UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SPRINT SPECTRUM L.P., CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, AND AT&T MOBILITY LLC
Petitioners

v.

ADAPTIX, INC.
Patent Owner

Case No. IPR2016-00824
Patent 8,934,375

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,934,375
Claims 2, 4-8, 11, 13-14, 18, 20-24, 27, 29, 30

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I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311-319, and 37 C.F.R. § 42.100, Petitioners Sprint Spectrum L.P., Cellco Partnership d/b/a Verizon Wireless, and AT&T Mobility LLC (collectively "Petitioners") request *inter partes* review ("IPR") of claims 2, 4-8, 11, 13-14, 18, 20-24, 27, and 29-30 (the "challenged claims") of U.S. Patent No. 8,934,375 (the "'375 Patent," attached as Ex. 1101), issued on January 13, 2015.[1]

The '375 Patent is currently being asserted against Petitioners in the United States District Court for the Eastern District of Texas. The '375 Patent was applied for and issued in seven months during the course of other litigation against Petitioners involving related U.S. Patent Nos. 7,454,212 ("the '212 Patent" attached as Ex. 1118) and 6,947,748 ("the '748 Patent" attached as Ex. 1117).[2] The '375 Patent relates to a well-known technique for adaptively allocating wireless frequency channels, called "subcarriers," in an orthogonal frequency division multiple access ("OFDMA") system. In particular, the '375 Patent relates to a system and method for allocating subcarriers to remote devices, called "subscriber units," and dynamically adjusting those allocations based on changing channel conditions.

As set forth below, the subject matter of the '375 Patent was well known, and the claimed inventions obvious, to those of ordinary skill in the art. Accordingly, Petitioners

[1] Petitioners are filing another petition challenging different claims of the '375 Patent.

[2] Final judgments were entered in favor of Verizon and AT&T in those other litigations.

request *inter partes* review and subsequent cancellation of the challenged claims.

II. GROUNDS FOR STANDING UNDER 37 C.F.R. § 42.104(A)

Petitioners certify that the '375 Patent is available for IPR and that Petitioners are not barred or estopped from requesting IPR of any claim of the '375 Patent.

III. IDENTIFICATION OF CHALLENGE AND RELIEF REQUESTED

Petitioners request IPR on the following grounds:

Challenged Claims	Basis	References
2, 8, 14, 18, 24, 30	§ 103(a)	Ritter, Gesbert, & Thoumy
4-7, 11, 13, 20-23, 27, 29	§ 103(a)	Ritter, Gesbert, Thoumy, & Gitlin
6-8, 11, 13, 22-24, 27, 29	§ 103(a)	Thoumy, Gesbert, & Gitlin
2, 14, 18, 30	§ 103(a)	Thoumy, Gesbert, & Ritter
4, 5, 20, 21	§ 103(a)	Thoumy, Gesbert, Gitlin, & Ritter

Section IV.D identifies how the challenged claims are to be construed. Section VI identifies (1) the specific statutory grounds on which the challenge to each claim is based, (2) an explanation of how each challenged claim is unpatentable for each ground, and (3) the exhibit numbers and relevance of the supporting evidence. The expert declaration of Richard Gitlin, Sc.D. (Ex. 1102), is provided in further support of this Petition. Taken together, this evidence establishes a reasonable likelihood that Petitioners will prevail as to the challenged claims.

IV. OVERVIEW OF THE '375 PATENT

The '375 Patent issued on January 13, 2015, from Application No. 14/294,106, which was filed seven months earlier on June 2, 2014 with a Track 1 Request. The '375

Patent claims priority to, among other applications, Application No. 09/738,086, filed on December 15, 2000, and issued as the '748 Patent, and Application No. 11/199,586, filed on August 8, 2005, and issued as the '212 Patent. All three patents share a common specification. According to Patent Office records, the '375 Patent is assigned to Adaptix, Inc. ("Adaptix" or "Patent Owner"). Ex. 1102, Gitlin Decl. at ¶¶ 42-44.

A. The Alleged Invention of the '375 Patent

The claims of the '375 Patent recite a method and apparatus for adaptively allocating subcarriers in an OFDMA system. Generally speaking, the claims require a subscriber unit (1) measuring channel information for subcarriers based on pilot symbols received from a base station; (2) providing feedback information to the base station, including a modulation and coding rate, for clusters of subcarriers based on the measurements; (3) receiving an allocation of OFDMA subcarriers from the base station, including a modulation and coding rate, selected by the base station for use by the subscriber unit; and (4) repeating these steps at a second time to receive a second allocation of OFDMA subcarriers that is different from the first allocation. *See, e.g.*, Claim 1; Ex. 1102, Gitlin Decl. at ¶ 43.

B. Summary of the Prosecution History of the '375 Patent

During prosecution, the Patent Owner submitted five Information Disclosure Statements (including a 48 page Form PTO-1449 upon initial filing), citing over 1,400 references, including hundreds of documents from pending litigation involving the

related '748 and '212 Patents. The Examiner noted, "the number of references submitted is unreasonably large in quantity and without any indication of relevancy. Examiner made only a best effort in considering all of them. Any reference that may have escaped the Examiner's attention thus is because of this large number of reference[s] and application shares the burden for both, submitting a large quantity of references and failing to indicate the relevant ones." Ex. 1113, File History of 14/294,106, June 27, 2014 Non-Final Rejection at page 2. After multiple clarifying amendments to address rejections under 35 U.S.C. § 112, the Examiner issued a final notice of allowance. *Id.* at December 2, 2014, Notice of Allowance. Ex. 1102, Gitlin Decl. at ¶ 45.

C. Level of Ordinary Skill in the Art

A person having ordinary skill in the art in 2000 (when the first application leading to the '375 Patent was filed) would have had either a Bachelor's degree in electrical engineering or a similar degree, with at least three to four years of experience in wireless communication technology or other communication-related technology, or a Master's degree in electrical engineering or a similar degree, with at least two years of experience in wireless communication technology or other communication-related technology. Ex. 1102, Gitlin Decl. at ¶ 25-29.

D. Claim Construction Under 37 C.F.R. § 42.104(b)(3)

A claim in *inter partes* review is given the "broadest reasonable construction in light of the specification in which it appears." 37 C.F.R. § 42.100(b). The broadest

reasonable construction is the broadest reasonable interpretation of the claim language. *See In re Yamamoto*, 740 F.2d 1569, 1572 (Fed. Cir. 2004). Any claim term that lacks a definition in the specification is therefore also given a broad interpretation. *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007). Further, applying the claim construction standard of *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) would not change the analysis or conclusions covered in this petition. The prior art teaches each claim limitation under any reasonable interpretation of the claim terms, and the analysis is not dependent on application of the "broadest reasonable interpretation" standard. Ex. 1102, Gitlin Decl. at ¶ 31.

1. "pilot symbols"

In other litigation and a PTAB proceeding involving the '748 Patent "pilot symbols" was construed to mean "symbols, sequences, or signals known to both the base station and subscriber." Ex. 1112, Claim Construction Order, 6:13-cv-438, Dkt. 901 (E.D. Tex., Sept. 19, 2-14) at 17; Ex. 1111, IPR2015-00319 Paper 10. Further, the specification of the '375 Patent discloses that "pilot symbols, often referred to as a sounding sequence or signal, are known to both the base station and the subscribers." Ex. 1101, 5:38-40. Accordingly, the broadest reasonable construction of "pilot symbols" is "symbols, sequences, or signals known to both the base station and subscriber." Ex. 1102, Gitlin Decl. at ¶ 32.

2. "cluster"

The specification of the '375 Patent defines a "cluster" as "a logical unit that contains at least one physical subcarrier." Ex. 1101 at 5:20-21. Accordingly, the broadest reasonable construction of "cluster" is "a logical unit that contains at least one physical subcarrier." Ex. 1102, Gitlin Decl. at ¶ 33.

3. "diversity cluster"

The specification of the '375 Patent describes a "diversity cluster" as a cluster "containing multiple subcarriers with at least some of the subcarriers spread far apart over the spectrum." Ex. 1101 at 14:28-30. Accordingly, the broadest reasonable construction of a diversity cluster is "a cluster containing multiple subcarriers with at least some of the subcarriers spread far apart over the spectrum." Ex. 1102, Gitlin Decl. at ¶ 34.

4. "coherence cluster"

The specification of the '375 Patent describes a "coherence cluster" as a cluster "containing multiple subcarriers close to each other." Ex. 1101 at 14:27-28. Accordingly, the broadest reasonable construction of a coherence cluster is "a cluster containing multiple subcarriers close to each other." Ex. 1102, Gitlin Decl. at ¶ 35.

5. "coherence bandwidth"

The specification of the '375 Patent describes channel "coherence bandwidth" as "the bandwidth within which the channel response remains roughly the same." Ex. 1101 at 11:55-60. Accordingly, the broadest reasonable construction of "coherence bandwidth" is "the bandwidth within which the channel response remains roughly the same." Ex. 1102, Gitlin Decl. at ¶ 36.

V. PRIOR ART

A. Summary of the Prior Art

The subject matter claimed in the '375 Patent—adaptive allocation of subcarriers in an OFDMA system based on channel quality measurements—was well known as of December 15, 2000, the filing date of the '375 Patent's priority application. Each of the prior art references relied upon in this petition has an effective filing date earlier than December 15, 2000. Ex. 1102, Gitlin Decl. at ¶ 27.

B. Overview of Ritter

German Patent DE 19800953 C1 to Ritter (Ex. 1103) is entitled "Procedure and Radio Communication System to Allocate the Radio Resources of a Radio Interface" ("Ritter"). Ritter was published on July 29, 1999, and is prior art to the '375 Patent under 35 U.S.C. § 102(b). Ex. 1103, Ritter at 1. Ritter was cited on the face of the '375 Patent, but was not substantively discussed during prosecution of the application that issued as the '375 Patent. The English translation of Ritter (Ex. 1104) was substantively considered during prosecution of the '212 Patent. *See, e.g.*, Ex. 1108, '212 Pros. Hist. Ritter was also substantively considered by the Board in multiple IPR petitions challenging claims of the related '748 and '212 Patents. *See* Ex. 1109 IPR2014-01525 Institution Decision; Ex. 1110 IPR2014-01524 Institution Decision; Ex. 1111 IPR2015-00319 Institution Decision; Ex. 1114 IPR2014-01525, Termination; Ex. 1115 IPR2014-01524, Termination; Ex. 1116 IPR2015-00319, Judgment; Ex. 1102, Gitlin Decl. at ¶ 47.

Ritter teaches an OFDMA wireless communication system in which sets of

OFDMA subcarriers, referred to as "segments," are allocated between a base station and multiple mobile stations. Ex. 1104, Ritter at 2-3. Each mobile station uses a training sequence to measure the channel quality of segments of the frequency spectrum and transmits feedback information to the base station identifying suitable segments. Using this feedback information, the base station allocates a segment to each mobile station for data transmission. *Id*. at 4-5. A "segment" in Ritter, like a "cluster" in the '375 Patent, may comprise a plurality of subcarriers. *Id*. at 12-13 (disclosing, as an example, segment Sx comprising subcarriers oc00 – oc40); *see also* Ex. 1102, Gitlin Decl. at ¶ 48.

C. Overview of Gesbert

U.S. Patent No. 6,760,882 to Gesbert ("Gesbert") was filed on September 19, 2000, and issued on July 6, 2004. Gesbert is prior art to the '375 Patent under 35 U.S.C. § 102(e). Ex. 1105. Gesbert was cited on the face of the '375 Patent, but was not substantively discussed during prosecution. Gesbert generally teaches a wireless communication system in which modulation and coding rates are dynamically selected based on measured channel quality between a base station and subscriber units. Ex. 1105, Gesbert at 3:60-4:6, Fig. 1; Ex. 1102, Gitlin Decl. at ¶ 49. Gesbert expressly teaches that its concepts can be used in an OFDMA wireless system. Ex. 1105, Gesbert at 3:57-59. To assess channel quality, Gesbert teaches that "training tones" are transmitted on each subcarrier by the base station. *Id.* at 8:14-19. These training tones are then used by the subscriber units to measure the quality of each channel. *Id.* at 5:24-54, 7:7-62, 8:13-34,

Fig. 5. Based on these measurements, feedback information is transmitted from each subscriber unit to the base station. *Id.* at 9:52-10:8. Within this feedback information, the subscriber unit includes a "mode" that indicates a modulation and coding rate to be used for subsequent communications. *Id.* at 4:30-32 ("The system also has a *feedback mechanism for communicating the subsequent mode from the receive unit to the transmit unit*.")[3], 6:35-39 (explaining that modes "identify the modulation and coding rates which are to be applied to data") & Table 1; *see also* Ex. 1102, Gitlin Decl. at ¶ 50.

D. Overview of Thoumy

U.S. Patent No. 7,039,120 to Thoumy ("Thoumy") was filed on November 30, 1999, and issued on May 2, 2006. Ex. 1107. Thoumy is prior art to the '375 Patent under 35 U.S.C. § 102(e) and was not cited on the face of the '375 Patent. Thoumy discloses a system for dynamic allocation of carrier frequencies in an OFDMA system. Ex. 1107, at 13:10-19. Thoumy discloses a network with multiple peripheral stations (*id. at* 15:17-19 ("FIG. 14 is a general view of a network according to the invention including a base station SIB [sic] and several peripheral stations SPi") & Fig. 14), implementing OFDM (*id*. at 1:28-41 ("one particular case is Orthogonal Frequency Division Multiplex, or OFDM.")). Thoumy discloses continuously monitoring the actual conditions of the channel for transmission, providing feedback to the base station, and adapting the number of carriers and modulation based on those

[3] Unless otherwise indicated, all emphasis is added.

measurements. *Id.* at 13:20-23; *see also* Ex. 1102, Gitlin Decl. at ¶ ¶51-52.

E. Overview of Gitlin

U.S. Patent No. 6,018,528 to Gitlin ("Gitlin") was filed on April 28, 1994, and issued on January 25, 2000. Ex. 1106. Gitlin is prior art to the '375 Patent under at least 35 U.S.C. § 102(a). Gitlin was cited on the face of the '375 Patent, but was not substantively discussed during prosecution. Gitlin discloses a system and method for optimizing frequency allocation to multiple subscribers by using contiguous and non-contiguous frequency assignments for multi-tone, *i.e.*, OFDMA, systems. Ex. 1106, Gitlin at 3:1-12, 5:32-6:18, Fig. 6; *see also* Ex. 1102, Gitlin Decl. at ¶ 53.

VI. SPECIFIC GROUNDS FOR PETITION

Pursuant to 37 C.F.R. §§ 42.104(b)(4)-(5), as demonstrated below and confirmed by Dr. Gitlin (Ex. 1102), the challenged claims are obvious under 35 U.S.C. § 103.

A. Ground 1: Ritter in View of Gesbert and Thoumy Renders Claims 2, 8, 14, 18, 24, and 30 Obvious

1. Claims 2 and 18

Claims 2 and 18, which depend from independent claims 1 (method) and 17 (apparatus), contain nearly identical limitations. Petitioners address these common limitations of claims 2 and 18 together, with reference to claim 2 (including the limitations of independent claim 1), in the ground below. Claim 18 additionally requires a processor in the subscriber unit to perform the recited steps. Ritter

discloses a control means in the mobile station for measuring channel quality, selecting carriers, and transmitting and receiving information from the base station. Ex. 1104, Ritter at 5 ("Control means in each mobile station to measure the quality of various segments…[and] transmit appropriate information to the base station"). Accordingly, Ritter teaches this limitation. Ex. 1102, Gitlin Decl. at ¶ 54.

(a) [Claim 1] *The preamble:* A method for a wireless system employing orthogonal frequency division multiple access (OFDMA)

Ritter discloses a wireless system employing OFDMA. *See* Ex. 1104, Ritter at 4-5; Ex. 1102, Gitlin Decl. at ¶ 56.

(b) [Claim 1] *Limitation (a):* measuring, at a first time by a subscriber unit, a first channel information for a plurality of subcarriers based on a first plurality of pilot symbols received from a base station

Ritter teaches that each subscriber unit measures channel quality information for subcarriers between it and a base station. For example, Ritter discloses that:

> "[a]nother advantageous model of the invention to ***measure the quality of segments of the frequency spectrum envisions***, ***that the mobile station receives all subcarriers in the time slot allocated to it, checks for each subcarrier***, whether an amplitude modulation of the data symbols transmitted in the time slot is present, and ***forms an average value from the results of the test for all subcarriers belonging to the respective segment***. The advantage lies in the two-step procedure in which initially ***the quality is determined for the individual subcarriers*** and then ***the quality of the subcarriers can be ascertained to determine the quality of the segment***

that was examined in particular."

Ex. 1104, Ritter at 8-9; *see also id.* at 12; Ex. 1102, Gitlin Decl. at ¶ 57.

To the extent the Patent Owner argues that Ritter does not explicitly disclose "measuring . . . based on a first plurality of pilot symbols," it would have nevertheless been obvious to measure channel quality using pilot symbols in view of Gesbert. In particular, Gesbert teaches an OFDMA system that performs subcarrier quality measurements based on training tones (known to both the subscriber and base station) received from the base station. Ex. 1105, at 8:13-34. Gesbert explains that "FIG. 5 indicates that ***training is performed on all tones during an OFDM training symbol***, it will be clear to a person skilled in the art that a subset of these tones could be used for training and the corresponding frequency response could be computed at the receiver by interpolating." *Id.* at 7:16-20. Gesbert uses these training tones to measure channel quality:

> "***SINR is sampled during training tones T*** occurring during sampling window τ_1. The present embodiment uses multiple carrier frequencies fc and thus the SINR is sampled and computed by block 102 for data 52 transmitted at each of the n carrier frequencies fc. ***By buffering the SINR values for all the training tones T during time window τ_1 statistics computation block 102 constructs the following matrix***:
>
> $$\begin{bmatrix} SINR_{1,1} & SINR_{1,2} & \dots & SINR_{1,w} \\ SINR_{2,1} & \dots & & \\ \dots & & & \\ SINR_{n,1} & & & SINR_{n,w} \end{bmatrix}$$

> where SINRi,j is the SINR at the i-th carrier frequency f_{ci} during training phase j. There are thus 1 to n carrier frequencies f_c and 1 to w training phases."

Id. at 8:13-34; *id.* at 7:57-59 ("quality parameters include signal-to-interference and noise ratio (SINR)"). One of ordinary skill in the art would understand the training tones of Gesbert to be the claimed "pilot symbols" according to the construction proffered above at least because the training tones are necessarily known to both the base station and subscriber. *See supra* IV.D.1. Indeed, the use of training tones was well known by those skilled in the art in 2000.[4] Ex. 1102, Gitlin Decl. at ¶ ¶58-60. Like Ritter and the '375 Patent, Gesbert teaches an OFDMA system in which subscriber units (*e.g.*, handsets) measure the quality of a wireless channel and provide feedback to the base station based on those measurements. *Compare* Ex. 1105, Gesbert at 2:61-65 ("***One or more quality parameters are sampled*** in the data received ***by the receive unit.*** Then, a first-order statistical parameter and a second-order statistical parameter of the ***quality parameter*** are computed and ***used for selecting a subsequent mode for encoding the data.***"), 4:30-32 ("The system also has a ***feedback mechanism for communicating the subsequent mode from the receive***

[4] See, *e.g.*, Bahai and Saltzberg, "Multi-Carrier Digital Communications Theory and Applications of OFDM," (Kluwer Academic Publishers, 1999), Ex. 1120, at 29 ("Usually OFDM systems provide pilot signals for channel estimation.").

unit to the transmit unit."), *with* Ex. 1104, Ritter at 12-13 ("According to the device of the invention ***every mobile station, MS, measures the quality of various segments of the frequency spectrum*****,** whereby it receives all subcarriers in the time slot assigned to it, ***checks the quality of each individual subcarrier and then determines the quality of the subcarriers. Then each mobile station*** determines at least a suitable segment preferred for its own communication link and ***transmits appropriate information to the base station*****,** BS."); *see also* Ex. 1102, Gitlin Decl. at ¶ 61.It would have been obvious to use pilot symbols to measure channel quality in the system of Ritter as taught by Gesbert for at least the following reasons. One rationale to combine is: "application of a known technique to a piece of prior art ready for the improvement" to "yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007). **Base system:** Ritter discloses an OFDMA system that dynamically allocates subcarrier segments (*i.e.*, subcarriers) to a mobile station (*i.e.*, subscriber unit) based on the quality of the segments. Ex. 1104, at 8-9, 14. Ritter discloses using pilot symbols. *Id*. at 16. **Known technique:** As shown by Gesbert, using pilot symbols within an OFDMA wireless communication system to measure channel quality was well known in the art at the time of the alleged inventions, and was a simple design choice from among many possible alternatives. Ex. 1105, at 8:13-34. Even the '375 Patent acknowledges that measuring channel quality based on pilot symbols was a well-known technique.

Ex. 1101, at 9:14-17. **Predictable results and improved system:** One of ordinary skill in the art would have been motivated to modify Ritter to measure channel quality using pilot symbols, as taught by Gesbert, to obtain the predictable and desirable result of an improved channel allocation process. Ex. 1102, Gitlin Decl. at ¶¶ 62-65. Another rationale to combine is where "the substitution of one known element for another" yields predictable results. *See KSR*, 550 U.S. at 401. As discussed above, using pilot symbols to measure channel quality was a well-known technique in the art at the time of the alleged invention. And both Ritter and Gesbert disclose allocating channels based on channel quality measurements and using pilot symbols transmitted from the base station (in some form). As such, those of ordinary skill in the art would recognize that it would be easy to modify Ritter to measure channel quality using pilot symbols, as described in Gesbert. Such a modification would have yielded predictable results without requiring undue experimentation. Therefore, it would have been obvious to modify Ritter's OFDMA system to perform the channel quality measurements using pilot symbols, as in Gesbert. Ex. 1102, Gitlin Decl. at ¶ 66. Further, those of ordinary skill in the art in 2000 would have been motivated to modify Ritter's communication system to measure channel quality using pilot symbols, as in Gesbert, based on the similar nature of the problem solved: both references provide solutions for adapting to varying channel conditions in wireless OFDMA systems. Ex. 1104, Ritter at 4, 7-8;

Ex. 1105, Gesbert at 2:45-48, 11:44-48. Thus, the similar nature of the problem solved by Ritter and Gesbert, and the similar manner in which they each solve that problem, would have motivated those of ordinary skill in the art to modify Ritter's OFDMA system to use channel quality measurements based on pilot symbols, as described in Gesbert, as a substitute for Ritter's amplitude-based measurements, to yield predictable results. Moreover, both Ritter and Gesbert are in the same field of endeavor as the '375 Patent. Accordingly, the combination of Ritter and Gesbert teaches this limitation. Ex. 1102, Gitlin Decl. at ¶¶ 67-68.

(c) [Claim 1] *Limitation (b):* providing, by the subscriber unit, a first feedback information relating to a plurality of feedback clusters based on at least the measuring of the first channel information for the plurality of subcarriers based on the first plurality of pilot symbols, each feedback cluster of the plurality of feedback clusters being at least two subcarriers, the first feedback information relating to the plurality of feedback clusters based on the first plurality of pilot symbols includes an index corresponding to a first modulation and coding rate associated with each feedback cluster of the plurality of feedback clusters

Ritter teaches subscriber units providing channel information for a plurality of feedback clusters, that is, Ritter provides channel information for multiple subcarriers and subcarrier segments (*i.e.*, feedback clusters), where each segment includes at least two subcarriers. For example, Ritter discloses the following process for measuring and reporting channel information for subcarriers:

> "According to the device of the invention ***every mobile station, MS, measures the quality of various segments of the frequency spectrum***, whereby it receives all subcarriers in the time slot assigned to it, ***checks the quality of each individual subcarrier and then determines the quality of the subcarriers***. ***Then each mobile station determines at least a suitable segment preferred for its own communication link and transmits appropriate information to the base station, BS***. In this example the first mobile station determines a segment, Sx, with subcarriers oc00 … oc40 as the best suitable segment for it. In addition, it determines the segments, Sy, Sz as additional suitable segments preferred for its own communication link. ***Information about segments Sx, Sy, Sz is entered on a priority list, PL1, numbered according to their suitability for the communication link and sent to the base station, BS***."

Ex. 1104, Ritter at 12-13; *see also id.* at 15 ("Shown schematically in Figure 2 is the structure of a radio block with data symbols in a time slot, as well as the ***OFDMA sub-carriers to form the segments*** …. ***There are thus available***, for example, ***several hundred sub-carriers***, oc, - with a separation of several kilohertz between two adjacent carriers - in the radio cell of Figure 1 with three mobile stations, MS, linked to the base station, BS. ***Sub-carriers oc00 … oc40 define segment Sx, sub-carriers oc41 … oc60 define segment Sa, and sub-carriers oc61 … oc100 define segment Sm***."); *id.* at 19 ("In another step (4) ***the mobile station, MS, sends via the radio interface to the base station, BS, its priority lists, PL1 … PL3, with the information about several preferred, suitable segments***, i.e., ***about segments Sx,***

Sy, Sz or Sa, Sb, sc or Sm, Sn, So for which a sequence of suitability is determined by the mobile station, MS."); Ex. 1102, Gitlin Decl. at ¶ 69.

To the extent the Patent Owner argues that Ritter does not explicitly disclose "an index corresponding to a first modulation and coding rate," it would have been obvious to those of ordinary skill in the art at the time to include in the feedback an index corresponding to a modulation and coding rate, as described in Gesbert, to address the problem of efficiently providing feedback information to a base station. In particular, Gesbert discloses that receive units (*i.e.*, subscriber units) transmit an index indicating a modulation and coding rate to the transmit unit (*i.e.*, base station). Ex. 1105, at 10:17-22. Gesbert further teaches that "***[t]he modes are indexed by a mode number so as to conveniently identify the modulation and coding rates*** which are to be applied to data 52 in each mode." *Id.* at 6:37-39. Table 1 from Gesbert shows the mode indices and corresponding modulation and coding rates: According to Gesbert, "***[t]able 1 illustrates some typical modes with their modulation rates and coding rates*** and the corresponding throughputs for data 52." *Id.* at 6:35-37; *see also id.* at 4:30-32 ("The system also has a ***feedback mechanism for communicating the***

TABLE 1

Mode	Modulation Rate (bits/symbol)	Coding Rate	Throughput (bits/s/Hz)
1	2	3/4	3/2
2	2	2/3	4/3
3	2	1/2	1
4	2	1/3	2/3
5	4	3/4	3
6	4	2/3	8/3
7	4	1/2	2
8	4	1/3	4/3
9	5	3/4	15/4
10	5	2/3	10/3
11	5	1/2	5/2
12	5	1/3	5/3
13	6	3/4	9/2
14	6	2/3	4
15	6	1/2	3
16	6	1/3	2

subsequent mode from the receive unit to the transmit unit."); *id.* at 4:60-62 ("transmit unit 12 is a Base Transceiver Station (BTS) and a receive unit 14 is a mobile or stationary wireless user device"). Ex. 1102, Gitlin Decl. at ¶ 70-71.

To the extent the Patent Owner argues that Ritter does not explicitly disclose this limitation, it would have been obvious to one of ordinary skill in the art to modify Ritter to provide an indication of a modulation and coding rate in conjunction with the channel information for the subcarrier segments (*i.e.*, feedback clusters), as in Gesbert, based on "application of a known technique to a piece of prior art ready for the improvement" to "yield predictable results." *KSR*, 550 U.S. at 401. **Base system**: Ritter discloses the subscriber unit providing channel quality information for feedback clusters to the base station. Ex. 1104 at 12-13, 15, 19. **Known technique**: Gesbert discloses communicating an index to a modulation and coding rate associated with each feedback cluster. *See, e.g.*, Ex. 1105 at 3:38-51, 6:35-42, 9:66-10-44, 11:9-24, Figs. 3-4. **Predictable results and improved system**: A person having ordinary skill in the art would have been motivated to combine Gesbert's well-understood technique of indicating a modulation and coding rate using an *index* with the teachings of Ritter in order to maximize network resources and optimally provide feedback information to a base station relating to subcarrier selection. Combining Ritter and Gesbert in this way would have resulted in an improved wireless communication system that included the

well-known advantages of allocating subcarriers through an ongoing, adaptive feedback and allocation scheme, as taught by Ritter, and the advantages of adaptive modulation and coding schemes, as taught by Gesbert. Such a modification would have yielded predictable results without requiring undue experimentation. Ex. 1102, Gitlin Decl. at ¶ 72-75.

Further, as previously discussed, Ritter and Gesbert are in the same field of endeavor as the '375 Patent. *See supra* (b). Ritter acknowledges that its "improved OFDMA multi-carrier procedure can be combined with other multiplex access procedures which transmit data symbols of a finite duration in time slot into a more effective radio system." Ex. 1104, Ritter at 7. Therefore, it would have been obvious to modify Ritter's OFDMA system to provide an indication of a modulation and coding rate in conjunction with the channel quality feedback, as in Gesbert, and the combination of Ritter and Gesbert discloses this limitation. Ex. 1102, Gitlin Decl. at ¶ 76.

(d) [Claim 1] *Limitation (c)*: receiving, by the subscriber unit, a first allocation of OFDMA subcarriers based on at least the providing of the first feedback information selected by the base station for use by the subscriber unit, the first allocation of OFDMA subcarriers including an indication of a modulation and coding rate associated with the first allocation of OFDMA subcarriers

Ritter teaches a subscriber unit receiving a first allocation of OFDMA subcarriers selected by the base station based on feedback information from the subscriber unit. For

example, Ritter describes "[b]y means of the allocation system described the advantages of the OFDMA multi-carrier procedure can be used and possibly ***optimal frequency resources can be provided for all communication links operated by a base station with the help of a flexible allocation of several sub-carriers and a thereby defined segment of a frequency spectrum***." Ex. 1104, Ritter at 6. Notably, "***[t]he base station***, BS, evaluates all information received from the mobile stations, MS, and ***assigns each mobile station a segment for the respective communication link depending on the evaluation***. ***The base station sends the mobile station information about the assigned segment***." *Id.* at 14; *see also id.* at 19-20; Ex. 1102, Gitlin Decl. at ¶ 77.

It would have been obvious to combine Gesbert's adaptive modulation and coding functionality with the adaptive channel allocation functionality of Ritter for all the reasons discussed above. *See supra* at (b), (c). It would have further been obvious to modify the combined Ritter-Gesbert system to inform the subscriber unit of what modulation and coding rate to use to decode the allocated subcarriers, as taught by Thoumy. For example, Thoumy teaches that the base station transmits information concerning allocated subcarriers to the subscriber unit, including an indication of modulation and coding: "***[T]he transmission parameters***, ***namely the number of carriers and the modulation***, which are allocated to the transmission in question, ***are transmitted*** (step **2630**) ***by the management unit*** 2172 to the information reception unit 2072 and to the information sending unit 2070 ***with a***

view to the sending of these parameters to the peripheral station 1402." Ex. 1107, Thoumy at 31:16-22; *see also id.* at 9:31-34 ("the device proposed in this document ***allocates a group of given carriers to each of the sources and selects an appropriate modulation type and coding efficiency for each of the groups***"); Ex. 1102, Gitlin Decl. at ¶¶ 78-79.

Thoumy, like the combination of Ritter and Gesbert, teaches dynamically allocating channels in an OFDMA system to account for changing channel conditions. Ex. 1107, at 9:31-34 ("the device proposed in this document allocates a group of given carriers to each of the sources and selects an appropriate modulation type and coding efficiency for each of the groups."); 12:65-13:9 ("the invention relates to a method of receiving information coming from a radio communication channel, including … a step of ***reconfiguring the number of carriers and the modulation to be selected according to a required service quality***, in terms of transmission error rate and transmission rate for a given information transmission, the number of carriers and the modulation reconfigured differing according to the required service qualities."). It would have been obvious to one of ordinary skill in the art to incorporate Thoumy's teaching of indicating a modulation and coding rate to a subscriber unit into the combined Ritter-Gesbert system for the following reasons. Ex. 1102, Gitlin Decl. at ¶ 80.

One rationale to combine is "application of a known technique to a piece of prior

art ready for the improvement" to "yield predictable results." *KSR*, 550 U.S. at 401. Base system: Ritter discloses an OFDMA system that dynamically allocates subcarrier segments (*i.e.*, subcarriers) to a mobile station (*i.e.*, subscriber unit) and then informs the subscriber unit of the allocated subcarriers. Ex. 1104 at 6, 8, 19-20. Ritter explains that its "invention has the goal of providing an improved procedure and radio communication system for allocating radio sources, when using an OFDMA-multicarrier procedure." *Id.* at 4. Known technique: Gesbert and Thoumy disclose adaptive modulation and coding. Gesbert recognized that it would be advantageous "to provide a mode selection technique which allows the system to rapidly and efficiently select the appropriate mode for encoding data in a quickly changing channel." Ex. 1105 at 2:45-48. Likewise, Thoumy teaches that "a dynamic transmission method [] makes it possible to preserve optimum efficiency when there are variations in characteristics of the transmission channel." Ex. 1107 at 5:4-7. Thoumy further teaches that the peripheral station (*i.e.*, "subscriber unit") has to be informed of the modulation and coding to use. *Id.* at 31:8-22, 31:66-32:9. Predictable results and improved system: One of ordinary skill in the art would have been motivated to include adaptive modulation and coding in the combined Ritter-Gesbert system, as taught by Gesbert and Thoumy, because Gesbert and Thoumy both teach that it increases system efficiency. One would have been further motivated to inform the subscriber unit of what modulation and coding rate to use with the allocated subcarriers in order to correctly decode and demodulate data. Thus, the combined Ritter-Gesbert-

Thoumy system would be capable of informing the subscriber unit of both the allocated subcarriers and the corresponding modulation and coding rate to use. Accordingly, the combination of Ritter, Gesbert, and Thoumy teaches this limitation. Ex. 1102, Gitlin Decl. at ¶¶ 81-85.

(e) [Claim 1] *Limitation (d)*: measuring, at a second time by the subscriber unit, a second channel information for the plurality of subcarriers based on a second plurality of pilot symbols received from the base station

For the reasons presented with respect to limitation (a) of claim 1, the combination of Ritter and Gesbert discloses measuring channel information based on pilot symbols. *See supra* (b). In addition, both Ritter and Gesbert describe performing repeated channel quality measurements for the plurality of subcarriers to obtain current and reliable channel quality measurements. For example, Ritter discloses "[i]n the process, ***the quality of the actual communication link plays a decisive role*** with respect to the frequency situation which ***according to the procedure of the invention can be individually changed after the determination of the best suitable segments in each mobile station overseen by a base station and can thereby be improved***." Ex. 1104 at 6. Further, Ritter teaches that "***the best suited segments for communication can be determined at any time*** for individual communications links which differ from each other ***and they can be changed as needed***." *Id.* at 7-8; *see also id.* at 16 ("In addition, for each mobile station the number of assigned subcarriers in a time slot ***can be variably adjusted by the base***

station.”). Ex. 1102, Gitlin Decl. at ¶ 86.

As another example, Gesbert discloses that “[o]nce mode selection block 112 determines which modes should be used for each of the k streams, these subsequent modes are fed back to transmit unit 50 and applied to the k streams. ***This operation repeats itself***, and each new selection of subsequent modes is fed back to transmit unit 50 ***to thus account for the changing conditions of channel 22***.” Ex. 1105, Gesbert at 11:20-25. Accordingly, the combination of Ritter and Gesbert disclose this claim limitation. See *supra* (b) (reasons to combine). Ex. 1102, Gitlin Decl. at ¶ 87.

(f) [Claim 1] *Limitation (e)*: providing, by the subscriber unit, a second feedback information relating to the plurality of feedback clusters based on at least the measuring of the second channel information for the plurality of subcarriers based on the second plurality of pilot symbols, the second feedback information relating to the plurality of feedback clusters based on the second plurality of pilot symbols includes an index corresponding to a second modulation and coding rate associated with each feedback cluster of the plurality of feedback clusters

As discussed with respect to limitations (b) and (d) of claim 1, the combination of Ritter and Gesbert teaches providing updated feedback information on channel quality and modulation and coding rate. *See supra* (c); (e). For example, Ritter discloses that “***the quality of the actual communication link plays a decisive role*** with respect to the frequency situation which ***according to the procedure of the invention can be individually changed after the determination of the best suitable segments in each***

mobile station overseen by a base station and can thereby be improved." Ex. 1104, Ritter at 6. Ex. 1102, Gitlin Decl. at ¶88.

Gesbert discloses that "[o]nce mode selection block 112 determines which modes should be used for each of the k streams, these subsequent modes are fed back to transmit unit 50 and applied to the k streams. ***This operation repeats itself***, and each new selection of subsequent modes is fed back to transmit unit 50 ***to thus account for the changing conditions of channel 22***." Ex. 1105 at 11:20-25. Accordingly, the combination of Ritter and Gesbert discloses this claim limitation. *See supra* (b)-(d) (discussing reasons to combine); Ex. 1102, Gitlin Decl. at ¶¶ 89-90.

(g) [Claim 1] *Limitation (f):* receiving, by the subscriber unit, a second allocation of OFDMA subcarriers based on at least the providing of the second feedback information selected by the base station for use by the subscriber unit, the second allocation of OFDMA subcarriers including an indication of a modulation and coding rate associated with the second allocation of OFDMA subcarriers, the second allocation of OFDMA subcarriers being different from the first allocation of OFDMA subcarriers, the first and second allocations of OFDMA subcarriers being received by the subscriber unit at two different times.

As described with respect to limitation (c) of claim 1, the combination of Ritter, Gesbert, and Thoumy discloses adaptively allocating OFDMA subcarriers and modulation and coding rates, and informing the subscriber unit of the allocated subcarriers and modulation and coding rate. *See supra* (d). In other words, when combined with Gesbert and Thoumy, Ritter's OFDMA system re-allocates subcarriers

and modulation and coding rates based on changing channel conditions, including instances where the second allocation is different from the first allocation. Ex. 1102, Gitlin Decl. at ¶ 91.

For example, Ritter teaches an OFDMA system for adaptively allocating subcarriers to subscriber units: "[t]he best suited segments for communication can be determined at any time for individual communications links which differ from each other ***and they can be changed as needed***." Ex. 1104 at 7-8; *see also id.* at 16. Similarly, Gesbert teaches that the base station dynamically adjusts wireless channel parameters in accordance with the channel feedback information. *Compare* Ex. 1105, Gesbert at 3:46-48 ("***[T]he subsequent mode is*** communicated to the transmit unit and ***applied to the data to maximize a communication parameter in the channel.***"), *and id.* at 1:30-33 ("***as the channel changes in time, the communication parameters also change.*** Under altered conditions former data rates, coding techniques and data formats may no longer be feasible.") *with* Ex. 1104, Ritter at 11 ("The Operation and Maintenance Center, OMC, and the base station control, BSC, usually perform the functions of ***regulating and adapting the allocation of radio resources*** within the radio cells of the base station, BS."), *and id.* at 14 ("***The base station*****,** BS, evaluates all information received from the mobile stations, MS, and ***assigns each mobile station a segment for the respective communication link depending on the evaluation.*****"**); *see also* Ex. 1102, Gitlin Decl. at ¶¶ 92-93.

Thoumy also describes adaptively reconfiguring the modulation based on current transmission conditions. Ex. 1107 at 13:15-22. ("Advantageously, the result of this measurement supplies information on the actual conditions of the current transmission and therefore makes it possible to ***reconfigure the number of carriers and the modulation allocated to this transmission*** where the required service quality is not met. The actual conditions of the current transmission can therefore be monitored continuously ***and the number of carriers and the modulations adapted accordingly.***"); *id.* at 11:35-44; see also *id.* at 9:31-34. Ex. 1102, Gitlin Dec. at ¶ 94.

For the reasons presented with respect to limitation (c) of claim 1, it would have been obvious to those skilled in the art to combine Ritter with the teachings of Gesbert and Thoumy regarding methods for adaptively selecting modulation and coding rates. Specifically, it would have been obvious to combine Ritter, Gesbert, and Thoumy in the proposed manner based on: "application of a known technique to a piece of prior art ready for the improvement" to "yield predictable results." *KSR*, 550 U.S. at 401. **Base system:** Ritter discloses a base station that allocates sets of subcarriers based on channel quality feedback in order to efficiently utilize available bandwidth in light of dynamically changing channel conditions. Ex. 1104 at 7-8, 19-20. **Known technique:** Gesbert and Thoumy disclose dynamically allocating modulation and coding rates based on subscriber feedback information. Ex. 1105 at 1:30-33, 3:46-48; Ex. 1107, Thoumy at 10:31-37, 13:15-22. **Predictable results and improved system:** Upon reading the

disclosures of both Gesbert and Thoumy, a person of ordinary skill would have recognized that the advantages of dynamically allocating modulation and coding rates based on feedback information from the subscriber unit would similarly benefit the system of Ritter and result in a more robust OFDMA system in which both the allocated subcarriers and modulation and coding rates for those allocated subcarriers would be dynamically adjusted as system conditions change. For example, the system described in Ritter already includes a base station that allocates subcarriers based on channel quality feedback in order to efficiently utilize available bandwidth in light of dynamically changing channel conditions. While allocating subcarriers, the system of Ritter would benefit from additionally adjusting the modulation and coding rates applied to the allocated subcarriers as disclosed in Gesbert and Thoumy. Because Ritter, Thoumy, and Gesbert each disclose providing channel quality feedback from the subscriber unit to the base station, the adaptive modulation and coding functionality of Gesbert and Thoumy could easily be added to the subcarrier allocation functionality of Ritter in order to improve transmission quality and the bandwidth utilization of the OFDMA wireless system. The result of combining Gesbert's and Thoumy's dynamic modulation and coding functionality with the adaptive channel allocation functionality of Ritter would result in a system where (1) channel feedback information from the subscriber unit to the base station identifies both the proposed subcarrier segments and corresponding modulation and coding rate, and (2) the allocation received by the subscriber unit from

the base station identifies both the allocated subcarrier segments and a particular modulation and coding rate to use. Such a modification would have yielded predictable results without requiring undue experimentation. Accordingly, the combination of Ritter, Gesbert, and Thoumy teaches this limitation. Ex. 1102, Gitlin Decl. at ¶¶ 95-9.

(h) [Claims 2 and 18] wherein the plurality of feedback clusters at the second time is different than the plurality of feedback clusters at the first time

The combination of Ritter, Gesbert, and Thoumy further discloses an allocation "wherein the plurality of feedback clusters at the second time is different than the plurality of feedback clusters at the first time," as required by claims 2 and 18. For example, Ritter discloses that the mobile station takes measurements of "the quality of various segments." Ex. 1104 at 12, 27. As noted above, segments are comprised of multiple subcarriers. One of ordinary skill in the art would understand Ritter's disclosure of measuring the quality of "various segments" to mean that the subscriber unit can measure different segments at different times. Further, Ritter discloses an embodiment in which each mobile station provides feedback on only certain segments. *Id.* at 13. Because Ritter recognizes that the "best suited segments for communications" vary with changing channel conditions, one of ordinary skill in the art would understand that this system described in Ritter could include a different plurality of feedback clusters at a second time. *Id.* at 15; Ex. 1102, Gitlin Decl. at ¶ 110. Accordingly, the combination of Ritter, Gesbert, and Thoumy renders claims 2

and 18 obvious. *Id.*

2. Claims 8 and 24

Claims 8 and 24 depend from claims 1 and 17. The Ritter-Gesbert-Thoumy combination discloses all limitations of claims 1 and 17. *See supra* VI.A.1(a)-(g).

(a) wherein the receiving of the first allocation of OFDMA subcarriers is receiving a first allocation of at least one coherence cluster

The combination of Ritter, Gesbert, and Thoumy further discloses receiving an allocation of at least one "coherence cluster," as recited in claims 8 and 24. As discussed above, the '375 Patent describes a "coherence cluster" as "a cluster containing multiple subcarriers close to each other." *Supra* IV.D.4. Ritter discloses allocating "segments" comprised of adjacent subcarriers. For example, Ritter discloses that "[t]here are thus available, for example, several hundred sub-carriers, oc, - with a separation of several kilohertz between two adjacent carriers - in the radio cell of Figure 1 with three mobile stations, MS, linked to the base station, BS. Sub-carriers oc00 … oc40 define segment Sx, sub-carriers oc41 … oc60 define segment Sa, and sub-carriers oc61 … oc100 define segment Sm." Ex. 1104, Ritter at 15. The adjacent subcarriers in each segment allocated in Ritter constitute a "coherence cluster." The combination of Ritter, Gesbert, and Thoumy renders claims 8 and 24 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 102-103.

3. Claims 14 and 30

Claim 14 depends from claims 9 and 1. Claim 30 depends from claims 25 and 17. The Ritter-Gesbert-Thoumy combination discloses all limitations of claims

1 and 17. *See supra* VI.A.1(a)-(g). The Ritter-Gesbert-Thoumy combination further discloses "receiving a first allocation of at least one group of clusters selected by the base station for use by the subscriber unit," as recited in claims 9 and 25. The '375 Patent states that a "cluster" is "a logical unit that contains at least one physical subcarrier." *See supra* IV.D.2. If one physical subcarrier can constitute a "cluster," then a group of two or more physical subcarriers can constitute a "group of clusters." As described above, Ritter discloses the subscriber unit receiving a first allocation of a segment comprising multiple subcarriers (*i.e.*, a group of clusters) for use by the subscriber unit. Ex. 1104 at 19-20 ("the base station, BS, assigns the segments, Sx, Sa and Sm…[I]nformation about the allocated segments, Sx, Sa, Sm is sent via the radio interface to the mobile stations"). Accordingly, the Ritter-Gesbert-Thoumy combination discloses the limitations of claims 9 and 25. Ex. 1102, Gitlin Decl. at ¶ 101.

(a) wherein the receiving of the first allocation of the at least one group of clusters includes receiving a group identifier that identifies one group of the first allocation of the at least one group of clusters

The combination of Ritter, Gesbert, and Thoumy further discloses "receiving a group identifier that identifies one group of the first allocation of the at least one group of clusters," as recited in claims 14 and 30. For example, Ritter describes the base station assigning segments of subcarriers (*i.e.*, groups of subcarriers), where the segments are identified as Sx, Sa, and Sm. Ex. 1104, Ritter at 19-20 ("the base station, BS, assigns

the segments, Sx, Sa and Sm…information about the allocated segments, Sx, Sa, Sm is sent via the radio interface to the mobile stations"). Sx, Sa, and Sm each constitutes a group identifier that identifies one group of clusters, as recited in claims 14 and 30. Accordingly, the combination of Ritter, Gesbert, and Thoumy renders claims 14 and 30 obvious. Ex. 1102, Gitlin Decl. at ¶ 104.

B. Ground 2: Ritter in View of Gesbert, Thoumy, and Gitlin Renders Claims 4-7, 11, 13, 20-23, 27, and 29 Obvious

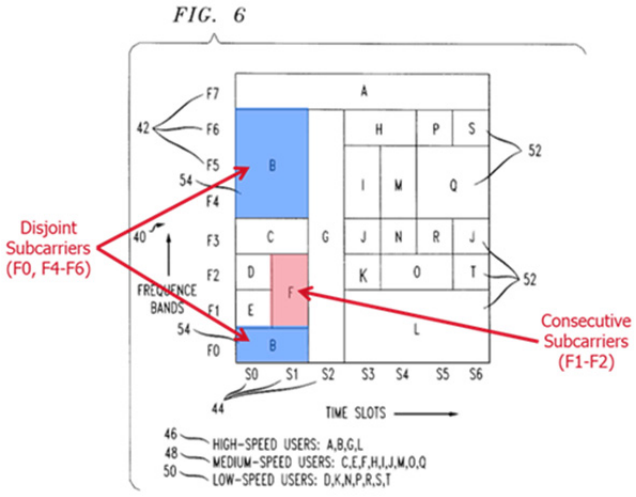
Gitlin is directed to "a system and method for maximizing usage of a communications transmission medium while preserving optimum access to the medium for users of differing access speeds and while maximizing spectral use and bandwidth efficiencies." Ex. 1106 at 1:6-12. Gitlin describes a "multi-tone" system, which is another way to describe an OFDM system. *Id.* at 5:35-41. Gitlin also describes a system with multiple users. *Id.* at 1:6-12. Thus, Gitlin describes an OFDMA system. It would have been obvious to those of ordinary skill in the art to incorporate the teachings of Gitlin into the combined Ritter-Gesbert-Thoumy system. Because Gitlin, Thoumy, Ritter, and Gesbert are all in the same field of endeavor (wireless OFDMA systems) and are directed to solving the same problem (providing quality service to multiple users in changing conditions), a person of ordinary skill in the art at the relevant time would have been motivated to combine the teachings of Gitlin with other wireless, OFDMA references or systems, such as Ritter, Thoumy, and Gesbert. Further, combining Gitlin's teachings discussed

below with the teachings of Ritter, Thoumy, and Gesbert would be a predictable use of prior art elements according to their established functions. Ex. 1102, Gitlin Decl. at ¶¶ 112-114*; see also KSR*, 550 U.S. at 416.

1. Claims 4 and 20

Claim 4 depends from claims 3 and 1. Claim 20 depends from claims 19 and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1 and 17. *See supra* VI.A.1(a)-(g). The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses receiving an allocation "wherein at least one subcarrier of the first allocation of OFDMA subcarriers is non-contiguous with other subcarriers of the first allocation of OFDMA subcarriers," as recited in claims 3 and 19. For example, Ritter teaches a subscriber unit receiving a first allocation of OFDMA subcarriers: "**[t]*he base station***, BS, evaluates all information received from the mobile stations, MS, and ***assigns each mobile station a segment for the respective communication link depending on the evaluation***. ***The base station sends the mobile station information about the assigned segment***." Ex. 1104 at 14. Gitlin teaches subcarrier allocation wherein some subcarriers of an allocation are non-contiguous with other subcarriers of the same allocation: "FIG. 6 thus depicts a variation of the time-frequency slicing method of the invention where ***noncontiguous frequency arrangements may be employed***. For instance, higher-speed users 46 operating on multi-tone modulation may benefit from ***non-***

contiguous frequency arrangements."[5] Ex. 1106 at 5:47-51, Fig. 6. Specifically, Figure 6 of Gitlin shows an allocation of frequency bands (*i.e.,* clusters of subcarriers), to High-Speed User B [54] that includes frequency bands F0 and F4-F6. In this allocation, the subcarriers in frequency band F0 are non-contiguous with the subcarriers in frequency bands F4-F6. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin discloses the additional limitation of claims 3 and 19. Ex. 1102, Gitlin Decl. at ¶¶ 115-118.



(a) wherein the first allocation of OFDMA subcarriers includes a cluster identifier that identifies a first plurality of subcarriers in a first time slot and a second plurality of subcarriers in a second time slot, at least two subcarriers of the first plurality of subcarriers and of the second plurality of subcarriers being disjoint

The Ritter-Gesbert-Thoumy combination also discloses an allocation that includes a cluster identifier that identifies disjoint subcarriers in different time

[5] The frequency units in Gitlin Fig. 6 are generic and the smallest frequency cluster may include multiple subcarriers. Ex. 1102, Gitlin Decl. at ¶ 118.

slots, as recited in claims 4 and 20. Ritter teaches a subscriber unit receiving allocations of OFDMA subcarriers that include a cluster identifier. Ritter describes the base station assigning segments of subcarriers, where the segments (clusters) are identified as Sx, Sa, and Sm. Ex. 1104 at 14, 19-20 ("the base station, BS, assigns the segments, Sx, Sa and Sm…[I]nformation about the allocated segments, Sx, Sa, Sm is sent via the radio interface to the mobile stations"). Sx, Sa, and Sm each constitutes a cluster identifier that identifies a plurality of subcarriers in a time slot, as recited in claims 4 and 20. Figure 6 of Gitlin teaches allocations wherein some subcarriers of an allocation are disjoint from other subcarriers, both within the same time slot and across two different time slots (e.g., User B is allocated disjoint frequency bands F0 and F6 in time slots S0 and S1), as explained above. *See supra* VI.B. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin renders claims 4 and 20 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 115-118, 122.

2. Claims 5 and 21

Claim 5 depends from claims 4, 3, and 1. Claim 21 depends from claims 20, 19, and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1, 3, 4, 17, 19, and 20. *See supra* VI.A.1(a)-(g); VI.B.1.

(a) wherein at least one subcarrier of the first plurality of subcarriers in the first time slot is different than all of the subcarriers of the second plurality of subcarriers in the second time slot

The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses an allocation in wherein at least one of the subcarriers allocated in the first time slot is different from all of the subcarriers allocated in the second time slot, as recited in claims 5 and 21. One of ordinary skill in the art would understand from Gitlin that a user could be allocated one frequency band in the first time slot and a different frequency band in the second time slot (*e.g.*, frequency band F1 in time slot S1 and frequency band F2 in time slot S2). Ex. 1106 at 5:8-10; Fig. 6. In such an allocation, the subcarriers allocated in the first time slot are different from all of the subcarriers allocated in the second time slot. Additionally, Thoumy discloses that the given number of subcarriers allocated in a time slot can be less than the number that was previously allocated. Ex. 1107 at 11:61-64 ("The given number of carriers to be allocated to said at least one communication channel between the base station and the peripheral station can also be less than that allocated previously to this communication channel."). In this example from Thoumy, at least one subcarrier allocated in the first time slot would not be allocated in the second time slot and therefore would be different from all of the subcarriers allocated in the second time slot, as claims 5 and 21 require. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin renders claims 5 and 21 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 128-129.

3. Claims 6 and 22

Claims 6 and 22 depend from independent claims 1 and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1 and 17. *See supra* VI.A.1(a)-(g).

(a) wherein the receiving of the first allocation of OFDMA subcarriers is receiving a first allocation of at least one diversity cluster

The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses receiving at least one diversity cluster, as recited in claims 6 and 22. The '375 Patent describes a diversity cluster as "a cluster containing multiple subcarriers with at least some of the subcarriers spread far apart over the spectrum." *See supra* IV.D.3. Gitlin discloses an allocation of OFDMA subcarriers that satisfies this requirement. Figure 6 of Gitlin shows an allocation of frequency bands F0 and F4-F6 to User B. In this allocation, the subcarriers in frequency bands F0 and F4-F6 are spread far apart over the frequency spectrum (which comprises frequency bands F0-F7). Ex. 1106, Gitlin at 5:47-51, and Fig. 6. Accordingly, claims 6 and 22 are obvious. Ex. 1102, Gitlin Decl. at ¶¶ 115-118, 121.

4. Claims 7 and 23

Claim 7 depends from claims 6 and 1. Claim 23 depends from claims 22 and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1, 6, 17, and 22. *See supra* VI.A.1(a)-(g); VII.B.3.

(a) wherein the at least one diversity cluster includes two or more subcarriers spread farther apart than a coherence bandwidth of a respective channel

The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses receiving a diversity cluster that includes subcarriers spread farther apart than a coherence bandwidth, as recited in claims 7 and 23. The '375 Patent describes channel "coherence bandwidth" as "the bandwidth within which the channel response remains roughly the same." *See supra* IV.D.5. Gitlin discloses an allocation of OFDMA subcarriers that satisfies this requirement. As discussed above, Gitlin teaches allocation of a diversity cluster of subcarriers to User B comprising frequency bands F0 and F4-F6, where each set of subcarriers is at the band edge. Ex. 1107 at 5:47-51, Fig. 6. One of ordinary skill in the art in 2000 would understand that this arrangement is a diversity cluster, and that the subcarriers of frequency band F0 and the subcarriers of frequency band F6 are spread farther apart than the coherence bandwidth. *See also* Ex. 1119, Rappaport at 335. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin renders claims 7 and 23 obvious. Ex. 1102, Gitlin Decl. at ¶ ¶ 115-118, 121, 125-127.

5. Claims 11 and 27

Claim 11 depends from claims 10, 9, and 1. Claim 27 depends from claims 26, 25, and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1 and 17 (*see supra* VI.A.1(a)-(g)), and further discloses

the limitations recited in claims 9 and 25 *(see supra* VI.A.3). The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses receiving an allocation wherein at least one cluster of the group of clusters is "disjoint from at least one other cluster . . . to obtain frequency diversity," as recited in claims 10 and 26. Ritter teaches a subscriber unit receiving a first allocation of OFDMA subcarriers, as explained above. *See supra* VI.A.1. Figure 6 of Gitlin shows an allocation of frequency bands (*i.e.,* clusters of subcarriers), to High-Speed User B [54] that includes frequency bands F0 and F4-F6. In this allocation, frequency bands F0 and F4-F6 constitute a group of clusters wherein at least one cluster (F0) is disjoint from at least one other cluster (*e.g.*, F6) to obtain frequency diversity. Gitlin explains that allocating disjoint clusters may reduce the degradation from frequency-selective multipath fading. Ex. 1106, at 6:10-16 ("These tones may be scheduled in possibly non-contiguous frequency slots within one or more time slots, as, for example, for user B in FIG. 6. In fact, it has been found that spreading the frequency allocations of a high-speed user may offer some propagation benefits (*e.g.*, a reduction in the degradation from frequency-selective multipath fading)."). Those of ordinary skill in the art in 2000 would understand this disclosure as an example of allocating disjoint clusters to obtain frequency diversity. Ex. 1102, Gitlin Decl. at ¶¶ 115-121, 125-127.

(a) wherein disjoint clusters of the first allocation of the at least one group of clusters are spread farther apart than a coherence bandwidth of a respective channel

The combination of Ritter, Gesbert, Thoumy, and Gitlin further discloses receiving an allocation comprising disjoint clusters spread farther apart than a coherence bandwidth, as recited in claims 11 and 27. The '375 Patent describes channel "coherence bandwidth" as "the bandwidth within which the channel response remains roughly the same." *See supra* IV.D.5. Gitlin discloses an allocation of disjoint clusters that satisfies this requirement. As explained above, Figure 6 of Gitlin discloses allocating to User B disjoint frequency bands F0 and F6 (disjoint clusters of subcarriers). *See supra* VI.B.5. One of ordinary skill in the art would understand that the subcarriers of frequency band F0 and the subcarriers of frequency band F6, being at the respective band-edges, are spread farther apart than the coherence bandwidth. *See* Ex. 1119, Rappaport at 335. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin renders claims 11 and 27 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 115-121,125-127.

6. Claims 13 and 29

Claim 13 depends from claims 9 and 1. Claim 29 depends from claims 25 and 17. The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses all limitations of claims 1, 9, 17, and 25. *See supra* VI.A.1(a)-(g); VII.A.3.

(a) wherein the receiving of the first allocation of the at least one group of clusters includes an indication of

space between each cluster of the first allocation of the at least one group of clusters

The combination of Ritter, Gesbert, Thoumy, and Gitlin discloses including an indication of space between each cluster in the group of clusters, as recited in claims 13 and 29. For example, Figure 6 of Gitlin discloses allocating to User B a group of clusters comprising frequency bands F0 and F4-F6. Ex. 1106, Gitlin at Fig. 6; *supra* VI.B.1. Figure 6 of Gitlin also discloses an indication of space between frequency band F0 (a first cluster) and frequency bands F4-F6 (a second cluster), namely, frequency bands F1-F3, which are not allocated to User B. Ex. 1106, Gitlin at Fig. 6. Accordingly, the combination of Ritter, Gesbert, Thoumy, and Gitlin renders claims 13 and 29 obvious. Ex. 1102, Gitlin Decl. at ¶ 124.

C. Ground 3: Thoumy in View of Gesbert and Gitlin Renders Claims 6-8, 11, 13, 22-24, 27, and 29 Obvious

1. Claims 6 and 22

Claims 6 (method) and 22 (apparatus), depend from independent claims 1 and 17 and contain nearly identical limitations. Petitioners address these common limitations of claims 6 and 22 together.. Claim 22 additionally requires a processor in the subscriber unit. Thoumy discloses a processor for executing the steps described in his patent. Ex. 1107 at 14:32-34 ("a micro-processor holding instructions of a computer program, wherein it permits implementation of the process according to the invention"). Accordingly, Thoumy teaches this limitation. Ex. 1102, Gitlin Decl. at ¶ 130.

(a) [Claim 1] *The preamble*

Thoumy discloses a method of operating an OFDMA wireless system. For example, Thoumy discloses that his "invention concerns the allocation of carrier frequencies for transmission systems using multi-carrier type modulation" in systems having one or more peripheral stations. Ex. 1107, Thoumy at 1:11-13; *see also id.* at 15:17-19 ("FIG. 14 is a general view of a network according to the invention including a base station SIB [sic] and several peripheral stations SPi"), Fig. 14. And, "one particular case is Orthogonal Frequency Division Multiplex, or OFDM." *Id*. at 1:37-38; *see also id*. at 9:24-28; Ex. 1102, Gitlin Decl. at ¶ 132.

(b) [Claim 1] *Limitation (a)*

Thoumy teaches an OFDMA system that includes subscriber stations repeatedly performing channel quality measurements. Thoumy describes, "[T]he device also has: a post-demodulator means including**: *a means of extracting, from the signal issuing from the demodulator, an FCD signal representing the transmission quality observed by the remote device B on each subcarrier*** in the "outward" direction A→B, said signal being generated by the remote device B." Ex. 1107 at 6:33-39; *see also id.* at 5:14-20, 5:56-61. Thoumy also acknowledges that pilot signals or symbols are known to persons of skill in the art for measuring channel quality. *Id.* at 18:6-9 ("There are several analysis techniques (***pilot signals*** at fixed frequencies, at frequencies sliding in time, etc) known to persons skilled in the art."). As noted above, the term "pilot

symbols" should be construed to mean "symbols, sequences, or signals known to both the base station and subscriber." Thoumy's remote device B provides a FCD signal that represents the characteristics of the channel observed by the remote device. *Id.* at 18:21-23. FCD refers to a frequency classification extraction unit 210. *Id*. at 17:61-63. Thoumy teaches the use of pilot signals to perform channel characteristics analysis and also explains that pilot signals are known to those skilled in the art. *Id.* at 18:6-9. Accordingly, one of ordinary skill in the art in 2000 would understand that Thoumy is describing performing channel quality measurements at the remote device B using pilot signals from the base station A. *See* Ex. 1102, Gitlin Decl. at ¶ 133-134.

To the extent the Patent Owner argues Thoumy does not specifically disclose the subscriber monitoring pilot symbols from a base station, as discussed above, Gesbert teaches the subscriber making OFDMA subcarrier quality measurements based on training signals (known to both the subscriber and base station) received from the base station. For example, "FIG. 5 indicates that ***training is performed on all tones during an OFDM training symbol***, it will be clear to a person skilled in the art that a subset of these tones could be used for training and the corresponding frequency response could be computed at the receiver by interpolating." Ex. 1105, Gesbert at 7:16-20; *see also id.* at 8:13-34, 7:57-59; see also *supra* (b). Ex. 1102, Gitlin Decl. at ¶ 135.

Further, it would have been obvious to modify the OFDMA system of Thoumy to measure channel quality using pilot symbols, as in Gesbert, based on: "the substitution of

one known element for another yields predictable results to one of ordinary skill in the art." *In re Icon Health & Fitness, Inc.,* 496 F.3d 1374 (Fed. Cir. 2007). One of ordinary skill in the art in 2000 would recognize that training tones are necessarily known to both the base station and subscriber, and that training tones were well known by those of skill in the art. It would be obvious for one of ordinary skill to combine the training tones and subscriber measurements of Gesbert with Thoumy's channel quality measurement techniques. Pilot symbols were well known in the art and their use for channel quality measurements was a simple design choice from among many possible alternatives. Even the '375 Patent disclosed that this technique was well known in the art. Ex. 1101 at 9:14-17 ("***The channel/interference estimation*** by processing block 301 ***is well-known in the art by monitoring the interference that is generated due to full-bandwidth pilot symbols*** being simultaneously broadcast in multiple cells."). Because both Thoumy and Gesbert disclose subscriber units measuring channel quality and both also teach pilot symbols transmitted from the subscriber unit (Thoumy also acknowledges the use of pilot symbols for channel quality measurements, Ex. 1107 at 18:6-9), the pilot symbol-based measurements disclosed in Gesbert could easily be added to the channel quality measurement functionality of Thoumy. Such a modification would have yielded predictable results without requiring undue experimentation. Further, as is evident from the descriptions above, both Thoumy and Gesbert are in the same field of endeavor as the '375 Patent. Accordingly, the combination of Thoumy and Gesbert teaches this

limitation. Ex. 1102, Gitlin Decl. at ¶ 136.

(c) [Claim 1] *Limitation (b)*

Thoumy teaches an OFDMA system that includes subscriber units repeatedly performing channel quality measurements and transmitting those measurements back to the base station. For example, "the device also has: a post-demodulator means including: a means of extracting, from the signal issuing from the demodulator, an FCD signal ***representing the transmission quality observed by the remote device B on each subcarrier in the "outward" direction A→B*****,** said signal being generated by the remote device B." Ex. 1107, Thoumy at 6:33-39. Further, "[t]he FCD extractor unit 210 extracts, from the data received and demodulated by the demodulator 70, an FCD signal 230, a signal generated and inserted by the channel analysis unit 220 and data insertion control unit 115 of the remote device B. ***This FCD signal 230 represents the characteristics of the channel in the direction A→B, as observed by the remote device B.***" *Id.* at 18:18-23; *see also id.* at 19:40-50. Thus, Thoumy discloses the subscriber unit providing feedback on all subcarriers, which means Thoumy necessarily discloses providing feedback of channel quality on a plurality of feedback clusters, where each feedback cluster includes at least two subcarriers. Ex. 1102, Gitlin Decl. at ¶ 137.

To the extent the Patent Owner argues that Thoumy does not explicitly disclose "an index corresponding to a first modulation and coding rate associated

with each feedback cluster of the plurality of feedback clusters," it would have been obvious to those of ordinary skill in the art in 2000 to include in the feedback an index corresponding to a modulation and coding rate, as described in Gesbert. *See supra* (c). For example, Gesbert discloses that receive units (*i.e.*, subscriber units) transmit an index indicating a modulation and coding rate to the transmit unit (*i.e.*, base station). Ex. 1105 at 10:17-22. Gesbert further teaches that "***[t]he modes are indexed by a mode number so as to conveniently identify the modulation and coding rates*** which are to be applied to data 52 in each mode." *Id.* at 6:37-39. Table 1 from Gesbert shows the mode indices and corresponding modulation and coding rates. According to Gesbert, "***[t]able 1 illustrates some typical modes with their modulation rates and coding rates*** and the corresponding throughputs for data 52." *Id.* at 6:35-37; *see also id.* at 4:30-32 ("The system also has a ***feedback mechanism for communicating the subsequent mode from the receive unit to the transmit unit***."); *id.* at 4:60-62 ("transmit unit 12 is a Base Transceiver Station (BTS) and a receive unit 14 is a mobile or stationary wireless user device"). Ex. 1102, Gitlin Decl. at ¶¶ 138-140.

Like Thoumy and the '375 Patent, Gesbert teaches an OFDMA system in which subscriber units (*e.g.*, handsets) measure the quality of a wireless channel and provide feedback to the base station based on those measurements. *Compare* Ex. 1105, Gesbert at 2:61-65 ("***One or more quality parameters are sampled*** in the data received ***by the***

receive unit. ***Then, a*** first-order statistical parameter and a second-order statistical parameter of the ***quality parameter*** are computed and ***used for selecting a subsequent mode for encoding the data***."), 4:30-32 ("The system also has a ***feedback mechanism for communicating the subsequent mode from the receive unit to the transmit unit***."), *with* Ex. 1107, Thoumy at 18:18-23 ("[t]he FCD extractor unit 210 extracts, from the data received and demodulated by the demodulator 70, an FCD signal 230, a signal generated and inserted by the channel analysis unit 220 and data insertion control unit 115 of the remote device B. ***This FCD signal 230 represents the characteristics of the channel in the direction A→B, as observed by the remote device B***."); *see also* Ex. 1102, Gitlin Decl. at ¶ 141. It would have been obvious to one of ordinary skill in the art to modify Thoumy to provide an indication of a modulation and coding rate in conjunction with the channel characteristics, as in Gesbert, based on "application of a known technique to a piece of prior art ready for the improvement" to "yield predictable results." *KSR*, 550 U.S. at 401. **Base system**: Thoumy discloses the subscriber unit providing channel quality information on feedback clusters to the base station. Ex. 1107 at 18:18-23. **Known technique**: Gesbert discloses communicating an index to a modulation and coding rate associated with each feedback cluster. Ex. 1105 at 3:38-51, 6:35-42, 9:66-10-44, 11:9-24, Figs. 3-4. **Predictable results and improved system**: As both Gesbert and Thoumy teach techniques for implementing an OFDMA system, it would be

obvious for one of skill in the art to take Gesbert's index of modulation and coding rate and combine it with Thoumy's system. Thoumy is concerned with continually monitoring channel quality and adjusting modulation and coding based on channel quality. Gesbert teaches an index for easily transmitting to the base station an indication of modulation and coding rate based on signal measurements performed by the subscriber. A person having ordinary skill in the art would have been motivated to combine Gesbert's well-understood technique of using an index with the teachings of Thoumy in order to maximize network resources and optimally provide feedback information to a base station relating to subcarrier selection. Such a modification would have yielded predictable results without requiring undue experimentation. *See KSR*, 550 U.S. at 416. Therefore, it would have been obvious to modify Thoumy's OFDMA system to provide an index corresponding to a modulation and coding rate in conjunction with the channel quality measurements, as in Gesbert. Accordingly, the combination of Thoumy and Gesbert teaches this limitation. Ex. 1102, Gitlin Decl. at ¶¶ 142-146.

(d) [Claim 1] *Limitation (c)*

Thoumy teaches a subscriber unit receiving (1) a first allocation of OFDMA subcarriers and (2) a modulation and coding rate for those subcarriers, both selected by the base station based on feedback information from the subscriber unit: "the device proposed in this document ***allocates a group of given carriers to each of the sources and***

selects an appropriate modulation type and coding efficiency for each of the groups." Ex. 1107 at 9:31-34; *see also id.* at 10:6-22. Further, "[t]he method proposes, ***for a given group of carriers of an OFDM symbol, to select a type of modulation and a coding efficiency which are appropriate according to the interference affecting the communication channel and the protection level required***." *Id.* at 9:24-28. And, "[t]he determination means 2174 determines the number of carriers and the modulation adapted to a service quality request, with a view to their allocation to the radio communication channel allocated to the relevant information transmission. These determination means 2174 communicate with the information sending unit 2070 in order to transmit to the peripheral station 1402 the transmission parameters ***which are the number of carriers and the modulation***." *Id.* at 30:8-15; *see also id.* at 31:8-22, 31:66-32:9. Thus, Thoumy discloses the subscriber unit receiving both (1) an allocation of subcarriers based on the feedback provided by the subscriber unit and (2) an indication of the modulation and coding rate for the allocation of subcarriers. Ex. 1102, Gitlin Decl. at ¶ 147.

(e) [Claim 1] *Limitation (d)*

Thoumy discloses repeatedly monitoring channel conditions, including using pilot signals to make those channel condition measurements. For example, "[a]ccording to the results of measurements of the noise level and the quality of reception of the OFDM symbols transmitted over the communication channel, the base station decides to replace some of the carriers which, for example, give rise to data transmissions affected by an

excessively high error rate, with other carriers less affected by noise." Ex. 1107, Thoumy at 9:53-59. And, "[t]he invention makes provision for adapting, to each required service quality which, as has just been seen, can be very different from one information transmission to another, a given pair consisting of a number of carriers and a modulation." *Id.* at 30:46-50; *see also id.* at 10:60-67, 13:10-22, 32:51-65. To extent the Patent Owner argues Thoumy does not explicitly disclose base station pilot symbols, as argued above (*supra* (b)), Gesbert teaches this limitation. Ex. 1102, Gitlin Decl. at ¶ 148.

(f) [Claim 1] *Limitation (e)*

Thoumy combined with Gesbert discloses the subscriber repeatedly submitting (1) feedback information related to the channel conditions for a plurality of feedback clusters and (2) an index for a modulation and coding rate. For example, Gesbert discloses that "[o]nce mode selection block 112 determines which modes should be used for each of the k streams, these subsequent modes are fed back to transmit unit 50 and applied to the k streams. ***This operation repeats itself***, and each new selection of subsequent modes is fed back to transmit unit 50 ***to thus account for the changing conditions of channel 22***." Ex. 1105 at 11:20-25; *see also id.* at 1:30-33. Thoumy describes "the method according to the invention includes a step of carrying out at least one measurement of the transmission error rate on the radio communication channel allocated to the information transmission in question. Advantageously, the result of this measurement supplies information on the actual conditions of the current transmission and therefore makes it

possible to reconfigure the number of carriers and the modulation allocated to this transmission where the required service quality is not met. ***The actual conditions of the current transmission can therefore be monitored continuously and the number of carriers and the modulations adapted accordingly***." Ex. 1107 at 13:10-22; *see also id.* at 30:46-50 and 9:31-34. Thus, the combination of Thoumy and Gesbert teaches this limitation. Ex. 1102, Gitlin Decl. at ¶ 149.

(g) [Claim 1] *Limitation (f)*

Thoumy discloses adaptively allocating OFDMA subcarriers and modulation and coding rates based on updated feedback from the subscriber unit. For example, "According to the results of measurements of the noise level and the quality of reception of the OFDM symbols transmitted over the communication channel, the base station ***decides to replace some of the carriers which, for example, give rise to data transmissions affected by an excessively high error rate, with other carriers less affected by noise.***" Ex. 1107 at 9:53-59. Additionally, Thoumy discloses that the second, updated allocation can have a different allocation as a prior allocation. *Id.* at 11:35-39 ("[t]he method includes ***a step of determining a number of carriers to be allocated which is different from that which was previously allocated to said at least one communication channel between the base station and the peripheral station.***"); *see also id.* at 11:39-52. Thoumy also describes adaptively reconfiguring the modulation and coding based on current transmission conditions. *Id.* at 13:15-22 ("Advantageously, the

result of this measurement supplies information on the actual conditions of the current transmission and *therefore* ***makes it possible to reconfigure the number of carriers and the modulation allocated to this transmission where the required service quality is not met. The actual conditions of the current transmission can therefore be monitored continuously and the number of carriers and the modulations adapted accordingly***."); s*ee also* 9:31-34. Thoumy teaches first and second allocations of OFDMA subcarriers that are different. *Id.* at 11:35-44 ("a step of determining a number of carriers to be allocated ***which is different from that which was previously allocated*** to said at least one communication channel between the base station and the peripheral station … for example in order to guarantee a required service quality"). Thus, the Thoumy-Gesbert combination teaches this limitation. Ex. 1102, Gitlin Decl. at ¶¶ 150-151.

(h) Claims 6 and 22

Claims 6 and 22 depend from claims 1 and 17. The combination of Thoumy and Gesbert discloses all limitations of Claims 1 and 17. *See supra* VI.C.1(a)-(g). Gitlin further discloses receiving at least one diversity cluster, as recited in claims 6 and 22. *See supra* VI.B.3. Accordingly, the combination of Thoumy, Gesbert, and Gitlin renders claims 6 and 22 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 156-158.

2. Claims 7 and 23

Claim 7 depends from claims 6 and 1. Claim 23 depends from claims 22 and 17. The combination of Thoumy, Gesbert, and Gitlin discloses all limitations of

claims 1, 6, 17, and 22. *See supra* VI.C.1(a)-(h). Gitlin further discloses receiving a diversity cluster that includes subcarriers spread farther apart than a coherence bandwidth, as recited in claims 7 and 23. *See supra* VI.B.4. Accordingly, the combination of Thoumy, Gesbert, and Gitlin renders claims 7 and 23 obvious. Ex. 1102, Gitlin Decl. at ¶ 160.

3. Claims 8 and 24

Claim 8 and 24 depend from claims 1 and 17. The combination of Thoumy and Gesbert discloses all limitations of claims 1 and 17. *See supra* VI.C.1(a)-(g). Gitlin further discloses receiving an allocation of at least one "coherence cluster," as recited in claims 8 and 24. As discussed above, the '375 Patent describes a "coherence cluster" as "a cluster containing multiple subcarriers close to each other." *Supra* IV.D.4. Gitlin discloses allocating frequency bands comprising contiguous subcarriers. For example, Gitlin discloses that "[o]ftentimes, it is advantageous that high-speed users 46 be assigned contiguous frequencies 42. Such contiguous assignments eliminate the need for guard bands between the frequencies assigned to a given user." Ex. 1106, Gitlin at 5:31-35. Figure 6 of Gitlin shows an example of allocating to User F contiguous frequency bands F1 and F2. *Id.* at Fig. 6. The contiguous subcarriers in each frequency band allocated in Gitlin constitute a "coherence cluster." Accordingly, the combination of Thoumy, Gesbert, and Gitlin renders claims 8 and 24 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 161-163.

4. Claims 11 and 27

Claim 11 depends from claims 10, 9, and 1. Claim 27 depends from claims 26, 25, and 17. The combination of Thoumy and Gesbert discloses all limitations of Claims 1 and 17. *See supra* VI.C.1(a)-(g). Thoumy also discloses receiving an allocation of at least one group of clusters selected by the base station. Ex. 1107, Thoumy at 9:31-34. Gitlin further discloses receiving an allocation wherein at least one cluster of the group of clusters is "disjoint" from at least one other cluster "to obtain frequency diversity," as recited in claims 10 and 26. *See supra* VI.B.1. Gitlin further discloses receiving an allocation comprising disjoint clusters spread farther apart than a coherence bandwidth, as recited in claims 11 and 27. *See supra* VI.B.5. Accordingly, the combination of Thoumy, Gesbert, and Gitlin renders claims 11 and 27 obvious. Ex. 1102, Gitlin Decl. at ¶ 152, 157-158 and 160.

5. Claims 13 and 29

Claim 13 depends from claims 9 and 1. Claim 29 depends from claims 25 and 17. Thoumy and Gesbert disclose all limitations of Claims 1 and 17. *See supra* VI.C.1(a)-(g). Gitlin further discloses receiving a first allocation of at least one group of clusters selected by the base station for use by the subscriber unit, as recited in claims 9 and 25. *See supra* VI.B. Gitlin further discloses including an indication of space between each cluster in the group of clusters, as recited in claims 13 and 29. *See supra* VI.B.6. Thus, Thoumy, Gesbert, and Gitlin renders

claims 13 and 29 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 152,159.

D. Ground 4: Thoumy in View of Gesbert and Ritter Renders Claims 2, 14, 18, and 30 Obvious

1. Claims 2 and 18

Claims 2 and 18 depend from claims 1 and 17. The combination of Thoumy and Gesbert discloses all limitations of claims 1 and 17. *See supra* VI.C(a)-(g). Ritter discloses that the plurality of feedback clusters at the second time is different than the plurality of feedback clusters at the first time, as recited in claims 2 and 18. *See supra* VI.A.1(h). Accordingly, the combination of Thoumy, Gesbert, and Ritter renders claims 2 and 18 obvious. Ex. 1102, Gitlin Decl. at ¶ 165.

2. Claims 14 and 30

Claim 14 depends from claims 9 and 1. Claim 30 depends from claims 25 and 17. The Thoumy-Gesbert combination discloses all limitations of Claims 1 and 17. *See supra* VI.C(a)-(g). Ritter discloses receiving a first allocation of at least one group of clusters selected by the base station for use by the subscriber unit, as recited in claims 9 and 25. *See supra* VI.A.2. Ritter further discloses receiving a "group identifier" that identifies one group of clusters, as recited in claims 14 and 30. *See supra* VI.A.3. Thus, the combination of Thoumy, Gesbert, and Ritter renders claims 14 and 30 obvious. Ex. 1102, Gitlin Decl. at ¶¶ 152, 166.

E. Ground 5: Thoumy in View of Gesbert, Gitlin, and Ritter Renders claims 4, 5, 20 and 21 Obvious

1. Claims 4 and 20

Claim 4 depends from claims 3 and 1. Claim 20 depends from claims 19 and 17. As discussed above (*supra* VI.C.1) the combination of Thoumy, Gesbert, and Gitlin disclose all limitations of claims 1 and 17. Regarding claims 3 and 19, Gitlin teaches subcarrier allocation where some subcarriers of an allocation are non-contiguous with other subcarriers of the same allocation, as discussed above in detail in Ground 2 (*supra* VI.B). In addition to the limitations of claims 1, 3, 17, and 19, claims 4 and 20 require a cluster identifier and at least two of the "subcarriers being disjoint." As discussed above (*supra* VI.B.1) Gitlin and Ritter disclose the additional features of claims 4 and 20. Accordingly, the combination of Thoumy, Gesbert, Gitlin, and Ritter disclose all the limitations of claims 4 and 20. Ex. 1102, Gitlin Decl. at ¶ 169.

2. Claims 5 and 21

In addition to disclosing all the limitation of claims 4 and 20, the combination of Thoumy, Gesbert, Gitlin, Ritter discloses that at least one subcarrier of the first plurality of subcarriers is different from all of the subcarriers of the second plurality of subcarriers, as recited in claims 5 and 21. As previously discussed in Ground 2 *supra* VI.B.2, Thoumy discloses that at least one subcarrier in the first plurality of subcarriers would not be in the second plurality of subcarrier and, then, that at least one subcarrier in the first plurality of subcarriers in the first time slot is different than all the subcarriers in the second plurality of

subcarriers in the second time slot. Therefore, claims 5 and 21 are obvious in view of Thoumy, Gesbert, Ritter, and Gitlin. Ex. 1102, Gitlin Decl. at ¶ 170.

VII. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)

A. Real Party-In-Interest and Related Matters

Petitioners identify the following real parties-in-interest. 37 C.F.R. § 42.8(b)(1):

AT&T: The AT&T Petitioner is AT&T Mobility LLC. AT&T Mobility LLC also identifies AT&T Services, Inc. as a real party in interest. Out of an abundance of caution, AT&T Mobility LLC also identifies AT&T Inc. as a real party in interest only for the purpose of this proceeding based on recent decisions of the PTAB, and only to the extent that Patent Owner contends that this separate legal entity should be named a real party in interest in this IPR. AT&T Inc. is and always has been a holding company that is a legally and factually distinct entity from its subsidiaries. Each of AT&T Inc.'s subsidiaries, including AT&T Mobility LLC and AT&T Services, Inc., maintains its own independent status, identity, and structure. AT&T Inc. does not provide any of the products and services at issue in the underlying patent infringement lawsuit.

Sprint: The real parties-in-interest for Petitioner Sprint Spectrum L.P. are Sprint Spectrum L.P., Sprint Solutions, Inc., Virgin Mobile USA, L.P., and Boost Mobile, LLC. Out of an abundance of caution, Sprint Spectrum L.P. also identifies Sprint Corporation as a real party in interest only for the purpose of this proceeding based on recent decisions at the PTAB, and only to the extent that Patent Owner contents that this separate legal

entity should be named a real party in interest in this IPR. Sprint Corporation is and always has been a holding company that is a legally and factually distinct entity from its subsidiaries. Each of Sprint Corporation's subsidiaries, including Sprint Spectrum L.P., maintains its own independent status, identity, and structure. Sprint Corporation does not provide any of the products and services at issue in the underlying patent lawsuit.

Verizon: The Verizon Petitioner is Cellco Partnership d/b/a Verizon Wireless. Out of an abundance of caution, the Verizon Petitioner also identifies Verizon Communications Inc. and Verizon Corporate Resources Group LLC as real parties-in-interest only for the purpose of this proceeding based on recent decisions of the PTAB, and only to the extent that Patent Owner contends that these separate legal entities should be named a real parties-in-interest in this IPR. No unnamed entity is funding, controlling, or otherwise has an opportunity to control or direct the Verizon Petitioner's participation in this Petition or in any resulting IPR. The Verizon Petitioner notes that as of the time of filing of this petition it has numerous affiliated entities and each of these entities agrees to be estopped to the same extent as the Verizon Petitioner under the provisions of 35 U.S.C. §§ 315 and/or 325 as a result of any final written decision in the requested IPR.

The '375 Patent is presently the subject of three patent infringement lawsuits filed by Adaptix against Petitioners in the United States District Court for the Eastern District of Texas. 37 C.F.R. § 42.8(b)(2). These three actions are styled as: *Adaptix, Inc. v. AT&T Mobility LLC* (6:15-cv-43), *Adaptix, Inc. v. Sprint Spectrum, L.P.* (6:15-cv-44), and

Adaptix, Inc. v. Cellco Partnership d/b/a Verizon Wireless (6:15-cv-45). Petitioners are concurrently filing an additional IPR petition challenging other claims of the '375 Patent.

B. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3)

Petitioners provide the following designation and service information for lead and back-up counsel. Petitioners consent to electronic service.

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VIII. CONCLUSION

For the forgoing reasons, Petitioners respectfully request *inter partes* review of claims 2, 4-8, 11, 13-14, 18, 20-24, 27, and 29-30 of U.S. Patent No. 8,934,375.

Respectfully Submitted,

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APPENDIX OF EXHIBITS

Exhibit	Description
1101	U.S. Patent No. 8,934,375 ("the '375 Patent")
1102	Declaration of Dr. Richard Gitlin ("the Gitlin Decl.")
1103	German Patent No. DE 198 00 953 C1
1104	Translation of German Patent No. DE 198 00 953 C1 ("Ritter")
1105	U.S. Patent No. 6,760,882 ("Gesbert")
1106	U.S. Patent No. 6,018,528 ("Gitlin Patent")
1107	U.S. Patent No. 7,039,120 ("Thoumy")
1108	Prosecution history of U.S. Patent No. 7,454,212
1109	IPR2014-01525, Institution Decision, Paper No. 15
1110	IPR2014-01524, Institution Decision, Paper No. 16
1111	IPR2015-00319, Institution Decision, Paper No. 10
1112	Claim Construction Order, 6:13-cv-438, Dkt. 901 (E.D. Tex., Sept. 19, 2-14)
1113	Prosecution history of U.S. Patent No. 8,934,375
1114	IPR2014-01525, Termination-Settlement, Paper No. 43
1115	IPR2014-01524, Judgment – Termination of Proceeding
1116	IPR2015-00319, Judgment, Paper No. 15
1117	U. S. Patent No. 6,947,748 ('the '748 Patent")
1118	U.S. Patent No. 7,454,212 ("the '212 Patent")
1119	Theodore Rappaport, "Wireless Communications: Principles & Practice" (1995) (excerpts)

1120	Bahai and Saltzberg, "Multi-Carrier Digital Communications Theory and Applications of OFDM," (1999)

CERTIFICATE OF SERVICE ON PATENT OWNER
UNDER 37 C.F.R. § 42.105(a)

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned certifies that on March 30, 2016, a true and correct copy of the foregoing materials:

- Petition for *Inter Partes Review* of U.S. Patent No. 8,934,375, Claims 2, 4-8, 11, 13-14, 18, 20-24, 27, and 29-30
- Petitioners' List of Exhibits
- Exhibits 1101-1120
- Sprint Spectrum L.P. Power of Attorney
- Cellco Partnership d/b/a Verizon Wireless Power of Attorney
- AT&T Mobility LLC Power of Attorney

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