

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZYXEL COMMUNICATIONS CORPORATION,
Petitioner,

v.

UNM RAINFOREST INNOVATIONS,
Patent Owner.

PTAB Case No. IPR2021-00734
Patent No. 8,265,096 B2

PRELIMINARY RESPONSE TO PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 8,265,096 B2
CLAIMS 1-4 AND 6-8

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I. INTRODUCTION

Patent Owner UNM Rainforest Innovations (hereinafter “UNM” or “Patent Owner”) respectfully submits this Patent Owner Preliminary Response to the Petition for *Inter Partes* Review dated Mar. 29, 2021 (“Petition”) of U.S. Patent No. 8,265,096 (EX1001, “’096 patent”) filed by ZyXEL Communications Corporation (“ZyXEL” or “Petitioner”). ZyXEL submitted an effectively verbatim copy of Intel’s IPR2020-01576 (which has already been dismissed), albeit with the signature of a different expert witness. *Intel Corporation v. UNM Rainforest Innovations f/k/a STC.UNM*, Case IPR2020-01576 (Paper 8) (PTAB Feb. 02, 2021) (Termination Decision). Qualcomm Incorporated, has also filed an IPR petition challenging the ’096 Patent. *Qualcomm Incorporated v. UNM Rainforest Innovations*, IPR2021-00375, Paper 1 (Dec. 28, 2020). ZyXEL filed a motion for joinder with IPR2021-00375. Petitioner asserts that claims 1-4 of the ’096 patent are unpatentable on two grounds based solely on 35 U.S.C. § 103:

Ground 1 – Claims 1-4, 6, and 7 are unpatentable as obvious over *Talukdar* and *Li*.

Ground 2 – Claim 8 is unpatentable as obvious over *Talukdar* and *Nystrom*.

This Preliminary Response is timely filed based on the Board’s Notice Of Filing Date Accorded To Petition And Time For Filing Patent Owner Preliminary Response. *See* Paper 5.

II. RELATED PROCEEDINGS

Related Proceedings are listed in Paper 2, at 2-3.

III. UNM BACKGROUND

UNM Rainforest Innovations is the economic development and technology transfer organization of The University of New Mexico, the State of New Mexico's flagship university. EX2005 (Economic Impact Report). In that role, UNM protects and licenses technology owned by the university, including those developed by university researchers. It connects the business community to the university and facilitates the university's role in the state's economic development initiatives.¹ As a nonprofit corporation formed and owned entirely by the University of New Mexico Board of Regents, UNM significantly contributes to the mission statement of the University of New Mexico.

Since 1996, UNM university researchers have disclosed 2,222 new inventions to UNM. UNM, in turn, has filed 1,628 patent applications, received 754 issued U.S. patents, executed 733 licensing agreements, and facilitated the formation of nearly 160 new startup companies to take those inventions to market.² These startups have created or stimulated the creation of hundreds of New Mexico jobs and tens of millions of dollars in local economic output.³ UNM also

¹ See <https://innovations.unm.edu/about/>.

² See <https://innovations.unm.edu/unm-rainforest-innovations-celebrates-25-years/>.

³ See <https://innovations.unm.edu/about/metrics/>.

subsidizes college students from the Navajo Nation by housing them at the UNM Lobo Rainforest Building using licensing proceeds.⁴

Today, UNM is a core component of New Mexico's innovation ecosystem and an economic driver of high-tech industry. Among its 18 peer institutions nationwide, UNM ranks first in number of licensing agreements, eighth in number of faculty and staff invention disclosures, and second in number of startup companies formed. Since the COVID-19 pandemic began, UNM has initiated new programs to assist New Mexico small businesses and trained over 225 businesses on how to build and scale an e-commerce platform that is tailored to their business.

UNM is a highly innovative institution involved in the international scientific and technological community. As part of its international involvement and to facilitate and support the mission of the University of New Mexico, UNM acquired a patent portfolio including the '096 patent from the Industrial Technology Research Institute of Taiwan and has offered a license to its patent portfolio relating to wireless technology to ZyXEL, which to date, ZyXEL has refused to consider.

⁴ See <https://housing.unm.edu/living-on-campus/housing-options/navajo-nation-student-housing.html>.

IV. THE BOARD SHOULD DENY INSTITUTION UNDER § 314(a).

The Board should exercise its discretion under 35 U.S.C. § 314(a) to deny ZyXEL's Petition. First, ZyXEL improperly filed its Petition as an *in rem* proceeding, in violation of 35 U.S.C. § 311(a), authorizing a person who is not the owner of a patent to "file with the Office a petition to institute an *inter partes* review of the patent." ZyXEL's *in rem* petition does not satisfy the *inter partes* requirement. Second, Petitioner concedes that all the claims that are at issue in the *UNM Rainforest Innovations v. ZyXEL Communications Corporation*, No. 6:20-cv-00522 (W.D. Tex.) ("the ZyXEL Litigation") are also at issue here. Paper 2, at 8. Accordingly, this proceeding would be duplicative of the related district court case involving the same parties and the same patent, and that case will outpace a final written decision in this proceeding.

Section 314(a) provides the Director with discretion to deny a petition. *See* 35 U.S.C. § 314(a); *Cuozzo Speed Techs. v. Lee*, 136 S. Ct. 2131, 2140 (2016) ("[T]he agency's decision to deny a petition is a matter committed to the Patent Office's discretion."). When considering whether to exercise its discretion not to institute, the circumstances surrounding proceedings "related to the same patent, either at the Office, in the district courts, or the ITC" are considered. *See* Consolidated Trial Practice Guide (November 2019) at 58. Several factors inform that consideration:

whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
investment in the parallel proceeding by the court and the parties;
overlap between issues raised in the petition and in the parallel proceeding;
whether the petitioner and the defendant in the parallel proceeding are the same party; and
other circumstances that impact the Board's exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11, at 5-6 (PTAB Mar. 20, 2020)

(precedential); *Philip Morris Prod., S.A. v. RAI Strategic Holdings, Inc.*, IPR2020-00921, Paper 9, at 14-15 (PTAB Nov. 16, 2020). The Board must then take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Fintiv*, IPR2020-0019, Paper 11, at 6.

Applying the *Fintiv* analysis to the facts in this instance, ZyXEL's Petition must be denied.

A. ZyXEL's *In Rem* Petition Is Not Authorized Under 35 U.S.C. 311(A).

ZyXEL's *in rem* petition violates the explicit requirement of 35 U.S.C. § 311(a), authorizing a “person who is not the owner of a patent” to “file with the Office a petition to institute an *inter partes* review of the patent.” ZyXEL's *in rem* petition does not satisfy the *inter partes* requirement.

ZyXEL has not filed this Petition as an *inter partes* petition, but instead as an *in rem* proceeding against the patent itself. (Paper 1 at caption). ZyXEL thus

explicitly introduces the issue of patent ownership in this forum—despite having previously unsuccessfully raised it in district court—by filing its Petition effectively as *in rem*, *i.e.*, against the patent itself, instead of against Patent Owner UNM Rainforest Innovations (“UNM”). This forum is not authorized to adjudicate patent ownership and exploration of this issue in this forum would unquestionably derail this proceeding. Out of 13,419 original, corrected, or amended petitions for IPR found on Docket Navigator, ZyXEL’s petitions in this matter and two related matters are the only instances in which an IPR petition has ever been filed as “in the patent of,” *i.e.*, as an *in rem* proceeding against a patent itself, as opposed to the owner of the patent. ZyXEL’s improper *in rem* IPR defeats the very purpose of the *inter partes* aspect of this reexamination. As a result of this failure, ZyXEL has not met all the necessary prerequisites for institution. 35 U.S.C. § 311(a).

Although ZyXEL has stated that they do not want the PTAB to address patent ownership, by proceeding only against the patent itself, ZyXEL has squarely brought the issue of patent ownership into this IPR, thereby requiring the PTAB to rule on this issue, including addressing the fact that this IPR is fundamentally not an *inter partes* proceeding. However, the PTAB does not have jurisdiction under the AIA to rule on the issue of patent ownership that has been presented on the very face of the Petition by the Petitioner since it is not a patent validity issue. The AIA is explicit in stating that only grounds related to Sec. 102 or 103 can be raised

in an IPR. 35 U.S.C. § 311(b) (stating that “[a] petitioner in an *inter partes* review may request to cancel as unpatentable 1 or more claims of a patent only on a ground that could be raised under section 102 or 103 and only on the basis of prior art consisting of patents or printed publications.”) For these reasons alone, this IPR should not be instituted.

B. All of the *Fintiv* Factors Favor Denial of Institution.

Regarding *Fintiv* Factor 1 (likelihood of a stay), no stay has been granted in the related ZyXEL litigation. Per the current Scheduling Order, the ZyXEL litigation is now less than nine months from trial. EX2006. The district Court is therefore likely to reach a final decision well before a final written decision will be reached in this IPR. Although ZyXEL has requested a stay as in the related Dell litigation (*UNM Rainforest Innovations v. Dell Technologies Inc. et al.*, No. 6:20-cv-00468 (W.D. Tex.)), which has been stayed in light of the lawsuit that UNM filed in New Mexico state court to quiet title to the '326, '096, and '204 patents (*UNM Rainforest Innovations v. Industrial Technology Research Institute, et al.*, case number D-202-CV-2021-02803 in the Second Judicial District Court of Bernalillo County, New Mexico), the defendant Industrial Technology Research Institute has challenged the jurisdiction of the Court over it as a foreign entity. It is therefore possible/likely that this case will be dismissed and the Dell trial resumed in short order. If this occurs even within the next 8 months, it remains likely that

the Dell trial will occur before the final written decision in this matter can be expected. This factor therefore favors denying institution.

Regarding *Fintiv* Factor 2 (trial date proximity), the ZyXEL litigation has not been stayed and the trial is scheduled to begin on Apr. 4, 2022, less than nine months from the writing of this preliminary response. EX2006. An institution decision in this IPR will likely issue just about six months before the scheduled trial. A final written decision would then not issue until Oct. 2022, six months after a final decision in the ZyXEL litigation. Further, Judge Albright explicitly confirmed in a recent order that his default schedule is much faster than other courts and that “this Court is fully open and equipped to safely conduct jury trials in the COVID-19 pandemic.” *Ecofactor, Inc. v. Vivint, Inc.*, 6-20-cv-00080 (Order dated Apr. 16, 2021) (W.D. Tex.) (Alan D. Albright). Thus, this factor also favors denying institution. See *Philip Morris Prod., S.A. v. RAI Strategic Holdings, Inc.*, IPR2020-00921, Paper 9, at 16 (PTAB Nov. 16, 2020); *Intel Corp. v. VLSI Tech., LLC*, IPR2020-00106, Paper 17 at 13 (PTAB May 5, 2020).

Regarding *Fintiv* Factor 3 (investment in the district court action), there has already been substantial activity in the ZyXEL litigation and the Dell litigation that is relevant to the issues of patent validity. Per the Scheduling Order, the parties in the ZyXEL litigation submitted a Joint Claim Construction Statement and have exchanged final infringement and invalidity contentions. See EX2006. By the

time an institution decision issues in this IPR, fact discovery will be nearly closed in the ZyXEL litigation. *Id.* This factor therefore favors denying institution.

Regarding *Fintiv* Factor 4 (overlap of issues), there is a substantial overlap between the issues of invalidity presented in this IPR and the ZyXEL litigation. ZyXEL deceptively argues that the issues “will be different” because here ZyXEL “challenges claims ... which are not asserted” in the ZyXel litigation. Paper 1 at 11. However, ZyXEL is indeed challenging all the claims asserted in the ZyXEL litigation in this IPR. Thus, there is a 100% overlap with the district court independent claims. ZyXEL also argues that Factor 4 favors institution because it has stipulated that it “will not pursue invalidity of the challenged claims on the same grounds or even the same references at issue in this Petition.” Paper 1 at 11. However, that narrow stipulation does not eliminate the possibility that substantially similar art and arguments will be raised in the ZyXEL litigation. *See Philip Morris*, IPR2020-00921, Paper 9, at 19 (considering Petitioner stipulation that “it will not pursue any IPR grounds in the EDVA case if the Board institutes”). This factor therefore strongly favors denying institution.

Regarding *Fintiv* Factor 5 (whether petitioner and defendant are the same), Petitioner ZyXEL is the same party as in the related ZyXEL litigation. ZyXEL does not explain or provide support for its argument that this factor should be

discounted merely because other parties are also litigants in district court. This factor therefore favors denying institution.

Regarding *Fintiv* Factor 6 (other circumstances), Patent Owner submits that for the reasons detailed herein, ZyXEL's grounds are not strong on the merits. Further, ZyXEL's petition relies primarily on the *Talukdar* reference (EX1012) which does not predate the priority date of the '096 patent. Although *Talukdar* derives priority from its provisional application No. 60/956,031, filed on Aug. 15, 2007, that priority date does not predate the provisional application from which the challenged '096 patent derives priority (provisional application No. 60/929,798, filed on Jul. 12, 2007). *Talukdar* is thus not prior art to the '096 patent at all, and UNM has offered uncontroverted expert testimony that the challenged claims of the '096 patent are fully supported by its provisional application.

In addition, ZyXEL has not filed this petition as an *inter partes* petition, but instead as an *in rem* proceeding against the patent itself. ZyXEL thus explicitly introduces the issue of patent ownership in this forum—despite having previously unsuccessfully raised it in district court—by filing its Petition effectively as *in rem*, *i.e.*, against the patent itself, instead of against Patent Owner UNM Rainforest Innovations (“UNM”). This forum is not authorized to adjudicate patent ownership and exploration of this issue in this forum would unquestionably derail this proceeding. Out of 13,419 original, corrected, or amended petitions for IPR

found on Docket Navigator, ZyXEL's petitions in this matter and two related matters are the only instances in which an IPR petition has ever been filed as "in the patent of," *i.e.*, as an *in rem* proceeding against a patent itself, as opposed to the owner of the patent. ZyXEL's improper *in rem* IPR defeats the very purpose of the *inter partes* aspect of this reexamination. As a result of this failure, ZyXEL has not met all the necessary prerequisites for institution. 35 U.S.C. § 312(a). Accordingly, ZyXEL's Petition must be denied as fatally defective procedurally. This factor therefore favors denying institution.

Thus, all of the *Fintiv* factors favor discretionary denial in this case.

C. Efficiency and Integrity of the System Are Best Served by Denying Institution.

"In general, an anticipated district court trial date substantially in advance of a projected statutory deadline for the Board to issue a final decision increases the likelihood that the district court will reach a determination of the parties' dispute as to the validity of the challenged claims before the Board will. Under such circumstances, the application of Office policy has often resulted in the denial of institution." *Philip Morris Prod., S.A. v. RAI Strategic Holdings, Inc.*, IPR2020-00921, Paper 9, at 28 (PTAB Nov. 16, 2020) (citations omitted).

Here, there are no factors that favor institution. The petition is weak on the merits and the primary alleged prior art reference (*Talukdar*) is not prior art at all because it does not predate the priority date of the challenged claims. Even if the

merits of the asserted grounds were to favor institution, “the efficiency and integrity of the system ... taking into account the consistent application of Office policy” requires that institution be denied. *Id.*, at 28-29; *see also NHK Spring Co., Ltd v. Intri-Plex Techs., Inc.*, Case IPR2018-00752, Paper 8, at 19-20 (PTAB Sept. 12, 2018); *NetApp, Inc. v. Realtime Data LLC*, Case IPR2017-01195, Paper 9, at 12-13 (PTAB Oct. 12, 2017). UNMRI is a university institution that protects and licenses the University of New Mexico’s technology and, as ZyXEL admits, UNMRI has not asserted any patents against ZyXEL. The patent system is not advanced by allowing a large, non-defendant to attack the valuable intellectual property owned by a sovereign institution of higher learning.

Finally, the AIA was designed to “limit unnecessary and counterproductive litigation costs.” H.R. Rep. No. 112-98, pt. 1, at 40 (2011), 2011 U.S.C.C.A.N. 69, 69; Consolidated Trial Practice Guide at 56. Given the substantial overlap between the district court action and this IPR, this proceeding is not an effective and appropriate use of the Board’s resources and is contrary to the AIA’s overall goal to “make the patent system more efficient by the use of post-grant review proceedings.” *See General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha*, Case IPR2016-01357, Paper 19, at 16-17 (PTAB Sept. 6, 2017) (precedential). IPRs are not a tool to delay prosecution for infringement. Thus, institution is not justified. *NHK Spring*, Paper 8, at 19-20; *NetApp*, Paper 8, at 12-13; *see also*

Mylan Pharms., Inc. v. Bayer Intellectual Property GMBH, Case IPR2018-01143, Paper 13, at 12-14 (PTAB Dec. 3, 2018).

Accordingly, the Board should deny to institute institution under § 314(a).

V. THE '096 PATENT

A. Technical Background

Dr. Vojcic provides a short explanation of the technical background of the '096 patent in paragraphs 46-51 of his declaration, which is reproduced in full here:

46. The invention of the '096 patent relates to methods for constructing frame structures in orthogonal frequency-division multiple access (OFDMA) systems. EX1001, 1:16-19. “Orthogonal Frequency Division Multiple Access (OFDMA) is a multiple access scheme for transmitting data in different subcarriers in a channel, wherein the data may come from different users and may be transmitted in disjoint subsets of sub-channels in a transmission bandwidth.” *Id.* 1:22-24.

47. The '096 patent first describes the prior art. *Id.*, Figs 1 (illustrating an OFDMA frame structure under the IEEE 802.16 standard) and 2 (illustrating a placement of guiding signals (or pilot symbols) 24-1 for time-domain and frequency -domain OFDMA signals under the IEEE 802.16 standard).

48. “Referring to FIG. 2, upper and lower frequency bands may serve as guard bands 22-1 and 22-2, respectively, which may not be used to carry information.” *Id.* 1:61-63. “The placement of information may include a first part and a second part. For example, the first part of the placement includes a preamble 10'-1 having a fixed length, and the second part of the placement includes data and guard intervals between an upper row and a lower row of the data interlaced with the pilot symbols 24-1, represented by blocks marked with 'X'.” *Id.*, 1:63-2:2.

49. Then, '096 patent illustrates problems faced by the prior art, including that: “[i]n some applications such placement of information may be inflexible to bandwidth scaling due to the fixed-length preambles 10'-1 and/or 10'-2 and

the often unusable guard bands 22-1 and 22-2. Moreover, the placement may be susceptible to a Doppler effect in a high mobility scenario because the placement may be usually designed with a relatively large symbol period, which in turn may induce relatively short carrier spacing and less dense pilot symbol placement. Moreover, the limitation on pilot symbol placement may cause channel estimation error at a receiving end because of insufficient information provided for channel estimation.” *Id.*, 2:2-14.

50. The invention of the '096 patent directly addresses these problems. For example, the '096 patent discloses “a method for constructing a frame structure for data transmission, the method comprising generating a first section comprising data configured in a first format compatible with a first communication system, generating a second section following the first section comprising data configured in a second format compatible with a second communication system, wherein the second format is different from the first format, generating at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section, and combining the first section, the second section and the at least one non-data section to form the frame structure.” *Id.*, at 2:18-30. The patent further details other examples of its invention. *Id.*, 2:31-54, 2:55-67, 3:1-13, and 3:14-32.

51. The invention of the '096 patent enables “data of an old orthogonal frequency-division multiple access (OFDMA) system (hereinafter a legacy system) and data of a new OFDMA system to co-exist in an OFDMA frame by changing a frame structure of the OFDMA frame.” *Id.*, 4:21-25. The new system has the advantages of allowing larger bandwidth, higher mobility, and may use updated transmission technology while maintaining backward compatibility. *Id.*, 4:26-30.

B. The Challenged Claims

1. Claim 1

1. A method of constructing a frame structure for data transmission, the method comprising:

a. generating a first section comprising data configured in a first format compatible with a first communication system using symbols;

b. generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system's symbols and the second communication system's symbols co-exist in one transmission scheme and wherein:

c. the second format is compatible with the second communication system configured to support higher mobility than the first communication system, wherein each symbol in the second communication system has a shorter symbol period than that in the first communication system;

d. generating at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section; and

e. combining the first section, the second section and the at least one non-data section to form the frame structure.

2. Claim 2

2. The method of claim 1, wherein the non-data section comprises mapping information for at least one of the first section and the second section.

3. Claim 3

3. The method of claim 1, wherein the non-data section comprises at least one of a preamble, a frame control header 60 (FCH), a burst, and a map of at least one of the first section and the second section.

4. Claim 4

4. The method of claim 3, wherein the second section follows the first section in at least one of time sequence and frequency spectrum.

5. Claim 6

6. The method of claim 1, wherein each of the first section and the second section carries at least one of uplink and downlink data.

6. Claim 7

7. The method of claim 1, wherein the second section carries mapping information for data in the second section.

7. Claim 8

8. A method of constructing a frame structure for data transmission, the method comprising:

a. generating a first section comprising data configured in a first format compatible with a first communication system using symbols;

b. generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system's symbols and the second communication system's symbols co-exist in one transmission scheme and wherein the second communication system has pilot symbols that are denser than those in the first communication system;

c. generating at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section; and

d. combining the first section, the second section and the at least one non-data section to form the frame structure.

8. Prosecution History

The application that resulted in the '096 patent was filed on July 7, 2008.

EX1001. An office action issued on Apr. 13, 2010 included a preliminary rejection of claims 1-50. EX1004, at 38-40. Patent Owner responded on Apr. 17, 2010 and amended its claims. A final rejection issued on Aug. 31, 2010. Patent Owner responded on Nov. 30, 2010 and noted that "the claimed invention is patentably distinct from Ahmadi, Terabe, Seki, and Adams, but nonetheless amended claim 23 and added new claim 51. Another office action issued on Nov. 23, 2011 which allowed claims 23-29 and 51 and rejected the remaining claims. Patent Owner submitted a response on Apr. 23, 2011 further amending its claims.

Patent Owner conducted an interview with the examiner, and a notice of allowance issued on May 11, 2012.

C. Priority Date – Based on Provisional Application dated 2007/07/11

The '096 patent identifies its parent applications; provisional application No. 60/929,798, filed on Jul. 12, 2007 and provisional application No. 60/973,157, filed on Sep. 17, 2007. UNM's expert Dr. Vojcic has reviewed these provisional applications to determine whether the subject matter claimed in the '096 patent is supported. His opinion reflects that both provisional applications properly support the subject matter claimed in the '96 patent. The priority date of the '096 patent is therefore the filing date of its earliest provisional application in which the inventions are properly disclosed and supported, which is provisional application No. 60/929,798, filed on Jul. 12, 2007. The below table assembled by Dr. Vojcic provides the specific references to the provisional application for each claim element at issue in this proceeding:

VI. LEVEL OF ORDINARY SKILL IN THE ART

At the relevant time, a person of ordinary skill in the art in the technical field of the '096 patent would have had at least a Master's Degree in Computer Engineering or Electrical Engineering, or equivalent work experience, along with at least 1 year of experience related specifically to wireless communications, including knowledge of MIMO and OFDM. EX2004, ¶17.

VII. PATENT OWNER’S CLAIM CONSTRUCTIONS

Patent claims are construed using the framework set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–15 (Fed. Cir. 2005) (*en banc*).

A. Claim Construction Order in *UNM Rainforest Innovations v. Apple Inc.*, No. 1-20-cv-00351 (W.D. Tex.)

The Court in *UNM Rainforest Innovations v. Apple Inc.*, No. 1-20-cv-00351 (W.D. Tex.) addressed a number of claim terms in the ’096 patent. The following table represents these claim construction, which Patent Owner agrees with and adopts for the purpose of this proceeding. EX1005 (Apple Claim Construction Order).

Term	Construction
Whether the preambles for all asserted claims are limiting	<u>Court’s Construction:</u> Each preamble is limiting.
“frame structure”	<u>Court’s Construction:</u> “a single structure comprising one or more frames, wherein each frame may have one or more subframes”
“symbol”	<u>Court’s Construction:</u> Plain-and-ordinary meaning, wherein the plain-and-ordinary meaning means “a transmissible unit of information”
“pilot symbols that are denser than”	<u>Court’s Construction:</u> “more pilot symbols per unit time than, wherein a unit time is the symbol period of the first communication system”

“[first & second] communication system”	<u>Court’s Construction:</u> Construction for “communication system”: Plain-and ordinary meaning, where the plain-and-ordinary meaning is “a combination of hardware and software that transmits and receives data according to one or more communications standards”
“wherein the first communication system’s symbols and the second communication system’s symbols co-exist in one transmission scheme”	<u>Court’s Construction:</u> Plain-and-ordinary meaning where the plain-and-ordinary meaning is “wherein symbols of the first communication system and symbols of the second communication system exist together in one transmission scheme”
“data” / “non-data”	<u>Court’s Construction:</u> Data: Plain-and-ordinary meaning Non-data: Plain-and-ordinary meaning
“support higher mobility than”	<u>Court’s Construction:</u> Not indefinite. “support higher relative velocity between a transmitter and a receiver than”
“at least one of [...] and [...]”	<u>Agreed Construction:</u> “[...] and/or [...]”
“symbol period”	<u>Agreed Construction:</u> “the time it takes to transmit one symbol”

VIII. THE ASSERTED PRIOR ART

A. *Talukdar* (EX1012)

Talukdar refers to U.S. Patent Application 2009/0067377 A1 entitled “Medium Access Control Frame Structure In Wireless Communication System.”

Talukdar was filed on Aug. 13, 2008, and therefore does not predate the challenged ’096 patent. Although *Talukdar* derives priority from its provisional application No. 60/956,031, filed on Aug. 15, 2007, that priority date also does not predate the provisional application from which the challenged ’096 patent derives

priority (provisional application No. 60/929,798, filed on Jul. 12, 2007). *Talukdar* is thus not prior art to the '096 patent at all.

Talukdar concerns a “wireless communication infrastructure entity configured to allocate radio resources, in a radio frame, to a wireless terminal compliant with a first protocol and to a wireless terminal compliant with a second protocol.” EX1012, *Abstract*.

Talukdar recognizes that wireless communication systems may typically implement more than one communication technology. EX1012¶27. “For example, one or more of the base units 101 may be legacy technology base stations, for example, IEEE 802.16(e) protocol base stations, and other base station may be newer generation technologies, for example, IEEE 802.16(m) protocol base stations.” *Id.* “In these cases, it is generally desirable for the new technologies to be backward compatible with the legacy technology.” *Id.* For example, “[f]or the evolution of IEEE 802.16(e), the backward compatibility constraint implies that the legacy frame structure, for example, the 5 msec duration 802.16(e) frame, must be supported by 802.16(m) base stations. Additionally, in order to efficiently support delay sensitive applications, 802.16(m) base stations should be able to service both 802.16(m) and legacy terminals within the common frame structure.” *Id.*

Talukdar specifically addresses the problem of one-way air-interface latency, which is primarily dependent on the MAC frame duration. *Id.*, ¶2. However, this concern is balanced against the referenced need for backward compatibility. *Id.*, ¶3. The desire to vary the frame structure to improve latency must be balanced against the need of legacy systems to have a compatible frame structure:

Regarding frame structure, it is generally necessary to design frames having a relatively short duration in order to reduce latency. Thus to deliver low latency in 802.16m systems with backward compatibility, it is necessary to develop a sub-frame structure based on the legacy 802.16(e) frame. In order to address the latency requirements, it is necessary to design frames with shorter than 5 msec duration. However, to efficiently serve legacy traffic, it is also necessary that 802.16(m) systems have 5 msec legacy frames. Thus two broad classes of frames would be required for an 802.16(m) system having reduced latency and support for legacy 802.16(e) devices.

EX1012¶28.

In summary, *Talukdar* discloses frames with the 1st and 2nd communication systems sections, where the 2nd section *could have* different symbol duration—but does not specifically disclose a shorter duration. *Talukdar* further discloses that the 2nd section *could have* a different pilot structure—but does not specifically disclose a denser structure. Regarding symbol duration, *Talukdar* discloses only that “in the 802.16(m) downlink and uplink zones (second protocol regions on downlink and uplink) the . . . symbol duration, may be *the same as or different from* those defined in 802.16(e).” EX1012¶64 (emphasis added). Similarly,

regarding pilot structures, *Talukdar* discloses only that “the structures of the 802.16(m) region (sub-channel and pilot structures) *can be different* from those of the 802.16(e) regions.” EX1012¶29 (emphasis added); “The m-D L and m-UL regions in these frames may have different sub-channel/pilot structures than the legacy systems.” EX1012¶64 (emphasis added). It also includes at least one non-data section.

B. *Li* (EX1016)

Li refers to U.S. Patent Application 2007/0155387 A1 entitled “Techniques For Scheduling And Adaptation To Combat Fast Fading.” *Li* concerns “techniques to perform scheduling and adaptation to combat fast fading,” which specifically refers to a “scheduling/adaptation scheme for a communications system for which different Orthogonal Frequency Division Multiplexing (OFDM) symbol durations and subcarrier spacing are employed for slow and fast subscribers, respectively.” *Id.*

Li recognizes that “[t]he grouping of subscribers according to their speed and apportionment of subcarrier spacing accordingly may reduce inter-subcarrier interference (“ICI”) in OFDM and the corresponding OFDMA systems that support the subscribers.” EX1016¶10.

Li discloses “slow subscribers with ... longer OFDM symbol durations” and “fast subscribers with ... shorter OFDM symbol durations.” EX1016¶22; Fig. 8.

However, in *Li* all subscribers belong to 802.16e (a single system). Further, in *Li*, separate scheduling for slow and fast users occurs in separate frames, not in the same frame. So *Li* does not disclose one frame format with the 1st and 2nd sections corresponding to the 1st and 2nd communication systems as disclosed in the '096 patent.

C. *Nystrom* (EX1017)

Nystrom refers to U.S. Patent Application 2007/0104174 A1 entitled “Method And Apparatus For Allocating A Pilot Signal Adapted To The Channel Characteristics.” *Nystrom* concerns a “set of different pilot structures[,] designed for use in different environments and/or different user behaviors that are expected to occur in a cell.” EX1017, *Abstract*. *Nystrom* thus attempts to adapt pilot structure to the particular radio conditions for a given user. *Id.* *Nystrom* teaches two embodiments to accomplish this, one in which “the entire resource space is provided with different pilot structures in different parts (110A-D) in advance and allocation of resources to the users are then performed in order to match estimated radio conditions to the provided pilot structure.” *Id.* In the second, “allocation is performed first, and then the actual pilot structure is adapted within the allocated resource space area to suit the environmental conditions.” *Id.*

Nystrom addresses the problem of adapting a multi-carrier system to the “difficult, ever changing, hard-to-predict multi-user environments that are

envisioned for future wireless systems.” EX1017¶5. It teaches a balanced design of its pilot structure to accommodate the worst-case scenario so that detection becomes possible even under the worst possible conditions, as well as when the situation is better than the worst case, which typically is the case most of the time. In the first situation, “such a [worst-case] pilot structure gives rise to a substantial pilot overhead, and is indeed necessary in these worst-case scenarios.” EX1017¶6. In the second, the normal case, “the pilot structure is unnecessarily extensive, giving an unnecessary pilot overhead for most users.” *Id.* “This reduces data capacity in the own cell and furthermore increases the interference to the neighboring cells (so called 'pilot pollution').” *Id.*

In summary, *Nystrom* thus discloses the use of denser pilots for high mobility users: Users with “radio conditions demanding a high density of pilots”—such as fast-moving users—could be allocated resource space with increased pilot density in the time dimension, frequency dimension, or both.” EX1017¶43; Fig. 5A (showing portions of the radio resource space 110A, 110C, and 110D with higher pilot density). But *Nystrom* also does not disclose one frame format with the 1st and 2nd sections.

IX. PETITIONER HAS FAILED TO DEMONSTRATE A REASONABLE LIKELIHOOD OF PREVAILING AS TO ANY CHALLENGED CLAIM.

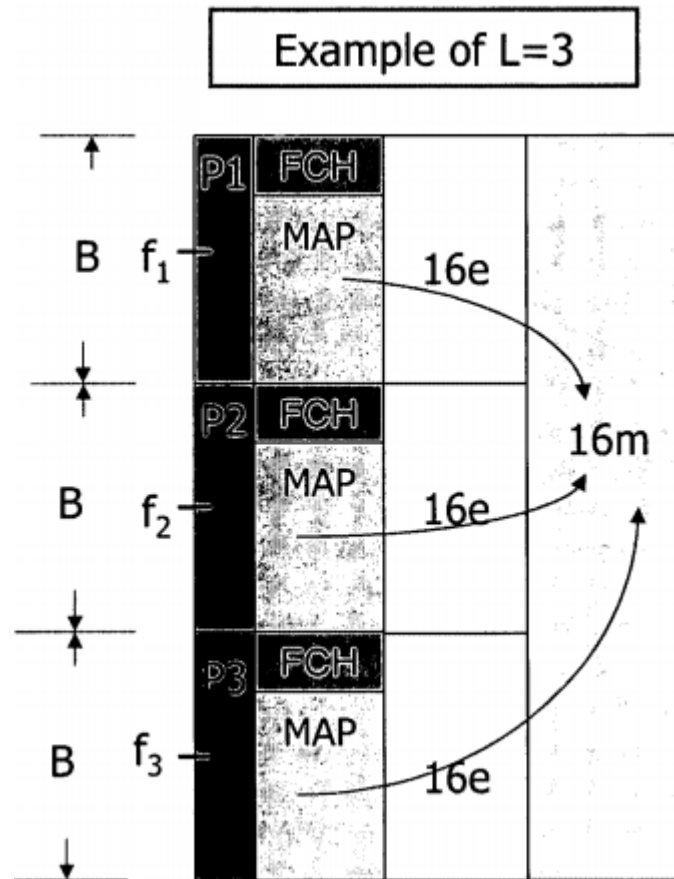
A. *Talukdar* Is Not Prior Art

Talukdar was filed on Aug. 13, 2008, and therefore does not predate the challenged '096 patent. Although *Talukdar* derives priority from its provisional application No. 60/956,031, filed on Aug. 15, 2007, that priority date also does not predate the provisional application from which the challenged '096 patent derives priority (provisional application No. 60/929,798, filed on Jul. 12, 2007). *Talukdar* is thus not prior art to the challenged claims of the '096 patent at all.

claim element	support in provisional No. 60/929,798
1. A method of constructing a frame structure for data transmission, the method comprising:	The provisional application discloses a method of constructing a frame structure for data transmission. The frame structure specifically supports the frame structure of 802.16m, while also ensuring backward compatibility with legacy systems. ✦ Backward compatibility • 802.16m shall be backward compatible with legacy system 802.16e • Systems based on IEEE 802.16m and 802.16e systems shall be able to operate on the same RF carrier, with the same channel bandwidth; and should be able to operate on the same RF carrier with different channel bandwidths. ✦ It is necessary to devise the frame structure of 802.16m frame supporting backward compatibility EX2007 ('096 Provisional) at 2. Exemplary frame structures are provided in the disclosure. EX2007 ('096 Provisional) at 3, 7.

a. generating a first section comprising data configured in a first format compatible with a first communication system using symbols;

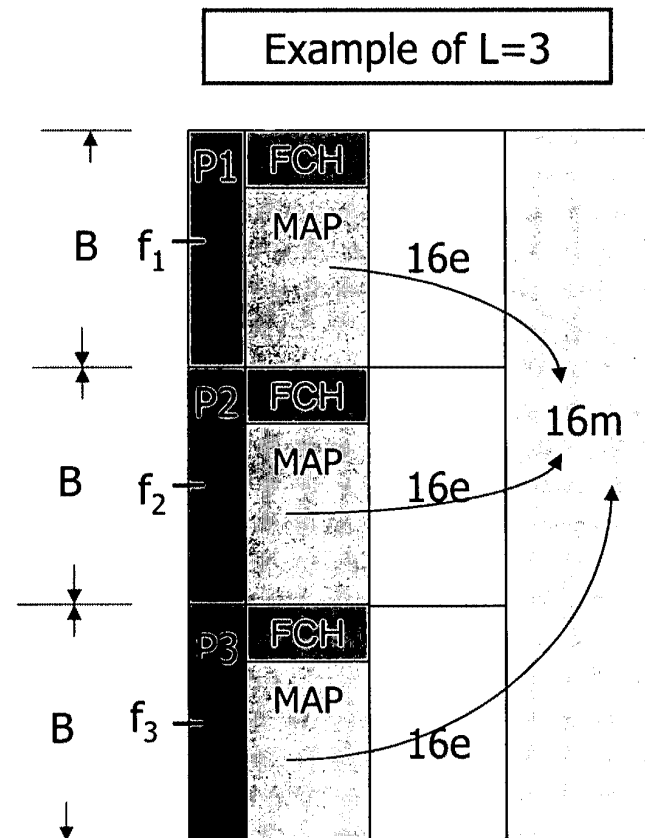
The provisional discloses a first section comprises data configured in a first format compatible with 802.16e:



EX2007 ('096 Provisional) at 2.

b. generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system's symbols and the second communication system's symbols co-exist in one transmission scheme and wherein:

The provisional discloses a second section in a second format compatible with 802.16m, which follows the first section compatible with 802.16e in one transmission scheme.



EX2007 ('096 Provisional) at 3.

✦ Structure A

- An OFDMA system with multiple zones

EX2007 ('096 Provisional) at 8.

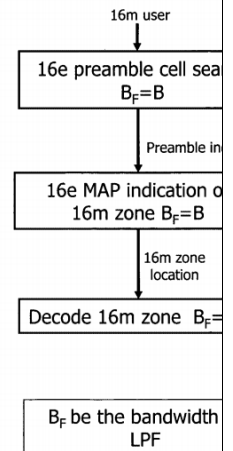
c. the second format is compatible with the second communication system configured to support higher mobility than the first communication system, wherein each symbol in the second communication system has a shorter symbol period than that in the first communication system;	The provisional discloses that the second format compatible with 802.16m is designed to support higher mobility, <i>i.e.</i>, speed at which the mobile unit is moving, and uses symbols that are shorter (<i>i.e.</i> the bandwidth is larger) than the symbols in 802.16e. ✦ New standard 802.16m is being developed for next generation wireless communication • Enhanced spectrum efficiency • Higher speed EX2007 ('096 Provisional) at 2. Both, “spectrum efficiency” and “higher speed” are advantages of the second communication system. The former implies higher data speed, which clarifies the meaning of “higher speed” as referring to a higher velocity mobile unit. ✦ Frequency planning • Occupy the same band class as 802.16e • A 802.16m channel uses multiple (L) contiguous 802.16e channels • L BS's share the same 802.16m zone with L*B bandwidth (802.16e BW with B) EX2007 ('096 Provisional) at 3. A POSITA would have known at the time of the provisional application that by use of the following formulas a “shorter symbol period” can be shown for the second system. N = number of subcarriers K = number of samples in the cyclic prefix $T_s = \frac{N + K}{3B}$ $T_{sL} = \frac{N_L + K_L}{B}$ Where T_s is the symbol period of the second system and T_{sL} is the symbol period of the legacy system.
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By explicitly disclosing that the bandwidth of the second system is larger, the provisional application clearly supports the claim requirement that the second system has a shorter symbol period.

Proposed structure A

Cell search by 16m user

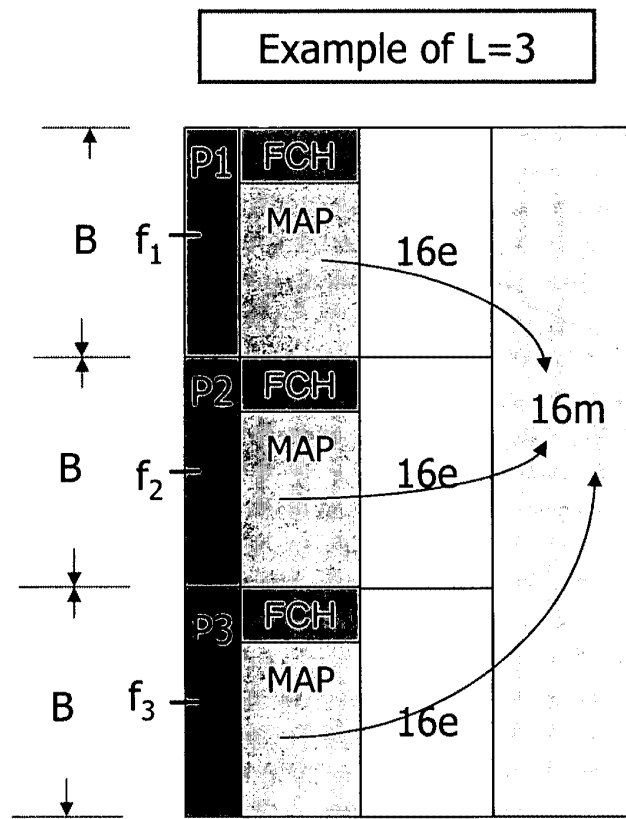
- Baseband BW of $L \cdot B$
- Detect 16e preamble with BW of B
- Decode FCH/MAP to decide the location of 16m zone
- Retrieve 16m zone with BS with BW of $L \cdot B$



EX2007 ('096 Provisional) at 4.

d. generating at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section; and

The provisional discloses legacy sections, *e.g.*, MAPs, which correspond to at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section. The FCH (frame control header) and preambles (*e.g.*, P1, P2, P3) also comprise non-data sections.



EX2007 ('096 Provisional) at 3.

Cell search by 16m user

- Baseband BW of $L \cdot B$
- Detect 16e preamble with BW of B
- Decode FCH/MAP to decide the location of 16m zone

EX2007 ('096 Provisional) at 4.

e. combining the first section, the second section and the at least one non-data section to form the frame structure.

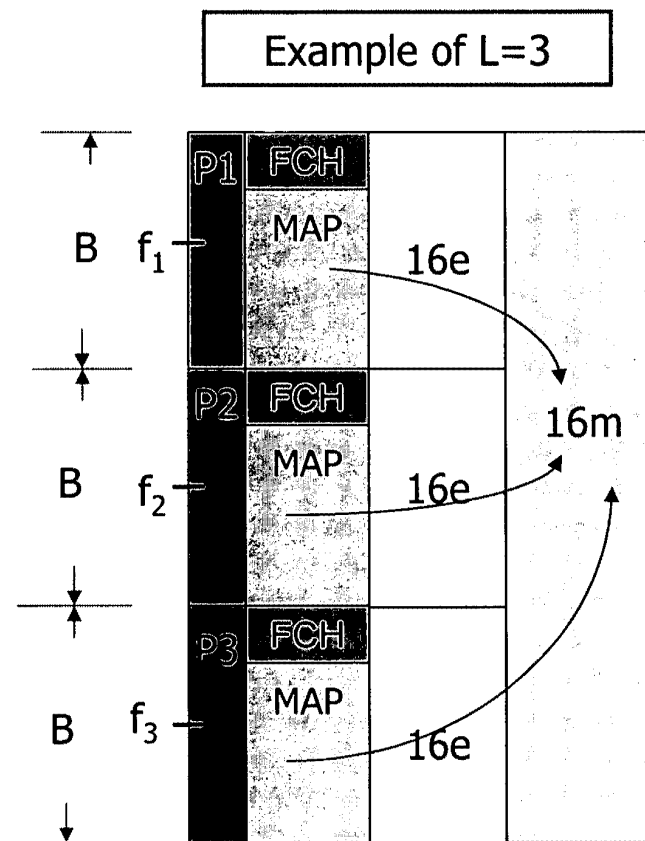
The provisional discloses a composite frame, which combines 802.16e and 802.16m sections plus MAP, FCH, and preamble sections (Pi's).

⌘ Backward compatibility

- 802.16m shall be backward compatible with legacy system 802.16
- Systems based on IEEE 802.16m and 802.16e systems shall be able to operate on the same RF carrier, with the same channel bandwidth should be able to operate on the same RF carrier with different channel bandwidths.

⌘ It is necessary to devise the frame structure of 802.16m frame supporting backward compatibility

EX2007 ('096 Provisional) at 2.

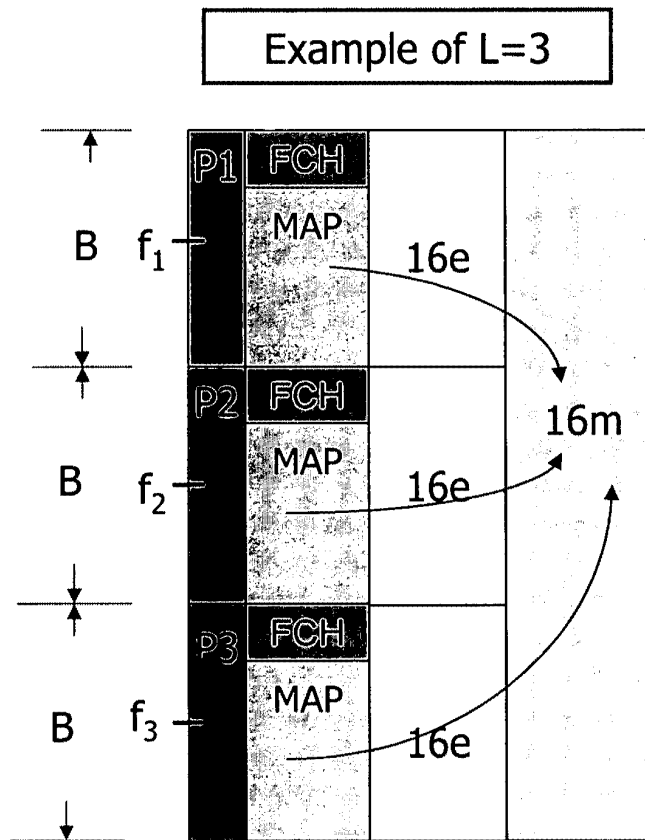


EX2007 ('096 Provisional) at 3.

2. The method of claim 1, wherein the non-data section comprises mapping information for at least one of the first section and the second section.	The provisional discloses a non-data section which comprises MAPs that represent mapping information. • Backward compatibility ○ 16e preamble/FCH/MAP are kept unchanged ○ Only new DL (UL) 16m zones are appended (resource allocation is done by BS cooperation) EX2007 ('096 Provisional) at 3. • 16m service detection ○ Detection of 16e preamble/FCH/MAP, or ○ Detection of 16m preamble/FCH/MAP EX2007 ('096 Provisional) at 6.
3. The method of claim 1, wherein the non-data section comprises at least one of a preamble, a frame control header (FCH), a burst, and a map of at least one of the first section and the second section.	The provisional discloses a non-data section which comprises at least one of a preamble, a frame control header (FCH), a burst, and a map of at least one of the first section and the second section. • Backward compatibility ○ 16e preamble/FCH/MAP are kept unchanged ○ Only new DL (UL) 16m zones are appended (resource allocation is done by BS cooperation) EX2007 ('096 Provisional) at 3.

4. The method of claim 3, wherein the second section follows the first section in at least one of time sequence and frequency spectrum.

The provisional discloses a second section in a second format compatible with 802.16m, which follows the first section compatible with 802.16e in one transmission scheme.



EX2007 ('096 Provisional) at 3.

6. The method of claim 1, wherein each of the first section and the second section carries at least one of uplink and downlink data.

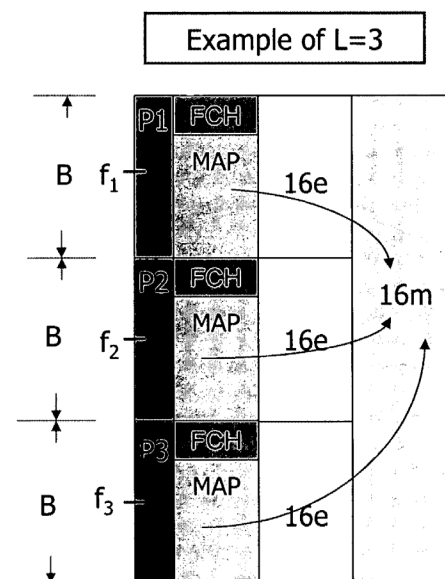
The provisional discloses a frame structure where each of the first section and the second section carries at least one of uplink and downlink data. For example, the provisional specifically discloses an OFDMA frame structure where multiple base stations transmit downlink (DL) 16e data in the first section using subcarriers with bandwidth B and in the second section transmit the DL 16m data by sharing the subcarriers on bandwidth $B \cdot L$.

The provisional application refers to “16e” in the proposed structure A on page 3. A POSITA would understand that the “16e” section includes DL or UL data because these systems transmit in both directions. EX2007 ('096 Provisional) at 3.

The provisional also refers to “[...]ew DL (UL) 16m zones are appended”. EX2007 ('096 Provisional) at 3. A POSITA would understand that these new DL (UL) 16m zones carry downlink and uplink data.

BS cooperation

- 16e BS's transmit 16e data using subcarriers with BW B of their own, while share subcarriers with BW $B \cdot L$ in 16m zone.



	EX2007 ('096 Provisional) at 3.
7. The method of claim 1, wherein the second section carries mapping information for data in the second section.	The provisional discloses a frame structure wherein the second section carries mapping information for data in the second section. ▪ Backward compatibility • 16e preamble/FCH/MAP are kept unchanged • Adjust the duty cycle so that 16e subframes are shorten in a frame with the other unused portion left for 16m service • 16m data can be informed by 16e MAP. In case 16e signal can not provide information of 16m service, 16m preamble is optionally given to 16m user for cell search ▪ BS cooperation • 16e/16m BS's share the same BW with TDMA-like approach • 16e zone can vanish if 16m preamble is given ▪ 16m service detection • Detection of 16e preamble/FCH/MAP, or • Detection of 16m preamble/FCH/MAP EX2007 ('096 Provisional) at 6. ▪ Example of a multi-standard frame Legend: p1: 16e preamble p2: 16m preamble EX2007 ('096 Provisional) at 7.
8. A method of constructing a frame structure for data transmission, the method comprising:	See 1 preamble.

a. generating a first section comprising data configured in a first format compatible with a first communication system using symbols;	See 1a.
b. generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system's symbols and the second communication system's symbols co-exist in one transmission scheme and wherein the second communication system has pilot symbols that are denser than those in the first communication system;	See 1b. I understand that the District Court in <i>UNM Rainforest Innovations v. Apple Inc.</i> , No. 1-20-cv-00351 (W.D. Tex.) construed the claim term “pilot symbols that are denser than” as “more pilot symbols per unit time than, wherein a unit time is the symbol period of the first communication system.” EX1011 (Apple Claim Construction Order). Given that construction, the provisional discloses the limitation regarding pilot density by pointing to increased density (in the temporal dimension) as a natural result of reduced symbol period – as shown above. Further, the goal of achieving “higher speed” in conjunction with the proposed dual-system frame structure would suggest modifying density of pilots in one of the systems as a solution to the problem caused by increased Doppler shifting due to high speed.
c. generating at least one non-data section containing information describing an aspect of data in at least one of the first section and the second section; and	See 1d.
d. combining the first section, the second section and the at least one non-data section to form the frame structure.	See 1e.

EX2004, ¶52. As detailed in the table, every element of the challenged claims is properly supported by the provisional application.

B. Ground 1: Claims 1-4, 6, and 7 are not obvious over *Talukdar* and *Li*.

1. Claim 1

a) 1b: “generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system’s symbols and the second communication system’s symbols co-exist in one transmission scheme”

Petitioner argues that the combination of *Talukdar* and *Li* discloses “generating a second section following the first section, the second section comprising data configured in a second format compatible with a second communication system using symbols, wherein the first communication system’s symbols and the second communication system’s symbols co-exist in one transmission scheme.” However, Petitioner mischaracterizes *Li* in several material aspects.

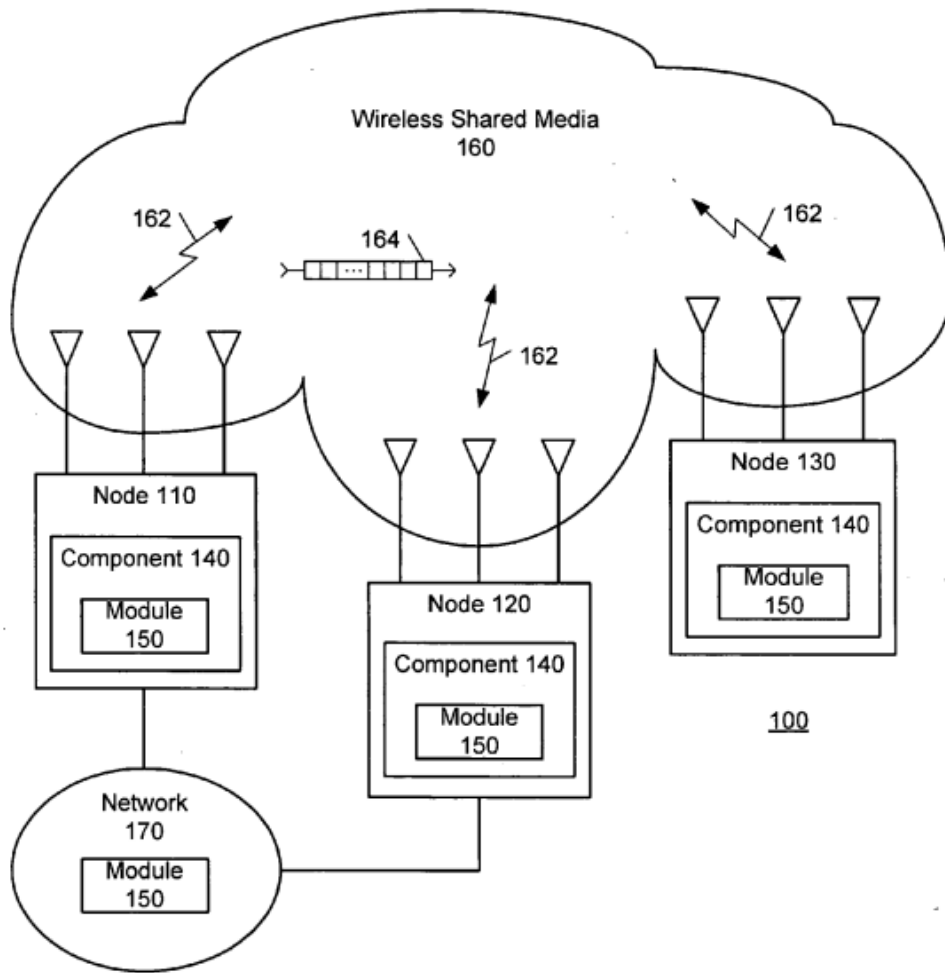
First, *Li* does not disclose a system where “the first communication system’s symbols and the second communication system’s symbols co-exist[ed] in one transmission scheme.” “A POSITA would understand the limitations of claim 1 to require that each one transmission scheme corresponds to one frame transmission.”

EX2004, ¶61. Dr. Roy agrees: “both 802.16(e) and 802.16(m) used

OFDM/OFDMA symbols and were part of one transmission scheme (same frame).” EX1002, ¶122. A POSITA would further understand that the claim limitation requires that “one transmission scheme (the same frame) includes a 1st and 2nd segments, respectively, carrying symbols of the 1st and 2nd communication systems, that correspond to at least somewhat different radio protocols, such as 802.16e and 802.16m, two versions of the WiMAX protocol.” EX2004, ¶61; *see, e.g.*, EX1001, 1:16-35. Close analysis of *Li* shows material differences.

Specifically, *Li* discloses a network in Fig. 1 which may include multiple nodes such that each node may possibly correspond to a different communication system, *e.g.*, Wi-Fi, cellular, etc. *See e.g.* EX1016, ¶¶26-27. However, *Li* does not disclose that any particular one of these nodes may include multiple communication systems. EX2004, ¶62. *Li* also does not disclose that any particular one of these nodes or communicate with two or more sets of subscribers where the subscribers in the two sets use different communication systems. *Id.*

FIG. 1



EX1016, Fig. 1. While *Li* describes various embodiments of this system in Figs. 3-7 and references that slow and fast users could use different symbol durations, *Li* never discloses that this could be done across multiple communication systems. “All descriptions are always in the context of only one communications system, 802.16e.”

EX2004, ¶63. This is directly supported by the below disclosures:

FIGS. 3-7 more specifically describe, for example, a frame structure and the arrangement of the communications system 100 and/or node

110 to generate the frame structure. For example, FIG. 3 illustrates a frame 300 according to the current IEEE 802.16e draft standard for which the Subcarrier spacing is constant for all Subscribers in the cell.

EX1016, ¶33.

FIG. 5 illustrates the time-frequency location of a fast subscriber of an embodiment for Band AMC of 802.16e. In an embodiment, a Subscriber is first categorized as to its speed.

EX1016, ¶36.

FIG. 6 illustrates the time-frequency location and grouping of multiple fast Subscribers of an embodiment. The frequency-time Zones of the fast Subscriber symbols according to the 802.16e draft standard are usually scattered in each frame as illustrated in frame 600 by fast subscribers 610-630.

EX1016, ¶40. In summary, all of *Li's* subscribers, slow and fast, are operating within the context of a single communication standard, 802.16e, contrary to Dr. Roy's statement.

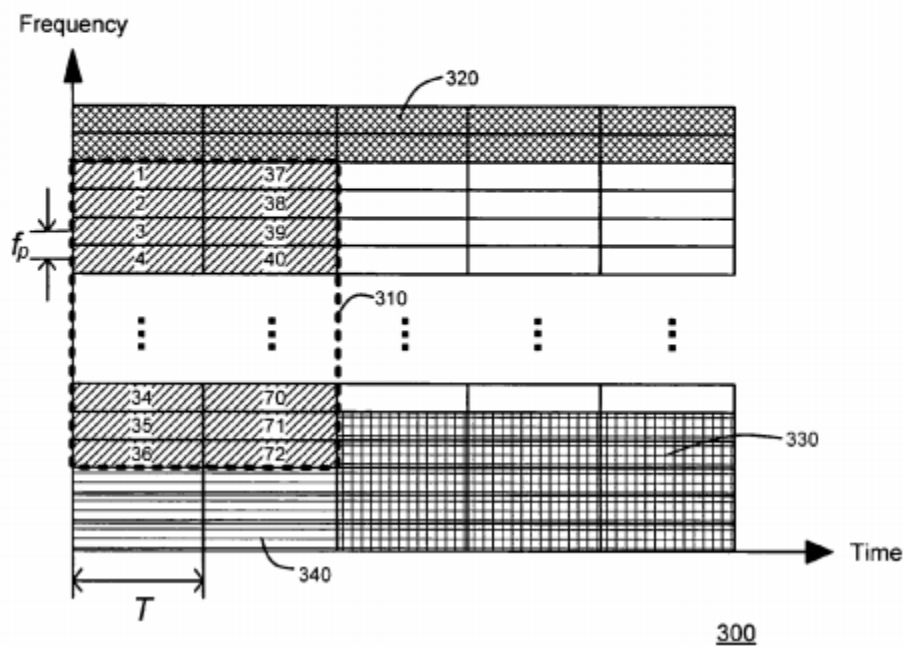
Petitioner further mischaracterizes *Li's* Fig.5 as disclosing a single frame with long and short symbols:

Referring to Figure 5 of *Li*, *Li* disclosed one embodiment in which a frame included symbols for a slower subscriber station with a symbol period of T , and symbols for a faster subscriber station with a symbol period half as long, $T/2$: 'In an embodiment, the communications system 100 and/or node 110 ***assigns the even OFDM subcarriers (e.g., $N/2$ nonadjacent subcarriers) to a fast subscriber and shortens the symbol duration from T to $T/2$.***'

EX1002, ¶123 (emphasis in original). Petitioner's statement is demonstrably wrong.

All relevant embodiments in *Li* disclose that any one individual frame has a fixed—*i.e.* the same—symbol duration and subcarrier spacing throughout the frame, as shown by the excerpts below. EX2004, ¶66.

FIG. 3



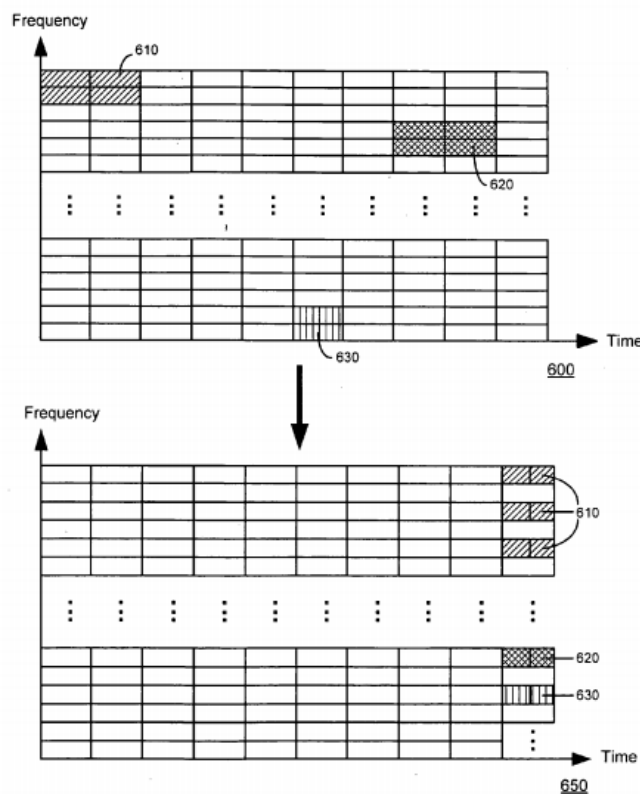
EX1016, Fig. 3. No variations in symbol length in a single frame are shown in the diagram.

FIGS. 3-7 more specifically describe, for example, a frame structure and the arrangement of the communications system 100 and/or node 110 to generate the frame structure. For example, FIG. 3 illustrates a frame 300 according to the current IEEE 802.16e draft standard for which the subcarrier spacing is constant for all subscribers in the cell. Each block of frame 300 represents one QAM symbol carried by one subcarrier to a subscriber and different fill patterns represent the frequency-time zones assigned to multiple subscribers. For example,

subscribers 310-340 have frequency-time zones assigned as illustrated. Furthermore, the frequency-time zones have been assigned to the subscribers 310-340 regardless of their speed. Said alternatively, while some subscribers may be mobile and other subscribers may be stationary, that distinction does not determine the frequency-time zone to which the subscribers 310-340 respective symbols are assigned.

EX1016, ¶33. Again, no variations in symbol length in a single frame are shown.

FIG. 6



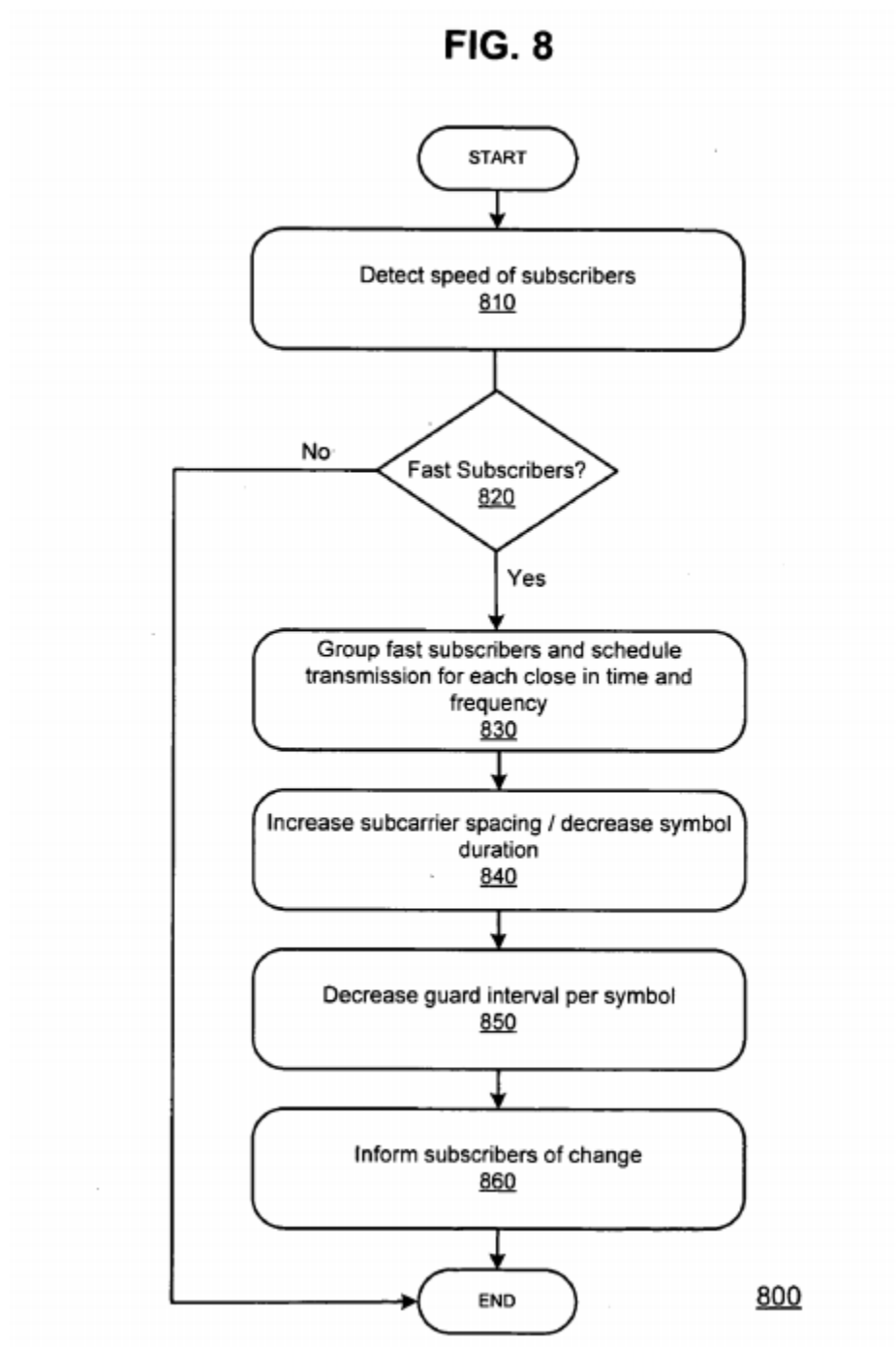
EX1016, Fig. 6. Like the above citations, Fig. 6 concerns multiple fast subscribers, but does not disclose any variations in symbol length in a single frame.

FIG. 6 illustrates the time-frequency location and grouping of multiple fast subscribers of an embodiment. The frequency-time zones of the fast subscriber symbols according to the 802.16e draft standard are

usually scattered in each frame as illustrated in frame 600 by fast subscribers 610-630.

EX1016 ¶40. Therefore, petitioner's citation to Fig. 5 of *Li*, does not support Petitioner's argument that it discloses a single frame with long and short symbols. *Li* simply does not disclose one frame with two segments with long and short symbols. *EX2004*, ¶67.

Fig. 8 of and its corresponding description similarly show that fast users are grouped in one frame:



EX1016, Fig. 8.

FIG. 8 illustrates one embodiment of a logic flow. FIG. 8 illustrates a logic flow 800 in accordance with one embodiment. At 810, the speed of a subscriber is detected. The subscriber speed can be detected by measuring the Doppler spread of the subscriber's OFDMA uplink signal, the delay spread of the OFDMA uplink signal, the intercarrier interference, or a combination thereof. The subscriber can thereafter be classified at 820 as a fast subscriber or a slow subscriber based on its speed compared to a threshold speed or speed relative to other subscribers. Thereafter for a fast subscriber, at 830 the subscriber is grouped with other subscribers of the same speed classification. For example, if the subscriber is classified as a fast subscriber, transmission to the fast subscriber can be scheduled closely (*e.g.*, close or adjacent portions of the OFDM frame in time-frequency). For fast subscribers, at 840 the subcarrier spacing for the transmission is increased and the OFDM symbol duration is decreased. Further, at 850, the guard interval for each shortened OFDM symbol is itself shortened. As noted, the OFDM signal for the fast subscribers may have a shorter delay spread enabling the guard interval for each symbol thereof to be shortened. As a result, the total guard interval for transmission to a fast subscriber with shorter symbol length and increased subcarrier spacing would be substantially the same. Accordingly, the transmission to the fast subscriber would have substantially the same data rate as transmissions to slow subscribers. Finally, at 860 all subscribers are informed of the change to the subcarrier spacing and symbol duration. For example, a downlink frame header or pilot location may be used to inform the subscribers when and where the change starts.

EX1016, ¶42. The conclusion that can readily be drawn from every one of these citations, is that “what Fig. 5 symbolically shows is actually two frames corresponding to two time intervals such that in the first time interval/frame, slow users are scheduled and subsequently in next time interval/frame, fast users are scheduled.” EX2004, ¶67.

Li thus discloses long and short symbols for slow and fast moving users, respectively, but only within one communication system, 802.16e. Further, these long and short symbols are not disclosed to be in a single communication system. Instead, “long symbols belong to one frame and short symbols to another frame.” EX2004, ¶69.

Petitioner further argues that a POSITA would have found it obvious to incorporate the teaching of *Li*, which petitioner alleges is a frame that included symbols for slower moving stations (each a “first communication system”) and faster-moving stations (each a “second communication system”) into *Talukdar*. However, as explained above, *Li* does not disclose a single frame that included various length symbols.

Further, “a POSITA would not find it obvious to combine the teachings in *Li* into *Talukdar* because *Li* is a single communications system, and uses separate frames for slow and fast users with long and short symbols, respectively, and as such is incompatible with *Talukdar*.” EX2004, ¶72. Petitioner provides no explanation as to how the incompatibilities between *Talukdar* and *Li* could be resolved, and a redesign of “*Talukdar* . . . would be a non-trivial undertaking.” *Id.*

b) 1c: “the second format is compatible with the second communication system configured to support higher mobility than the first communication system”

Neither *Talukdar* alone nor *Talukdar* and *Li* teach or suggest that “the second format is compatible with the second communication system configured to support higher mobility than the first communication system.”

Contrary to Petitioner’s speculative argument, *Talukdar* does not disclose high and low mobility. Petitioner’s reference to *Ahmadi* (EX1018) does not cure *Talukdar*’s deficiency. *Ahmadi* merely references the then-current next generation WiMAX system, and only stated that “[e]mbodiments of the invention may enable the next generation of mobile WiMAX systems (*e.g.*, based on IEEE 802.16m standard) to efficiently support substantially high mobility and low latency applications” EX1018, ¶27. Beyond that general statement, *Ahmadi* provides no detail that would lead a POSITA to the detailed claim limitation of the ’096 patent. EX2004, ¶73.

Petitioner’s expert further argues that this claim element would have been obvious based on *Talukdar* alone, because “a POSA would have found it obvious to try generating a hybrid frame configured in any one of these limited ways”. EX1002, ¶127. However, petitioner cites only very limited support in *Talukdar* for this position, and this argument is directly contradicted by the testimony of Dr. Vojcic: “A significantly more detailed disclosure would have been required to

allow a POSITA to arrive at and realized the importance of this inventive feature without knowledge of the '096 invention itself.” Without the impermissible application of hindsight based on the actual disclosure of the '096 patent as a roadmap, it would not easily have been possible to discern the invention of the '096 patent. “Dr. Roy’s opinion regarding obviousness of this claim limitation is not supported by the limited disclosures in *Talukdar*.” EX2004, ¶74.

Li does not cure the deficient disclosure of *Talukdar*. Petitioner is relying on the same mischaracterizations of *Li* addressed above in relation to limitation 1b. and fully incorporate here by reference. EX1002, ¶¶128-138. *Li*’s disclosure falls short for several reasons. First, Petitioner argues that “[e]ach of *Li*’s faster-moving subscriber stations was a ‘second communication system configured to support higher mobility than’ *Li*’s fixed or slower-moving subscriber stations, which were each ‘[a] first communication system.’” EX1002, ¶128. This is false. As shown above in relation to claim element 1b., “in *Li* both slow and fast subscribers used the same communication system, 802.16e.” EX2004, ¶76.

Further, contrary to Dr. Roy’s statement (EX1012, ¶129), neither *Talukdar* alone nor *Talukdar* in combination with *Li* renders obvious claim element 1[c] ‘wherein: the second format is compatible with the second communication system configured to support higher mobility than the first communication system.’” As explained *supra*, claim element 1.c is not obvious without the improper use of

hindsight. Further, even “if one brings the fast moving 802.16e user into the second part of the frame in *Talukdar*, then *Talukdar* (combined with *Li*) would have the same communication system, 802.16e in both parts of the frame, and the relevant part of limitation 1.c could not be met.” EX2004, ¶77. Given that “both low and high mobility users employ the same [communications] system, 802.16e” (EX2004, ¶78), Petitioner’s combination of *Talukdar* simply does not disclose claim limitation 1c. requiring that the “second communication system [be] configured to support higher mobility than the first communication system.”

1. For these reasons modifying *Talukdar* to incorporate the teachings of *Li* would not have resulted in the claimed invention of the ’096 patent. Therefore, Petitioner failed to show that *Talukdar* alone, or in combination with *Li*, teaches or suggests limitation 1.c of the ’096 patent.

2. Claim 2

Claim 2 depends on Claim 1 and is not taught or suggested by *Talukdar* alone or *Talukdar* with *Li* for the same reasons as stated in regard to Claim 1.

3. Claim 3

Claim 3 depends on Claim 1 and is not taught or suggested by *Talukdar* alone or *Talukdar* with *Li* for the same reasons as stated in regard to Claim 1.

4. Claim 4

Claim 4 depends on Claims 3 and 1 and is not taught or suggested by *Talukdar* alone or *Talukdar* with *Li* for the same reasons as stated in regard to Claim 1.

5. Claim 6

Claim 6 depends on Claim 1 and is not taught or suggested by *Talukdar* alone or *Talukdar* with *Li* for the same reasons as stated in regard to Claim 1.

6. Claim 7

Claim 7 depends on Claim 1 and is not taught or suggested by *Talukdar* alone or *Talukdar* with *Li* for the same reasons as stated in regard to Claim 1.

C. Ground 2 – Claim 8 is not obvious over *Talukdar* and *Nystrom*.

1. Claim 8

a) “the second communication system has pilot symbols that are denser than those in the first communication system”

Neither *Talukdar* alone nor *Talukdar* and *Nystrom* teach or suggest that “the second communication system has pilot symbols that are denser than those in the first communication system.”

While *Talukdar* does disclose frames with the 1st and 2nd communication systems sections, where the 2nd section *could have* a different pilot structure—*Talukdar* does not specifically disclose a denser structure. *Talukdar* discloses only that “the structures of the 802.16(m) region (sub-channel and pilot structures) *can*

be different from those of the 802.16(e) regions.” EX1012, ¶29 (emphasis added); “The m-D L and m-UL regions in these frames may have different sub-channel/pilot structures than the legacy systems.” EX1012, ¶64 (emphasis added). It also includes at least one non-data section.

Petitioner reaches out to *Nystrom* to fill the gap. However, contrary to Dr. Roy’s statement that “*Nystrom* disclosed a ‘second communication system [with] pilot symbols that are denser than those in the first communication system’ by describing mobile stations that used denser pilot patterns in the time and/or frequency dimension” (EX1002¶157), there is no disclosure in *Nystrom* that the first and second communication systems use different schemes at all. Instead, “all embodiments are in the context of one communications system.” EX2004, ¶88. Dr. Roy does not provide any citations supporting that there are two communications systems.

Dr. Roy further cites to paragraph 4 of *Nystrom* to argue that a POSITA would have known to incorporate *Nystrom*’s teaching of using denser pilot symbols into *Talukdar* because “*Nystrom* disclosed that this better compensated for the effects of Doppler shift and fading experienced by faster moving remote units (such as those in *Talukdar*’s wireless system) and thus provided a teaching, suggestion, or motivation to apply this technique in the context of *Talukdar*’s system.” EX1002, ¶162. To support his statement, Dr. Roy mischaracterizes

Nystrom as teaching “that mobile stations traveling at higher speeds experienced higher Doppler shift and fading in time and/or frequency.” *Id.* (citing EX1017, ¶4). EX1002, ¶162. However, this is a mischaracterization of *Nystrom*.

First, Dr. Roy cites only a portion of the relevant section of *Nystrom*. The full citation is:

In a cellular multi user, multi-carrier wireless communications system, the base station must accommodate many users that each experiences different channel characteristics due to fading in both time and frequency. Furthermore, different users travel at different speeds and thus experience different Doppler shifts.

EX1017, ¶4. This section generally discusses channel characteristic. Per Dr. Vojcic, this is “simply a general statement, known in the art, that users may experience ‘different channel characteristics due to fading in both time and frequency,’ and also that users travelling at different speeds may experience different Doppler shifts.” EX2004, ¶90. This section does not support Dr. Roy’s statement that “mobile stations traveling at higher speeds experienced higher Doppler shift and fading in time and/or frequency.” EX1002, ¶162. “A POSITA would understand that moving speed does not affect fading in frequency, *i.e.*, the frequency selectivity.” EX2004, ¶90.

Second, Dr. Roy argues that a POSITA would have been motivated combine *Nystrom* and *Talukdar* to get to the use of denser pilot symbols because “*Nystrom* disclosed that this better compensated for the effects of Doppler shift and fading

experienced by faster moving remote units (such as those in *Talukdar*'s wireless system) and thus provided a teaching, suggestion, or motivation to apply this technique in the context of *Talukdar*'s system." EX1002, ¶162. However, this is based also on Dr. Roy's mischaracterization of *Nystrom*. *Nystrom*'s integral teaching does not support Dr. Roy's obviousness conclusion.

The integral teaching of *Nystrom* is best illustrated by the embodiment shown in Fig. 1. The annotations by Dr. Vojcic specifically illustrate the high speed and low speed aspects of the embodiment.

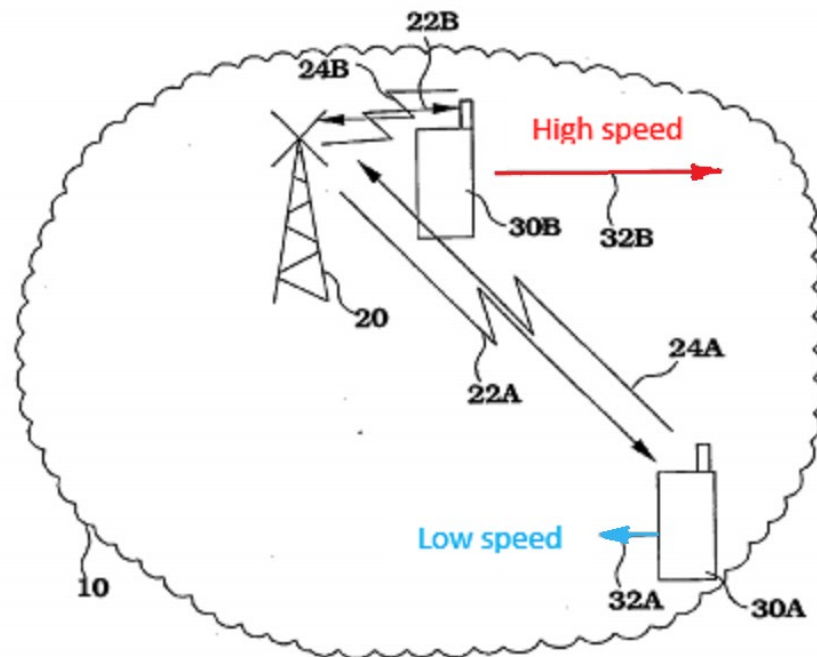


Fig. 1

EX2004, ¶92 (*citing* EX1017, Fig. 1) (emphasis added – red highlights correspond to high speed and blue highlights to low speed).

User equipment **30A** is located at a relatively large distance from the access point **20**, but the speed **32A** (illustrated as an arrow) of the user equipment **30A** is small. User equipment **30b** is located closer to the access point **20**, but has a high speed **32B** (also illustrated as an arrow). The user equipment **30A** may have a relatively high need for repetitive pilots in the frequency dimension, since the propagation conditions for the different carriers may differ considerably over the bandwidth in case of multi-path propagation with large delay spread. However, the radio conditions are probably quite slowly varying with time due to the small speed of user equipment **30A**. The user equipment **30B** is close to the access point, and a pilot on one frequency can probably be used for channel estimations for many neighboring carriers. However, the radio conditions are probably changing rapidly in time, whereby frequent pilots in time dimension are required.

EX2004, ¶92 (*citing* EX1017, ¶29) (emphasis added). The reference discloses multiple possibilities regarding fixed users and potentially mobile users, but does not disclose anything about the relative density of pilots between segments:

From this teaching in *Nystrom*, a POSITA would conclude that for fixed users with high delay spread in the first segment of the frame in *Talukdar* corresponding to 802.16e, pilots which are dense over frequencies would be appropriate, and in the second segment of the frame for 802.16m users, even if we accept that these would be mobile users, pilots dense over time would be appropriate. That is, *there is no basis to suggest that the density of pilots in the second segment would be higher than in the first segment*. Actually, it could be the opposite, depending on the delay spreads for fixed (or low speed) users and Doppler spreads, *i.e.*, velocity, for mobile users.

EX2004, ¶92 (emphasis added). Dr. Roy improperly focuses on only a part of this embodiment potentially relevant to hypothetical fast-moving users. For these reasons, Dr. Vojcic concludes that “a POSITA would not have been motivated to incorporate *Nystrom*’s teaching into *Talukdar*.” EX2004, ¶92.

This understanding of the integral teaching in *Nystrom* regarding the delay spread and Doppler spread in relation to the pilot density is confirmed by analysis of the embodiment show in Fig. 5A. “A POSITA would understand that the small/large delay spread corresponds to low/high frequency selectivity, requiring low/high pilot density over frequency.” EX2004, ¶93. “A POSITA would also understand that small/large Doppler spread (or equivalently velocity) corresponds to low/high time selectivity, requiring low/high pilot density over time.” *Id.*

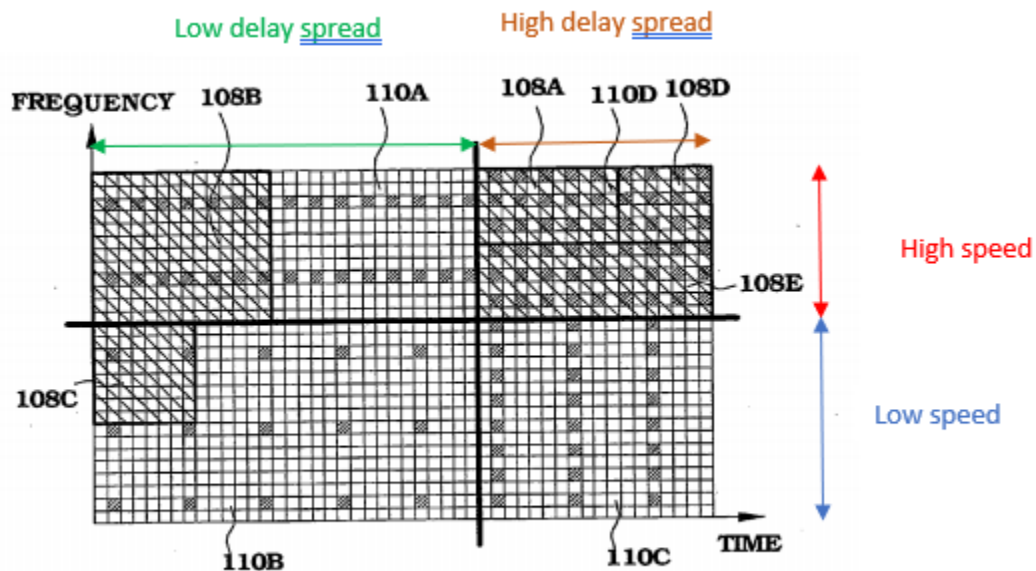


Fig. 5A

EX1017, Fig. 5A (emphasis and annotations added).

In the situation in FIG. 5A, there are pilot structures suitable for typically four combinations of Doppler and delay spread. In part 110A, the pilot structure is intended for a large Doppler and low delay spread. In part 110B, the pilot structure is intended for a low Doppler and low delay spread. In part 110C, the pilot structure is intended for a low Doppler and high delay spread. In part 110D, the pilot structure is intended for a high Doppler and high delay spread.

EX1017, ¶42. In effect, *Nystrom* discloses four different combinations of Doppler and delay spread, each with its own recommendations for variations in pilot structure. *Nystrom* therefore does not disclose a second communication system that definitively has “pilot symbols that are denser than those in the first communication system.” The communication system in *Nystrom*, at best, discloses various possibilities of pilot structure and thus teaches a POSITA that pilot structure should be flexible, unlike the specific requirement of this claim element.

Further, Dr. Vojcic clarifies that from the cited excerpts of *Nystrom*, a significant non-obvious redesign of the *Talukdar* system would be required to incorporate *Nystrom*’s disclosure. EX2004, ¶95-96.

First, a POSITA would understand that the methods suggested in *Nystrom* are on a per user basis; based on measurements and scheduling on a per user basis depending on the measured radio conditions. *Talukdar*’s frame structure, on the other hand, is based on a per system basis, 802.16e and/or 802.16m, and there are no facilities for measurements for adaptive real-time pilot structure and flexible scheduling as in *Nystrom*. In addition, in *Nystrom*, there are no first and second segments in a frame, corresponding to the first and second communication system. *Nystrom*’s disclosure/system is therefore incompatible with *Talukdar*’s system.

EX2004, ¶95. Combining *Nystrom*’s and *Talukdar* would therefore require a significant non-obvious redesign of *Talukdar*. *Id.*

Second, even if we accept that the per user features in *Nystrom* could be imported into *Talukdar*’s system without the required redesign as indicated above, a POSITA would be faced with a fixed pilot density design for the first segment (fixed 802.16e user) and the second segment (mobile 802.16m) users. The actual fixed pilot design, using

Nystrom's teaching would require a very comprehensive study that would take into account multiple criteria such as the range of delay spread for most users, the range of user speeds for most of mobile users, the overall diversity gains provided by the radio design (including channel coding, diversity, MIMO, etc.), the ratio of pilot overhead to useful data capacity, *i.e.*, resources dedicated for pilots and useful data, etc. The solution to such a design problem is not obvious, and it could further turn out that the first segment would have a higher density of pilots in the first segment in *Talukdar*. Dr. Roy has not shown or even addressed that such redesign would be obvious, and in my opinion, it would not be. Instead, Dr. Roy took an overly simplistic approach by using the '096 patent as a road map and extracting a partial feature from *Nystrom*, ignoring *Nystrom*'s integral teaching, and also by ignoring the incompatibilities between *Nystrom* and *Talukdar*.

EX2004, ¶95. Such an effort would not be possible without significant experimentation, an issue Petitioner did not address.

For these reasons, Petitioner has failed to show that all elements of Claim 8 of the '096 patent are taught or suggested by either *Talukdar* alone or *Talukdar* in combination with *Nystrom*.

X. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

There is substantial evidence of commercial success and significant licensing of the '204 Patent to industry leaders in the wireless chip industry. UNM Rainforest Innovations asserted the '204 Patent against defendants Dell Technologies Inc. et al., AsusTek Computer Inc., and Apple Inc. After significant litigation in District Court, Intel Corp. and Broadcom Corp., the entities that supplied the infringing products to Dell and Apple respectively, reached

satisfactory settlements with UNMRI for the same '204 Patents that is at issue in this IPR filed by ZyXEL. *See* EX2008, EX2009; *see, e.g.*, IPR2021-01578, Exhibit 1021 (confidential patent license agreement - filed under seal). Separately, Apple Inc. reached a satisfactory settlement with UNMRI for the same '204 Patent. EX2010, EX2011. These attractive licenses, negotiated by wireless industry leaders, provide strong evidence of secondary considerations supporting a finding of non-obviousness of the patents at issue in this IPR. After its settlement with UNMRI, Intel dismissed its IPR Petition filed against the '204 Patent. IPR2021-01578, Exhibit 1021 (confidential patent license agreement - filed under seal). Indeed, the current IPR Petition filed by ZyXEL against the '204 Patents is effectively a verbatim copy of the Intel IPR Petition, albeit with the signature of a different expert witness.

XI. CONCLUSION

The Board should exercise its discretion under § 314(a) and deny institution because (1) the district court case will outpace this proceeding even if instituted; (2) ZyXEL has failed to provide any evidence demonstrating that the district court case would be stayed; and (3) the *Fintiv* factors overwhelmingly support denial. Independently, the Board should deny institution because ZyXEL has failed to demonstrate a reasonable likelihood of prevailing as to any challenged claim because the combination of *Talukdar* and *Li* does not render obvious any of Claims

1-4, 6, or 7, and the combination of *Talukdar* and *Nystrom* does not render obvious Claim 8.

Dated: July 6, 2021

Respectfully submitted,

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UNM RAINFOREST INNOVATIONS

LIST OF EXHIBITS

Exhibit No.	Descriptions
2001	01/27/21 Text Order Denying XyXEL's Motion to Dismiss <i>UNM Rainforest Innovations v. XyXEL Communications Corp.</i> 6:20-cv-00522-ADA; WDTX
2002	02/09/21 Text Order Denying D-Link's Motion to Dismiss <i>UNM Rainforest Innovations v. D-Link Corporation</i> 6:20-cv-00143-ADA (WDTX)
2003	06/02/21 Declaration of Henning Schmidt In Support of Motion for Admission Pro Hac Vice
2004	Resubmission of the Declaration of Dr. Branimir Vojcic
2005	2018 UNM Economic Impact Report
2006	01/26/21 Scheduling Order (Dkt 52) <i>UNM Rainforest Innovations v. ZyXEL Communications Corp.</i> ; 6:20-cv-00522-ADA (WDTX)
2007	'096 Provisional
2008	01/15/21 Notice of Withdrawn Claims (Dkt 53) <i>UNM Rainforest Innovations v. Dell Technologies, Inc., et al.</i> ; 6:20-cv-00468-ADA (WDTX)
2009	01/26/21 Notice of Withdrawn Claims (Dkt 33) <i>UNM Rainforest Innovations v. AsusTEK Computer, Inc.</i> 6:20-c-v00142-ADA (WDTX)
2010	09/03/20 Joint Motion to Dismiss with Prejudice (Dkt 79) <i>UNM Rainforest Innovations f/k/a STC.UNM v. Apple, Inc.</i> 1:20-cv-00351-ADA (WDTX)
2011	09/04/20 Order of Dismissal (Dkt 80) <i>UNM Rainforest Innovations f/k/a STC.UNM v. Apple, Inc.</i> ; 1:20-cv-00351-ADA (WDTX)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4) and 42.25(b), the undersigned certifies that on July 6, 2021, a complete copy of Patent Owner UNM Rainforest Innovations' Preliminary Response to the Petition for Inter Partes Review dated March 29, 2021 of U.S. Patent No. 8,265,096 was filed electronically through the Patent Trial and Appeal Board's PTABE2E System and provided, via electronic service, to the Petitioner by serving the correspondence address of record.

Dated: July 6, 2021

/s/ Jay P. Kesan
Jay P. Kesan

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that the foregoing Patent Owner's Preliminary Response contains less than 14,000 words excluding the table of contents, table of authorities, certificate of service, certificate of word count, and appendix of exhibits. Patent Owner has relied on the word count feature of the word processing software used to create this paper in making this certification.

Dated: July 6, 2021

/s/ Jay P. Kesan
Jay P. Kesan