion to exceed the fifteen page limit on its motion in limine. The court's rulings with regard to the parties' various motions in limine are detailed below.

Plaintiff's Motions in Limine:

- *Motions Number 1 – 3*: Granted-in-Part and Denied-in-Part. The parties are not permitted to argue that the patent-in-suit is limited to telephone calls, Telephony, or Bluetooth. The parties' damages experts, however, can opine as to the primary application of the patent-in-suit.

- *Motion Number 4*: Granted-in-Part and Denied-in-Part. The motion is granted to the

extent that Cisco may not argue that it does not directly infringe the patent-in-suit. Cisco may, however, present evidence that it had a good faith belief that it did not infringe the patent-in-suit. Furthermore, Cisco may adduce evidence and argue that its consumers do not directly infringe the patent-in-suit. Finally, Cisco may argue that it had a good-faith belief that its customers did not directly infringe the patent-in-suit and that it did not induce its customers to engage in any such infringement.

- *Motion Number 5*: Denied.

- *Motion Number 6*: Granted. Cisco may not adduce any evidence that it had a good faith belief that the patent was invalid.

- *Motion Number 7*: Carried.

- *Motion Number 8*: Carried.

- *Motion Number 9*: Denied.

- *Motion Number 10*: Granted.

- *Motion Number 11*: Granted.

- *Motion Number 12:* Granted.

- *Motion Number 13:* Granted-in-Part and Denied-in-Part. Granted to the extent that Cisco may not refer to Commil as a "patent troll."

- *Motion Number 14*: Denied.

- *Motion Number 15*: Granted.

- *Motion Number 16*: Denied.

- *Motion Number 17*: Granted.

Defendant's Motions in Limine:

- *Motion Number 1*: Carried.

- *Motion Number 2*: Granted.

- *Motion Number 3*: Granted-in-Part and Denied-in-Part. The motion is granted with respect to subparts "b" and "c." The motion, however, is denied with respect to subpart "a" dealing with the display of the patent-in-suit.

- *Motion Number 4*: Denied.

- *Motion Number 5*: Denied.

- *Motion Number 6*: Carried.

- *Motion Number 7*: Granted.

- *Motion Number 8*: Denied.

SIGNED this 1st day of April, 2011.

/s/

CHARLES EVERINGHAM IV
UNITED STATES MAGISTRATE JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA, LLC	§	
	§	
vs.	§	CASE NO. 2:07-CV-341
	§	
CISCO SYSTEMS, INC.	§	

AMENDED FINAL JUDGMENT

On May 11, 2010, a jury trial commenced in this case. On May 17, 2010, the case was submitted to the jury, and the jury returned a verdict finding that defendant Cisco Systems, Inc. ("Cisco") had directly infringed claims 1, 4, and 6 of U.S. Patent No. 6,430,395 ("'395 Patent") (*See* Dkt. No. 335). The jury, however, did not find that Cisco had induced infringement of the '395 Patent. Furthermore, the jury failed to find the '395 Patent invalid. The jury awarded plaintiff Commil USA, LLC ("Commil") $3,726,207 to compensate for Cisco's direct infringement.

Subsequent thereto, Commil filed a motion for new trial on the issues of induced infringement and damages and the court granted Commil's motion (Dkt. No. 361). The new trial began on April 5, 2011. On April 8, 2011, the case was submitted to the jury, and the jury returned a verdict finding that Cisco had induced infringement of claims 1, 4, and 6 of the '395 Patent (Dkt. No. 422). The jury awarded Commil $63,791,153 to compensate for Cisco's induced infringement.

Accordingly, it is ORDERED, ADJUDGED, AND DECREED that Cisco directly infringed and induced infringement of claims 1, 4, and 6 of the '395 Patent and that those claims are valid. It is further ORDERED, ADJUDGED, AND DECREED that Commil recover from Cisco the amount of Sixty-three Million Seven Hundred Ninety-one Thousand One Hundred Fifty Three Dollars ($63,791,153) in actual damages.

It is further ORDERED, ADJUDGED, AND DECREED that Commil recover from Cisco prejudgment interest in the amount of Ten Million Two Hundred Ninety-five Thousand Three Hundred Eighty-six Dollars and Thirty-two Cents ($10,295,386.32).

It is further ORDERED, ADJUDGED, AND DECREED that Commil recover from Cisco post-judgment interest at the lawful federal rate.

It is further ORDERED, ADJUDGED, AND DECREED that Commil recover from Cisco the amount of Seventeen Thousand Seven Hundred Thirty Seven Dollars and Ninety Eight Cents ($17,737.98) as costs.

This is a FINAL JUDGMENT. All other pending motions are DENIED.

SIGNED this 28th day of September, 2011.

/s/
CHARLES EVERINGHAM IV
UNITED STATES MAGISTRATE JUDGE

CORRECTED 10.25.2013

United States Court of Appeals
for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

ON PETITION FOR REHEARING EN BANC

MARK S. WERBNER, Syles Werbner, P.C., of Dallas, Texas, filed a petition for rehearing en banc for plaintiff-appellee. With him on the petition were RICHARD A. SAYLES and MARK D. STRACHAN. Of counsel on the brief were LESLIE V. PAYNE, NATHAN J. DAVIS and MIRANDA Y. JONES, Heim, Payne & Chorush, of Houston, Texas.

WILLIAM F. LEE, Wilmer Cutler Pickering Hale and Dorr LLP, of Boston, Massachusetts, filed a response to the petition for defendant-appellant.

With him on the brief were MARK C. FLEMING, JONATHAN W. ANDRON and FELICIA H. ELLSWORTH; and WILLIAM G. MCELWAIN, of Washington, DC. Of counsel on the response were HENRY B. GUTMAN, Simpson Thacher & Bartlett LLP, of New York, New York; and JEFFREY E. OSTROW, HARRISON J. FRAHN, IV, PATRICK E. KING and JONATHAN SANDERS, of Palo Alto, California.

Before RADER, *Chief Judge*, NEWMAN, LOURIE, DYK, PROST, MOORE, O'MALLEY, REYNA, WALLACH, TARANTO, and CHEN, *Circuit Judges*.[1]

REYNA, *Circuit Judge*, with whom RADER, *Chief Judge*, NEWMAN, LOURIE, and, WALLACH *Circuit Judges*, join, dissents from the denial of the petition for rehearing en banc.

NEWMAN, *Circuit Judge*, with whom RADER, *Chief Judge*, REYNA and WALLACH, *Circuit Judges*, join, dissenting from the denial of the petition for rehearing en banc.

PER CURIAM.

O R D E R

A petition for rehearing en banc was filed by plaintiff-appellee, and a response thereto was invited by the court and filed by defendant-appellant. The petition for rehearing en banc was first referred as a petition for rehearing to the panel that heard the appeal, and thereafter the petition for rehearing en

[1] Circuit Judge Hughes did not participate.

banc and response were referred to the circuit judges who are authorized to request a poll of whether to rehear the appeal en banc. A poll was requested, taken, and failed.

Upon consideration thereof,

IT IS ORDERED THAT:

(1) The petition of plaintiff-appellee for panel rehearing is denied.

(2) The petition of plaintiff-appellee for rehearing en banc is denied.

(3) The mandate of the court will issue on November 1, 2013.

FOR THE COURT

October 25, 2013
Date

/s/ Daniel E. O'Toole
Daniel E. O'Toole
Clerk

United States Court of Appeals for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

REYNA, *Circuit Judge*, with whom RADER, *Chief Judge*, and NEWMAN, LOURIE and WALLACH, *Circuit Judges*, join, dissenting from the denial of the petition for rehearing en banc.

The *Commil* majority established a substantive, precedential change in patent law by expressly "hold[ing] that evidence of an accused inducer's good-faith belief of invalidity may negate the requisite intent for induced infringement." *Commil USA, LLC v. Cisco Sys., Inc.*, 720 F.3d 1361, 1368 (Fed. Cir. 2013). Its analysis may be summed by its expressed view that because "[i]t is axiomatic that one cannot infringe an invalid patent" there is "no principled distinction between a good-faith belief of invalidity and a good-faith belief of non-

infringement for the purpose of whether a defendant possessed the specific intent to induce infringement of a patent." *Id.*

By holding that a good faith belief in the invalidity of a patent may negate the requisite intent for induced infringement, the two-judge *Commil* majority created a new noninfringement defense to induced infringement that is premised on the accused infringer's belief of invalidity. As Judge Newman aptly points out in her dissent, "This absolution applies, according to the panel majority, although the patent receives the presumption of validity, and validity is sustained in litigations." (Newman, J., dissenting from the denial of the petition for rehearing en banc, at 1.)

Because I believe the *Commil* majority opinion is without foundation in law and precedent, and for the reasons stated below, I respectfully dissent from the vote taken of the court to not conduct an en banc review of the majority opinion in *Commil*.

I.

My primary dispute with the majority holding is that it wrongly rearranges the legal foundation that underpins the enforceability of valid patents and the finding of liability for infringement.

First, the induced infringement statute states simply that "[w]hoever actively induces infringement of a patent shall be liable as an infringer." 35 U.S.C. § 271(b). The law recognizes that the statute's use of the words "actively induces" imparts an intent

requirement into the statute. As stated by the Supreme Court, "[t]he addition of the adverb 'actively' suggests that the inducement must involve the taking of affirmative steps to bring about the desired result." *Global-Tech. Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2065 (2011). In § 271(b), the "desired result" that a party accused of inducement must be affirmatively seeking to bring about is defined in the statute as simply "infringement."

The term "infringement" is used consistently throughout § 271 to mean that all of the limitations of a patent claim are satisfied by an accused product or accused conduct. *See, e.g.*, *TecSec, Inc. v. Int'l Bus. Mach. Corp.*, --- F.3d ----, No. 2012-1415, 2013 WL 5452049, at *13 (Fed. Cir. 2013) (citations omitted) ("An act of infringement occurs when all the elements of a claimed product or method are met by the accused device or process."). In *Global-Tech*, the Court concluded that in order to satisfy the intent element of induced infringement under § 271(b), an accused infringer must possess "knowledge that the induced acts constitute patent infringement," *Global-Tech.*, 131 S. Ct. at 2068, but it did not alter the fundamental meaning of "infringement." Our recent en banc decision in *Akamai* further confirms that "infringement" in the context of "induced infringement" is resolved solely with reference to the limitations of a patent claim. *See Akamai Techs., Inc. v. Limelight Networks, Inc.*, 692 F.3d 1301, 1306 (Fed. Cir. 2012) ("we hold that all steps of a claimed method must be performed in order to find induced infringement").

The legislative history explains that the language of § 271(b) "recites in broad terms that one

who aids and abets an infringement is likewise an infringer." H.R. Rep. No. 82–1923, at 9. Neither the statute nor its legislative history provides that one who knowingly and successfully induces another to engage in conduct that infringes a valid patent can escape liability by showing it held a good faith belief that the patent was invalid. Indeed, the rationale for imposing liability on the party who is inducing infringement is simple: one who causes, urges, encourages, or aids in an infringement is just as, if not more, culpable for the invasion of the patentee's exclusive rights than those who actually perform the acts of infringement. *See generally Akamai*, 692 F.3d at 1309-13. Yet, under the majority's holding, an accused inducer that is deriving a benefit by knowingly and intentionally inducing an unsuspecting third party to directly infringe patent rights can itself escape liability based on a belief that the patent is invalid while the unsuspecting third party cannot. This situation is directly contrary to the plain language and purpose of the induced infringement statute.

II.

Second, infringement and invalidity are separate issues under the patent code and our precedent. This is not controversial. We have "long recognized that patent infringement and invalidity are separate and distinct issues." *Pandrol USA, LP v. Airboss Ry. Prods., Inc.*, 320 F.3d 1354, 1365 (Fed. Cir. 2003). This distinction is further reflected in the organization of the patent code, which places the issues of infringement and invalidity in separate "Parts." *Compare* 35 U.S.C. §§ 251-329 (Part III:"Patents and Protection of Patent Rights"), *with*

35 U.S.C. §§ 100-212 (Part II: "Patentability of Inventions and Grant of Patents").

Given this, there is no reasonable basis to impute questions of invalidity or liability into § 271(b) through the term "infringement." If a patent is found invalid, that is a complete defense to liability because it negates the patent's existence and thereby extinguishes any exclusionary rights. Conversely, if there is a patent—i.e., it is not invalid—then the question is merely whether there has been conduct that actively induces acts of infringement *per se*. This too is not controversial under our precedent because we have long recognized that "[t]hough an invalid claim cannot give rise to *liability* for infringement, whether it is infringed is an entirely separate question capable of determination without regard to its validity." *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 721 F.2d 1563, 1583 (Fed. Cir. 1983) (emphasis added).

Despite that "Supreme Court precedent and our cases make clear that patent infringement and patent validity are treated as separate issues," *Pandrol*, 320 F.3d at 1365, the *Commil* majority nevertheless imputes questions of invalidity into induced infringement under the guise of "intent." It attempts to justify this departure from controlling precedent on the premise that "[i]t is axiomatic that one cannot infringe an invalid patent." *Commil*, 720 F.3d at 1368. But this "axiom" is materially wrong in the present context and does not withstand scrutiny in view of controlling precedent. *See, e.g.*, *Medtronic*, 721 F.2d at 1583. A more accurate statement of our precedent is that *liability* for patent infringement depends on an infringed claim being valid and

enforceable; that is, one cannot *be liable for infringement* of an invalid patent.

III.

Third, the *Commil* majority holding wrongly conflates the defense of noninfringement with the defense of invalidity. "An important limitation on the scope of induced infringement is that inducement gives rise to liability only if the inducement leads to actual infringement." *Akamai*, 692 F.3d at 1308. The *Commil* majority expands the inquiry regarding noninfringement to include invalidity on grounds that it "see[s] no principled distinction between a good-faith belief of invalidity and a good-faith belief of non-infringement for the purpose of whether a defendant possessed the specific intent to induce infringement of a patent." *Commil*, 720 F.3d at 1368. This statement ignores the statutorily-mandated presumption of validity, *see* § 282(a), in that it sets up all patents as invalid, at least in the mind of the inducer. In doing so, the majority strikes at the very heart of the presumption of validity by eroding patent rights that have been duly granted by the PTO based solely on an erroneous—albeit good faith—belief that the PTO erred in granting the patent. This has profound and negative implications that are not contemplated by the patent statute.

Conflating infringement and invalidity also unnecessarily complicates the induced infringement inquiry. In this regard, infringement and non-infringement are opposite sides of the same coin whereas infringement and invalidity are altogether entirely different coins. The intent element of § 271(b) is met when the accused infringer acts with

actual knowledge of the patent claim and was "actively inducing" conduct that it knew to be within the scope of an asserted claim. *See Akamai*, 692 F.3d at 1308. Whether the accused infringer held a good faith belief that it was inducing conduct that fell outside the scope of the claims is directly relevant to this intent inquiry. But whether the accused infringer held a good faith belief in invalidity—e.g., an erroneous belief regarding obviousness—is wholly unrelated to the accused infringer's conduct vis-à-vis the limitations of a presumptively valid patent claim. These fundamental differences between the defenses provide a reasoned and legally sound basis for differentiating between a good faith belief of non-infringement and a good faith belief in invalidity in the context of induced infringement.

* * *

There exists another axiom of more universal application that is appropriate here: "if it's not broken, don't fix it." The *Commil* majority has strained to fix current law without ever showing exactly what is broken, and its fix has been to create an entirely new infringement defense, a new rule of law.

In addition, the majority does not instruct the lower courts how they are to apply the fix. Is the new rule a question of fact? Is it a question of law? Is it a question of law with underlying factual basis? Should the question of good faith belief of invalidity be tried along with the invalidity issues, or perhaps before any other issues are heard given its determinative effect on the outcome of the case?

A grave concern that I have with the new rule is that it fundamentally changes the operating landscape, much like waking up and unexpectedly finding that the sky is now green. The new rule is a powerful tool in patent litigation in that it establishes an escape hatch from liability of infringement that is not now in the statute. This has a compromising effect on the only axiom that we should all observe, and that is issued patents are presumed valid.

United States Court of Appeals for the Federal Circuit

COMMIL USA, LLC,
Plaintiff-Appellee,

v.

CISCO SYSTEMS, INC.,
Defendant-Appellant.

2012-1042

Appeal from the United States District Court for the Eastern District of Texas in No. 07-CV-0341, Magistrate Judge Charles Everingham.

NEWMAN, *Circuit Judge*, with whom RADER, *Chief Judge*, REYNA and Wallach, *Circuit Judges*, join, dissenting from the denial of the petition for rehearing en banc.

By decision issued June 25, 2013, a split panel announced a change in the law of induced infringement, creating a new rule of law whereby an adjudged inducer of infringement is absolved of liability for infringement if the infringer had a "good faith belief" that the patent it infringed was invalid. This absolution applies, according to the panel majority, although the patent has a statutory presumption of validity, and validity of the patent is litigated and sustained. I explained, in my dissenting opinion, why this position is contrary to

law and precedent. And I took some comfort from the protocol that a panel cannot change the law established by decisions of the court; only the en banc court can do so.

Indeed, it is not "axiomatic that one cannot infringe an invalid patent" as the majority opinion states. Precedent is contrary. *See Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 721 F.2d 1563, 1583 (Fed. Cir. 1983) ("Though an invalid claim cannot give rise to liability for infringement, whether it is infringed is an entirely separate question capable of determination without regard to its validity."); *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F. 2d 1524, 1535 (Fed. Cir. 1987) ("The single instruction to the jury that invalid claims cannot be infringed (a nonsense statement), one of many on supposed general principles of patent law, does not operate to convert the interrogatories on infringement into general verdicts which subsumed all of Spectra's invalidity defenses, including best mode."). If the court now wishes to change this law, it must be done en banc. It disserves the public, and diminishes the court, to continue to issue conflicting statements.

Now, however, the full court's majority refusal of en banc review of the panel's ruling adds uncertainty to the law and its application. Investors, competitors, and trial courts cannot be confident as to the law that will be applied by the Federal Circuit. Such destabilization is a disservice not only to patentees but also to the public that benefits from technological advance. A court's creative judicial rulings are readily clarified; our refusal to do so in patent cases not only spawns avoidable litigation but also is a disincentive to industrial innovation.

To compound the inequity, here the panel majority, on remanding for retrial of infringement with the defense that the infringer believed the patent to be invalid, nonetheless does not permit retrial of validity. In the posture of the remand, the prior jury verdict of validity is the law-of-the-case. However, the issues of infringement and validity are interwoven in the new defense of subjective "belief", and the restricted remand procedure can impart "confusion and uncertainty, which would amount to a denial of a fair trial." *Anderson v. Siemens Corp.*, 335 F.3d 466, 475–76 (5th Cir. 2003). It is only fair that the new jury, at a new trial for determination of this "belief", receives full evidence of the premises. At a minimum, the panel's instructions for limited retrial should receive en banc review.

Thus I must, respectfully, dissent from denial of the request for rehearing en banc.

35 USCS § 271

Current through PL 113-72, with a gap of 113-66, approved 12/26/2013

United States Code Service - Titles 1 through 51 > TITLE 35. > PART III. > CHAPTER 28.

Notice

Part 1 of 2. You are viewing a very large document that has been divided into parts.

§ 271. Infringement of patent

(a) Except as otherwise provided in this *title [35 USCS §§ 1* et seq.], whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.

(b) Whoever actively induces infringement of a patent shall be liable as an infringer.

(c) Whoever offers to sell or sells within the United States or imports into the United States a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce

suitable for substantial noninfringing use, shall be liable as a contributory infringer.

(d) No patent owner otherwise entitled to relief for infringement or contributory infringement of a patent shall be denied relief or deemed guilty of misuse or illegal extension of the patent right by reason of his having done one or more of the following: (1) derived revenue from acts which if performed by another without his consent would constitute contributory infringement of the patent; (2) licensed or authorized another to perform acts which if performed without his consent would constitute contributory infringement of the patent; (3) sought to enforce his patent rights against infringement or contributory infringement; (4) refused to license or use any rights to the patent; or (5) conditioned the license of any rights to the patent or the sale of the patented product on the acquisition of a license to rights in another patent or purchase of a separate product, unless, in view of the circumstances, the patent owner has market power in the relevant market for the patent or patented product on which the license or sale is conditioned.

(e)

> **(1)** It shall not be an act of infringement to make, use, offer to sell, or sell within the United States or import into the United States a patented invention (other than a new animal drug or veterinary biological product (as those terms are used in the Federal Food, Drug, and Cosmetic Act and the Act of March 4, 1913) which is primarily manufactured

using recombinant DNA, recombinant RNA, hybridoma technology, or other processes involving site specific genetic manipulation techniques) solely for uses reasonably related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs or veterinary biological products.

(2) It shall be an act of infringement to submit–

> **(A)** an application under section 505(j) of the Federal Food, Drug, and Cosmetic Act [*21 USCS § 355(j)*] or described in section 505(b)(2) of such Act [*21 USCS § 355(b)(2)*] for a drug claimed in a patent or the use of which is claimed in a patent,
>
> **(B)** an application under section 512 of such Act [*21 USCS § 360b*] or under the Act of March 4, 1913 *(21 U.S.C. 151-*158) for a drug or veterinary biological product which is not primarily manufactured using recombinant DNA, recombinant RNA, hybridoma technology, or other processes involving site specific genetic manipulation techniques and which is claimed in a patent or the use of which is claimed in a patent, or
>
> **(C)** (i) with respect to a patent that is identified in the list of patents

described in section 351(l)(3) of the Public Health Service Act [*42 USCS § 262(l)(3)*] (including as provided under section 351(l)(7) of such Act [*42 USCS § 262(l)(7)*]), an application seeking approval of a biological product, or

(ii) if the applicant for the application fails to provide the application and information required under section 351(l)(2)(A) of such Act [*42 USCS § 262(l)(2)(A)*], an application seeking approval of a biological product for a patent that could be identified pursuant to section 351(l)(3)(A)(i) of such Act [*42 USCS § 262(l)(3)(A)(i)*], if the purpose of such submission is to obtain approval under such Act to engage in the commercial manufacture, use, or sale of a drug, veterinary biological product, or biological product claimed in a patent or the use of which is claimed in a patent before the expiration of such patent.

(3) In any action for patent infringement brought under this section, no injunctive or other relief may be granted which would prohibit the making, using, offering to sell, or selling within the United States or importing into the United States of a patented invention under paragraph (1).

(4) For an act of infringement described in paragraph (2)–

(A) the court shall order the effective date of any approval of the drug or veterinary biological product involved in the infringement to be a date which is not earlier than the date of the expiration of the patent which has been infringed,

(B) injunctive relief may be granted against an infringer to prevent the commercial manufacture, use, offer to sell, or sale within the United States or importation into the United States of an approved drug, veterinary biological product, or biological product,

(C) damages or other monetary relief may be awarded against an infringer only if there has been commercial manufacture, use, offer to sell, or sale within the United States or importation into the United States of an approved drug, veterinary biological product, or biological product, and

(D) the court shall order a permanent injunction prohibiting any infringement of the patent by the biological product involved in the infringement until a date which is not earlier than the date of the expiration of the patent that has been infringed under paragraph (2)(C), provided the patent is the subject of a final court decision, as defined in section 351(k)(6) of the Public Health

> Service Act [*42 USCS § 262(k)(6)*], in an action for infringement of the patent under section 351(l)(6) of such Act [*42 USCS § 262(l)(6)*], and the biological product has not yet been approved because of section 351(k)(7) of such Act [*42 USCS § 262(k)(7)*].
>
> The remedies prescribed by subparagraphs (A), (B), (C), and (D) are the only remedies which may be granted by a court for an act of infringement described in paragraph (2), except that a court may award attorney fees under section 285 [*35 USCS § 285*].

(5) Where a person has filed an application described in paragraph (2) that includes a certification under subsection (b)(2)(A)(iv) or (j)(2)(A)(vii)(IV) of section 505 of the Federal Food, Drug, and Cosmetic Act (*21 U.S.C. 355*), and neither the owner of the patent that is the subject of the certification nor the holder of the approved application under subsection (b) of such section for the drug that is claimed by the patent or a use of which is claimed by the patent brought an action for infringement of such patent before the expiration of 45 days after the date on which the notice given under subsection (b)(3) or (j)(2)(B) of such section was received, the courts of the United States shall, to the extent consistent with the Constitution, have subject matter jurisdiction in any action brought by such person under section 2201 of title 28 for a declaratory

judgment that such patent is invalid or not infringed.

(6) (A) Subparagraph (B) applies, in lieu of paragraph (4), in the case of a patent –

> **(i)** that is identified, as applicable, in the list of patents described in section 351(l)(4) of the Public Health Service Act [*42 USCS § 262(l)(4)*] or the lists of patents described in section 351(l)(5)(B) of such Act [*42 USCS § 262(l)(5)(B)*] with respect to a biological product; and
>
> **(ii)** for which an action for infringement of the patent with respect to the biological product –
>
> > **(I)** was brought after the expiration of the 30-day period described in subparagraph (A) or (B), as applicable, of section 351(l)(6) of such Act [*42 USCS § 262(l)(6)*]; or
> >
> > **(II)** was brought before the expiration of the 30-day period described in subclause (I), but which was dismissed without prejudice or was not prosecuted to judgment in good faith.
> >
> > **(B)** In an action for infringement of a patent described in subparagraph

(A), the sole and exclusive remedy that may be granted by a court, upon a finding that the making, using, offering to sell, selling, or importation into the United States of the biological product that is the subject of the action infringed the patent, shall be a reasonable royalty.

(C) The owner of a patent that should have been included in the list described in section 351(l)(3)(A) of the Public Health Service Act [*42 USCS § 262(l)(3)(A)*], including as pro- vided under section 351(l)(7) of such Act [*42 USCS § 262(l)(7)*] for a biological product, but was not timely included in such list, may not bring an action under this section for infringement of the patent with respect to the biological product.

(f)

(1) Whoever without authority supplies or causes to be supplied in or from the United

States all or a substantial portion of the components of a patented invention, where such components are uncombined in whole or in part, in such manner as to actively induce the combination of such components outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.

(2) Whoever without authority supplies or causes to be supplied in or from the United States any component of a patented invention that is especially made or especially adapted for use in the invention and not a staple article or commodity of commerce suitable for substantial noninfringing use, where such component is uncombined in whole or in part, knowing that such component is so made or adapted and intending that such component will be combined outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.

(g) Whoever without authority imports into the United States or offers to sell, sells, or uses within the United States a product which is made by a process patented in the United States shall be liable as an infringer, if the importation, offer to sell, sale, or use of the product occurs during the term of such process patent. In an action for infringement of a process patent, no remedy may be granted for infringement on account of the noncommercial use or retail sale of a product unless there is no adequate

remedy under this title for infringement on account of the importation or other use, offer to sell, or sale of that product. A product which is made by a patented process will, for purposes of this title, not be considered to be so made after –

> **(1)** it is materially changed by subsequent processes; or
>
> **(2)** it becomes a trivial and nonessential component of another product.

(h) As used in this section, the term "whoever" includes any State, any instrumentality of a State, and any officer or employee of a State or instrumentality of a State acting in his official capacity. Any State, and any such instrumentality, officer, or employee, shall be subject to the provisions of this title in the same manner and to the same extent as any nongovernmental entity.

(i) As used in this section, an "offer for sale" or an "offer to sell" by a person other than the patentee, or any designee of the patentee, is that in which the sale will occur before the expiration of the term of the patent.

35 USCS § 282

Current through PL 113-72, with a gap of 113-66, approved 12/26/2013

United States Code Service - Titles 1 through 51 > TITLE 35. > PART III. > CHAPTER 29.

§ 282. Presumption of validity; defenses

(a) In general. A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

(b) Defenses. The following shall be defenses in any action involving the validity or infringement of a patent and shall be pleaded:

> **(1)** Noninfringement, absence of liability for infringement or unenforceability,
>
> **(2)** Invalidity of the patent or any claim in suit on any ground specified in part II [*35 USCS §§ 100* et seq.] as a condition for patentability.
>
> **(3)** Invalidity of the patent or any claim in suit for failure to comply with–

(A) any requirement of section 112 [*35 USCS § 112*], except that the failure to disclose the best modeshall not be a basis on which any claim of a patent may be canceled or held invalid or otherwise unenforceable; or

(B) any requirement of section 251 [*35 USCS § 121*].

(4) Any other fact or act made a defense by this title.

(c) Notice of actions; actions during extension of patent term. In actions involving the validity or infringement of a patent the party asserting invalidity or noninfringement shall give notice in the pleadings or otherwise in writing to the adverse party at least thirty days before the trial, of the country, number, date, and name of the patentee of any patent, the title, date, and page numbers of any publication to be relied upon as anticipation of the patent in suit or, except in actions in the United States Court of Federal Claims, as showing the state of the art, and the name and address of any person who may be relied upon as the prior inventor or as having prior knowledge of or as having previously used or offered for sale the invention of the patent in suit. In the absence of such notice proof of the said matters may not be made at the trial except on such terms as the court requires. Invalidity of the extension of a patent term or any portion thereof under section 154(b) or 156 [*35 USCS § 154(b)* or *156*] because of the material failure–

(1) by the applicant for the extension, or

(2) by the Director,

to comply with the requirements of such section shall be a defense in any action involving the infringement of a patent during the period of the extension of its term and shall be pleaded. A due diligence determination under section 156(d)(2) [*35 USCS § 156(d)(2)*] is not subject to review in such an action.

(12) **United States Patent**
Arazi et al.

(10) **Patent No.: US 6,430,395 B2**

(45) **Date of Patent: Aug. 6, 2002**

(54) **WIRELESS PRIVATE BRANCH EXCHANGE (WPBX) AND COMMUNICATING BETWEEN MOBILE UNITS AND BASE STATIONS**

(75) Inventors: **Nitzan Arazi**, Ramat Hasharon; **Yaron Soffer**, Nes-Ziona; **Halm Barak**, Kfar Saba, all of (IL)

(73) Assignee: **Commil Ltd.**, Ramat Hasharon (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/784,109**

(22) Filed: **Feb. 16, 2001**

Related U.S. Application Data

(60) Provisional application No. 60/195,219, filed on Apr. 7, 2000, and provisional application No. 60/208,306, filed on Jun. 1, 2000.

(51) **Int. Cl.**[7] **H04B 5/00**

(52) **U.S. Cl.** **455/41**; 455/426; 455/432; 455/562; 370/347; 370/466

(58) **Field of Search** 455/555, 561, 455/560, 41, 436, 554, 426, 562, 446, 449 432, 557, 502; 370/331, 347, 466, 467 469; 709/268, 223

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Primary Examiner–Tracy Legree
(74) *Attorney, Agent, or Firm*–Mark M. Friedman

(57) **ABSTRACT**

Methods to create a cellular-like communication system, such as a Wireless Private Branch Exchange

(WPBX), which includes mobile devices such as standard cordless phones (handsets), particularly, mobile devices utilizing the Bluetooth short-range wireless communication protocol. The methods provide seamless and reliable handoff of sessions between Base Stations while the mobile device is moving between picocells, by implementing a high-level of synchronization between the Base Stations and the Switch. Base Stations of picocells having small coverage areas communicate with the handsets. The communication protocol is divided into a low-level protocol performed by the Base Stations and a high-level protocol performed by the Switch connected to all the Base Stations. The methods support mobile computing or telephony devices and communication protocols, which are not specified to handle handoffs of sessions while moving between Base Stations coverage areas in a data, voice or telephony wireless network.

12 Claims, 24 Drawing Sheets

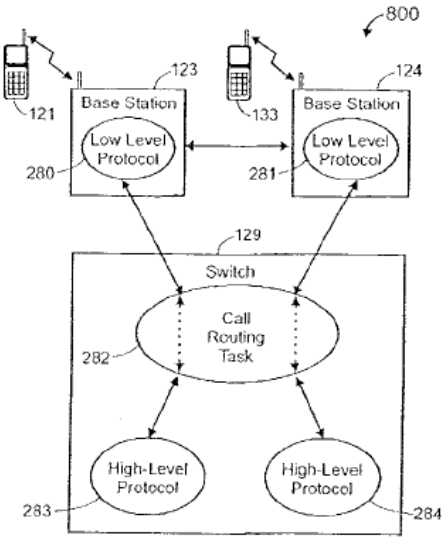

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Figure 1

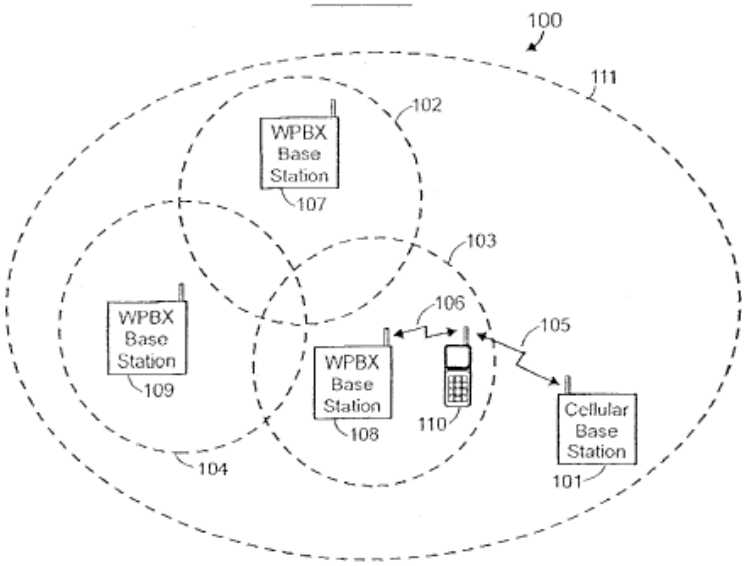

Figure 2

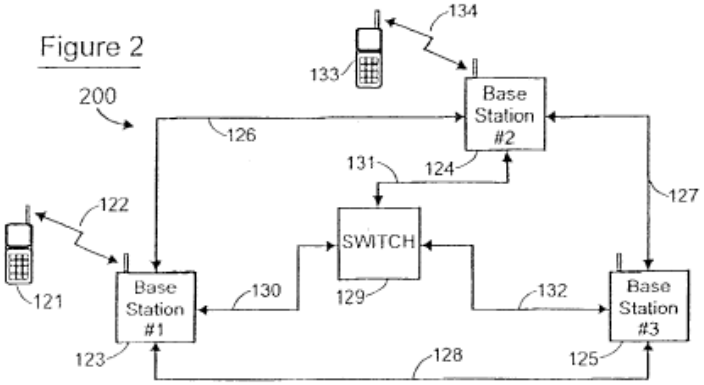

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Figure 3A

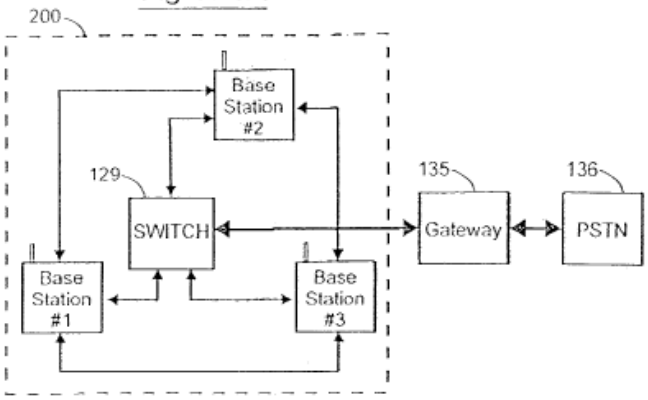

Figure 3B

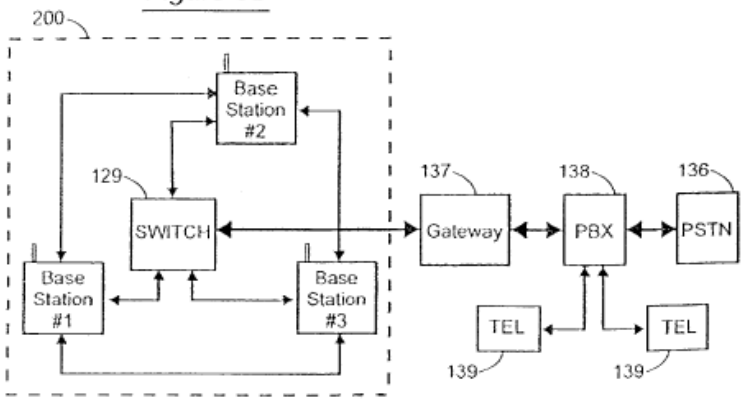

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Figure 4

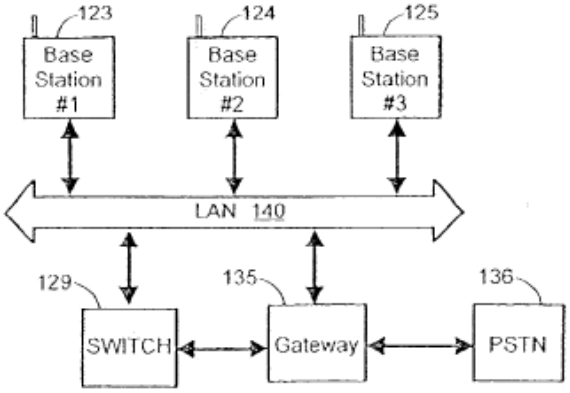

Figure 22

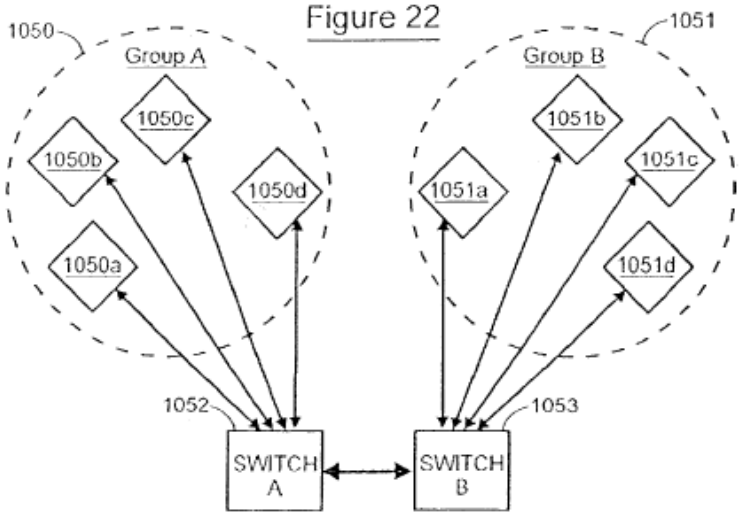

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Fig. 5

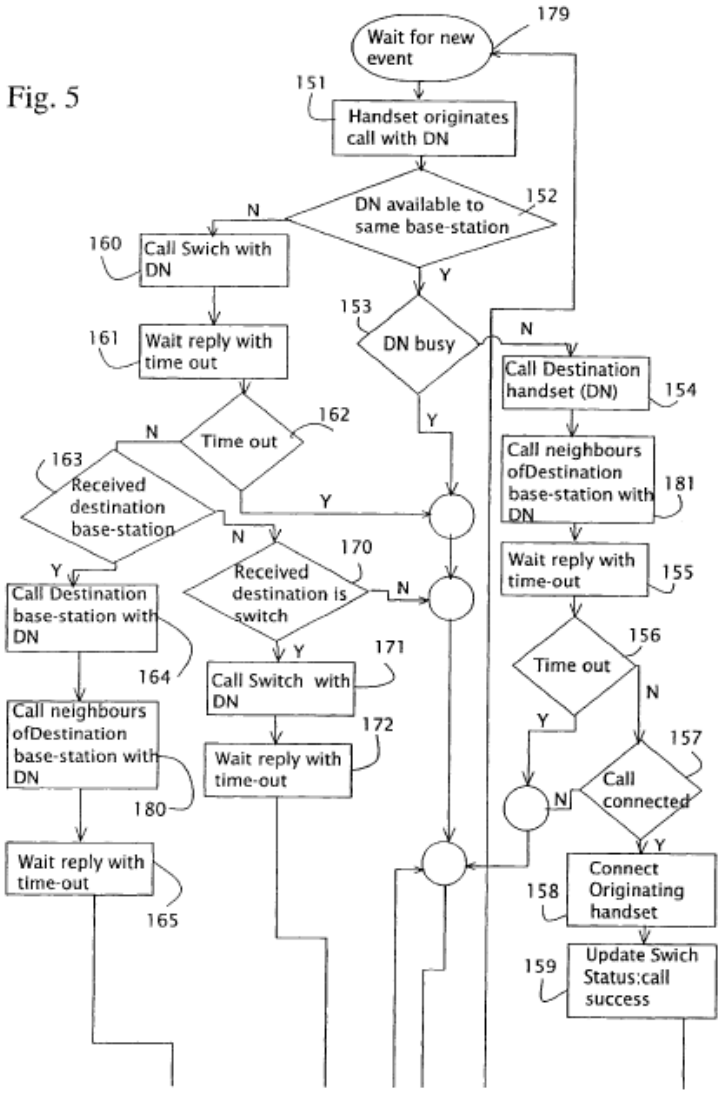

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Fig. 5

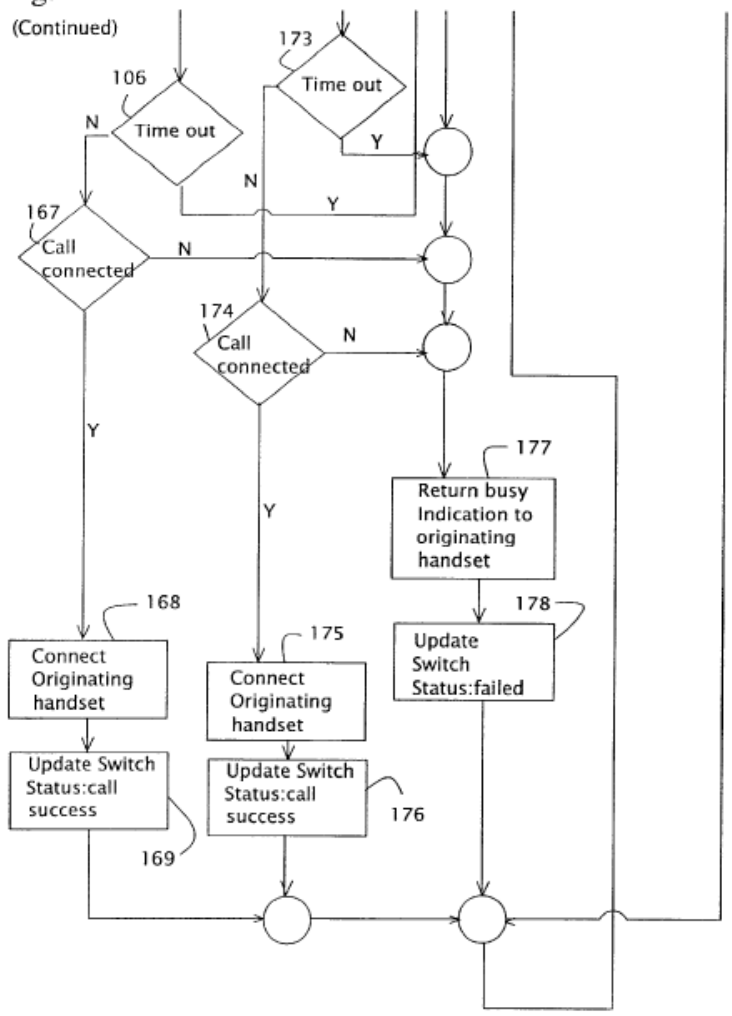

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Fig. 6

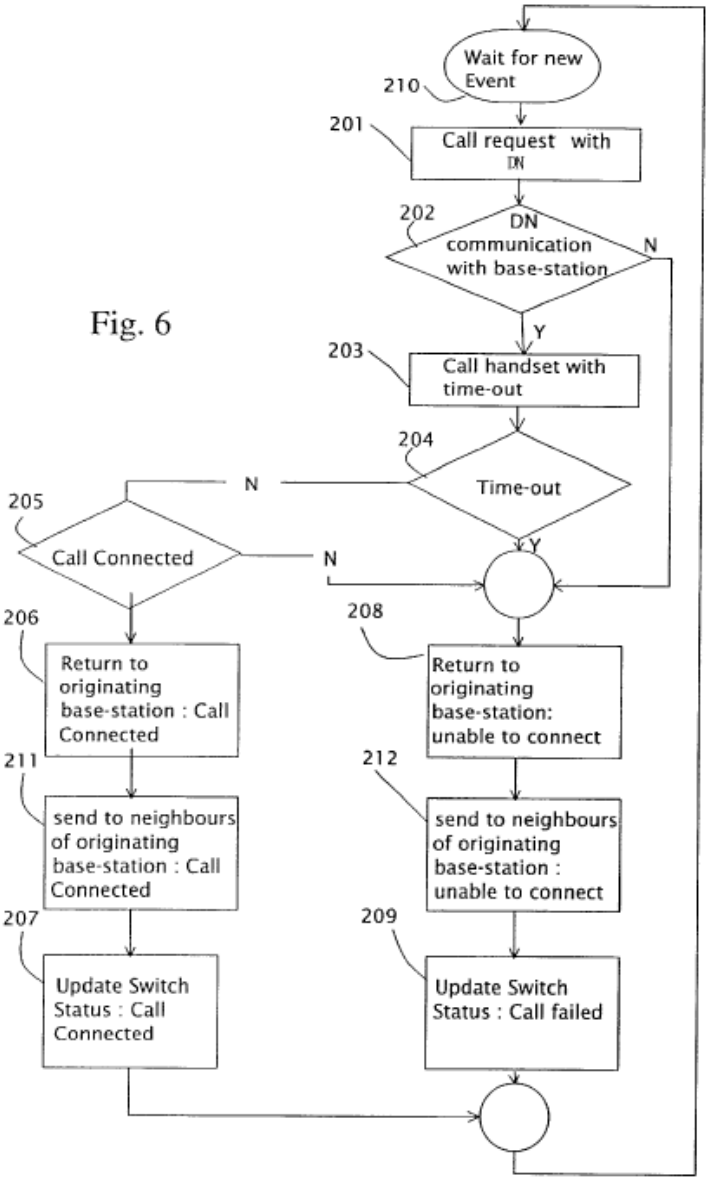

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Fig. 7

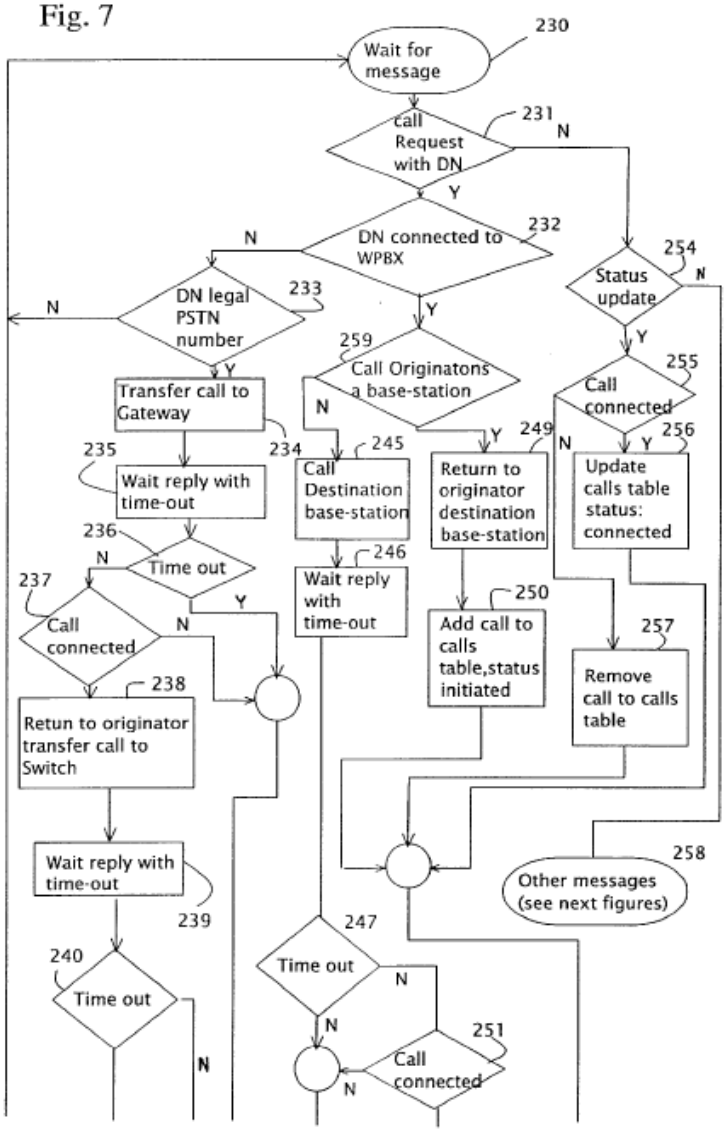

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Fig. 7
(Continued)

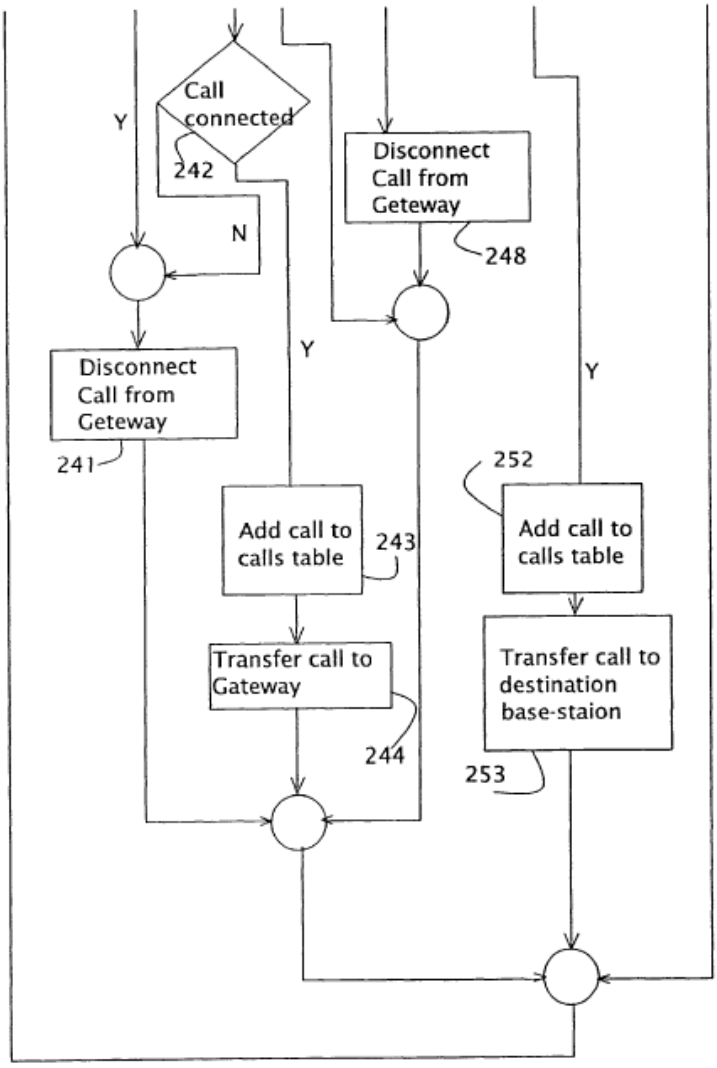

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Figure 8A

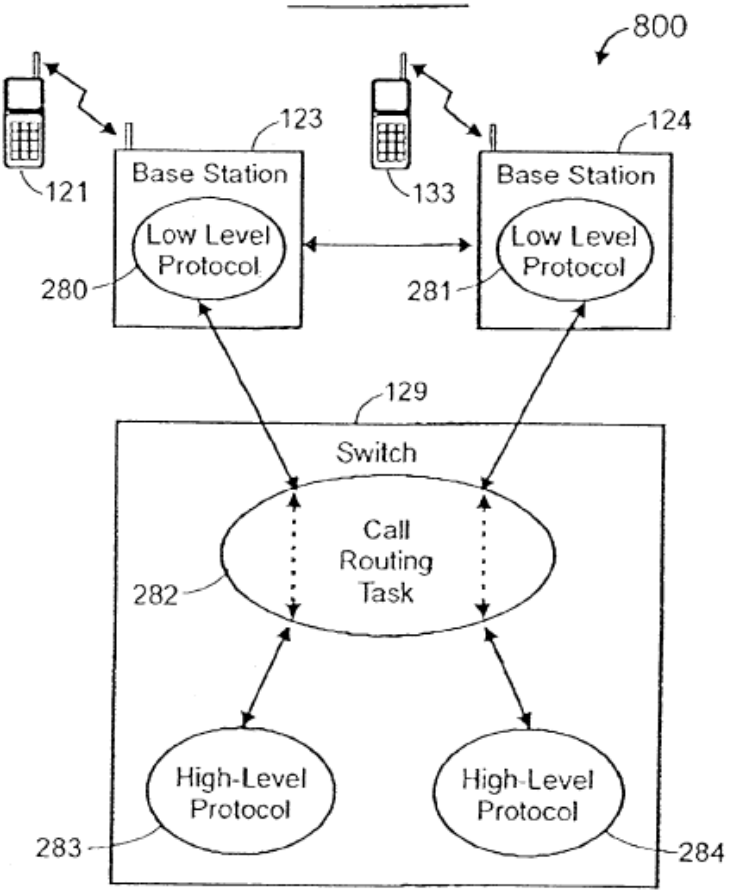

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Figure 8B

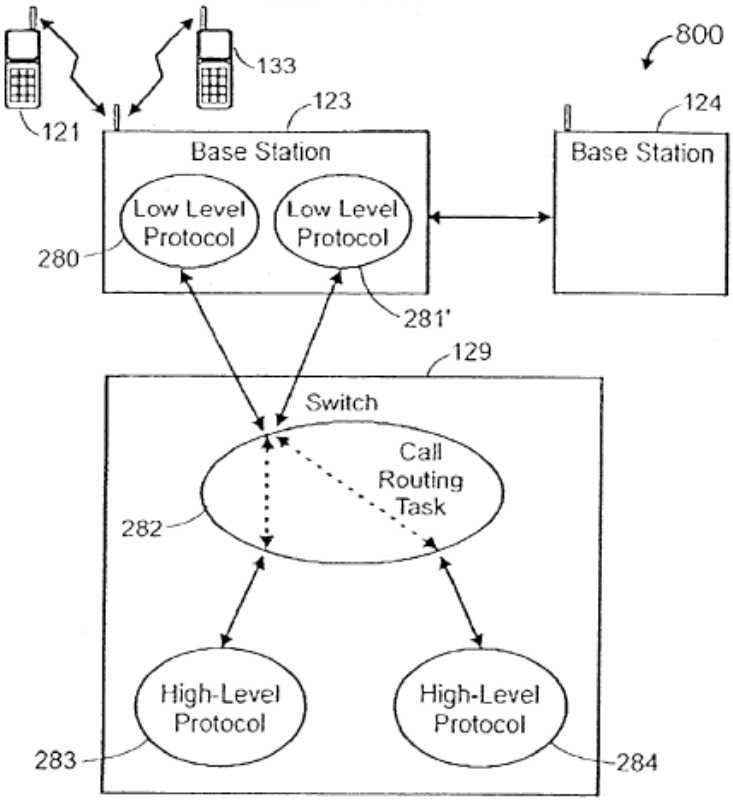

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Figure 9A

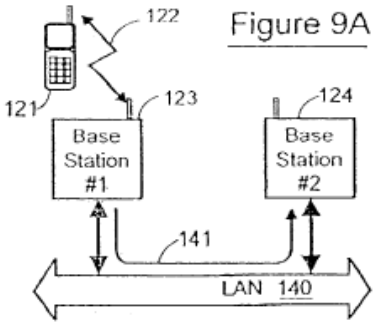

Figure 9B

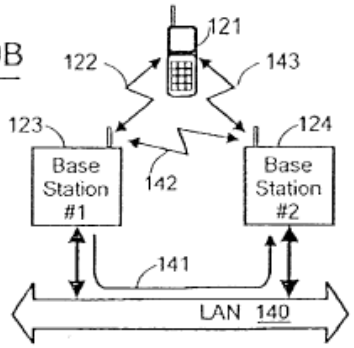

Figure 9C

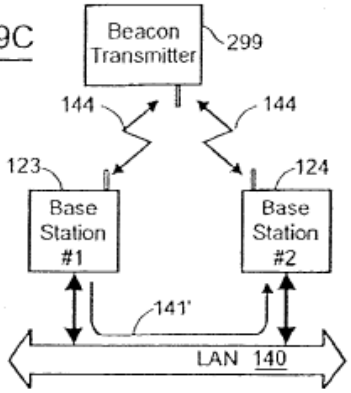

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Figure 10

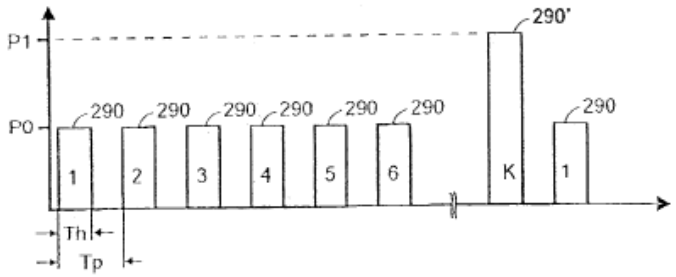

Figure 11

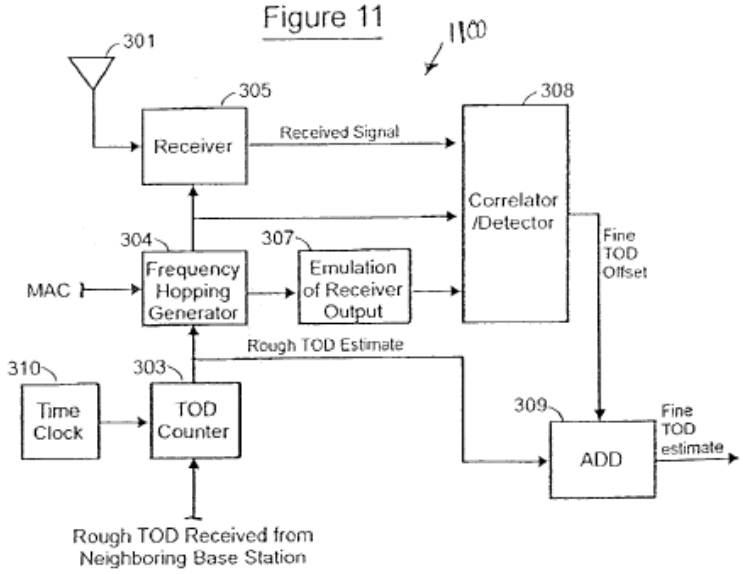

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Fig. 12

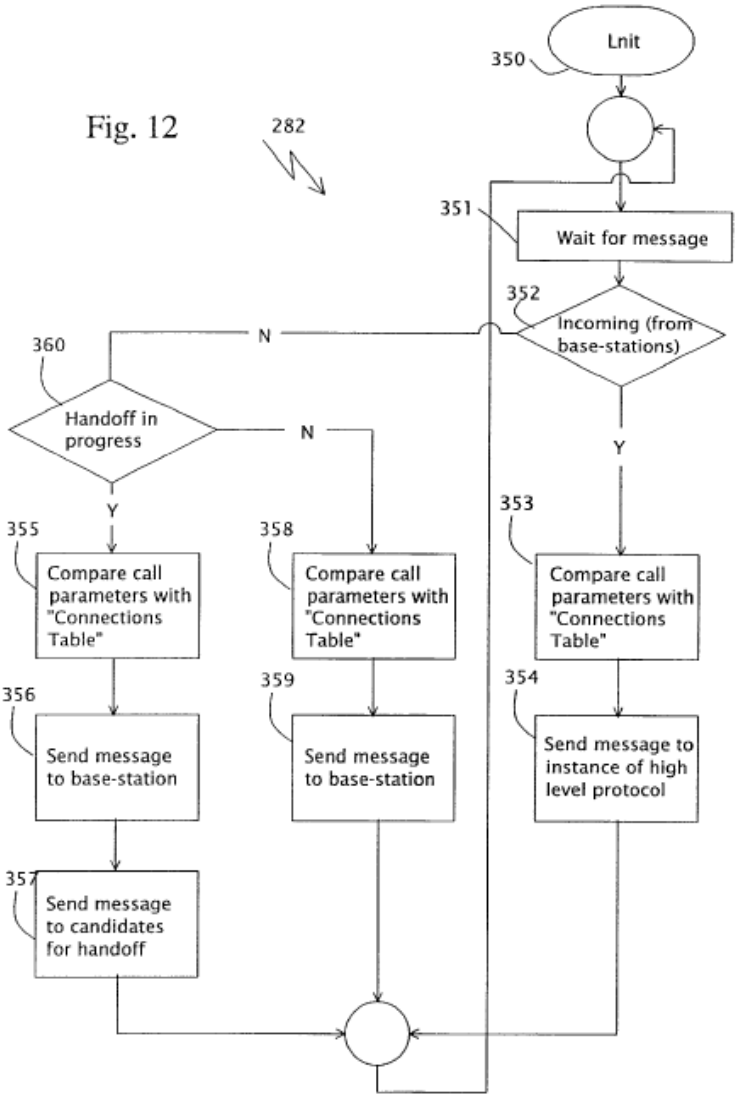

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Fig. 13

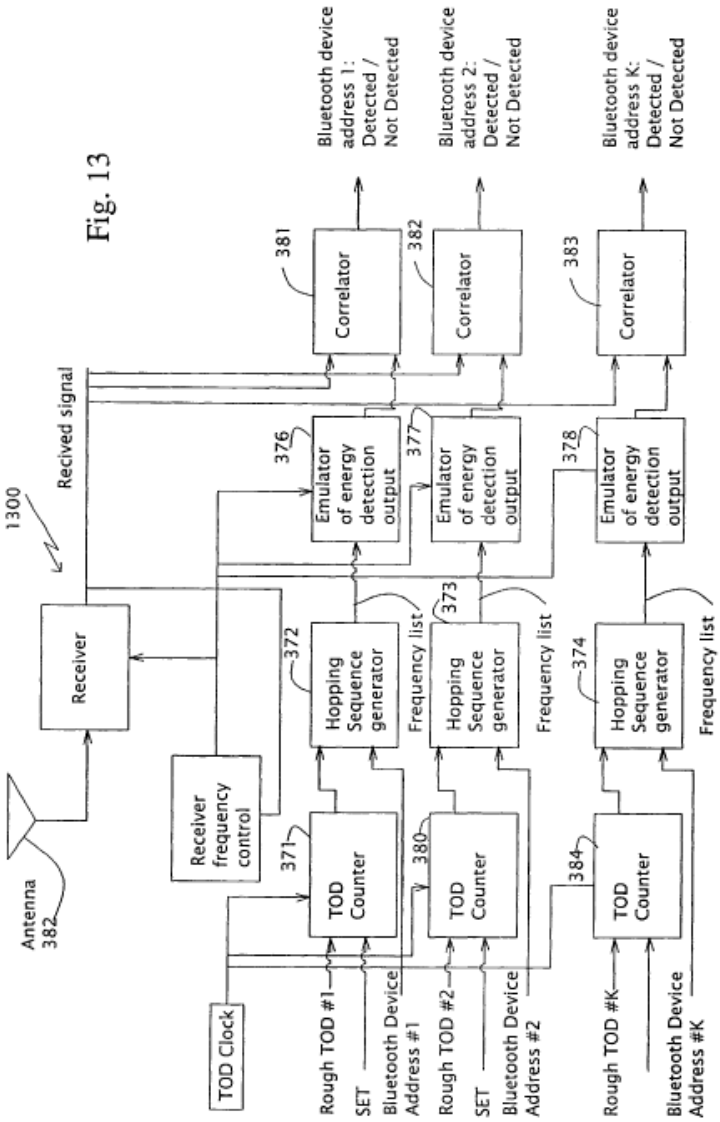

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Figure 14A

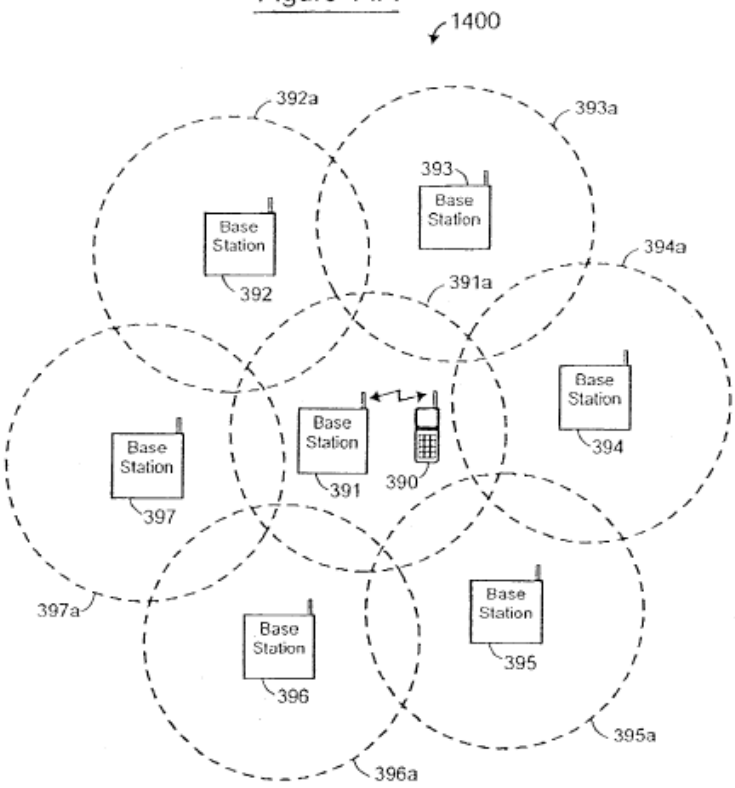

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Figure 14B

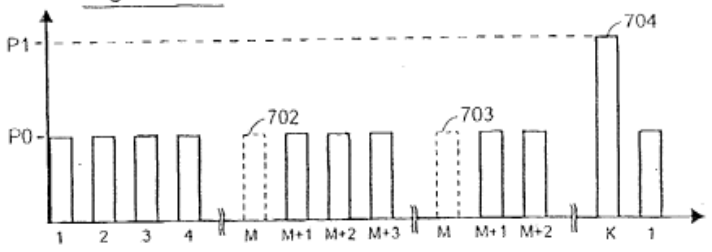

Figure 14C

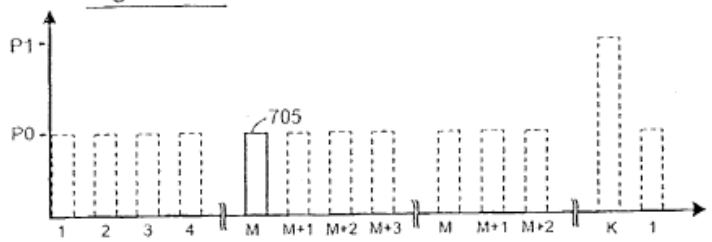

Figure 14D

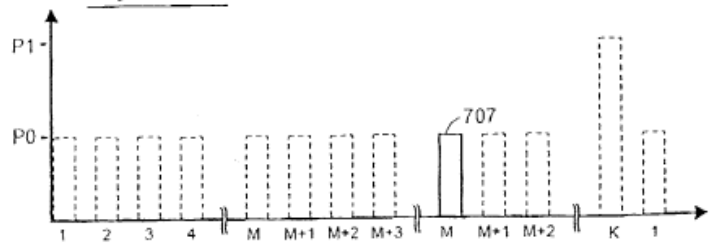

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Figure 15A

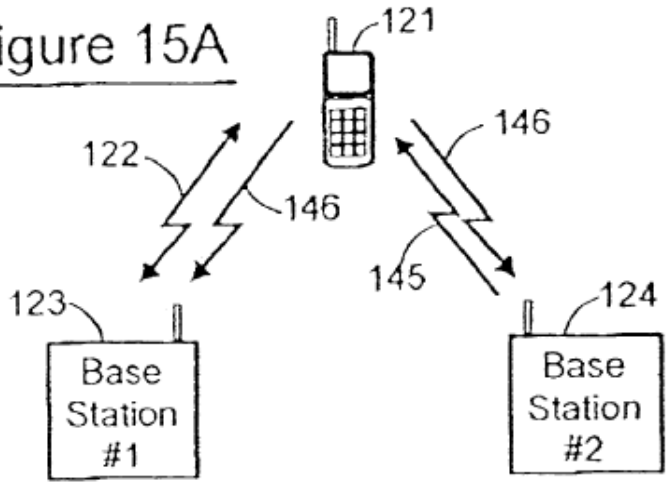

Figure 15B

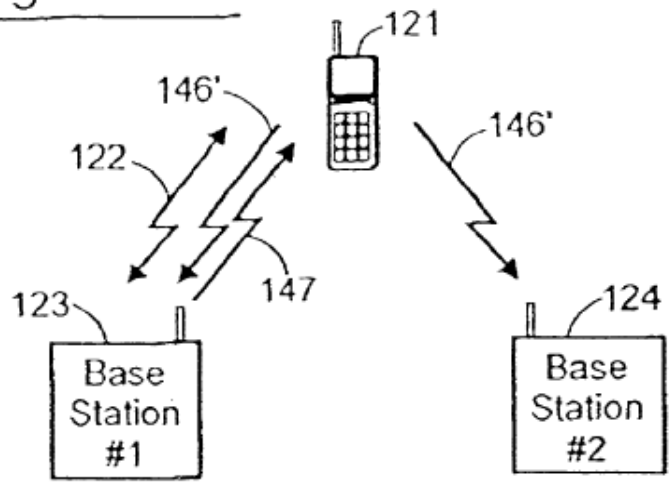

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Fig. 16A

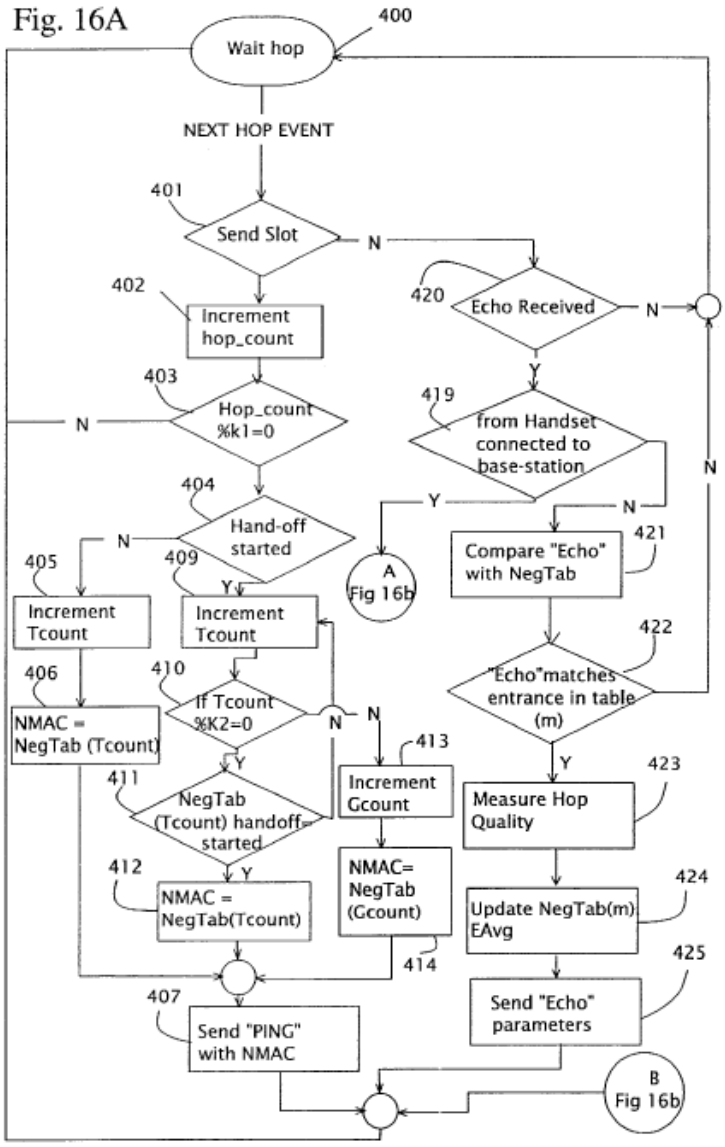

Fig. 16B

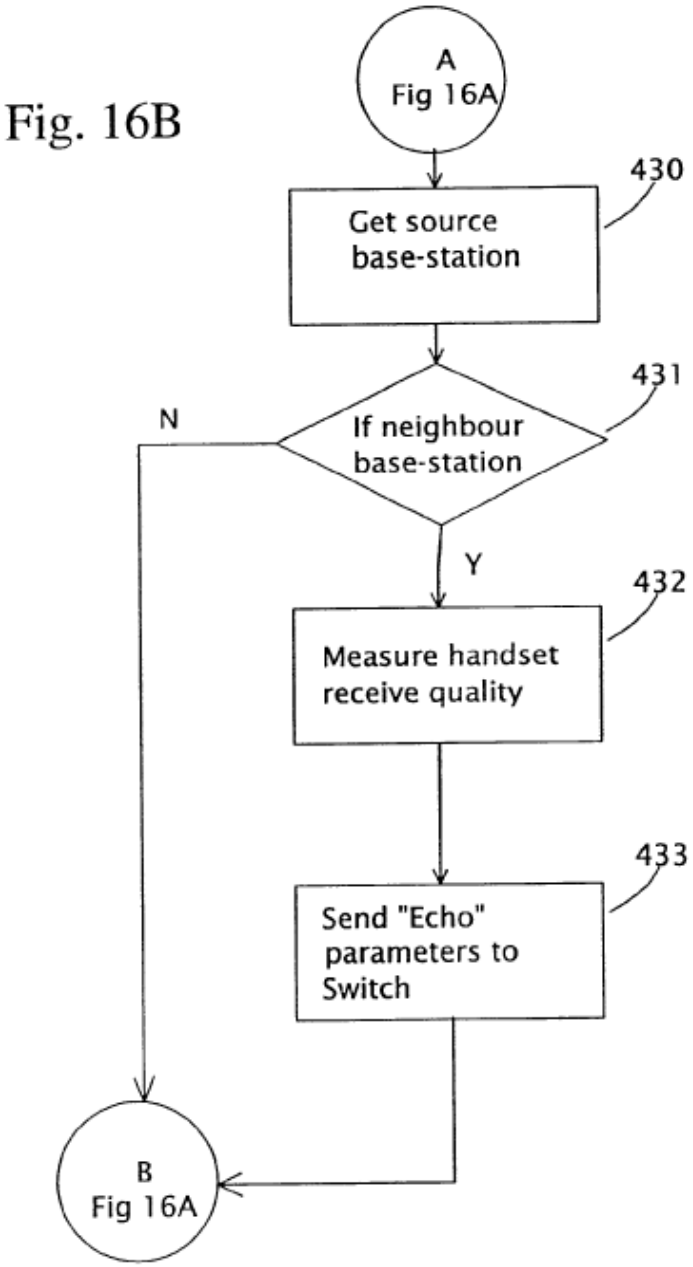
A
Fig 16A
430
Get source base-station
431
If neighbour base-station
N
Y
432
Measure handset receive quality
433
Send "Echo" parameters to Switch
B
Fig 16A

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Figure 17A

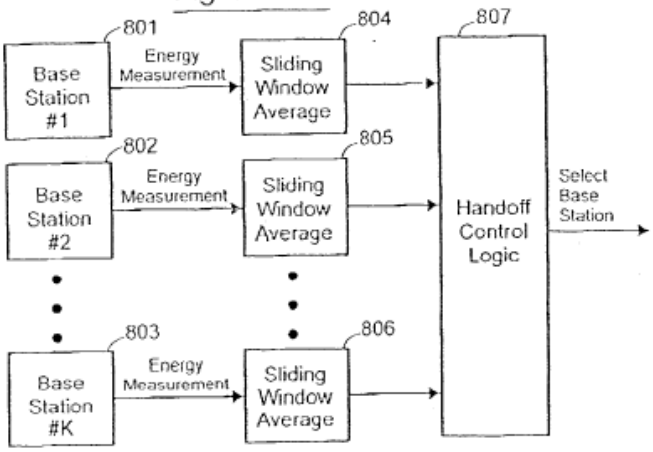

Figure 17B

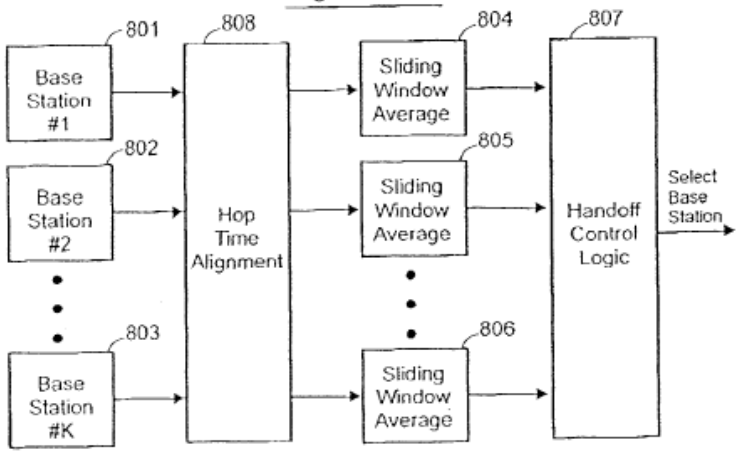

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Figure 18

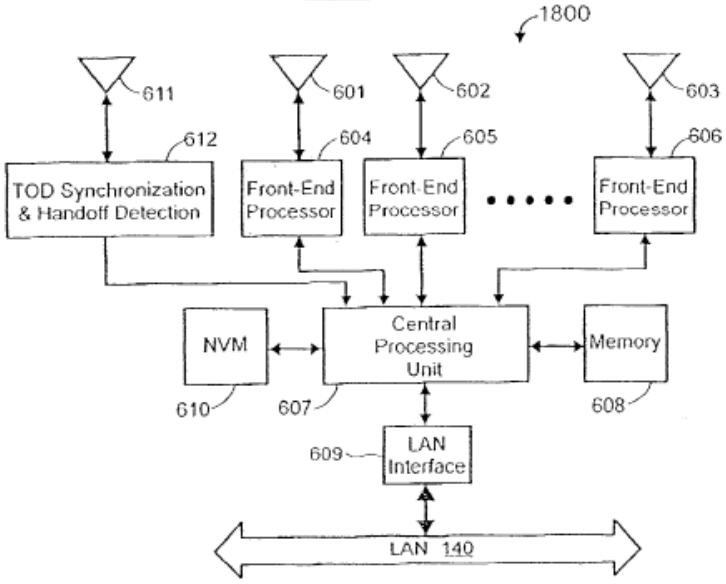
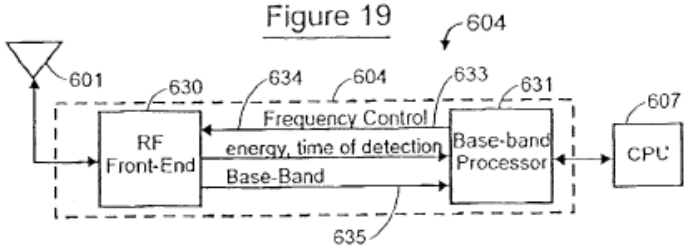


Figure 19



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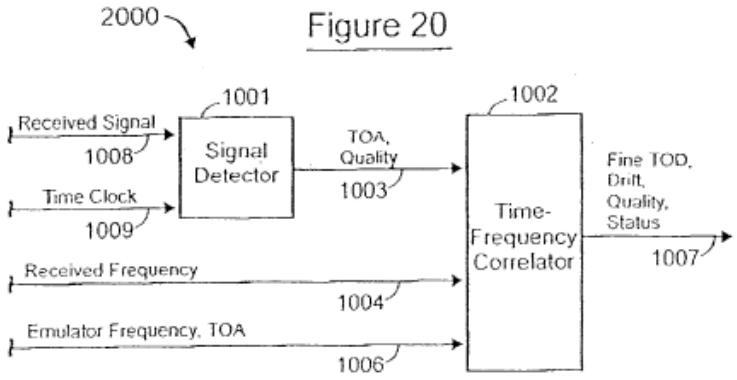

Figure 20

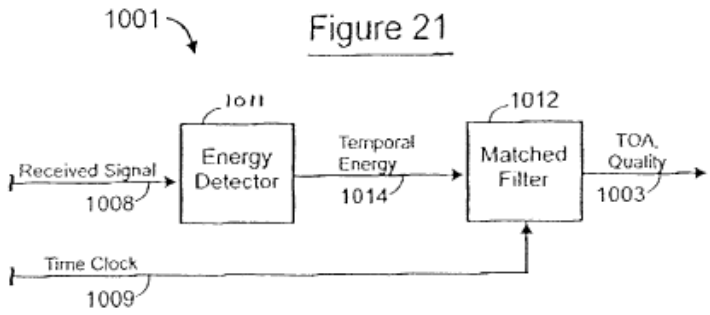

Figure 21

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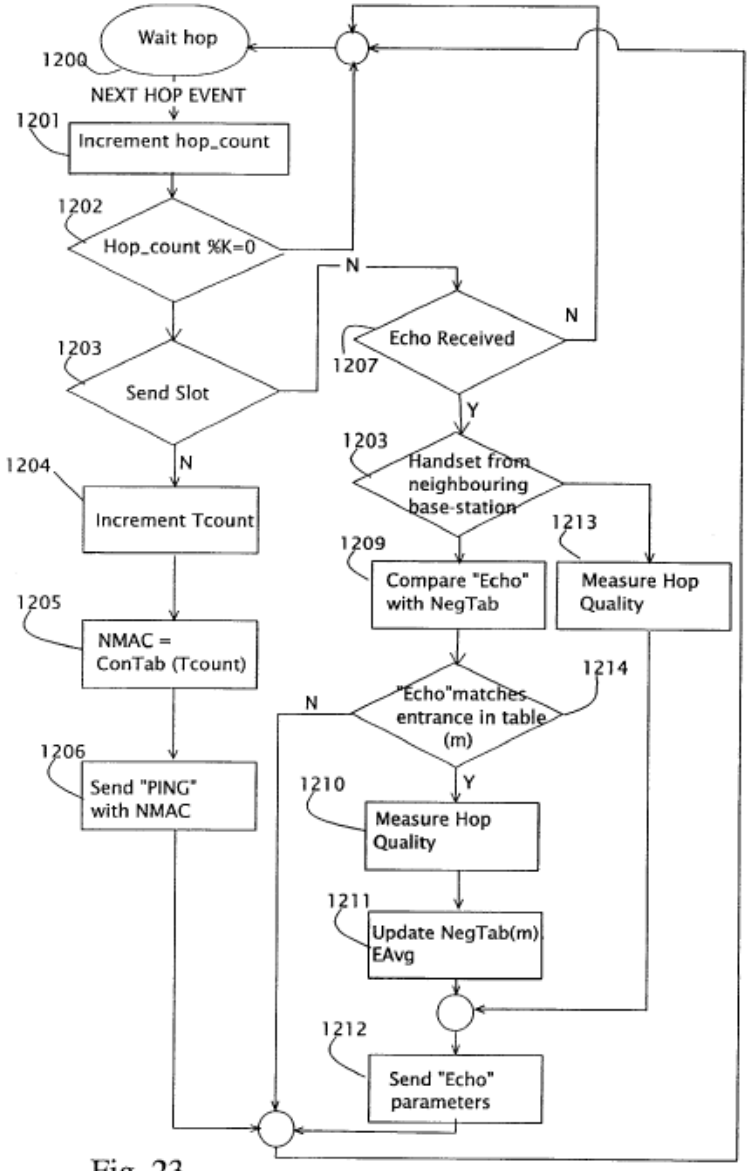

Fig. 23

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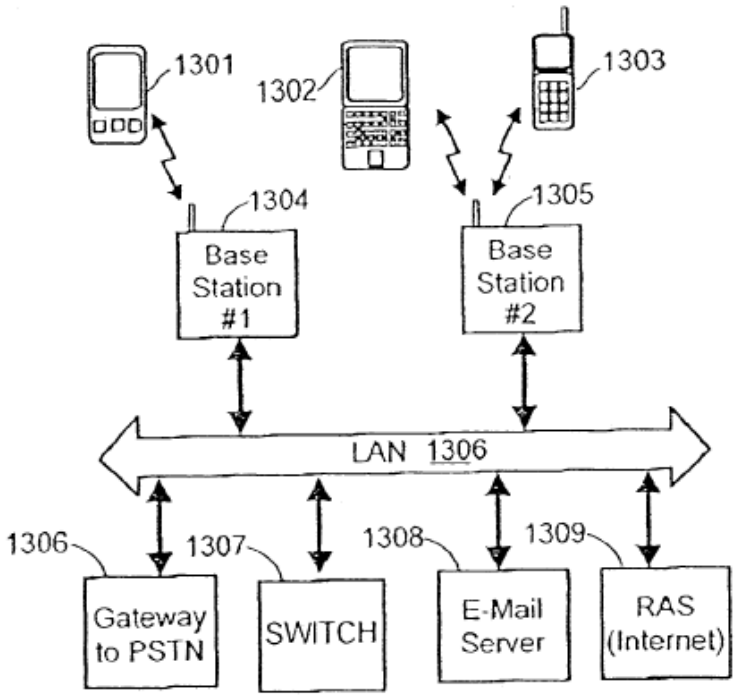
Figure 24



WIRELESS PRIVATE BRANCH EXCHANGE (WPBX) AND COMMUNICATING BETWEEN MOBILE UNITS AND BASE STATIONS

This application claims benefit of Provisional No. 60/195,219 filed Apr. 7, 2000 and claims benefit of Provisional No. 60/208,306 filed Jun. 1, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to wireless communications systems having a plurality of mobile units (devices) having the ability to connect short-range with a plurality of Base Stations, and techniques for handing off a mobile unit from one Base Station to another when the mobile unit moves between areas of coverage of neighboring Base Stations.

BACKGROUND OF THE INVENTION

The effective range of a mobile device, such as a cordless handset, from its Base Station is limited by its transmission power and by the receiver sensitivity of the mobile device and the Base Station. Wireless Private Branch Exchange (WPBX) systems address this limitation by using more than one Base Station (BS). The area that a Base Station covers is called a cell. In the main, hereinafter, mobile units (devices) that are cordless (telephone) handsets are discussed.

In a WPBX, the Base Stations are interconnected in order to allow handsets that are in different cells to communicate with one another. When a handset moves from one cell to another during a call, the handoff (or handover) of communication from one Base Station to another Base Station enables uninterrupted communication. A central unit that is usually called the "Switch" is connected to all the Base Stations. The Switch controls the operation of the system, routes the call to Base Stations and to Gateways, which connect the

WPBX to external communication systems. The transmission power of a cordless handset in the WPBX is usually lower than the transmission power of the handset of a standard cellular system, which results in a WPBX for cordless handsets having much smaller cells (referred to as mini-cells, or micro-cells or picocells) than the cells of a standard cellular system.

Some cordless handsets use communication protocols that are also used in cellular system, but they transmit in a lower power than a mobile (cellular) handset. For examples protocols in use are GSM and IS-136. According to these protocols the handoff between cells is performed by collaboration of the cordless handset, the Base Stations and the Switch. These handsets can connect to the WPBX when they are in its coverage area, and can also connect to any other cellular system that supports the communication protocol that they are using.

Some handsets use communication protocols that were designed especially to allow communication with WPBX. Some examples are DECT, CT-2, PAC, and PACS. The handset is usually a dedicated handset that is used only in the area covered by the WBPX.

Some handsets have dual mode support. For example a handset may communicate with the WPBX using DECT, and may allow communication with other cellular systems using GSM.

Some WPBXs use standard cordless handsets. These handsets have no special mechanism to

support the handoff between cells. In these systems the Switch and the Base Stations perform the handoff, and the handset is not aware of (does not participate actively in) the handoff process. When a standard cordless handset moves from one cell to another the Switch routes the call to another cell. Since cordless phones use "simple" protocols, for example an analog fixed transmission, when the call is routed to the new cell, the cordless phone automatically will receive it.

During the last years short-range communication protocols have become much more complicated. Very low power is used in order to allow many systems to operate in close vicinity. Complex transmissions methods like frequency hopping and spread spectrum are used in order to overcome interference, and improve the communication quality. Digital communication methods are used allowing communication of data and voice on the same system. Error correction encoders are used in order to improve reliability. Security and privacy of the communication is improved with the use of Digital authentication and encryption.

Short-range communication systems are used for many purposes. A growing trend for short-range communication usage is Personal Area Network (PAN) devices and applications, among such is the "all in one handset" and personal data devices. Such type of handset supports standard cellular communication, and also has the ability to communicate with personal area network devices that are in its near vicinity, using short-range communication. Some PAN short-range

communication standards were not designed to allow mobility, i.e. they were not designed to allow handoff in between Base Stations in general and during an active session in particular. This limits a session via such device to be linked to a single Base Station and therefore to very limited area.

The "Bluetooth" standard is a short-range wireless communication standard that has many uses for voice applications and telephony (e.g. cordless phone, wireless headsets) and also for data applications (laptop to personal computer communication, wireless local area network Gateways etc.). The Bluetooth wireless technology is implemented using a universal radio interface in the 2.45 GHz frequency band that enables portable electronic devices to connect and communicate wirelessly via short-range, ad hoc networks. Each unit can simultaneously communicate with up to seven other units per piconet. Moreover, each unit can simultaneously belong to several piconets.

Bluetooth connection is planned to be standard feature in future cellular handsets, Personal Digital Assistants (PDAs), Palmtop and Laptop computers. The Bluetooth standard does not support mobility between Base Stations, since it was primarily designed for short-range communication as a cable replacement. A cellular handset with Bluetooth wireless technology will be able to operate as a cordless phone, but only in the near vicinity of a single Base Station. The same limitation applies to mobile personal data devices such as PDA's and mobile computers.

GLOSSARY

Unless otherwise noted, or as may be evident from the context of their usage, any terms, abbreviations, acronyms or scientific symbols and notations used herein are to be given their ordinary meaning in the technical discipline to which the invention most nearly pertains. The following glossary of terms is intended to lend clarity and consistency to the various descriptions contained herein, as well as in prior art documents:

ATM	Asynchronous Transfer Mode
BER	Bit Error Rate
Bluetooth	short-range wireless communications standard/interface/protocol
BS	Base Station
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check.
CT-2	a communication protocol
DECT	Digital Enhanced Cordless Telephone communication protocol
DN	Destination Number
ECHO	a response to a PING
FIFO	First In, First Out
FTP	File Transfer Protocol
Gateway	an interface for communications between dissimilar services
GHz	GigaHertz
GSM:	Global System for Mobile Communication
handoff	transfer of mobile devices from one Base Station to another Base Station
ID	Identification (number)
IEEE 802.2	Ethernet protocol

IS-136	communication protocol
ISDN	Integrated Services Digital Network
ITU-T 802.15	a communication standard similar to the Bluetooth standard
ITU-T Q.931	a telephony protocol for call setup
IVR	Interactive Voice Response
LAN	Local Area Network
LMSE	Least Mean Square Error
MSC	Mobile Switching Center (MSC)
PAC	a communication protocol
PACS	a communication protocol
PAN	Personal Area Network
PBX	Private Branch Exchange
PABX	Private Automatic Branch Exchange (also referred to as PBX)
PDA	Personal Digital (or Data) Assistant
picocell	a coverage area of a short-range Base Station
PING	a command which is sent, soliciting a response
PPP	Point-To-Point Protocol
PSTN	Public Switched Telephone Network
RF	Radio Frequency
SNR	Signal-to-Noise Ratio
Switch	Apparatus for routing telephone calls
TOD	Time Of Day
WAP	Wireless Application Protocol
WPBX	Wireless Private Branch Exchange

SUMMARY OF THE INVENTION

A general object of the invention is to provide a technique for allowing mobile units (devices) such as standard cordless telephone handsets and PDA (Personal Digital Assistant), laptop or notebook

computers or similar devices that support wireless communication (such as Bluetooth wireless technology) to seamlessly connect to a Wireless Private Branch Exchange (WPBX), or to a standard (wired) PBX or to a LAN or to a cellular telephone network or to a standard wired telephone network, thereby avoiding the use of special (typically expensive) handsets or attachments or software or hardware agents , with the abovementioned mobile devices.

According to the present invention there is provided, in a wireless communication system comprising at least two Base Stations, at least one Switch in communication with the Base Stations, a method of communicating between mobile units and the Base Stations comprising: dividing a communication protocol into a low-level protocol for performing tasks that require accurate time synchronization and a high-level protocol which does not require accurate time synchronization; and for each connection of a mobile unit with a Base Station, running an instance of the low-level protocol at the Base Station connected with the mobile unit and running an instance of the high-level protocol at the Switch.

According to the present invention there is provided, in a wireless communication system comprising a Base Station connected with a mobile unit, a method of synchronizing at least one neighboring Base Station to the Base Station connected with the mobile unit comprising: from the Base Station connected with the mobile unit, sending call parameters and rough synchronization

information to the at least one neighboring Base Station; and at the at least one neighboring Base Station, monitoring transmissions of at least one of: the Base Station connected with the mobile unit; the mobile unit; and a beacon signal from a beacon transmitter which is within range of the at least one neighboring Base Station and the Base Station connected with the mobile unit.

According to the present invention there is provided, in a wireless communication system comprising a plurality of Base Stations and at least one Switch in communication with the Base Stations, a method of synchronizing at least one neighboring Base Station to a Base Station connected with a mobile unit comprising: from the Base Station connected with the mobile unit, periodically transmitting during a selected time interval with higher transmission power than during normal transmission; and receiving the transmission with higher transmission power at the least one neighboring Base Station.

According to the present invention there is provided, in a wireless communication system comprising a Base Station connected with a mobile unit, a method of detecting the presence of a specific mobile unit in a coverage area of at least one neighboring Base Station, comprising: the Base Station connected with the mobile unit provides, to the at least one neighboring Base Station, information about the connection with the mobile unit, including rough TOD and a device address for the mobile unit; at the at least one neighboring Base Station, receiving information and generating a list

of frequencies in which the mobile unit is likely to transmit; and at the at least one neighboring Base Station, checking for a signal transmitted by the mobile unit.

According to the present invention there is provided a method for detecting a mobile unit by a Base Station, wherein frequency-hopping is used to communicate between Base Stations and mobile units, comprising: at a Base Station that is connected to a mobile unit, periodically yielding a hop; and during the hop which has been yielded by the Base Station connected with the mobile unit, communicating with the mobile unit from at least one neighboring Base Station.

According to the present invention there is provided, in a wireless communication system comprising a Base Station connected with a mobile unit, a method of detecting a handset by at least one Base Station which is waiting for the mobile unit to enter its coverage area, comprising: from the at least one Base Station waiting for the mobile unit to enter its coverage area and the Base Station connected with the mobile unit, sending a PING command to the mobile unit; and at the Base Station waiting for the mobile unit to enter its coverage area, receiving an ECHO reply from the mobile unit.

According to the present invention there is provided, in a wireless communication system comprising at least two Base Stations, at least one Switch in communication with the Base Stations, and at least one mobile unit, a method of handing off the mobile unit from a Base Station

communicating with the mobile unit and a neighboring Base Station, comprising: smoothing a plurality of signals received from a handset by a plurality of Base Stations; comparing the signals with one another; and selecting a Base Station for handoff based on signal quality.

According to the present invention there is provided, in a wireless communication system comprising at least two Base Stations and at least one Switch in communication with the Base Stations, a method of performing handoff of a session from a Base Station connected with a mobile unit to a neighboring Base Station, wherein an instance of a low-level communications protocol is running at the Base Station connected with the mobile unit, comprising: at the Switch, determining when to perform handoff to a selected one of the neighboring Base Stations; at the selected one of the neighboring Base Stations, creating a copy of the low-level communications protocol, including at least a synchronized time of day (TOD) parameter; from the Switch, sending a command to stop communication with the mobile unit at a specified TOD to the Base Station connected with the mobile unit and sending a command to start communication with the mobile unit at the specified TOD to the selected one of the neighboring Base Stations; and updating session status tables in the Switch and in the Base Stations.

According to the present invention there is provided, in a wireless communication system comprising a Base Station connected with a mobile unit, a method of detecting and synchronizing with the mobile unit prior to receiving a handoff of a

session with the mobile unit, comprising: from the Base Station connected with the mobile unit, sending rough synchronization information to at least one neighboring Base Station; at the neighboring Base Station, performing a wide-range search for "target" signals having the correct timing for a mobile unit, based on the rough synchronization information provided by the Base Station which is connected with the mobile unit; narrowing the search for an actual signal from the mobile unit; acquiring the target signal; and synchronizing the neighboring Base Station to the Base Station connected with the mobile unit.

According to the present invention, a system comprises one or more mobile units such as standard cordless handsets, two or more Base Stations, and at least one Switch. The Base Stations are connected to one another and to the Switch. The handsets communicate directly with the Base Stations, rather than with one another.

According to an aspect of the present invention, the Base Stations and Switch communicate directly with one another, rather than, for example, over the PSTN. However, the system may interface with the PSTN, the Internet or a LAN, or with a PBX via a Gateway.

According to a feature of the present invention, a method is provided for handing off calls from a one Base Station to another (neighboring) Base Station, with mobile units (e.g., standard cordless handsets) that do not support connection to more than one Base Station and that do not support

mobility with seamless handoff between Base Stations. This is an important feature because the mobile device uses complicated digital communication methods, so simple handoff methods that only the Switch supports are inadequate. Rather, the Switch and Base Stations cooperate with one another for the handoff operation. Accurate synchronization of Base Stations facilitates handoff. Advantageously, the handoff operation does not require explicit cooperation between the mobile device and the Base Stations.

According to an aspect of the present invention, a method is provided for dividing the short-range communication protocol that is used by the handset between high-level protocols which do not need accurate time synchronization and low-level protocols which have strict time synchronization requirements (require accurate time synchronization). The low-level protocols are performed by the Base Stations, and the high-level protocols are performed in the Switch. This enables handoff to be performed even when complex (e.g. frequency hopping, encryption, authentication) and multi-level protocols are used. This also reduces the synchronization requirements between Base Stations.

According to an aspect of the present invention, a method is provided for accurately synchronizing the Base Stations and, more particularly, for synchronizing the Base Stations when frequency-hopping communication is used.

According to an aspect of the present invention, a method is provided for detecting the presence of a mobile device in the coverage area of a Base Station (i.e., its picocell).

According to an aspect of the present invention, a method is provided for determining when to perform handoff of a session(i.e., a phone call, a data link, etc.), and to which Base Station to hand the session, by measuring signal quality at the Base Stations. This method is effective, even when complex transmission methods are used.

The methods disclosed herein are not limited to the communication of a certain type of data. Hence, they can be utilized for telephony applications and for data applications.

Other objects, features and advantages of the invention will become apparent in light of the following description thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will be made in detail to preferred embodiments of the invention, examples of which may be illustrated in the accompanying drawing figures. The figures are intended to be illustrative, not limiting. Although the invention is generally described in the context of these preferred embodiments, it should be understood that it is not intended to limit the spirit and scope of the invention to these particular embodiments.

In flowcharts presented herein, rectangular boxes generally represent a sequential step being performed, a diamond shaped box generally represents a decision step (test) having two mutually-exclusive results ("Y"=Yes; "N"=No), and an empty circle is not a step or a test, but is merely a graphical junction point at which two or more paths in the flowchart converge.

The structure, operation, and advantages of the present preferred embodiment of the invention will become further apparent upon consideration of the following description, taken in conjunction with the accompanying figures, wherein:

FIG. 1 is a diagram of a cellular system covering a relatively large area and a Wireless Private Branch Exchange (WPBX) system covering a relatively smaller area, illustrating that a cellular handset can communicate with a Base Station of the cellular system and also with Base Stations of the WPBX;

FIG. 2 is a schematic block diagram illustrating main components and architecture of a WPBX system, suitable for use as the WPBX system of FIG. 1;

FIG. 3A is a schematic block diagram of a communications system incorporating a WPBX, such as the WPBX of FIG. 2, with the addition of a Gateway connecting the WPBX to the Public Switched Telephone Network (PSTN);

FIG. 3B is a schematic block diagram of a communications system incorporating a WPBX, such as the WPBX of FIG. 2, with the addition of a Gateway connecting the WPBX to a Private Branch Exchange (PBX);

FIG. 4 is a schematic block diagram illustrating an architecture for a WPBX, with the Base Stations, the Switch and the Gateway interconnected by a local area network (LAN);

FIG. 5 is a flowchart illustrating a procedure for call "setup" at an originating Base Station of a WPBX;

FIG. 6 is a flowchart illustrating a procedure for call "setup" at a receiving Base Station of a WPBX;

FIG. 7 is a flowchart illustrating a procedure for call "setup" at a Switch of a WPBX;

FIGS. 8A and 8B are schematic block diagrams illustrating an architecture for dividing the communication protocol into low-level and high-level protocols for implementation in the Base Stations and in the Switch, respectively, of a WPBX particularly during a handoff, according to the invention;

FIGS. 9A, 9B and 9C are schematic block diagrams illustrating rough and fine synchronization of Base Stations in a WPBX, particularly during a handoff, according to the invention;

FIG. 10 is a graph of a Base Station's transmission power, during hops, illustrating that once in every K hops the energy that the Base Station transmits may be increased to allow other Base Stations that normally do not receive transmissions from the transmitting Base Station to synchronize to the transmitting Base Station, according to the invention;

FIG. 11 is a schematic block diagram illustrating an architecture for major components of a Base Station, according to the invention;

FIG. 12 is a flowchart illustrating a "call routing task" that runs in the Switch in order to isolate the high-level protocols from the occurrence of the handoff, according to the invention;

FIG. 13 is a schematic block diagram illustrating a passive method for detecting arrival of a handset in a Base Station's coverage area during a call, according to the invention;

FIG. 14A is a diagram illustrating a handset communicating with one Base Station, and six other neighboring Base Stations waiting for the handset to enter their coverage area, according to the invention;

FIGS. 14B, 14C and 14D are graphs illustrating transmissions by the Base Station communicating with the handsets, and by the neighboring Base stations, according to the invention;

FIGS. 15A and 15B are diagrams illustrating detection of a handset by a Base Station in communication with the handset and a neighboring Base Station, according to the invention;

FIG. 16A is a flowchart illustrating a procedure that Base Stations may use to detect a handset that enters their coverage area, according to the invention;

FIG. 16B is a flowchart illustrating a procedure that Base Stations may use to determine that a handset connected to them is moving into the coverage area of another Base Station, according to the invention;

FIG. 17A is a schematic block diagram illustrating a method for making a handoff decision, performed in the central Switch, when a passive detection method is used, according to the invention;

FIG. 17B is a schematic block diagram illustrating a method for making a handoff decision, performed in the central Switch, when an active detection method is used, according to the invention;

FIG. 18 is a schematic block diagram of a Base Station comprising a central processing unit (CPU), front end processors, memory, TOD synchronization and handset detection unit, and an interface to a local area network (LAN), according to the invention;

FIG. 19 is a schematic block diagram illustrating the front-end processor of the Base Station of FIG. 18, which comprises a base-band

processor and a radio frequency (RF) front end, according to the invention;

FIG. 20 is a schematic block diagram illustrating the structure of a detector and fine TOD estimator, based on a matching correlator, according to the invention;

FIG. 21 is a schematic block diagram of an implementation for the Time-Frequency Correlator of FIG. 20, according to the invention;

FIG. 22 is a diagram illustrating an implementation of a WPBX system with two Switches, according to the invention.

FIG. 23 is a flow chart illustrating a procedure for transmitting "PING" commands to a handset and receiving "ECHO" responses from the handset, when the Base Station originating the "PING" command is the same Base Station the handset is currently connected to, according to the invention; and

FIG. 24 is a schematic block diagram of a system utilizing the methods of the current invention to support mobility of personal data devices as well as wireless handsets, according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates the basic components and operation of an exemplary, overall communication system 100. A Base Station 101 of a cellular system covers a cell 111 having a relatively large coverage area 111. (The Base Station 101 is shown off-center

in its coverage area 111, and the coverage area 111 is shown as elliptical rather than circular, for illustrative clarity.) Base Stations 107, 108 and 109 of a WPBX system cover cells 102, 103 and 104, respectively, each having relatively smaller coverage areas. (The Base Stations 107, 108 and 109 are shown off-center in their respective coverage areas 102, 103 and 104, for illustrative clarity.) Sometimes, these smaller cells 102, 103 and 104 are referred to as "microcells", or "picocells", or "minicells".

A mobile handset 110 can communicate with the cellular Base Station 101 via a communication link 105 and, when it is in the coverage area of the WPBX, it also can use short-range communication link 106, to communicate with one of its Base Stations 107, 108 and 109. In this manner, a standard cellular handset 110, that is enhanced (additionally equipped) with a short-range communication link (e.g. Bluetooth wireless technology) can connect with the WPBX system whenever it is in range of one of the WPBX Base Stations 107, 108 and 109.

The WPBX system can also operate when there is no cellular coverage at all. And the handset 110 can be an ordinary cordless telephone handset. Therefore, the cellular Base Station 101 shown in FIG. 1 is optional, insofar as the WPBX system of the present invention is involved. In the main hereinafter, a handset which is an otherwise ordinary cordless telephone handset, equipped with a short-range communication link (e.g. Bluetooth wireless link) will be used to describe the invention.

In an office environment, a WPBX system improves availability of employees, who carry mobile handsets, and therefore reduces operational cost and increases productivity. In the home environment, a WPBX system enables the use of the standard cellular handsets instead of special cordless phones.

In the present invention, when the handset is the same as the cellular handset, the cost of equipment is lower then the cost of a standard WPBX which requires dedicated handsets. Since the WPBX handles calls between handsets connected to it, the communication charges are lower then when standard cellular communication is used for all the calls.

The handset 110 may indicate to the user that more then one service is available. The user decides which service to use (Cellular or WPBX). The ability to choose between services is a well-known feature in many mobile phones.

It should be understood that the handset 110 is merely an example of a "mobile unit" which can be any of a number of telephony, voice, computing or data devices which communicate via Base Stations, as described in greater detail hereinbelow. As used herein, "Mobile Units" are devices communicating wirelessly with (also referred to as "connected to") Base Stations.

As illustrated in FIG. 1 (and ignoring the cellular Base Station 101 and link 105) the handset 110 is currently communicating with (connected to) the Base Station 108. The Base Stations 107 and 109

are each referred to as "neighboring" Base Stations since they are each adjacent to the Base Station 108 that the handset is currently connected to. The present invention deals largely with how communication with a Mobile Unit such as a handset is handed off (or passed off) from a one Base Station to another (neighboring) Base Station when the handset moves from one minicell to another minicell.

FIG. 2 illustrates the main components and architecture of a WPBX system 200 suitable for use as the WPBX system of FIG. 1. The architecture of a WPBX system generally resembles the architecture of a cellular system. However, as described in greater detail hereinbelow, the function that each component performs is different, since the current invention deals with short-range communication with mobile units that have no built-in support for handoff.

The WPBX 200 comprises a plurality (three shown) of Base Stations 123, 124, 125. A handset 121 communicates via a short-range communication link 122 (e.g. Bluetooth wireless link) with Base Station #1 123. Base Station #2 124 and Base Station #3 125 are ready to receive the call should handset 121 move into their coverage area. At the same time, the other Base Stations may participate in calls with other handsets. For example, Base Station #2 124 communicates via a short-range communication link 134 (e.g. Bluetooth wireless link) with a handset 133. The handsets 121 and 133 may communicate with each other via the WPBX (as

opposed to directly with one another), as described in greater detail hereinbelow.

Communication links 126, 127, 128 connect the Base Stations 123, 124, 125 with one another, as illustrated. These communications links transfer data between the Base Stations 123, 124, 125, including voice communication, data communication, connection status information and synchronization information, as described in greater detail hereinbelow, and may be RF links or land lines (e.g., copper wires, optical fibers, etc.).

Communication links 130, 131, 132 connect the Base Stations 123, 124, 125, respectively, with a Central Switch (hereinafter "Switch") 129. These communication links enable the Switch 129 to control the operation of the Base Stations and to participate in the higher levels of the communication protocols, as described in greater detail hereinbelow, and may be RF links or land lines.

FIG. 3A illustrates the addition of a Gateway 135 to the WPBX system 200 of FIG. 2. The Gateway 135 connects the Switch 129 to a Public Switched Telephone Network (PSTN) 136. This enables the WPBX system 200 to receive incoming calls from and to send outgoing calls to other telecommunication systems (not shown) which are connected to the PSTN. The Gateway 135 may be implemented in any suitable manner, such as in hardware and/or software.

As used herein, a "Gateway" is a logical or physical connection between two different

communication networks. The term implies a need for conversion of some aspect of the information or communication in order to operate, as contrasted with a "port" which implies a point not requiring significant conversion of the message or information. Gateways are well known.

FIG. 3B illustrates the addition of a Gateway 137 to the WPBX system 200 of FIG. 2. The Gateway 137 connects the Switch 129 to a standard Private Branch Exchange (PBX) 138. This enables the WPBX system 200 to receive incoming calls from and to send outgoing calls to standard telephone sets 139 connected to the PBX 138. As illustrated, the PBX 138 is interfaced with the PSTN 136. Thus, the WPBX system 200 can also communicate with other telecommunication systems (not shown) which are connected to the PSTN.

Having dedicated connections for all the Base Stations 123, 124, 125 and the Switch 129, such as illustrated in FIG. 2, hereinabove, is generally not cost-effective. Rather, when real time interaction or synchronization is not required, a shared local network, for example a local area network such as the IEEE 802.2 Ethernet, can connect these units in a cost-effective manner.

FIG. 4 illustrates a plurality (three shown) of Base Stations 123, 124 and 125 (compare FIG. 2) connected via a communications link which is a Local Area Network (LAN) 140 which handles the transfer of information between the Base Stations 123, 124, and 125, the Switch 129 and, in this example, the Gateway 135 to the PSTN 136. Using a standard local area network (LAN) as the

communication backbone allows simple integration with other telephony application servers (not shown), such as IVR (interactive voice response), voice loggers, voice mail and billing systems. The LAN 140 can be either wired, or wireless.

FIGS. 2, 3A, 3B and 4 therefore illustrate, in a general manner, a number of ways in which the main components of a WPBX can be connected with one another, and interfaced with other communications systems (PSTN, PBX, etc.)

For office WPBX applications the Switch 129 may be a standard computer that has the processing power required for handling the switching of hundreds of calls simultaneously. It should support operation in a multi-server environment. This can be achieved with standard server hardware. For home WPBX applications, the Switch 129 may be a part of one Base Station, or a part of several Base Stations.

Call Setup Procedures

FIGS. 5, 6 and 7 illustrate call setup procedures for a single call at an "originating" Base Station (e.g., 123), at a "receiving" Base Station (e.g., 124), and at the Switch (e.g., 129), respectively. Call setup between the handset (e.g., 121) and the Base Station it is connected to (e.g., 123) is suitably performed according to standard telephony protocols, for example ITU-T Q.931. A similar protocol is a part of the Bluetooth protocol stack. However, the present invention is not limited to a specific protocol for call setup.

FIG. 5 illustrates a call setup procedure performed by an originating Base Station (e.g. 123) when a handset (e.g., 121) that is connected to it, tries to initiate a call. As shown in the step 151, the handset that is originating the call sends a destination number (DN). In a next step 152, the originating Base Station (e.g., 123) checks whether the destination handset (e.g., 133) is in its "Base Station Connection Table"--in other words, whether the destination handset is in the originating Base Station's coverage area. If not (step 152, "N"), in a step 160 the destination number (DN) is sent via the communications link (e.g., LAN 140) to the central WPBX Switch (e.g., 129). The originating Base Station then sets a timeout (step 161), and waits for a reply from the Switch. The timeout set in the step 161 is suitably on the order of up to 5 seconds. Next, it is determined in a step 162 whether there is a timeout.

If there is a timeout (step 162, "Y"), the Base Station sends a busy indication (suitably a tone) to the originating handset (step 177), and the Switch is updated about the failure of the call (step 178). If, there is not a timeout (step 162, "N"), the originating Base Station receives (from the Switch) the address of a destination Base Station (step 163). The originating Base Station then calls the destination Base Station (step 164), and it also calls all the neighbors (neighboring Base Stations) of the destination Base Station (step 180). Then the originating Base Station sets a timeout (step 165) and waits for a reply from the called Base Station (and its neighbors). Calling more then one destination Base Station is preferred in order to

overcome uncertainties during handoff. The timeout set in the step 165 is suitably on the order of up to 5 seconds. Next, it is determined in a step 166 whether there is a timeout.

If there is a timeout (step 166, "Y"), the Base Station sends a busy tone to the originating handset (step 177), and the Switch is updated about the failure of the call (step 178). If, there is not a timeout (step 166, "N"), and a reply from the destination Base Station is received, the originating Base Station checks if the call is connected (step 167), and then connects the originating handset (step 168), and updates the Switch about the success of the call (step 169).

If, in the step 163 the address of a destination Base Station is not received (N), it is determined (step 170) whether the destination of the call is the Switch itself. If so (step 170, "Y"), a procedure similar to that for sending a call to another Base Station is implemented, except that the call is sent to the Switch (step 171) and not to another Base Station. Then the originating Base Station sets a timeout (step 172) and waits for the Switch to reply (step 173). The timeout is suitably on the order of up to 5 seconds. Next, it is determined in the step 173 whether there is a timeout.

If there is a timeout (step 173, "Y"), the Base Station sends a busy tone to the originating handset (step 177), and the Switch is updated about the failure of the call (step 178). If the Switch responds that the call is connected, there is not a timeout (step 173, "N"), and the originating Base Station

connects the handset (step 175), and updates the Switch (step 176) about the status of the call.

If it is determined that the destination handset is in the originating Base Station's coverage area (step 152, "Y"), and a busy signal is not returned (step 153, "N"), the originating Base Station then attempts (step 154) to connect the call to the destination handset, and also to all the neighboring Base Stations (step 181). Again, the calling of neighboring Base Stations is preferred in order to overcome uncertainties, such as the handset moving, during the call setup. Then the originating Base Station performs a procedure similar to that described hereinabove of setting a timeout (step 155), waiting for the Switch to reply (step 156), connecting (step 158) or disconnecting (step 177) the call, and updating the Switch (steps 159 or 178).

In summary, the call setup procedure performed by an originating Base Station (e.g., 123) is that, first, the originating Base Station determines whether a call request from an originating handset (e.g., 121) is:

a. to a DN in the originating Base Station's coverage area (e.g., step 152), in which case the originating Base Station attempts (step 181) to also connect the call to its neighboring Base Stations; or

b. to a DN in another Base Station's coverage area (e.g., step 164), in which case the originating Base Station attempts (step 180) to also connect the call to Base

Stations which are neighbors of the destination Base Station; or

c. to a DN outside of the WPBX coverage area and is to be routed through a Gateway (see FIG. 7) associated with the Switch (steps 170, 171).

In each case, the originating Base Station then:

d. sets a timeout (steps 155, 165, 172);

e. waits for the Switch to reply (steps 156, 166, 173) that the call is connected (steps 157, 167, 174)

f. connects the originating handset (steps 158, 168, 175);

g. updates the Switch (steps 159, 169, 176) about the status of the call; and

h. waits (step 179) for a new event (a new call setup).

FIG. 6 illustrates the call setup procedure performed at a destination Base Station (e.g., 124) which is receiving a call, whether it be from another Base Station or from the Switch. When the destination Base Station receives a request (step 201) to connect a call to a handset (e.g., 133) which is reportedly within its coverage area, it first checks (step 202) whether the handset is already communicating with (connected to) it. If the handset

is already connected to the Base Station (step 202, "Y"), the Base Station tries to connect the call to the handset. A timeout is set (step 203), again on the order of up to 5 seconds, and the Base Station waits (step 204).

If a time-out occurs (step 204, "Y"), or if a timeout does not occur (step 204, "N") but the call was unable to connect (step 205, "N"), the destination Base Station returns an indication (step 208) of call setup failure ("unable to connect") to the originating Base Station (or to the Switch, as the case may be). If, however, the connection succeeds (step 205, "Y") the Base Station returns an indication (step 206) of successful call setup ("call connected") to the originating Base Station. In either case (call connected, unable to connect), the destination Base Station sends similar indications (steps 211, 212, respectively) to all the neighboring Base Stations of the originating Base Station Again, sending the reply to the neighboring Base Stations is to overcome uncertainties during handoff. In both cases the Switch is updated at steps 207 and 209, respectively. Finally the Base Station waits (step 210) for a new event (a new call setup).

FIG. 7 illustrates the call setup procedure performed at the Switch (e.g., 129). The Switch handles two types of messages, one is a request to establish a new call, and the other is an update to the status of the call. In a step 231, it is determined whether the request is for a new call (step 231, "Y") or a request to update a call (step 231, "N").

If the arriving message is a request to update a call (step 231, "N"), an update of the "Calls Table" is generally required (step 254, "Y"). The Switch checks if it receives indication that the call is connected (step 255). If the call is connected, (step 255, "Y"), the status of the call is updated in the Calls Table (step 256). Otherwise (step 255, "N"), the call is removed from the Calls Table (step 257).

If the arriving message is a request to initiate a new call (step 231, "Y"), the Switch checks if the call is intended to a handset connected to the WPBX (step 232). This is done by checking its "Connections Table". If the call is intended to connect to outside the WPBX (e.g., via the PSTN 136), the Switch checks (step 233) if the destination number (DN) is a legal (valid) number. If the DN is a valid number (step 233, "Y"), in a step 234 the Switch transfers the call to the Gateway (e.g., 135), sets a timeout (step 235) and waits (step 236). If not (step 233, "N"), the program exits.

If the connection via the Gateway succeeds (step 236, "N"), it is whether the call is connected determined (step 237). If the call is connected, (step 237, "Y"), the Switch requests from the originating Base Station to transfer the call to the Switch(step 238), and waits for connection with originating Base Station (steps 239, 240). If connection succeeds, and the call is connected (step 242, "Y"), the call is added to the "Calls Table" (step 243), and the call is routed to the Gateway (step 244). If connection fails (step 240, "Y"; or step 242, "N"), the connection with the Gateway is disconnected (step 241).

If the call destination is one of the Base Stations (step 259), its source may be another Base Station (step 249), or the Gateway (step 245). If the source is another Base Station, the Switch send to the originating Base Station the address of the destination Base Station, and adds the call to the "Calls Table". If the call arrived from the Gateway the Switch tries to connect the call to the destination Base Station (step 245). If is succeeds the call is added to the "Calls Table" (step 252), the call is transferred to the destination (step 253). If it fails the connection with the Gateway is disconnected.

The procedure described in FIG. 7 is also applicable to the case when more than one Gateway connects to the WPBX to the PSTN--for example, in a case where two branch offices share a single WPBX, and each has its own independent connection to the PSTN. The main difference would be that when the Switch handles an outgoing call, it will determine to which Gateway to send the call. This can either be done randomly, or can be pre-determined. The handling of the incoming calls would proceed as set forth above in FIG. 7.

FIGS. 5, 6 and 7 have illustrated a call setup procedure for the handling of a single call. When either the Base Stations or the Switch need to handle more then one call, several instances of these procedures can be run in parallel. For that purpose, both Base Station software and Switch software are preferably based on a real time operating system that supports multi-tasking. For each new call, a new task will be created, and the task will perform the procedures described in FIGS. 5, 6 and 7. The task will be closed when the procedure is completed.

In systems with a very large number of Base Stations, due to limited processing power of each Switch, it may be preferable to divide the Switch into two or more units. Dividing the Switch into several units can also improve the reliability of the WPBX, by eliminating the possibility of having a single point of failure shutting down the entire system.

FIG. 22 illustrates the division of the Base Stations, into two groups; a first group (Group A) 1050 comprising a plurality (four shown) of Base Stations 1050a, 1050b, 1050c and 1050d; and a second group (Group B) 1051 comprising a plurality (four shown) of Base Stations 1051 a, 1051b, 1051c, 1051d. The Base Stations of Group A are connected to a first Switch (Switch A) 1052, and the Base Stations of Group B are connected to a second Switch (Switch B) 1053. The Base Stations and the Switches function according to the procedures described in FIGS. 5, 6 and 7. All the Switches mirror all the status tables of the other Switches, i.e. by having copies of each other's "Calls Table" and "Connections Table". When a Switch updates one of its status tables, it sends the information to all the other Switches, and they update their tables accordingly. In order for this process to be reliable, the other Switches will send an indication that the message was received. If the originating Switch does not receive such a reply within T.sub.1 milliseconds, it will retransmit the message. The retransmission will be repeated up to P times. For example T.sub.1 shall be equal to 100, and P shall be equal to 5.

It is within the scope of the invention that more than two Switches, and corresponding more

than two groups of Base Stations can be employed. As described hereinabove, all of the Switches would mirror and update each other's status tables. The description of two Switches 1052 and 1053 is intended to be exemplary rather than limiting.

Calls Table

The Switch (129) maintains the "Calls Table", which contains the status and information about all the active calls being handled by the WPBX. The "Calls Table" comprises the following information:

1) Each active call has a unique "Call Identification number".

2) The origin of the call, which can be either "Internal" or "External".

3) The destination of the call, which can be either "Internal" or "External".

4) "Calling Number Identification (CNID)", the number of the calling party, if available.

5) Destination Number (DN), the number of the answering party if available.

6) "Originating Base Station Identification" for calls from internal origin

7) "Destination Base Station Identification" for calls with internal destination,

8) Status of call--initiated, connected, disconnected.

9) Additional information for billing, performance analysis, such as call starts time, number of handoffs, time since last handoff, etc.

The "Originating Base Station Identification" and the "Destination Base Station Identification" are updated when a handset moves from one Base Station to another. The Switch updates these fields when it determines that the handoff should occur. During handoff, for a short time, there may be uncertainty about the validity of these fields. The Base Stations compensate for the uncertainty by "multicasting" the call setup messages to a group of Base Stations, as described hereinabove with respect to FIGS. 5 and 6 (see, e.g., steps 180, 181, 211, 212).

The procedures described above do not limit the WPBX from handling all unique telephony features that the Gateway and the handsets can support. For example, multiple connections can be created between handsets, and between handsets and the Gateway, when each connection is treated as a separate call. Another example is "Caller ID", that the Gateway can send to a handset. Another example is a "Hook-Flash" (momentary disconnect) that the handset can pass to the Gateway. The WPBX acts as a transparent relay for all these telephony features.

High-Level and Low-Level Protocols

In the descriptions set forth hereinabove, it has generally been assumed that:

1. Each Base Station knows which handsets are in its coverage range.

2. The Switch is aware of the connections of all the Base Stations.

3. Connections appear static to users and also to the high-level call setup procedures described above.

A method to achieve mobility, which fulfills these three assumptions is described in detail, hereinbelow.

According to the invention, the short-range communication protocol stack is divided into two parts:

low-level protocols performing real time tasks, and

high-level protocols that do not have real time requirements.

For example in the Bluetooth short-range communication protocol stack, the low-level protocols are the radio frequency (RF) transmitter and the base-band controller. The base-band controller performs real time control over the RF, since the Bluetooth protocol utilizes frequency-hopping transmission. The base-band protocol also determines, for each time slot of transmission (i.e. each frequency hop), what information will be transmitted. The base-band protocol also deals with voice coding, error correction, encryption and

authentication. For example, higher level protocols of the Bluetooth stack include the "Link Manager" which determines what information will go through the channels created by the "Base-Band", and determines the state of operation (e.g. Active, Polling, Parked).

The low-level protocols that require real time capabilities are performed in the Base Station. The higher-level protocols are performed at the Switch. (However, as described hereinbelow, certain high-level protocols can also be performed in the Base Station, even though they do not require real time capabilities.) The Switch handles the routing of data from the higher-level protocols to the lower level protocols. (A call routing task (282) is described in greater detail hereinbelow.) Therefore, the higher-level protocols do not need to "know" in which Base Station the lower level protocol that they are controlling is being performed.

FIGS. 8A and 8B illustrate an example of a WPBX system 800 with two handsets 121 and 133, two Base Stations 123 and 124, and one Switch 129. In this example, two calls are being handled. Gateways (e.g., 135, 137) are omitted, for illustrative clarity. As mentioned hereinabove (see, e.g., FIG. 22), the Switch can be divided into several units.

As illustrated in FIG. 8A, the handset 121 is currently communicating with (connected to) the Base Station 123, and the handset 133 is currently communicating with the Base Station 124. An instance 280 of the low-level protocol is running on the Base Station 123, and another instance 281 of

the low-level protocol is running on the Base Station 124. Each instance of the low-level protocol supports only one call. In a similar manner, the Switch 129 handles an instance 283 of the high-level protocol for the call with the with the handset 121, and another instance 284 of the high-level protocol for the call with the handset 133. A single call routing task 282 handles the data that is transferred between the instances of the low-level protocols and the high-level protocols to the correct destination.

As illustrated in FIG. 8A, the call routing task 282 routes data arriving from instance 280 of the low-level protocol to instance 283 of the high-level protocol, and from the instance 281 of the low-level protocol to the instance 284 of the high-level protocol. Since interaction between the high-level-protocol and low-level protocol, is normally relatively rare (e.g. call setup), there are no strict real time requirements from the call routing task. The call routing task 282 is described in greater detail hereinbelow, with respect to FIG. 12.

As illustrated in FIG. 8B, the handset 133 is shown as having moved to the area covered by the Base Station 123. The Base Station 123 will handle the communication with the handset 133, by creating a copy 281' of the instance 281 of the low-level protocol, that previously ran on Base Station 124. This allows the handset 133 to continue communication without "knowing" that a changeover of Base Stations has occurred. The call routing task 282 will now route the data arriving from the instance 281' of the low-level protocol running on Base Station 123 to the instance 284 of the high-

level protocol 284 which is running on the Switch 129.

For each connection of a Base Station with a handset, there is a separate instance of the low-level protocol running at a Base Station connected to the handset, and a corresponding separate instance of the high-level protocol running at the Switch. These instances are created, on an as-needed basis, when a connection is initiated. Preferably, a real time multi-tasking operating system is used in order to allow handling of many instances of the protocols simultaneously in the Base Stations and in the Switch. The procedures that the Switch uses during initiation of a connection and later, during handoff, are discussed in greater detail hereinbelow.

Synchronization of Base Stations During a Handoff

There follows a description of procedures that are performed during handoff of a call from one Base Station to another Base Station. The Base Station with which a handset is currently connected is termed the "current" Base Station. The Base Station to which a handset is being handed off is termed the "next" Base Station, and is typically a "neighboring" Base Station. Once the handoff has occurred, this neighboring/next Base Station becomes the "current" Base Station and the Base Station from which the handset has moved becomes the "previous" Base Station.

According to an aspect of the invention, the handsets do not need to be (and preferably are not) specially equipped or enabled to support mobility (i.e. handoff). Therefore, when a handset moves from

one Base Station to another, the current and the next Base Stations are responsible for continuing the communication with the handset, preferably with no noticeable interruption in the communication, and the next Base Station to which the handset has moved should transmit substantially exactly as the previous Base Station from which the handset has moved would have transmitted. For purposes of the discussion of this example, it is assumed that it is known from which Base Station the handset has moved and to which Base Station the handset is moving, and that the exact timing of handoff is also known. These issues are discussed in greater detail hereinbelow.

FIGS. 9A, 9B and 9C illustrate, in a general manner, a handoff taking place between two Base Stations 123, 124 and a single handset 121 of a WPBX.

FIG. 9A illustrates the handset 121 communicating with (connected to) a Base Station (Base Station #1) 123 via a short-range communication link 122 (e.g. Bluetooth wireless link). The "current" Base Station 123 sends call parameters and rough synchronization information over the LAN 140 to the neighboring Base Stations, a one of which is shown as Base Station #2 124. In this manner, the neighboring Base Stations "know" that they are "candidate" Base Stations for receiving a handoff of the call from the current Base Station. The information which is broadcast by the current Base Station to the candidate next Base Stations includes low-level communications protocol states and parameters, discussed in greater detail

hereinbelow. This communication from the Base Station 123 to the Base Stations 124 is indicated by the arrow 141, and the information contained therein is used to achieve rough (coarse) synchronization between the Base Stations. Since this information does not need to be accurate in time, it can be transmitted over the data link (e.g., LAN 140) connecting all of the Base Stations.

FIG. 9B illustrates a handoff as it is about to take place. Here, the handset 121 is situated in an area covered by both Base Stations 123 and 124. Base Station 124 uses this situation to achieve exact (fine) synchronization with the current Base Station 123. This will enable the next Base Station 124 to transmit, after the handoff, substantially exactly as previous Base Station 123 would have transmitted if the handoff had not occurred. A method for effecting this fine synchronization between neighboring Base Stations is discussed in greater detail hereinbelow.

An important parameter of synchronization is Time Of Day (TOD), which can be determined with virtually any desired level of precision (e.g., microseconds). As described in greater detail hereinbelow, in order to achieve fine synchronization of TOD, the Base Station 124 that is waiting for the handset 121 may passively monitor the transmissions of either the handset 121, or of the Base Station 123 that is currently connected with the handset. In FIG. 9B, the two possible fine synchronization signals that the candidate next Base Station #2 124 can monitor are shown, a signal 142 originating from the Base Station #1 123, and another signal 143 originating from the handset 121.

FIG. 9C illustrates that synchronization of the Base Stations 123 and 124 may alternatively be achieved by use of a beacon signal from a beacon transmitter 299 which is within range of current and next Base Stations, in which case precise (fine) synchronization for the low-level protocols can also be achieved. The beacon transmitter 299 transmits a beacon signal 144 to both of the Base Stations 123 and 124 to achieve synchronization of the Base Stations. This method allows for the synchronization of many Base Stations, although only two are illustrated in this figure. In this case, there is no need to transmit synchronization information over the LAN 140. Only call parameters (e.g., low-level protocol) need to be communicated between the current Base Station and The neighboring candidate next Base Stations, as indicated by the arrow 141'.

Bluetooth Short-Range Wireless Communication Protocol

As discussed hereinabove, a short-range communication protocol with the handset can be divided into lower-level protocols which the Base Stations handle, since they have real time requirements, and higher-level protocols which the Switch handles since they do not require real time requirements. Bluetooth wireless technology is an example of such a short-range communication protocol. In Table 1, a division of the Bluetooth short range wireless protocol into such low-level and high-level protocols is presented.

TABLE 1

Communication Protocols

Element (Protocol Name	Description of Protocol (Bluetooth Protocol)	Real time requirements	Level/ Where
Radio Frequency (RF)	Defines the modulation scheme and the frequency range	Control of radio frequency in real time required, modulates each symbol	Low/ Base Station
Base-band	Frequency control, channel definition, transmission/ reception control, encryption, error correction, authentication	Control frequency hopping in real time. Determines what packets will be sent at each hop. Encryption/ Error correction for each hop. Accurate time synchroni-zation	Low/ Base Statio n

Link manager	Link setup and control	None	Low or High Base station or Switch
Host Controller Interface	Communication between protocol stack and lower level implementation	None	Low or High Base station or Switch
Logical link manager	High level protocol multiplexing, packet segmentation and Reassembly, quality of service management	None	High/ Switch
Service discovery	Locating a service available by a Bluetooth device	None	High/ Switch
RE COMM	A subset of the ETSI TS 07.10 standard, emulation of serial port over the Logical link manager	None	High/ Switch

Ird Interoperability	Interoperability for applications over Bluetooth and infra-red protocols	None	High/ Switch
Telephony control protocol	Call control signaling and establishing of speech and data calls between Bluetooth devices	none	High/ Switch
Interoperability requirements for Bluetooth technology as WAP bearer	Bluetooth protocol with PPP as communication bearer for WAP	none	High/ Switch
Host control Interface	Command interface to the baseband controller and link manager, and access to status information	none	High/ Switch
Generic Access Protocol	Generic procedures for Discovery of services and connection of Bluetooth devices	none	High/ Switch

Service discovery application profile	Procedures for an application in a Bluetooth device to discover the services in other Bluetooth devices	none	High/ Switch
Cordless Telephony Profile	Procedures in an all in one handset	none	High/ Switch
Intercom Profile	Support for intercom feature in an all in one handset	none	High/ Switch
Serial Port Profile	Procedure for emulation of serial cable	none	High/ Switch
Headset Profile	Headset use over Bluetooth wireless link	none	High/ Switch
Dial up Networking Profile	Support for dial up networking in a device with Bluetooth wireless technology	none	High/ Switch
FAX Profile	Support for fax transmission or reception on a device with Bluetooth wireless technology	none	High/ Switch

LAN Access Profile	Defines how device with Bluetooth wireless technology can access a LAN with PPP	none	High/ Switch
Generic Object Exchange Profile	Defines the possibility of Generic Object Exchange	none	High/ Switch
Object Push Profile	Support for object push model	none	High/ Switch
File Transfer Profile	Support for file transfer	none	High/ Switch
Synchronization Profile	Synchronization of Bluetooth enabled device, e.g. PDAs Laptops	none	High/ Switch

Table 1 shows the elements of the Bluetooth protocol, generally, as currently implemented. Other profiles may be added in the future (or may have already been added), and it is anticipated that these profiles will be high-level protocols, which do not have strict real time requirements.

As shown in Table 1, the Link Manager and the Host Controller Interface can be implemented in either the Base Station or in the Switch. Although the Link Manager and Host Controller Interface, do not require real time performance, they may readily be implemented in the base-band controller of the

Base-Station. It is within the scope of the invention that any of the high-level protocols can also be implemented in the Base Station as part of the low-level protocol, but then they will take part in the handoff.

According to the inventive technique of dividing the low-level and high-level protocols, the high-level protocols are "buffered" from the occurrence of handoff by the Base Stations and the routing task that runs on the Switch. Therefore, the present invention allows mobility of any device with Bluetooth wireless technology that supports any of the high-level protocols (e.g. LAN access, WAP, FAX, FTP). The solution for mobility of cordless phones, described hereinabove, is only an example of how the methods can be utilized.

As described hereinabove with respect to FIGS. 8A and 8B, different instances of the low-level protocols that represent the same connection (e.g., 281, 281') need to be synchronized. Table 2, presents elements (parameters) of the low-level protocols that the Base Stations will synchronize. For each element, it also shows whether rough or fine synchronization is required. Again, the protocols are described, by way of example, in the context of the Bluetooth short-range communication protocol.

Rough synchronization may be achieved via the local area network (see, e.g., LAN 140, FIGS. 9A and 9B) connecting the Base Stations. Fine synchronization may be achieved by other methods described in greater detail hereinbelow.

TABLE 2

Low-Level Protocol Synchronization

Element/ Parameter	Description	Synchronization method
device address	The unique address of the Base Station, determines the hopping sequence, effects the encryption and authentication keys.	Via LAN
TOD	Time Of Day, measured in micro-seconds, it determines the exact timing of the hopping sequence	Rough synchronization via LAN, fine synchronization by other methods
SCO	Synchronous voice channels allocation	Via LAN
FEC	Forward error correction parameters	Via LAN
Encryption key	Used to encrypt data and voice	Via LAN
Authentication key	Used to initiate a connection	Via LAN
Voice coding	Method of voice coding: CVSD or PCM	Via LAN
AM_ADDR	Address of member in a picocell	Via LAN

PM_ADDR	Address of a paired handset (energy saving mode, when the handset is inactive)	Via LAN
ACL	Definition of the asynchronous data link	Via LAN
FIFO	Data FIFOs	Flush of data, and using flow control to halt data during handoff

All the parameters listed in Table 2, except for the TOD, can be sent prior to handoff, thorough the local area network (e.g., LAN 140), or any other communication link connecting the Base Stations. As described hereinabove with respect to FIG. 9A, rough (coarse) TOD can also be sent through the LAN.

If one of the other parts of the Bluetooth protocol stack is also implemented in the Base Station, then it will also take part in the handoff. Synchronizing the instances of the same protocols in different Base Stations is done as described above, by sending internal state parameters via the local area network (LAN 140). For example, by implementing the Link Manager and Host Controller Interface in the Base Station, the internal state parameters of these protocols will be broadcast to the neighboring Base Stations, by the Base Station that is connected to the handset.

Fine Synchronization

As mentioned hereinabove, in order to achieve fine synchronization of TOD, the Base Station that is waiting for the handset, should passively monitor the transmission of the handset and/or the Base Station that is currently connected with the handset. In FIG. 9B, the two possible signals that the receiving (next) Base Station 124 can monitor are shown, one originating from Base Station 123, and the other originating from the handset 121 which is currently connected to the Base Station 123.

According to the invention, the next Base Station 124 can be finely synchronized by receiving synchronization signals from the current Base Station 123. Normally, the Base Station 124 does not receive signals from the Base Station 123. Therefore, to facilitate the Base Station 124 receiving synchronization signals from the Base Station 123, Base Station 123 periodically transmits with higher transmission power than during normal transmission. This allows the Base Station 124 to receive transmissions from Base Station 123, without a substantial increase in spectral contamination. The inventive technique is described in the context of frequency-hopping. Frequency-hopping techniques are well known, including techniques that change frequency with each hop.

FIG. 10 illustrates a technique for controlling the transmission power of a Base Station (e.g., 123) that is currently connected with the handset, for a plurality (series) of successive hops 290. The vertical axis of the graph is the Base Station's transmission

power (in arbitrary units), and the horizontal axis is time. T.sub.h is the duration of a hop 290. In this example, the hops 290 all have equal duration. T.sub.p is the time interval between successive hops (or "hop time slot") and, in this example, the intervals between successive hops are constant (evenly spaced in time). The normal transmission power for each hop 290 is P.sub.0. For example, in a short-range communication system, the normal transmission power P.sub.0 of a Base Station is suitably on the order of a hundreds of milliwatts.

According to the invention, in order to effect synchronization between a Base Station and its neighboring Base Stations, every Kth hop 290' is a "synchronization" hop that is transmitted with increased power P.sub.1. P.sub.1 is suitably substantially (e.g., 2-10 times) greater than P.sub.0. In the case that the transmitter changes the transmission frequency in each hop, every Kth (synchronization) hop will also be transmitted at a different frequency.

Alternatively, it is within the scope of the invention that a variable time interval (Tp) is provided between the synchronization hops 290' that are transmitted with high power P.sub.1. For example a changing K (that shall be denoted by K(n), i.e. K for hop number `n`), can be generated by a pseudo random sequence such as a maximal length shift register sequence. Pseudo random sequences are well known for use in communication systems.

In the case that a beacon transmitter (e.g., 299) is used (in addition to signals received from the

Base Station and handset) to synchronize the Base Stations (see, e.g., FIG. 9C), it can suitably transmit the beacon signal once in K hops, and K can either be constant or it can be changed over time (variable), as described above.

Low-Level Synchronization at the Base Station

FIG. 11 illustrates major components of a Base Station 1100 waiting for handoff, and a method of accurately synchronizing the TOD at the Base Station to the TOD of the Base Station which the handset is about to leave, including:

Time Clock 310;

TOD counter 303;

Antenna 301;

Receiver 305;

Frequency Hopping Generator 304;

Emulator 307;

Correlation Detector 308; and

Adder (ADD) 309;

all connected as illustrated in the figure and as discussed hereinbelow.

As described hereinabove with respect to FIG. 9A, a rough TOD from the Base Station currently

connected with the handset is available to the (next) Base Station waiting for a handoff on a communication link such as the LAN 140. This rough TOD is provided to the TOD counter 303 (e.g., via an interface to the LAN 140). A Time Clock 310 generates clock signals for incrementing the TOD counter 303. The output of the TOD counter 303 is therefore a rough estimate of the TOD ("TOD Estimate"). There is an uncertainty (margin of error) "Tu" between the rough estimate of TOD and the actual TOD, and which depends on the transmission latencies thorough the LAN 140. "Tu" is readily calculated for a given WPBX system, according to its physical configuration.

From the rough estimate of the TOD output by the TOD counter and the device address ("Commonly denoted by Media Access Control Address, or MAC address",), a frequency-hopping list is generated by a frequency-hopping generator 304 and supplied to an emulator 307 which emulates the output of the receiver 305. In a window with size of 2OT.sub.u, a single frequency from the hopping sequence is chosen, and the receiver 305 will wait on this frequency for duration of 2-T.sub.u. Once in a period of 2-T.sub.u, the receiver 305 will switch frequency, in response to a signal generated by the frequency-hopping generator 304. Opening an acquisition window of 2-T.sub.u ensures that during this time duration the receiver 305 will capture at least one hop. A correlator/detector 308 receives the receiver's output (e.g. a base-band or intermediate frequency signal) and an emulation 307 of the signal that should appear at the receiver's output. The output of the receiver 305 can be emulated, since a

rough estimate of the TOD is available, and also from the hopping frequency list, and the receiver frequency list. The emulator 307 continuously checks for a match between receiver frequency and the hopping frequency and, when it finds a match, it reports the frequency and the time (rough TOD) to the correlator/detector 308. By comparing the actual received signal with the emulation that is based on the rough TOD, the correlator 308 computes (and outputs) a fine estimate of the TOD offset (i.e., the error between the TOD estimate and the actual TOD), and provides this to Adder 309, which also receives the rough TOD estimate from the TOD counter 303 and generates a signal ("Fine TOD") indicative of the actual TOD. Correlator-based time offset measurement is a standard estimation method that is described in many textbooks, and an example of its implementation is described in greater detail hereinbelow.

Since the Base Station to which the call is to be handed "knows" which call it is going to receive, and it has received the call parameter (via the LAN), and is able to accurately estimate the TOD, it will be able to perform a seamless handoff, transmitting substantially exactly as the Base Station that the handset is about to leave. As mentioned above, an iteration of the low-level protocol (e.g., 281') can be prepared at the receiving Base Station in anticipation of the handoff.

Call Routing Task (282)

The higher-level protocols are run at the Switch, and are therefore "ignorant" of the handoff

processes. At the Switch the "call routing task" 282 (FIGS. 8A, 8B) isolates the high-level protocols from the changing environment. The "call routing task" 282 maintains the "Connections Table", which contains information about all the connections between handsets and Base Stations. Maintaining the Connections Table is described in greater detail hereinbelow. The following sections describe an example of how the Connections Table is used by the "call routing task" 282.

The following information is included in the Connections Table:

1) Handset ID

2) Current Base Station ID

3) Handle (of instance) of high-level protocols

4) Handle (of instance) of low-level protocols

5) Number of candidate Base Stations for handoff

6) List of candidate Base Stations for handoff

7) List of Handoff status for each candidate Base Station (i.e., Idle/Started)

The messages that the high-level protocol (that runs on the Switch) and the low-level protocol (that runs on the Base Station), send each other have the following format:

1) Message Header

Origin:

from low-level protocol

from high-level protocol

Handset ID

Base Station ID

Low-Level Protocol Handle in the Base Station (number of instance of low-level protocol)

High-Level Protocol Handle in the Switch, (number of instance of high-level protocol)

HEC (header error correction)

2) Message Data

3) CRC (Cyclic Redundancy Check)

FIG. 12 illustrates a method of implementing the "call routing task" 282 which was mentioned hereinabove with respect to FIG. 9A. The "call routing task" 282 is performed in the Switch 129.

In a first step 351, the call routing task 282 waits for a message from one of the high-level protocol instances running on the Switch 129 or from one of the low-level protocol instances running on the Base Stations (e.g., 123). Then, in a step 352, it is determined where the call came from.

If the message arrived from one of the Base Stations (step 352, "Y"), the call parameters are compared with the Connections Table (step 353) and the message is sent (step 354) to the instance of the high-level protocol running on the Switch (129).

If the message arrived from the Switch (step 352, "N") the ID of the sending low-level protocol instance is located (step 353) in the "Connections Table", and the message is sent (step 354) to an instance of a corresponding high-level protocol. If the message arrived from one of the high-level protocols (step 352, "N"), it is determined (step 360) whether a handoff has begun (is in progress). If a handoff is not in progress (step 360, "N"), the call parameters are compared with the Connections Table (step 358) and the message is sent to the Base Station on which the destination low-level protocol instance is running (step 359). If a handoff is in progress (step 360, "Y") the call parameters are compared with the Connections Table (step 355) and the message is sent to the Base Station on which the destination low-level protocol instance is running (step 356). The message is also sent (step 357) to all the Base Stations that are candidates for handoff--e.g., neighboring Base Stations. The Base Stations receiving the message can then check if they are running the destination low-level protocol and, if not, the message is simply discarded. The procedure shown in FIG. 12 handles a single message. By using a multi-tasking operating system, it is possible to run several instances of these procedures, and thus handle more than one message simultaneously.

Detecting a Handset

The methods described thus far enable the communication protocols to continue operation when a handoff occurs. They rely on the ability to determine, which handset is in the coverage area of which Base Station, where a handset is moving, and when is the best time to perform handoff. By definition, handoff occurs between only two Base Stations, but for a certain time prior to the actual occurrence of the handoff there may be more than one Base Station that are candidates for handoff. Determining the candidates for handoff, which Base Station will actually participate in handoff and when to perform handoff requires collaboration of the Base Stations and the Switch.

As is evident from the discussions hereinabove, the handsets do not actively participate in the handoff operations. Therefore, the Base Stations will determine which handsets are in their coverage range, by either passively capturing transmission information, or by "tricking" the handset to transmit information that can be used for that purpose.

As discussed hereinabove, each Base Station will transmit, to all the neighboring Base Stations, information about the calls that are taking place in its coverage area. This information will include all the call parameters that can be sent through a low bandwidth communication link, such as the shared local area network (e.g., LAN 140). This information is sufficient for detecting which handset is moving

from one of the neighboring Base Stations into the coverage area of a Base Station.

FIG. 13 illustrates major components of a Base Station 1300, waiting for handoff, and a method of accurately synchronizing the TOD at the Base Station to the TOD of the Base Station, which the handset is about to leave, and a passive method for detecting the arrival of a handset in a Base Station's coverage area during a call, including:

Three TOD counters 371, 380 and 384 (compare 303)

Antenna 382 (compare 301);

Receiver 379 (compare 305);

A Receiver Frequency Controller 375;

Three Hopping Sequence Generators 372, 373 and 374;

Three Emulators 376, 377 and 378;

Three Correlators 381, 382 and 383 (compare 308), all connected as illustrated in the figure and as discussed hereinbelow.

FIG. 13 illustrates a passive method for determining which handsets' (i.e. handset which is participating in a call with a certain device address) transmissions is being received by a Base Station.

A plurality ("K", three shown) of TOD counters 371, 380 and 384 are set when a rough TOD ("Rough TOD") estimate is received, via the LAN (140), from other Base Stations. The counters 371, 380 and 384 are incremented by the TOD clock 310. Using the TOD and the device addresses ("Bluetooth Device Address") that are connected to calls in which handsets in the neighboring cells (connected to neighboring Base Stations) participates, a corresponding plurality ("K", three shown) of hopping frequency (sequence) generators 372, 373, 374 generate the list of frequencies in which the handsets are likely to transmit.

The receiver frequency controller 375 sets the frequency, which the receiver 379 will monitor. A plurality ("K", three shown) of correlators 381, 382 and 383 is used to compare the energy at the receiver's output, to the emulation of the receiver's output. The output of the receiver can be emulated, since a rough estimate of the TOD is available, as well as the hopping frequency list, and the receiver frequency list. The emulator continuously checks for a match between receiver frequency and the hopping frequency, when it finds the match it reports to the correlator the frequency and the time. By comparing the actual received signal with the emulation that is based on the rough TOD, the correlator detect the presence of the transmitter and computes a fine estimate of the TOD offset (i.e., the error between the rough TOD estimate and the actual TOD). Correlator-based time offset measurement is a standard estimation method that is described in many textbooks, example of implementation shall be described later on. The number of handsets that can

be detected simultaneously is equal to the number of hopping sequence generators, and the number of emulators of receiver output, and the number of correlators.

In FIG. 13 up to `K` handsets can simultaneously be detected. The main advantage of the method described above is that since the detection is passive, there is no need to achieve fine synchronization between Base Stations. Another advantage of this passive method is that there is no need to decode the messages that the handset transmits, and therefore it is relatively easy to implement.

The receiver frequency controller 375 selects the frequency on which the receiver 379 will wait to "capture" hops. To increase the probability of detection, the receiver frequency controller 375 should be programmed to choose frequencies that are not blocked by interferences (e.g., interferences from other than Bluetooth transmitters). For each frequency that the receiver frequency controller 375 chooses, a histogram of the number of hops that have been detected in a certain duration of time, and their average signal-to-noise ratios are maintained by the receiver frequency controller 375. A measure of the spectral "cleanness" of a certain frequency can be determined as a function of the signal-to-noise ratios (SNRs) of the hops--for example, as the number of hops multiplied by the average signal-to-noise ratios (SNRs) of the hops.

The receiver frequency controller 375 preferably chooses a group of `M` frequencies that

have the best "cleanness" measure, and the receiver 379 waits on them most of the time, when once in T1 milliseconds the controller changes the frequency. Once in T2 milliseconds (T2 is selected to be much larger then T1) the receiver frequency controller 375 selects a frequency which is not in the group of `M` best, and the receiver 379 waits on it for T3 milliseconds (T3 is selected to be smaller then T1). This enables the receiver frequency controller 375 to monitor the "cleanness" of frequencies that are not in the `M` best frequencies. If the receiver frequency controller 375 detects a frequency that is cleaner then one of the `M` frequencies that is in its list, it puts it in the list, instead of the frequency with the lowest "cleanness" measure. Typical values for the parameters M, T1, T2, T3 are 20, 250, 2500, 100, respectively.

Generally, the signal-to-noise ratio (SNR) or signal-to-interference ratio for each hop is measured by measuring the bursts of energy which match the expected hop duration, to all other signals that do not match the hop duration. The average noise level is continuously monitored. When the energy increases for duration ranging from Th-D to Th+D (Th is the nominal hop duration; D is a measurement "window" interval), the hop energy will be computed, and it will be added to the average hop energy. During the duration of the hop the average noise level is not be updated. Typical values for Th and D, are 0.65 milliseconds, and 1000 milliseconds respectively.

Another Method of Detecting a Handset

An alternative method for detecting a handset which enters the coverage area of a Base Station, is now described. This method is also passive, and also relies on a handset being engaged in a call in order to detect the handset. This method requires fine synchronization between the Base Stations and therefore is somewhat more complicated than the passive method previously described, but using this method has a few substantial advantages over the method previously described, including:

improved detection performance,

improved timing of handoff, and

the ability to detect a moving handset that is not currently participating in a call.

According to the invention, once in a while the Base Station that is currently communicating with the handset will "give up" (omit, yield to its neighbors) a short transmission duration, during which one or more neighboring Base Stations may transmit to the handset. In order for the handset to receive their transmission, the neighboring Base Station(s) must therefore be synchronized with the Base Station that is currently communicating with the handset, and during the time that the neighboring Base Station(s) transmits, it (they) acts as if it were the Base Station that has yielded a transmission slot for handset detection by the neighboring Base Stations.

This method can be illustrated in the context of the Bluetooth short-range communication, wherein frequency hopping is used. The Base Station that is currently communicating with the handset, will give up a single hop. Any of the neighboring Base Stations that are not close to each other may use the same hop to transmit to the handset. The neighboring Base Stations that are close to each other will use different hops to call (communicate with) the handset. This is illustrated in FIGS. 14A, 14B, 14C and 14D.

FIG. 14A, which is similar to FIG. 1, illustrates a wireless communication system 1400 (e.g., WPBX) having a Base Station 391 that is currently communicating with a mobile unit 390 that is a wireless telephone handset, and a plurality (six shown) of neighboring Base Stations 392, 393, 394, 395, 396 and 397 that are waiting (available) for the handset 390 to enter their coverage areas. Each Base Station 391, 392, 393, 394, 395, 396 and 397 has an area of coverage 391a, 392a, 393a, 394a, 395a, 396a and 397a, respectively. The interconnections between the Base Stations, and between the Base Stations and a central Switch, such as shown in FIGS. 2 and 4, are omitted, for illustrative clarity.

FIG. 14B, which is similar to FIG. 10, illustrates that the Base Station 391 which is currently communicating with the handset 390, periodically (once in K hops) transmits with higher power P.sub.1, in order to enable the neighboring Base Stations to synchronize their TOD. According to the handset detection technique being discussed,

the Base Station 391 also periodically (once in M hops) skips a transmission on a single hop 702, 703 (shown as dashed lines) in order to allow the neighboring Base Stations 392, 393, 394, 395, 396 and 397 to transmit at these times. As shown in FIG. 14C, three of the neighboring Base Stations 393, 395, 397 transmit on even-numbered skipped hops 705. As shown in FIG. 14D, the other three of the neighboring Base Stations 392, 394, 396 transmit on odd-numbered skipped hops 707. At other times (other than the hops 705, 707), the neighboring Base Stations 392, 393, 394, 395, 396 and 397 may transmit normally to other handsets (not shown) to which they are connected.

As described hereinabove, the Base Station that is communicating with the handset sends the call parameters to neighboring Base Stations via the local area network (LAN 140) that connects all of the Base Stations. It will also send information regarding the timing of hops that they may use to call handsets that it is communicating with. As described hereinabove with respect to FIG. 11, the neighboring Base Stations can synchronize the TOD. According to the timing of the hops received with high energy (P.sub.1), the Base Stations that wait for the call, can determine the times in which they are allowed to try to call the handset. In these times the Base Stations transmit to all handsets that are communicating with neighboring Base Stations.

Detecting Movement of a Handset

The two techniques for detecting a handset, described immediately hereinabove, are "passive" in

the sense that they do not require any actions to be taken by the handset, other than the initial action of being engaged in a call (connected to a Base Station). The technique described immediately hereinbelow is "active" in the sense that it requires some further participation (albeit minimal) from the handset. However, such a mechanism is standard in most wireless communication protocols, even in those that were not originally meant to support mobility (handoff). In either case ("passive" or "active"), it is important to recognize that the present invention can work with standard handsets, without modification thereto.

Although the handsets do not need to have a mechanism for supporting (actively participating in) handoff, they preferably have a mechanism that allows checking whether their communication links are operating normally. For example, in the Bluetooth short-range communication link, a "PING" command that is sent on the asynchronous link is used to check whether the data communication link is operative. When the handset receives a "PING" command it will automatically respond with an "ECHO" message (response). Since the "PING" command is sent on an asynchronous link, and not the synchronous link that is used for voice communication, in does not disrupt the voice quality, but only slightly (and temporarily) reduces the available bandwidth for data transfer.

The "PING" command includes the following data fields:

Device address

Identifier

Length

Data (optional)

The "ECHO" response includes the:

Identifier

Length

Data (optional)

In the Identifier, an identification of the originating Base Station is sent. Hence, when the handset replies it is possible for any Base Station receiving the "ECHO" reply to know which Base Station originated the reply.

The "PING" command and "ECHO" response are used by a Base Station in order to determine whether a certain handset has entered its coverage area. Unlike the methods of passively detecting the handset presence, discussed hereinabove, this method allows detection of a Base Station that was not actively engaged in a call at the time of handoff. It is enough for the handset to have only created an initial communication with a Base Station.

FIGS. 15A and 15B, illustrate the use of "PING" command and the "ECHO" response by the Base Station that is waiting for the call.

As shown in FIG. 15A, the handset 121 is currently communicating with the Base Station #1 123 via communications link 122. During this time, the Base Station #2 124 that is waiting for the call will periodically send a "PING" command 145 to the handset 121. When the handset 121 enters the coverage area (is in range) of the waiting Base Station 124, and when it receives a "PING" command with its address, it will reply with an "ECHO" response 146. The "ECHO" response 146 is also received by the Base Station #1 123.

The waiting Base Station #2 124 transmits the "PING" command 145 during the hops that the Base Station #1 123 has dedicated (yielded) for this operation, as described hereinabove (see, e.g., FIG. 14B, 702, 703). The "ECHO" reply 146 will be received by both Base Stations 123 and 124, whereupon the Base Stations 123 and 124 can each measure the quality of the received signal ("ECHO") and report the measurements to the Switch (e.g., 129; FIG. 2). Based on this measurement of the quality of the received signal, the Switch 129 can compare signal quality and decide when is the right time to perform the handoff, and implement the handoff procedures described hereinabove.

FIG. 15B illustrates an alternative, "active" method for detecting the handset 121. In this example, The Base Station #1 123 that is currently connected to the handset 121 transmits a "PING" command 147, once in M hops. The handset 121 replies with an "ECHO" response 146' for each "PING" command 147 it receives. When the handset 121 enters the coverage area of neighboring Base

Station #2 124, the neighboring Base Station #2 124 will receive the "ECHO" response 146' by monitoring each Mth hop, in order to receive the "ECHO" response of the handset 121 that is approaching it. When the neighboring Base Station #2 124 receives the "ECHO" response 146', it measures the quality of the received signal, and reports to the Switch 129. This method is different from the method previously described with respect to FIG. 15A in two aspects:

1) In the method of FIG. 15B, the Base Station 123 connected to the handset, does not skip each Mth hop, but rather transmits a "PING" to the handset

2) In the method of FIG. 15B, the neighboring Base Stations (e.g., 124) do not transmit "PING"s to the handset 121--rather, they only passively monitor each Mth hop.

The quality of each hop may be measured by many known methods, such as energy level measurement, signal-to-noise ratio (SNR) measurement, packet loss ratio and bit error rate measurement (BER) that can be performed on the header of each message.

Another Handset Detection Technique

Each Base Station maintains a "Neighbor Connections Table", which includes information about the connections between handsets and neighboring Base Stations. The "Neighbor Connections Table", includes the following information:

Connection number

Handset ID

Base Station ID

Handoff status: Idle/Started

Handset detection status

Number of successful "PING"

Time of last successful "PING"

Quality measurements in successful "PING"

FIG. 16A illustrates a technique (procedure) for detecting a handset that enters the coverage area of a Base Station when (as in the example of FIG. 15B) the Base Station that the handset is currently connected to generates the "PING" command that is sent to the handsets. All of the Base Stations (e.g., 391-397; FIG. 14A) preferably perform the same detection procedure, whether they the handset is connected with them or not.

When a hop is due (steps 400, 401), the even-numbered hops are used by the handset, and the Base Stations use the odd-numbered hops. In a step 402, a hop counter is incremented by one, and if (as determined in the step 403) it is the Kth hop, the Base Station will to try to send a "PING" to one of the handsets that are candidates for handoff. If it is not the Kth hop (step 403, "N"), the Base Station waits for the next hop (step 400).

As used herein, "NMAC" represents the address of the handset that will be called, and "NegTab" is an abbreviation of "Neighboring Connection Table".

If handoff has not started yet with any handset (step 404, "N"), all the handsets will be called in order. The pointer to the NegTab is incremented (step 405), and the address of the handset is retrieved from the NegTab (step 406). The Base Station then transmits a "PING" command with the address of the handset (step 407). When handoff has already started with one or more than one handsets, these handsets are "PING"ed more often than the others. The next item in the NegTab is checked (step 411) and, if handoff with it has already started, it will be "PINGED" (steps 412, 407). The handsets that have not started handoff, will be "PING"ed only once in K2 "PING"s (steps 410, 413, 414).

When an "ECHO" is received (step 420, "Y") and it is determined to be from a handset that communicates with a neighboring Base Station (step 419, "N"), it will be compared to all the entries in the "Neighbor Connections Table" (NegTab) 421,422. If it is found in the NegTab (step 422, "Y"), the quality of the hop is measured (step 423) and a record of the average quality in the previous hops is maintained in the "Neighbor Connections Table" (step 424). The following measurement parameters are sent to the Switch (step 425):

Base Station communicating with handset

Base Station originating "PING"

Base Station receiving "PING"

Identification of handset

Quality of received signal

FIG. 16B illustrates a procedure that a Base Station performs when it receives an "ECHO" response from one of the handsets that are connected to it (from FIG. 16A, step 419, "Y"). The "ECHO" response can be received either when the connected Base Station or one of its neighbors sends a "PING" message to the handset. (See, e.g., FIGS. 15A and 15B.) First, the Base Station checks to see if the "ECHO" reply was caused by itself, or by one of the neighboring Base Stations (steps 430, 431). This information is contained in the Identifier of the "ECHO" reply, as described hereinabove.

If the "ECHO" was caused by a neighboring Base Station (step 431, "Y"), the quality of the received signal is measured and averaged (step 432), and the measurement parameters are sent the Switch (step 433) to be used by the Switch in determining when to perform handoff. If the Base Station itself caused the "ECHO" reply (step 431, "N"), the task simply exits ("B").

FIGS. 16A and 16B illustrated the procedure of transmitting the "PING" from the Base Station that the handset is connected too, and detecting the arrival of a handset from a neighboring Base Station.

FIG. 23 illustrates a procedure for performed by the Base Station when reception or transmission of a hop is required (steps 1200, 1201). Once in K hops (step 1202), if the next time slot is for transmission (step 1203), the Base Stations sends a "PING" to one of the handsets that are connected to it. Tcount is incremented (step 1204), and the next handset that appears in the list of handsets (Connection Table, or "ConTab") that are connected to the Base Station is chosen (step 1205).

The "PING" is sent with the address taken from the ConTab (step 1206). When it is time to receive a hop, the receiver looks for an "ECHO" response (step 1207). If an "ECHO" is received, and it originator was a neighboring Base Station (step 1208), the parameters are compared to the NegTab (step 1209), and if it is found in the table (step 1214), the quality of the signal is measured (step 1210) and averaged (step 1211). If the "ECHO" response was to a "PING" command that originated from the same Base Station, the quality is measured (step 1213). In both cases the connection parameters and the quality are sent to the Switch (step 1212).

When an "ECHO" response is received (FIG. 16A, step 425; or FIG. 16B, step 433; or FIG. 23, step 1212), the following data is sent to the Switch:

Received quality

If from handset from neighbor Base Station, the average quality of the received "PINGS"

If from handset connected to same Base Station, the received quality that is monitored continuously, and also the average quality of the received "PINGS"

Base Station originating "PING"

Base Station receiving "ECHO"

Base Station currently connected to handset

Measurement TOD

Performing Handoff

Two methods for detecting that a handset moves from one Base Station to another have been described hereinabove. The first handset detection method (FIGS. 13, 14A, 14B, 14C, 14D) is based on passive monitoring of the handset. In the second handset detection method (FIGS. 15A, 15B, 16A, 16B) the handsets are actively "PING"ed, and their "ECHO" responses are noted. Using either one of these two methods, a Base Station that is connected to a handset continuously sends received quality measurements to the Switch and, when a neighboring Base Station detects a handset, a quality measurement is also sent by the neighboring Base Station to the Switch. A Base Station receiving an "ECHO" from one of the handsets that are connected to it (e.g., FIG. 15B), also sends the quality measurement to the Switch. The decision as to when to perform handoff, between one Base Station and another, is made at the Switch, which uses these signal quality measurements from the Base Stations to determine the time for and

destination of a handoff. FIG. 17A illustrates a method for making the handoff decision, when a passive detection method is used. FIG. 17B illustrates a method for making the handoff decision, when an active detection method is used.

FIG. 17A illustrates a procedure that is implemented at the Switch (129) in order to decide to which Base Station the handset should be handed. Energy measurements from two or more (three shown) Base Stations 801, 802 and 803 receiving a signal (i.e., the same signal) from a single handset (i.e., the same handset, not shown) are provided to the Switch, as described hereinabove (e.g., over the LAN 140). At the Switch, these measurements are "smoothed" by a plurality (three shown) of sliding window averaging filters 804, 805 and 806, respectively, and they are compared with one another by decision (handoff control) logic 807, which issues a signal ("Select Base Station") to effect handoff. The sliding widow average filters 804, 805 and 806 compute the average quality received from a given Base Station over the previous T.sub.r milliseconds, typically hundreds of milliseconds, (over a time interval encompassing at least two subsequent signals from the receiving Base Station), taking into account only the times in which the handset signal was received by more than one Base Station.

The following pseudo-code describes a preferred operation of the decision logic 807:

The inputs to the decision logic are marked by $X_l \ldots X_k$

The current Base Station communicating with the handset is Base Station `m`

(1) If maximum (X_l, . . . ,X_k)=X_j

(2) If $X_j > X_m + D_1$

(3) If time from previous handoff > T_d

(4) Transfer call to Base Station j

(5) If $X_j > X_m + D_2$

(6) Transfer call to Base Station j

If a Base Station receives the handset at a level which is stronger by at least D_1 decibels than the level which is currently received by the Base Station with which the handset currently communicates, and at least T_d milliseconds have passed from the last handoff, a handoff is required. This is intended to address the situation of a moderate and slow movement of a handset from one Base Station to another.

If a Base Station receives the handset at a level, which is stronger by at least D.sub.2 decibels than the level, which is currently received by the Base Station with which the handset currently communicates a handoff will be performed immediately. This is intended to address the situation of an abrupt move from one Base Station to another.

When the Base Stations use one of the active methods to detect handset presence, the decision algorithm is basically the same as has just been described. The main difference comes from the fact that in the active method the different Base Stations are able to determine the quality that they measured for a single hop, which all of them can identify. Therefore, the Switch is able to compute the quality difference per hop, and thus improve the timing accuracy of handoff.

FIG. 17B illustrates the handoff decision method when using an active detection method. According to the TOD indication that is received along with the quality measurements, the measurements of the same hops are aligned in time (808). They are then averaged over X hops (804, 805, 806), and the same decision logic (807) that was described above may be used to determine which is the most suitable Base Station to connect to the handset, and issue the "select Base Station" signal.

The methods described hereinabove relate to performing handoff between Base Stations when the handset is conducting a call. When a handset is not conducting a call it may move from one Base Station to the other. When it moves, one connection will be ended, and another will be created. The mechanism for ending a connection, and initiating a new one is part of the short-range wireless communication protocol. For example in the Bluetooth protocol, the handset searches for a Base Station, when it finds one, it stays connected to it. If it leaves the coverage area of the Base Station, the connection will end, and the handset will search again for a Base Station.

This mechanism is sufficient for a handset that is not currently in a call, but it does not guarantee smooth handoff while in a call. Although this method may be suitable in some conditions, disconnecting from one Base Station and re-establishing connection with the other may take several seconds, and during this time it will not be possible to initiate a call. One of the advantages of the method of actively "PING"ing a handset is that its movement can be detected quickly, even when it is not engaged in a call, and this "waiting" period can be eliminated.

Operation Procedures

The following sections describe the operation procedures of the Base Stations and the Switch, that are used on the following events:

A new connection is created

A connection is closed

A handset presence is detected

Switch decides on handoff

Handoff performed by Base Stations

When receiving an update message from a Base Station

Base Station Procedures:

1) New connection created:

Create new low-level protocol instance.

Add connection to "Base Station Connections Table"

Set reserved hops for neighbors transmissions (if active detection method is used)

Send new connection information (handset ID, Base Station ID, handle to low-level protocol instance) to Switch

Send new connection information to all neighboring Base Stations (handset, id, Base Station id, reserved hops, call's parameters: TOD, device address, encryption key, authentication key, links status, etc.)

2) Connection closed:

Close low-level protocol instance.

Remove connection from "Base Station Connections Table"

Send closed connection information to Switch (handset ID, Base Station ID, handle to low-level protocol instance)

Send closed connection information to neighboring Base Stations (handset ID, Base Station ID)

3) Receive new connection information from neighboring Base Station

Add connection information to "Neighboring Connections Table"

4) Receive closed connection information from neighboring Base Station

Remove connection from "Neighboring Connections Table"

5) Detect presence of handset in coverage area

Create low-level protocol instance.

Synchronize TOD

Measure received quality

Update Switch (handset ID, neighbor Base Station ID, and Base Station ID, TOD, handle of low-level protocol instance).

6) Receive message from high-level protocol

Check if corresponding low-level protocol is running on Base Station and, if it is:

Route message to the corresponding low-level protocol instance.

7) Receive handoff command with TOD of handoff

If the Base Station is the Base Station currently communicating with the handset:

Wait until handoff TOD

Stop transmissions to the handset

Move connection parameters from "Base Station connection table" to "Neighboring Connection Table"

If the Base Station was a neighbor of the Base Station communicating with the handset:

Wait until handoff TOD

Start transmitting to handset

Route call to destination Base Station or Switch

Send new connection information (handset id, Base Station ID, handle to low-level protocol instance) to Switch

Send new connection information to all neighboring Base Stations (handset, ID, Base Station ID, reserved hops, call's parameters: TOD, device address, encryption key, authentication key, links status, etc.)

Switch procedures:

1) Receive new connection information

Create instance of high-level protocol

Update "Connections Table"

1) Receive close connection message

Close high-level protocol instance

Remove from "Connections Table"

1) Receive quality measurement from Base Station

If from Base Station connected to the handset,

Store measured quality and TOD of measurement

Check if a neighboring Base Stations should be removed from the handoff candidate list (according to last TOD in which they detected the handset), and remove if necessary

If from a neighbor of the Base Station connected to the handset,

Add neighbor as candidate for handoff to "Connection Table" with TOD of message.

Perform quality comparison and decision of handoff.

If a handoff is required:

Send handoff commands to the originating Base Station and the Base Station receiving the handset.

Update "Connections Table"

When there is more than one Switch in the system (see, e.g., FIG. 22) the Switch procedures will be slightly different, as follows:

1) Receive new connection information

   Create instance of high-level protocol

   Update "Connections Table"

   Send new connection information to all the Switches.

1) Receive close connection message

   Close high-level protocol instance

   Remove from "Connections Table"

   Send remove connection to all Switches

1) Receive quality measurement from Base Station

   If from Base Station connected to the handset

   Store measured quality and TOD of measurement

   Check if the neighboring Base Stations should be removed from handoff candidate list (according to last TOD in which they detected the handset), and remove if necessary

   If one of the neighboring Base Stations is connected to a different Switch, send updated information to the other Switch.

   If from a neighbor of the Base Station connected to the handset

Add neighbor as candidate for handoff to "Connection Table" with TOD of message.

Perform quality comparison and decision of handoff.

If a handoff is required:

Send handoff commands to the originating Base Station and the Base Station receiving the handset.

Update "Connections Table"

Update "Calls Table"

Send information to all Switches

1) Receive update from another Switch

If new connection: add item to "Connections Table"

If closed connection: remove item from "Connections Table"

If quality measurement: update "Connection Table"

If handoff

Update "Connections Table"

Update "Calls Table"

The Switch also keeps a LOG file of the events in the system. The LOG file includes the quality measurements, call parameters (time, caller ID, called ID, reason for termination, etc.) and the handoff decisions. These may serve to analyze the Base Station's topology and allow for topology improvements and adjustments. For example the reason for a call termination may be correlated to low receive quality, which could imply that there is a "hole" in the coverage pattern.

Detection and Time Synchronization

FIG. 20 illustrates the implementation of detection and time synchronization method that is based on a correlator. As described hereinabove, the correlator/detector (308) was the basis for synchronization of TOD in FIG. 11, and for the detection of presence of a transmitter and synchronization in FIG. 13.

It is important for a neighboring Base Station to be able to detect and synchronize with a mobile unit prior to receiving a handoff. This process should be done as quickly as possible to ensure seamless handoff of a session. Generally, the process begins with a wide-range search for "target" signals having the correct timing for a mobile unit, based on the rough synchronization information provided by the Base Station which is connected with the mobile unit. These "target" signals are estimated, based on the rough synchronization data. When a match is found (an actual signal from mobile unit is acquired) the search range can be narrowed accordingly (and

dramatically). Then, synchronization can proceed as described hereinabove.

The detector/correlator 2000 comprises a signal detector 1001 and a correlator 1002. The task of the detector/correlator 2000 is to provide information whether a target signal is currently received, and to estimate the parameters which serve the hand-off process. The signal detector 1001 and correlator 1002 receive the actual received signal 1008 and its corresponding time 1009 and frequency 1004, as illustrated, and correlates them to the emulated time and frequency instances 1006. The fine TOD, drift and quality of the target signal are estimated by the correlator 1002 which reports the estimated parameters 1007, along with a status which indicates whether the target signal has been acquired, or not. The task of the signal detector 1001 is to process the received signal 1008 and to estimate its time of arrival (TOA), i.e. the exact timing of a hop, and quality values 1003. This may be done by several techniques, which are well known from classical detection theory. As an example of such techniques, an energy detector and a matched filter can be used.

FIG. 21 shows an example of the implementation of the signal detector 1001 of FIG. 20. In FIG. 21, the received signal 1008, which is received from the RF receiver output, is fed to an energy detector 1011. The energy detector 1011 produces a signal 1014, which represents the temporal energy shape of the signal. The temporal energy shape 1014 is fed into a matched filter 1012. The matched filter 1012 has an impulse response,

which matches the energy shape the target signal. As is known, per classical estimation and detection theory, the matched filter 1012 will produce maximum value at the time instance which represents an estimation of the time of arrival (TOA), i.e. exact timing of the hops, of the target signal 1008. The maximum value of the filter output represents an estimation of the received signal quality. The time instance, which represents the estimation of the TOA, is represented in terms of the time clock 1009. The matched filter 1012 reports TOA and quality values of which the quality is above a threshold value T.sub.h, and the maximum is a global maximum within a two-sided time window of T.sub.s1 microseconds. Other implementations of the signal detector 1001 in FIG. 20 can be utilized. Such implementations can correlate the received signal 1008 with the known portions of the target signal temporal pattern instead of its energy temporal shape. Such implementations may achieve improved estimation performance.

The time-frequency correlator 1002 in FIG. 20 receives the TOA and quality values 1003 produced by the signal detector 1001 and corresponding frequency values 1004, which are the actual tuning frequency of the RF receiver. These inputs are referred to herein as the `actual` TOA-frequency-quality instances. These include the estimated information of the signals, which are received from the various sources. On the other inputs, the time/frequency correlator 1002 receives emulated values of TOA and frequency 1006 instances for a specific target source (i.e. a specific handset). We will refer to these values hereafter as `target` TOA-

frequency instances. The time-frequency correlator seeks matches in the instances from both sources--the `actual` and the `target` and detects TOA-frequency patterns at the `actual` instances which are `similar` to the `target` pattern. This process is performed in two possible modes:

1. `Acquisition` mode in which a match of the `target` to `actual` patterns is searched over longer time shifts periods, which cover the uncertainty of the possible fine TOD.

2. `Tracking` mode in which the fine TOD and drift have been already estimated, and the match between of the `target` to `actual` is searched and verified on new TOA-frequency instances over a shorter uncertainty period.

The `actual` data 1003 and 1004 is written into `actual` instances history buffer (e.g., FIFO) and constitutes a list of which records consists of `actual_TOA`, `actual frequency` and `actual_quality`. The `target` data 1006 is written into `target` instances histories buffer (e.g., FIFO) and constitutes a list of which records consist of `target_TOA` and `target_frequency`.

In the `acquisition` mode, at any given time, records from both lists of which TOA values are `younger` than T.sub.y1 milliseconds (where T.sub.y1 is typically 10,000) in relation to current time clock (to be referred hereafter as `young` records) are processed as follows:

For each `target` record, look for `actual` records, which satisfy:

Matching frequency value (i.e. `actual frequency`=`target_frequency`).

Absolute value of `TOA_diff` (`TOA_diff`=`known_diff`--(`actual_TOA`-`target_TOA`)) is smaller than T.sub.y2 milliseconds (where T.sub.y2 is typically 500). Note: `known_diff` is 0 in the acquisition mode.

The `target` and `actual` records, which satisfy the conditions, are referred hereafter as `candidate_records`.

For each of the `candidate_records` write the corresponding `TOA_diff`, `actual_quality` value and `actual_TOA` value into a `candidates_list`.

When all the `young_target` records are processed against all `young_actual` records, sort the `candidate_list` by the `TOA_diff` values and produce a `diff_histogram` with resolution of T.sub.y3 microseconds (where T.sub.y3 is typically 1000) as follows:

Scan the sorted `candidate_list` records, identify the `TOA_diff` values which are within the TOA diff range of each bin, and accumulate the corresponding `quality_values` producing `diff_quality_histogram` values per each bin.

Search the `diff_quality_histogram` for values, which are bigger than Ky (where Ky is typically 50). If found, set the status output 1007 value to `detected`, and identify the corresponding `actual_TOA` and `TOA_diff` values. The corresponding `actual_TOA` and `actual_diff` values are referred to hereinafter as a `diff_cluster` of records. If no `diff_quality_histogram` values exceed Ky, set the status output 1007 to `not_detected`.

If status has been set to `detected` perform a `least mean square error` (LMSE) estimation of a linear line which mostly fits the two-dimensional `diff cluster` instances (`actual_TOA` by `actual_diff`). LMSE estimation is a well-known estimation technique and is described in the classical literature.

The estimated linear line can be represented as:

diff='est diff0'+'est drift'*(TOA-TOA0) where TOA0 is the smallest `actual TOA` value out of the `diff cluster` records, `est diff0` is the estimated output parameter of `fine TOD` 1007 and `est drift is the estimation the output parameter `drift` 1007. The `diff quality histogram` value normalized by the corresponding `bin population` is the `quality` output 1007 value.

In the `tracking` mode, at any given time, process the data in a similar way as in the `acquisition mode but with the following differences:

The value of `known diff` is set to `prev_est_diff0`+`prev_est_drift`*

(`current_TOA0`-`prev_TOA0`). The terms `prev_est.sub.--diff 0` and `prev_TOA0` represented the `est_diff0` and `TOA0` which has been evaluated in the previous calculation (either in `acquisition` mode or in `tracking` mode). The term `current_TOA0` is the `TOA0` of current calculation.

A smaller value of Ty.sub.4 microseconds (when Ty4 is typically 2000) for the `tracking` mode replaces Ty.sub.2 of the `acquisition` mode.

Base Station

FIG. 18 illustrates, in block diagram form, major components of a Base Station 1800. A plurality (three shown) of front-end processors 604, 605 and 606 are connected to a plurality (three shown) of antennas 601, 602 and 603, respectively. The front-end processors 604, 605 and 606 perform the low-level protocols of the short-range communication protocol, described hereinabove.

When idle, a front-end processor 604, 605 and 606 waits for a handset to establish a new connection. When a connection is created it reports the call parameters (e.g., Bluetooth device address, TOD, Encryption key, authentication key, etc.) and transfers the call stream to the central processing unit 607. When a front-end processor is idle, it can also be used to receive (detect, monitor) a handset that is leaving a neighboring Base Station. The central processing unit 607 then sends the front-end processor, the call parameters, and the exact time of handoff. The front-end processor, would at that time,

continue the communicating with the handset, as if it was still in the neighboring Base Station.

A separate circuit module 612 (TOD Synchronization & Handset Detection) is used to detect arrival of new handset, and also to synchronize the TOD of all the calls, according to the techniques described hereinabove. This unit 612 is shown having its own antenna 611.

The central processing unit 607 controls the operation of the front-end processors 604, 605 and 606, receives data about new handoff and fine TOD estimation, receives data from neighboring Base Station, maintains the "Neighbor Connection Table", communicates with the Switch and the other Base Stations. The local area network interface 609 is suitably a standard interface, for example a connection to a 10Base-T or 100-Base-T Ethernet, for connecting to the Local Area Network (LAN) 140. Memory 608 and Non-Volatile Memory (NVM) 610 is shown connected to the central processing unit (CPU) 607.

FIG. 19 illustrates, in greater detail, an implementation of a representative one 604 of the front-end processors 604, 605 and 606 described hereinabove with respect to FIG. 18. A base-band processor 631 determines the transmission and reception channels, encodes and decodes speech, deals with error correction, authentication and encryption. The radio frequency front end 630 modulates and demodulates the data, and connects to the antenna 601. The base-band processor 631 controls the frequency ("frequency control" 633) of

each hop, sends and receives data ("energy, time of detection" 634) from the RF front end, and receives indication of signal strength ("base band parameters" 635).

Applications for the WPBX

Most of the preceding sections discussed the use of the methods disclosed in the current invention for a WPBX supporting telephony applications. Except for the methods shown in FIGS. 5, 6 and 7, most of the methods disclosed hereinabove are application independent, as follows:

The method for dividing the short-range communication protocol in order to support mobility of devices. The high-level protocols, including telephony-related protocols, and also protocols for data transfer, such as PPP over the short-range communication link.

The methods for synchronizing the Base Station.

The methods for detecting movement of transmitter from one Base Station to another

The methods for decide when to perform handoff and to what Base Station to hand the call.

These methods can be implemented in order to connect mobile devices that are equipped with a short-range communication transmitter/receiver such as a Bluetooth chipset. Such devices may move from the coverage area of one Base Station to the coverage area of another, when the Switch and Base

Stations handle the handoff of the connection from one Base Station to another. Typical application may be the connection of laptop computers equipped with a Bluetooth short-range communication link to the organization's e-mail server. Another possible application is connecting such mobile devices that for example utilize the PPP (point-to-point protocol) over Bluetooth wireless link, to the Internet, via a central remote access server. A system may also support several such applications.

For example in FIG. 24, a personal data (or digital) assistant (PDA) 1301, a laptop computer 1302 and a cellular handset 1303, connect to the systems Base Stations 1304 and 1305, as illustrated. The PDA 1301 and the laptop 1302 may connect, via the local area network (LAN) 1306 to an e-mail server 1308 in order to send or receive messages, and may also connect to a remote access server (RAS) 1309 for Internet connection. The cellular handset 1303 may connect to another handset (not shown) or, via a Telephony Gateway 1306 to the PSTN. The Base Stations 1304 and 1305 and the Switch 1307 handle the various levels of the communication protocol, utilizing the methods described hereinabove.

It is within the scope of the invention that the mobile unit is a device which is any of the following devices: telephone handset, standard cordless telephone handset, cellular telephone handset, personal data device, personal digital assistant (PDA), computer, laptop computer, e-mail server, and a device utilizing point-to-point protocol (PPP) to the Internet via a central remote access server, a

headset (including a cordless headset), a personal server, a wearable computer (or computing device), a wireless (video or still) camera, or a mobile music players (i.e., MP-3 devices etc).

Although the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made, and are intended to be within the scope of the invention, as disclosed herein.

What is claimed is:

1. In a wireless communication system comprising at least two Base Stations, at least one Switch in communication with the Base Stations, a method of communicating between mobile units and the Base Stations comprising:

dividing a short-range communication protocol into a low-level protocol for performing tasks that require accurate time synchronization and a high-level protocol which does not require accurate time synchronization; and

for each connection of a mobile unit with a Base Station, running an instance of the low-level protocol at the Base Station connected with the mobile unit and running an instance of the high-level protocol at the Switch.

2. Method, according to claim 1, wherein:

the low-level protocol comprises procedures selected from the group consisting of control

and modulation of RF signals transmitted to the mobile unit by the Base Station, frequency hopping, error correction, accurate time synchronization, device address, rough Time Of Day (TOD), voice channel allocation, forward error correction parameters, encryption keys, authentication keys, voice coding, device addressing, address of a parked mobile unit, definition of an asynchronous data link, and data FIFOs; and

the high level protocol comprises procedures selected from the group consisting of procedures for link setup and control, high-level protocol multiplexing, packet segmentation and re-assembly, quality of service management, service discovery, emulation of serial port over a logical link manager, interoperability for applications over Bluetooth and infra-red protocols, call control signaling and establishment of speech and data calls between mobile units, interoperability for Bluetooth wireless technology with PPP as communication bearer for wireless application protocol (WAP), command interface to a base-band controller and link manager, access to status information, discovering available services, cordless telephony, supporting inter-com features in handsets, emulation of serial port, supporting the use of a headset, supporting dial up networking, supporting fax transmission and reception, defining how mobile units can access a LAN with PPP, defining generic object exchange, supporting

an object push model, supporting file transfer, and synchronizing the mobile units.

3. Method, according to claim 1**,** further comprising:

using a real time multi-tasking operating system in order to allow handling of many instances of the protocols simultaneously in the Base Stations and in the Switch.

4. Method, according to claim 1, wherein:

the Switch handles routing of data from the high-level protocols to the low-level protocols, and from the low-level protocols to the high-level protocols.

5. Method, according to claim 1, wherein:

the mobile unit is equipped with a short-range wireless communication transmitter/receiver.

6. Method, according to claim 1, wherein a mobile unit is a device selected from the group consisting of:

telephone handset, standard cordless telephone handset, cellular telephone handset, personal data device, personal digital assistant (PDA), computer, laptop computer, e-mail server, a device utilizing point-to-point protocol (PPP) to the Internet via a central remote access server, a headset, a personal server, a wearable computer, a wireless camera, and a mobile music player.

7. Method, according to claim 1, further comprising:

providing communication links between the Base Stations, wherein the communication links between the Base Stations are selected from the group consisting of RF links and land lines; and

transferring connection status information and synchronization information between the Base Stations over the communications links.

8. Method, according to claim 1, wherein:

the Base Stations and the Switch are connected via a wired or wireless local area network (LAN).

9. Method, according to claim 1, wherein:

a first plurality of Base Stations are connected to a first Switch;

a second plurality of Base Stations are connected to a second Switch;

the Switches maintain status tables for calls and connections that they are handling, and maintain copies of each other's status tables; and

when a Switch updates one of its status tables, it sends the updated status table to the other Switches.

10. Method, according to claim 1, wherein:

the wireless communication system comprises a wireless private branch exchange (WPBX) handling calls from mobile units comprising handsets.

11. Method, according to claim 10, further comprising:

in the Switch, maintaining a table of calls being handled by the WPBX, comprising information selected from the group consisting of a unique Call Identification number for each active call being handles by the WPBX, the origin of the call, the destination of the call, Calling Number Identification (CNID), Destination Number (DN), Originating Base Station Identification, Destination Base Station Identification, Status of call, information for billing, and information for performance analysis.

12. Method, according to claim 10, further comprising:

in the Switch, for each call, maintaining a table of connections comprising information selected from the group consisting of Handset ID, Current Base Station ID, handle of high-level protocols, handle of low-level protocols, Number of candidate Base Stations for handoff, List of candidate Base Stations for handoff, and List of handoff status for each candidate Base Station.

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA, LLC	)(
	)(CIVIL DOCKET NO.
	)(2:07-CV-341-CE
VS.	)(MARSHALL, TEXAS
	)(
	)(MARCH 24, 2011
CISCO SYSTEMS, INC.	)(9:30 A.M.

PRETRIAL HEARING
BEFORE THE HONORABLE JUDGE
CHAD EVERINGHAM
UNITED STATES MAGISTRATE JUDGE

APPEARANCES:

FOR THE PLAINTIFFS:
(See Attorney Sign-In Sheet)

FOR THE DEFENDANTS:
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(Proceedings recorded by mechanical stenography, transcript produced on a CAT system.)

* * * 10

instructions, and you have that where it says -- and maybe I should turn to that, but I don't have that at my fingertips.

There is a place where it says a person, and then there's a place when it says the product. We did the research, Your Honor, and we're very strongly of the opinion that it is that if the products in a method -- if the accused products perform all steps and elements of the claim, then a person who makes, uses, or sells that product is a direct infringer, we can think of many examples where otherwise there would be no direct infringement. I mean, if you have a product, you say here's the method, you take this chemical, you, you know, add that chemical, and then you heat it to 400 degrees, and the accused products perform that in an automated way. They were designed in a way to do that.

It doesn't require someone turning the switch. It's -- it's -- and so that's -- that's our view. We see no case that says that -- that the -- that the person has to commit the acts. Now, the only issue here I believe is the divide step, and the -- we have to show as to that that the accused products do divide, and we can do that, but it doesn't -- it's not focused --it's -- it's focused on the accused products performing the step, not the person that does it. Cisco designed

where it was done, but the accused products perform that step. When the software, the LWAPP software sits on top of the 802 chip, that software is taking the signals, the packets that -- are coming from the mobile device to the access point, and that software which sits in the access point is routing the headers that deal with the specific functions. If it's time critical, it stays under that software in the source code on that access point. If it's a function that's not, then that software tells it to go on to the controller, and the functions occur there. So that division occurs within the accused product.

The fact that it was designed to do that by Cisco and that Cisco designed it, you know, two years prior doesn't change the fact that someone is using -- of course, under direct infringement, they don't have to have any intent -- they're using a product that -- that infringes because it performs all the steps of the patent.

THE COURT: Okay.

MR. WERBNER: And -- and that ties to -- to the prior determination. The only possible issue where one could say the customer -- I mean, I don't -- I don't see how in this case it would be any different. If the customer turns on the accused products, because it's

already been determined that when the -- when the products are turned on it performs all those steps. So we would be relitigating matters that were already determined.

THE COURT: Well, here's where I am as far as the limine point is concerned. I'm going to -- I'm granting your request in No. 4 to prevent Cisco from denying that it is a direct infringer. But I haven't yet decided how much, if any, of the prior trial I'm going to allow to enter this trial.

I am denying your request to prevent Cisco from challenging infringement by the customers of the accused products because I -- I mean, I think that14 that's fairly within the scope of this case, notwithstanding what your view is as to what the prior jury found.

I am denying your request in No. 5 to prevent Cisco from challenging the fact that the accused products practice each step of the method.

I am granting your request in No. 6 to preclude evidence of invalidity or evidence of Cisco's good faith belief, if any, in the invalidity of the patent. I will allow Cisco to prove or attempt to prove that it had a good faith belief that it did not infringe the patent.

So you understand the distinction I'm drawing, Mr. Frahn?

MR. FRAHN: If I understand the distinction, you're allowing Cisco to put on proof that it had a good faith belief that it did not infringe the patent, but you are precluding Cisco from putting on any evidence that it had a good faith belief that the patent was invalid.

THE COURT: Correct.

MR. FRAHN: So Cisco may not adduce any evidence as to its belief on the validity of the patent?

THE COURT: That's correct.

MR. FRAHN: Well, Your Honor, we -- we strongly object to that. I think that it's squarely within the case law.

THE COURT: Okay. Which case law is that?

MR. FRAHN: Under DSU.

THE COURT: Was that an invalidity belief?

MR. FRAHN: It was a belief as to whether they infringed a valid patent. I mean, you can't infringe an invalid patent.

THE COURT: Is that the language of DSU?

MR. FRAHN: I think the specific issue --

THE COURT: And with respect to the statement in your brief that -- let's see, where was it?

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In Kinetic Concepts, Inc., against Blue Sky Medical Group, the Federal Circuit again found that the defendant's subjective belief and objective basis for believing the patent was invalid or not directly infringed was sufficient to defeat a claim for inducement. If you could point me to the portion of that case that states that, I would appreciate it.

MR. FRAHN: Your Honor, I'm not sure I can do it on the fly, but I will do my best. And if I find it during the course of the rest of the argument --

THE COURT: Okay. I'll be interested in seeing it.

MR. FRAHN: Thank you, Your Honor.

THE COURT: All right. That takes care of 4, 5, and 6.

MR. GARDNER: Your Honor, can I ask one question with one clarification?

Will plaintiff be able to say that no one has challenged the validity of the patent?

THE COURT: I hadn't gotten there yet, Mr. Gardner.

MR. GARDNER: Yes, sir, sorry.

MR. FRAHN: Your Honor, I --

THE COURT: Yes.

MR. FRAHN: -- I believe I have it while

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we're --

THE COURT: Okay.

MR. FRAHN: -- hot on the subject if you want to return to it.

This is the Kinetic Concepts case, and the pin cite is at Page 1025, and the testimony related to -- this is in the head note Section 21 and 22.

THE COURT: All right.

MR. FRAHN: Richard Weston testified that he thought that because the Versatile, and that is the product at issue, simply performed the Chariker-Jeter method, which was in the public domain, can't see how his patents could pose no barrier.

THE COURT: Okay.

MR. FRAHN: Okay. And so what that's -- that's saying that because what was already in the public domain was then claimed in the patents that were being asserted against them, the company that was accused of infringing didn't think that that was a problem.

THE COURT: Okay. I think the case went on to say that although practicing the prior art is not a defense to direct infringement, it could form a good faith belief that they were not directly infringing the claim, correct?

16

MR. FRAHN: I think, and that may be --

THE COURT: That's the same thing that the Echo Lab case said, as well, but they didn't come out and say that a subjective belief that the patent-in-suit was invalid is sufficient to defeat a claim for inducement. They always talk about it in terms of a subjective belief that you're not infringing.

MR. FRAHN: Well, you clearly read the case as have I. Perhaps we've come to different conclusions.

If this particular issue of whether a subjective belief of invalidity on -- is a specific point on which we need to provide you with additional case law that addresses that, I'm happy to do that. I thought that that point was --

THE COURT: I found one district court case that holds actually what you said the Circuit cases hold, but beyond that, I hadn't found much from the Circuit that helps me.

MR. FRAHN: Okay. Well, Your Honor, we'd be happy to do a search. We took it as a not disputed issue of law, particularly since there was no law cited in Commil's motion on either point that an accused inducer is allowed to induce evidence of its subjective intent or objectively reasonable basis for believing non-infringement or invalidity.

17

THE COURT: Okay.

MR. FRAHN: And if you found the cases that we did cite lacking, even despite the lack of contrary authority, I'd request the opportunity to supplement the briefing on that particular point.

THE COURT: Okay. That leave is granted.

MR. FRAHN: Thank you, Your Honor.

THE COURT: For now, I'm going to stick with my rulings on the limine points.

All right. 7, 8, and 9, I think, deal with damages issues; is that correct?

MR. WERBNER: 7 and 8 do, Your Honor. 9 relates to Cisco employing people in the district.

THE COURT: All right. 7 and 8, I'm going to table those until after jury selection. I'm going to consider all of the damages testimony --

MR. WERBNER: All right.

THE COURT: -- separately --

MR. WERBNER: Yes, sir.

THE COURT: -- on both -- that relates to both sides. 9 is denied.

MR. OSTROW: Your Honor?

THE COURT: Yes.

MR. OSTROW: Can I interrupt for one second?

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THE COURT: Yes.

MR. OSTROW: You said you were going to table them.

The last time we had Mr. Carlile give some testimony to Your Honor only -- do you want our damages witness here as to your questions with respect to that, or is that not going to be necessary?

THE COURT: I'm going to -- with respect to the folks that have already testified in --

MR. OSTROW: Yes, sir.

THE COURT: -- in the prior case --

MR. OSTROW: Same guy.

THE COURT: -- I'm not going to require them to be here again. I'll take judicial notice of their prior testimony. If you want to bring anybody, that's fine, or if you want to -- if you want to wait until your -- Mr. Becker is going to be here anyway, then I'll just -- I'll do it after hours one day, okay?

MR. OSTROW: Thank you, Your Honor.

THE COURT: He doesn't make a special trip.

MR. OSTROW: I just want to make sure that we're clear on that.

THE COURT: All right. 9 is denied.

10 is granted.

11 is granted.

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12 is granted.

13 is granted in part and denied in part. It's granted to the extent that Cisco is not going to refer to your client as a patent troll. It's otherwise denied with respect to his business that Commil is in.

No. 14 is denied.

No. 15 is granted.

16 is denied with the caveat that, you know, I don't -- I don't have any problems with fair cross-examination, but, you know, sidebar comments don't generally require an objection for me. So just be -- I'll leave you to your own good judgment.

17 is granted.

And that concludes plaintiff's motions in limine.

Motions in limine, folks, as they were last time, are not definitive rulings on the evidence. You know, you need to approach the bench before you get into anything that's covered by an order in limine.

All right. Mr. Werbner? Thank you.

MR. WERBNER: Thank you, Your Honor.

THE COURT: No. 1, I'm going to carry that.

No. 2 is granted.

No. 3 is granted, unless I change my mind on allowing in your good faith belief regarding the

validity of the patents. For now, it's granted.

No. 4, are y'all going to challenge whether it's a short-range communications protocol?

MR. FRAHN: Your Honor, we're not challenging whether 802.11 is short range, but their expert, if you recall from the prior times, said it was 802.11 plus --

THE COURT: Right.

MR. FRAHN: -- LWAPP. And if he maintains that position, I imagine we -- we would challenge that. We have no dispute about 802.11.

THE COURT: Okay. Well, 4 is denied.

5 is denied.

6, I'm going to table that until after jury selection.

Back to No. 3, portions -- subpart B and C are granted. Subpart A, with respect to the display of the patent, is denied.

7 was agreed to. That's granted.

8 is denied.

All right. Mr. Werbner?

MR. WERBNER: Yes, Your Honor.

THE COURT: How many additional disputes with respect to exhibits do y'all foresee having?

MR. WERBNER: Well, we made a lot of

objections, but we attached an Exhibit A which groups those into categories, and I think there's four or five categories. I think those can be resolved fairly quickly by category, so I don't see anything more there.

On the plaintiff's exhibits, we met and conferred this morning on this subject. Pretty much all the exhibits that we had before, there's no real problem at all there. Most are agreed, and the few that aren't are not a big problem.

But we -- we added 400 to 500. We reached agreement this morning. Most of those are -- are Cisco documents. We reached agreement that there's no question about authenticity, and counsel stated they need a little more time to talk to people to just get a better understanding of what some of those documents are.

I'm very hopeful that in the next few days that we can resolve those. A lot of them, if I can maybe just -- if it's helpful to the Court, I can give two -- the nature of a couple of those if the Court wishes.

THE COURT: Okay.

MR. WERBNER: We have about five or six videos off the Cisco website, each of which is about two to three minutes, where Cisco appears with a customer,

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA	* Civil Docket No.
	* 2:07-CV-341
VS.	* Marshall, Texas
	*
	* April 6, 2011
CISCO SYSTEMS, INC., ET AL	* 1:15 P.M.

TRANSCRIPT OF JURY TRIAL
BEFORE THE HONORABLE CHAD EVERINGHAM
UNITED STATES MAGISTRATE JUDGE

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* * * * * *

P R O C E E D I N G S

LAW CLERK: All rise.

(Jury in.)

THE COURT: Please be seated. I believe we were ready to hear a video excerpt from Mr. Calhoun. If you'll turn the lights down.

MR. WERBNER: Before we do that, Your Honor, we decided that since the other reading for Mr. Calhoun, we would just go to our last witness and not present that.

THE COURT: Okay.

MR. WERBNER: I told counsel. We will call at this time as our witness Mr. Yuval Dovev by video deposition.

THE COURT: Okay.

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(Video played.)

QUESTION: So you were the CEO of Commil -- and when I say Commil, I mean the Israeli entity. You were the CEO of Commil in 2004 and 2005, correct?

ANSWER: True.

(Video paused.)

MR. WERBNER: I just wanted to say that this was a telephone deposition, Your Honor, and that's why the sound -- the questioner is in the United States; the witness is in Israel.

(Video continued.)

QUESTION: In the same late 2004 timeframe that you were discussing earlier, did you ever approach Cisco?

ANSWER: Yes.

QUESTION: Why did you approach Cisco?

ANSWER: I wanted to engage them in a discussion about potentially acquiring --

QUESTION: Was that for --

ANSWER: -- Commil.

QUESTION: Any other reasons?

ANSWER: Not to my recollection, no.

QUESTION: Who did you speak with at Cisco, if you recall any of their names?

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ANSWER: I spoke to a guy called Yoav something, who was their manager in Israel at that time. I forget his last name. Yoav -- I don't remember. And there was another guy, a more junior guy. I mean, I think Yoav was in charge of their M & A activities in Israel.

Yoav Leshem? Could that be him? I'm not sure. And -- and as far as I remember, the discussion was pretty short.

QUESTION: When did you talk to him?

ANSWER: Sorry?

QUESTION: First of all, can you spell Yoav's name to the extent that you recall it?

ANSWER: I think it's Yoav Leshem, Y-O-A-V, L-E-S-H-A-M.

QUESTION: And when did you speak with Mr. Leshem?

ANSWER: Alleged Mr. Leshem -- I think --

QUESTION: Approximately?

ANSWER: I think Yoav --

QUESTION: Yoav. I'll just say that.

ANSWER: I think his first name is Yoav for sure, but his last name I'm not sure about. When did I speak to him? Around -- around about that sort of timeframe. I don't remember

5

exactly when.

QUESTION: About how many times did you talk to him?

ANSWER: Not more than three. Once, twice, or three times.

QUESTION: And what did you talk about with Yoav, just generally?

ANSWER: Hey, we are Commil. We're doing something. I -- again, I'm -- I'm not speaking I'm -- I'm kind of generally assuming that this is what I

said, because it has been a while ago. But I introduced Commil. I remember we had a phone conversation, so it wasn't like -- maybe a short e-mail. I don't remember how it was. But I introduced Commil. I said, is there a point for us to enter any sort of discussion? Is Commil interesting for you? And -- and I think the discussion was very -- as far as I remember, it was very brief. He said he will get back to me. I called him again after some time. And then he said, no, we don't see any -- we don't have any interest. And that -- that -- that was the extent of my relationship with him.

QUESTION: You were inquiring whether Yoav had an interest in acquiring Commil?

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ANSWER: I don't remember if I said it so explicitly, but I -- yes, that was -- that was my intent anyway.

QUESTION: Beyond what you've described, do you recall any other specific things that you discussed with Yoav?

ANSWER: I think I described to him Commil's solution and Commil's core technology, including its patents, very briefly, so without going in too much details.

QUESTION: Do you remember that specifically?

ANSWER: I -- I remember that was --

QUESTION: Or are you -- or are you just --

ANSWER: No, no, no. I --

QUESTION: -- assuming what you might have talked about?

ANSWER: I'm -- I'm -- I'm digging deep to try and kind of dig things out of my long-term memory. But I -- I -- I remember that we thought that -- that we could be interesting for Cisco, because we had what -- what we believed to be the core technology and the underlying technology of what they're using after their Airespace acquisition.

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But that's probably the extent of my memory there on -- on these discussions. Again --

QUESTION: Okay. I was just asking:

What was the technology that Cisco was practicing after the Airespace acquisition?

ANSWER: We believed that Airespace wireless switch technology is -- how shall I put it simply -- way too close for comfort for Commil's patents.

QUESTION: And what was that based on?

ANSWER: Our technological analysis of how things can be done and -- and about the -- and -- and -- so in two things:

A, on the architecture that they published off the Airespace system and of our anal -- our analysis that we -- our -- I mean, I'm not very technical, but my technology people basically told me, we don't see any other way that it could be done, other than the way that we described in our patents.

QUESTION: Other than what you've described so far, was there any other reason that you thought that Cisco's technology might be too close for comfort for Commil's patents?

ANSWER: You're speaking generally about Cisco or about Airespace?

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QUESTION: First, let me ask you about Cisco as it was implementing Airespace's technology after the acquisition.

ANSWER: Other than what I described internally, no. This is -- this is the analysis that we done at that time.

QUESTION: Did you ever tell Yoav that you believed Cisco might be infringing any Commil patents?

ANSWER: I -- I -- I remember telling him that we had the patent that we think line the core of the Airespace system. I didn't think it was as blunt as you describe it.

QUESTION: Tell me anything you recall specifically about what you told Yoav about the patents.

ANSWER: That goes down to what I -- what I told you. I mean, that we have a mobility system -- I mean, again, I don't remember the exact words. That we have a wireless mobility system and that we have patents for the wireless switch and wireless mobility between access points. But I don't -- I don't remember more than that. But that was the general gist of the discussion.

QUESTION: Why do you say that you assume you would have sent him some documents?

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ANSWER: Because normally, every company that I spoke to in that particular context, I had a -- a -- normally, a discussion of that sort ends: Okay, send me some materials. Let me see and talk to my friends and see.

And then I had this presentation that I sent, just a pretty generic kind of describing the things that I was talking about.

QUESTION: Just generally, what -- what did that presentation say?

ANSWER: Commil's assets, where we are at, what our patent's about, what is our technology about, what is the status of our commercial

relationship. Like a small prospectus, if you wish. I think -- I think --

QUESTION: Do you still have that presentation?

ANSWER: No. No. But I think you do.

QUESTION: I'm sorry. I didn't mean to interrupt you.

ANSWER: No, it's okay. I -- I -- I think it was --

QUESTION: Oh, we do?

ANSWER: Yeah, I think -- I think you do. I think it was -- I think it was the presentation I was

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA	* Civil Docket No.
	* 2:07-CV-341
VS.	* Marshall, Texas
	*
	* April 6, 2011
CISCO SYSTEMS, INC., ET AL	* 8:45 A.M.

TRANSCRIPT OF JURY TRIAL
BEFORE THE HONORABLE CHAD EVERINGHAM
UNITED STATES MAGISTRATE JUDGE

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(Proceedings recorded by mechanical stenography, transcript produced on CAT system.)

APPEARANCES CONTINUED:

* * *

present three witnesses, the first of whom we're calling now, Mr. Bob O'Hara, by a videotape deposition, which is about 20 minutes and reading, through an assistant, what he testified to on a prior occasion.

The deposition, both – both the prior testimony and the deposition were given by Mr. O'Hara under oath, and he was a founder of Airespace and a developer of the accused product who then went to work at Cisco in 2005 after Cisco acquired Airespace where he continued to work on, at Cisco, the accused products.

In the depo, there's a couple of exhibits where they're called Deposition Exhibit 5 or 200, which do not correspond to the trial, and we've – we've changed those so that the record would be clear.

And at this time, I would like to present, not the video but a few pages of what he testified previously.

THE COURT: Okay.

MR. WERBNER: And I would ask Mr. Payne to be reading the answers that Mr. O'Hara gave.

THE COURT: Come around to the witness stand. Thanks.

MR. GUTMAN: Could we just pause one moment, Your Honor? I want to be able to read along.

THE COURT: Yes.

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MR. WERBNER: Do I, Your Honor, need to start and stop at line and pages, or can I give this to the court reporter later for that?

THE COURT: You can give her those pages. Just make sure that they're identified, and then she'll be able to mark them page and line.

MR. WERBNER: Yes, I will do that at the recess.

MR. GUTMAN: I apologize, Your Honor. We seem to be having trouble finding our copy. Perhaps Plaintiff's counsel has –

THE COURT: Can you help him out?

MR. PATTERSON: This is the copy for the court reporter, so please don't mark on it.

MR. GUTMAN: I won't mark it.

THE COURT: Let's proceed.

(Excerpt from deposition of Robert O'Hara.)

MR. WERBNER: All right. From May 12th of 2010:

QUESTION: Good afternoon, Mr. O'Hara. Would you introduce yourself, please.

ANSWER: Yes. I'm Bob O'Hara.

QUESTION: And what happened after the Cisco acquisition for you personally? Did you go to

work at Cisco?

ANSWER: Yes. I continued as an employee of Cisco.

QUESTION: And what kind of work did you do?

ANSWER: To begin with, I was helping to integrate some proprietary functions that Cisco had in their own wireless LAN products into the Airespace controller and lightweight access point.

QUESTION: And how long did you continue working at Cisco?

ANSWER: I worked there for nearly three years.

QUESTION: All right. But we would know, don't we agree, that not only Cisco, but their lawyers would have been our notice of this '395 patent

sometime between 2001 and the issuance in '05, correct?

ANSWER: Yes.

QUESTION: In connection with the sales effort from 2003 forward of the accused products, was it ever the case that demonstrations of a running system were being made to customers to induce them to purchase it?

ANSWER: I made some demonstrations, yes.

QUESTION: And that was in order to help

make the sale to the customer, correct?

ANSWER: Yes, it was.

QUESTION: And that's what you would say, technical support by you to the sales group, right?

ANSWER: Yes.

QUESTION: So we have testing; we have demonstrations; we have involvement in the installations; testing again there. Are all of these things accurate?

ANSWER: Yes.

QUESTION: Don't Airespace and then later Cisco encourage customers to use the Split MAC functioning?

ANSWER: Yes.

QUESTION: Why do they do that?

ANSWER: I – I don't know why they do that.

QUESTION: Sir –

ANSWER: I can't speculate why they do anything.

QUESTION: Well, did Airespace do that?

ANSWER: Yes.

QUESTION: Why did Airespace encourage customers to use the Split MAC function?

ANSWER: We encouraged them to do that

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

COMMIL USA	* Civil Docket No.
	* 2:07-CV-341
VS.	* Marshall, Texas
	*
	* April 8, 2011
CISCO SYSTEMS, INC., ET AL	* 12:45 P.M.

TRANSCRIPT OF JURY TRIAL
BEFORE THE HONORABLE CHAD EVERINGHAM
UNITED STATES MAGISTRATE JUDGE

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APPEARANCES CONTINUED:

* * *

If the accused methods omit even a single limitation, then you must find that the claim is not infringed. You must consider each of the patent claims separately.

As just discussed, direct infringement requires a single party to perform each and every step of a claimed method. If you find that each and every limitation of a patented claim is performed, then the claim is infringed, even if the accused methods of use may be more or less efficient or may include additional features or functions not found in the claims.

Whether or not the third party knew that what it was doing was an infringement does not matter for direct infringement. A person may be found to be a direct infringer of a patent even if his or her believed in good faith that what he or she was doing was not an infringement of any patent and even if he or she did not even know of the patent.

If you find that a third party has directly infringed Claim 1, 4, or 6 of the '395 patent, then Commil must prove by a preponderance of the evidence that Cisco actively and knowingly aided and abetted that direct infringement.

Furthermore, Commil must show that Cisco actually intended to cause the acts that constitute

direct infringement and that Cisco knew or should have known that its actions would induce actual infringement.

Inducing third-party infringement cannot occur unintentionally. This is different from direct infringement, which can occur unintentionally. Cisco also cannot be liable for inducing infringement if it was not aware of the existence of the patent.

If you find that a third party has directly infringed Claim 1, 4, or 6 of the '395 patent and that Cisco knew or should have known that its actions would induce direct infringement, you may find that Cisco induced another to infringe Commil's patent if it provided instructions and directions to perform the infringing act through labels, advertising, or other sales methods.

You may also find that Cisco induced infringement by supplying the components that are used in an infringing manner with the knowledge and intent that its customer would directly infringe by using the components to perform every step of the claimed method.

Now, the asserted claims use the word comprising. When a claim uses the word comprising, comprising means included -- or excuse me -- including or containing.

A claim that uses the word comprising or

comprises is not limited to products or methods having only the elements that are recited in the claim but also covers products or methods that add additional elements.

Let's take as an example a claim that covers a table. If the claim recites a table comprising a tabletop, legs, and glue, the claim will cover any table that contains these structures even if the table also contains other structures, such as a leaf or wheels on the legs.

Let's talk about dependent claims. My instructions on infringement so far have related to independent claims. Patent claims may exist in two forms referred to as independent claims and dependent claims.

An independent claim does not refer to any other claim of the patent. Thus, it is not necessary to look at any other claim to determine what an independent claim covers.

Claim 1 of the '395 patent is an independent claim.

A dependent claim refers to at least one other claim in the patent. A dependent claim includes each of the elements of the other claim to which it refers, plus additional elements recited in the dependent claim itself.

Claims 4 and 6 of the '395 patent are dependent claims that depend on Claim 1. In order for you to find that Claims 4 or 6 of the '395 patent are infringed, you must first find that Claim 1 is infringed.

If you find that independent Claim 1 of the ‘395 patent is not infringed, you must also find that dependent Claims 4 and 6 are not infringed.

I will now instruct you as to the calculation of damages should you find that Commil has met its burden on any of its claims.

If you find that Cisco has induced infringement of the asserted claims of Commil's patent, then you should consider the amount of money Commil should receive as damages.

Commil has the burden of proving by a preponderance of the evidence the amount of damages caused by Cisco's conduct. The owner of a patent is entitled to an award of damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use Cisco made of the invention.

Commil is asking for damages in the amount of a reasonable royalty. Generally, a reasonable royalty is defined by the patent laws as the reasonable

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