

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT: US 7,454,212

INVENTOR: XIAODONG LI ET AL.

FILED: August 8, 2005

ISSUED: November 18, 2008

TITLE: OFDMA WITH ADAPTIVE SUBCARRIER-CLUSTER
CONFIGURATION AND SELECTIVE LOADING

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**DECLARATION OF DR. NICHOLAS BAMBOS IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. §42.100**

I, Nicholas Bambos, declare as follows:

1. I have been retained by Quinn Emanuel Urquhart & Sullivan LLP on behalf of Kyocera Corporation and Kyocera Communications Inc. for the above-captioned *inter partes* review (“IPR”) proceeding. I understand that this proceeding involves U.S. Patent No. 7,454,212 (the “’212 patent”) entitled “OFDMA with Adaptive Subcarrier-Cluster Configuration and Selective Loading,” and that the ‘212 patent is currently assigned to Adaptix, Inc.

2. I have reviewed and am familiar with the ‘212 patent, which was filed on August 8, 2005, and issued on November 18, 2008, and its prosecution history. The ‘212 patent was filed as a continuation of U.S. Patent No. 6,947,748 (“the ‘748 patent”), which was filed on December 15, 2000, and issued on September 20, 2005. I have also reviewed the ‘748 patent and its prosecution history.

3. I have reviewed and am familiar with: (1) U.S. Patent No. 6,726,978 to Frodigh (“Frodigh”); (2) U.S. Patent No. 6,0952,594 to Sollenberger (“Sollenberger”); (3) the certified translation of German Patent No. DE 198 00 953 C1 (“Ritter”); (4) U.S. Patent No. 5,933,421 to Alamouti (“Alamouti”); (5) U.S. Patent No. 6,072,988 to Minegishi (“Minegishi”) and (6) “A pilot based dynamic channel assignment scheme for wireless access TDMA/FDMA systems,” Chuang, J.C.-I.; Sollenberger, N.R.; Cox, D.C., *Universal Personal Communications*, 1993.

Personal Communications: Gateway to the 21st Century. Conference Record., 2nd International Conference, vol. 2, no., pp. 706,712 vol.2, 12-15 (“Chuang”).

4. I am familiar with the technology at issue as of the December 15, 2000 earliest priority date of the ‘212 patent.

5. I have been asked to provide my technical review, analysis, insights, and opinions regarding the above-noted references that form the basis for the grounds of rejection set forth in the Petition of *Inter Partes* Review of the ‘212 patent.

6. My work on this case is being billed at a rate of \$450 per hour, with reimbursement for actual expenses. My compensation is in no way contingent upon the outcome of this IPR or the content of my opinions.

I. PROFESSIONAL BACKGROUND

7. I am a Professor at Stanford University, having a joint appointment in the Department of Electrical Engineering and the Department of Management Science & Engineering. Before joining Stanford as an Associate Professor in 1996, I served as an Assistant Professor (1990-95), and tenured Associate Professor (1995-96) in the Electrical Engineering Department of the University of California at Los Angeles (UCLA). I received my Ph.D. from the University of California at Berkeley (1989) in Electrical Engineering and Computer Sciences (EECS). Also from U.C. Berkeley, I received a M.S. in EECS (1987), and a M.A.

in Mathematics (1989). I graduated in Electrical Engineering from the National Technical University of Athens-Greece (1984) with first class honors.

8. At Stanford University, I head the Network Architecture and Performance Engineering research group. From 1999 to 2005 I was the Director of the Stanford Networking Research Center project. I have held the Cisco Systems Faculty Development Chair (1999-2003) in computer networking at Stanford University and have won the IBM Faculty Development Award (2002) for research in performance engineering of computer systems and networks. I have also been the recipient of the National Young Investigator Award of the National Science Foundation (1992). I have served as editor of various research journals (including the "Wireless Networks" research journal), as technical reviewer for numerous networking and computing research journals, and on various technical panels for the National Science Foundation, etc.

9. For over 20 years, I have done research in and taught computing/networking technology concepts and design principles (at Stanford since 1996 and at UCLA during 1989-96). I have graduated over 20 Ph.D. students who have then been in leadership positions in academia and the information technology industry (Stanford University, California Institute of Technology, Columbia University, New York University, University of Michigan;

Cisco, IBM Labs, Qualcomm, ST Micro, Google, Intel, Nokia, MITRE, Sun Labs, Broadcom, etc.).

10. My complete curriculum vitae is attached hereto at Exhibit A.

II. LEGAL UNDERSTANDING

11. Counsel has informed me of the legal concepts relevant to IPR proceedings and to the opinions I offer in this matter. My understanding of these concepts and their proper application to this IPR is as follows:

A. Legal Standard for Prior Art

12. I am informed by counsel that a patent or other publication must first qualify as prior art before it can be used to invalidate a patent claim.

13. I am informed by counsel that a U.S. or foreign patent qualifies as prior art to an asserted patent if the date of issuance of the patent is prior to the invention of the asserted patent. I am further informed by counsel that a printed publication, such as an article published in a magazine or trade publication, qualifies as prior art to an asserted patent if the date of publication is prior to the invention of the asserted patent.

14. I am informed by counsel that a U.S. or foreign patent qualifies as prior art to an asserted patent if the date of issuance of the patent is more than one year before the filing date of the asserted patent. I am further informed by counsel that a printed publication, such as an article published in a magazine or trade

publication, constitutes prior art to an asserted patent if the publication occurs more than one year before the filing date of the asserted patent.

15. I am informed by counsel that to qualify as prior art, a reference must contain an enabling disclosure that allows one of ordinary skill to practice the claims without undue experimentation.

16. I am informed by counsel that documents and materials that qualify as prior art can be used to invalidate a patent claim as anticipated or as obvious.

17. I am informed by counsel that in a *inter partes* review proceeding, invalidity must be shown by a preponderance of the evidence.

B. Legal Standard for Obviousness

18. I have been instructed by counsel on the law regarding obviousness, and understand that even if a patent is not anticipated, it is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the pertinent art.

19. I am informed by counsel that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious. I am informed by counsel that

obviousness cannot be based on the hindsight combination of components selectively drawn from the prior art.

20. I am also informed by counsel that an obviousness determination includes the consideration of various factors such as (1) the scope and content of the prior art, (2) the differences between the prior art and the Asserted Claims, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, etc.

21. I am informed by counsel that secondary indicia of non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success or lack of commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; and (6) deliberate copying of the invention. I am also informed by counsel that there must be a causal relationship between any such secondary indicia and the invention. I am further informed by counsel that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

22. I am informed by counsel that an obviousness evaluation can be based on a combination of multiple prior art references. I am informed by counsel that

the prior art references themselves may provide a suggestion, motivation, or reason to combine, but other times the nexus linking two or more prior art references is simple common sense. I am further informed by counsel that obviousness analysis recognizes that market demand often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

23. I am informed by counsel that if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

24. I am also informed by counsel that practical and common sense considerations should guide a proper obviousness analysis because familiar items may have obvious uses beyond their primary purposes. I am further informed by counsel that a person of ordinary skill in the art looking to overcome a problem will often be able to fit the teachings of multiple publications together like pieces of a puzzle, although the prior art need not be like two puzzle pieces that must fit perfectly together. I am informed by counsel that obviousness analysis therefore takes into account the inferences and creative steps that a person of ordinary skill in the art would employ under the circumstances.

25. I am informed by counsel that a particular combination may be proven obvious merely by showing that it was obvious to try the combination. For

example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp because the result is likely the product not of innovation but of ordinary skill and common sense.

26. I am informed by counsel that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, obviousness likely bars its patentability.

27. I am informed by counsel that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, I am informed by counsel that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

28. I am informed by counsel that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not found explicitly or inherently in the reference can be supplied by the common sense of one of skill in the art.

29. I am informed by counsel that a person of ordinary skill could have combined two pieces of prior art or substituted one prior art element for another if the substitution can be made with predictable results, even if the swapped-in element is different from the swapped-out element. In other words, the prior art need not be like two puzzle pieces that must fit together perfectly. The relevant question is whether prior art techniques are interoperable with respect to one another, such that that a person of skill would view them as a design choice, or whether a person of skill could apply prior art techniques into a new combined system.

30. In sum, I am informed by counsel that prior art teachings are properly combined where a person of ordinary skill in the art having the understanding and knowledge reflected in the prior art and motivated by the general problem facing the inventor, would have been led to make the combination of elements recited in the claims. Under this analysis, the prior art references themselves, or any need or problem known in the field of endeavor at the time of the invention, can provide a reason for combining the elements of multiple prior art references in the claimed manner.

31. I am informed by counsel that the obviousness analysis requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

32. I make this declaration with the understanding that obviousness in a IPR review proceeding must be shown by a preponderance of the evidence.

C. Legal Standard for Claim Construction

33. I have been instructed by counsel on the law regarding claim construction and patent claims, and understand that a patent may include two types of claims, independent claims and dependent claims. An independent claim stands alone and includes only the limitations it recites. A dependent claim can depend from an independent claim or another dependent claim. I am informed by counsel that a dependent claim includes all the limitations that it recites in addition to all of the limitations recited in the claim from which it depends.

34. I am informed by counsel that claims in an IPR are given their broadest reasonable interpretation (“BRI”) that is consistent with the patent specification, and that claim language should be read in light of the specification and teachings in the underlying patent.

35. I am informed by counsel that the claims of a patent define the scope of the rights conferred by the patent. The claims particularly point out and distinctly claim the subject matter which the patentee regards as his or her invention.

36. I am informed by counsel that to determine how a person of ordinary skill would understand a claim term, one should look to those sources available

that show what a person of skill in the art would have understood disputed claim language to mean. Such sources include the words of the claims themselves, the remainder of the patent's specification, the prosecution history of the patent (all considered "intrinsic" evidence), and "extrinsic" evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.

37. I am informed by counsel that, in construing a claim term, one looks primarily to the intrinsic patent evidence, including the words of the claims themselves, the remainder of the patent specification, and the prosecution history.

38. I am informed by counsel that extrinsic evidence, which is evidence external to the patent and the prosecution history, may also be useful in interpreting patent claims when the intrinsic evidence itself is insufficient.

39. I am informed by counsel that words or terms should be given their ordinary and accepted meaning unless it appears that the inventors were using them to mean something else. In making this determination, the claims, the patent specification, and the prosecution history are of paramount importance. Additionally, the specification and prosecution history must be consulted to confirm whether the patentee has acted as its own lexicographer (i.e., provided its own special meaning to any disputed terms), or intentionally disclaimed, disavowed, or surrendered any claim scope.

40. I am informed by counsel that the claims of a patent define the scope of the rights conferred by the patent. The claims particularly point out and distinctly claim the subject matter which the patentee regards as his or her invention. Because the patentee is required to define precisely what he claims his invention to be, it is improper to construe claims in a manner different from the plain import of the terms used consistent with the specification. Accordingly, a claim construction analysis must begin and remain centered on the claim language itself. Additionally, the context in which a term is used in the asserted claim can be highly instructive. Likewise, other claims of the patent in question, both asserted and unasserted, can inform the meaning of a claim term. For example, because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

41. I am informed by counsel that the claims of a patent define the purported invention. I am also informed by counsel that the purpose of claim construction is to understand how one skilled in the art would have understood the claim terms at the time of the purported invention.

42. I am informed by counsel that a person of ordinary skill in the art is deemed to read a claim term not only in the context of the particular claim in

which the disputed term appears, but in the context of the entire patent, including the specification. For this reason, the words of the claim must be interpreted in view of the entire specification. The specification is the primary basis for construing the claims and provides a safeguard such that correct constructions closely align with the specification. Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim as set forth in the patent itself.

43. I am informed by counsel that it is improper to place too much emphasis on the ordinary meaning of the claim term without adequate grounding of that term within the context of the specification of the asserted patent. Hence, claim terms should not be broadly construed to encompass subject matter that, although technically within the broadest reading of the term, is not supported when the claims are read in light of the invention described in the specification. Put another way, claim terms are given their broadest reasonable interpretation that is consistent with the specification and the prosecution history. Art incorporated by reference or otherwise cited during the prosecution history is also highly relevant in ascertaining the breadth of claim terms.

44. I am informed by counsel that claim terms must be construed in a manner consistent with the context of the intrinsic record. In addition to consulting

the specification, one should also consider the patent's prosecution history, if available. The prosecution file history provides evidence of how both the Patent Office and the inventors understood the terms of the patent, particularly in light of what was known in the prior art. Further, where the specification describes a claim term broadly, arguments and amendments made during prosecution may require a more narrow interpretation.

45. I am informed by counsel that while intrinsic evidence is of primary importance, extrinsic evidence, e.g., all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises, can also be considered. For example, technical dictionaries may help one better understand the underlying technology and the way in which one of skill in the art might use the claim terms. Extrinsic evidence should not be considered, however, divorced from the context of the intrinsic evidence. Evidence beyond the patent specification, prosecution history, and other claims in the patent should not be relied upon unless the claim language is ambiguous in light of these intrinsic sources. Furthermore, while extrinsic evidence can shed useful light on the relevant art, it is less significant than the intrinsic record in determining the legally operative meaning of claim language.

46. I am informed by counsel that in general, a term or phrase found in the introductory words of the claim, the preamble of the claim, should be construed

as a limitation if it recites essential structure or steps, or is necessary to give life, meaning, and vitality to the claim. Conversely, a preamble term or phrase is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. In making this distinction, one should review the entire patent to gain an understanding of what the inventors claim they actually invented and intended to encompass by the claims.

47. I am informed by counsel that language in the preamble limits claim scope (i) if dependence on a preamble phrase for antecedent basis indicates a reliance on both the preamble and claim body to define the claimed invention; (ii) if reference to the preamble is necessary to understand limitations or terms in the claim body; or (iii) if the preamble recites additional structure or steps that the specification identifies as important.

48. I am informed by counsel that claims of a patent may be written in what is known as a “means-plus-function” form. I am also informed by counsel that a claim element is in means-plus-function form when it is expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support of the function. I am further informed by counsel that such claims are construed to cover the corresponding structure, material, or acts described in the specification and their equivalents. I am informed by counsel that

in a means-plus-function claim in which the disclosed structure is a computer, or microprocessor, programmed to carry out an algorithm, the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm. Absent any such algorithm, the claim lacks sufficient disclosure of structure and is therefore indefinite.

III. THE ‘212 PATENT

A. Background

49. The ‘212 patent (Ex. 1003) issued on November 18, 2008, from Application No. 11/199,586 filed on August 8, 2005, which was a continuation of Application No. 09/738,086, filed on December 15, 2000, now U.S. Patent No. 6,947,748 (“the ‘748 patent”).

50. The ‘212 patent describes a method and apparatus for enabling subcarrier selection in a cellular system. Ex. 1003 at Abstract. To make the selection, each subscriber measures channel and interference information for a plurality of subcarriers. *Id.* The measurement can be based on pilot symbols received from a base station. *Id.* A subscriber selects a set of candidate subcarriers and provides feedback information on the set of candidate subcarriers to the base station. *Id.* In response, the base station selects subcarriers from the set and provides an indication to the subscriber of the selected subcarriers for use by the subscriber. *Id.*

B. Prosecution History

51. In preparing this declaration, I have reviewed the prosecution history of the '212 patent and the '748 patent.

C. Claims

52. The claims-at-issue are reproduced in full below:

1. A method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA) comprising:

a subscriber unit measuring channel and interference information for a plurality of subcarriers based on pilot symbols received from a base station;

the subscriber unit selecting a set of candidate subcarriers;

the subscriber unit providing feedback information on the set of candidate subcarriers to the base station;

the subscriber unit receiving an indication of subcarriers of the set of subcarriers selected by the base station for use by the subscriber unit; and

the subscriber unit submitting updated feedback information, after being allocated the set of subcarriers to be allocated an updated set of subcarriers, and

thereafter the subscriber unit receiving another indication of the updated set of subcarriers.

8. The method defined in claim 1 further comprising the base station selecting the subcarriers from the set of candidate subcarriers based on additional information available to the base station.

9. The method defined in claim 8 wherein the additional information comprises traffic load information on each cluster of subcarriers.

10. The method defined in claim 9 wherein the traffic load information is provided by a data buffer in the base station.

11. The method defined in claim 1 wherein the indication of subcarriers is received via a downlink control channel.

12. The method defined in claim 1 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.

13. The method defined in claim 1 wherein providing feedback information comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers.

15. The method defined in claim 1 wherein providing feedback information comprises sequentially ordering candidate clusters.

18. An apparatus comprising:

a plurality of subscriber units in a first cell operable to generate feedback information indicating clusters of subcarriers desired for use by the plurality of subscriber units; and

a first base station in the first cell,

the first base station operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber units;

each of said plurality of subscriber units to measure channel and interference information for the plurality of subcarriers based on pilot symbols received from the first base station and

at least one of the plurality of subscriber units to select a set of candidate subcarriers from the plurality of subcarriers, and

said at least one subscriber unit to provide feedback information on the set of candidate subcarriers to the base station and

to receive an indication of subcarriers from the set of subcarriers selected by the first base station for use by the at least one subscriber unit, and

wherein the subscriber unit submits updated feedback information after being allocated the set of subscriber units to receive an updated set of subcarriers and

thereafter receives another indication of the updated set of subcarriers.

19. The apparatus defined in claim 18 wherein each of the plurality of subscriber units continuously monitors reception of the pilot symbols known to the base station and

the plurality of subscriber units and measures signal-plus-interference-to-noise ratio (SINR) of each cluster of subcarriers.

23. The apparatus defined in claim 18 wherein the base station selects the subcarriers from the set of candidate subcarriers based on additional information available to the base station.

24. The apparatus defined in claim 23 wherein the additional information comprises traffic load information on each cluster of subcarriers.

25. The apparatus defined in claim 24 wherein the traffic load information is provided by a data buffer in the base station.

26. The apparatus defined in claim 18 wherein the indication of subcarriers is received via a downlink control channel between the base station and the at least one subscriber unit.

27. The apparatus defined in claim 18 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.

28. The apparatus defined in claim 18 wherein the plurality of subscriber units provide feedback information that comprises an arbitrarily ordered set of candidate subcarriers as clusters of subcarriers.

29. The apparatus defined in claim 18 wherein providing feedback information comprises sequentially ordering candidate clusters.

D. Claim Construction

1. SINR

53. In cellular networks, a typical wireless communication link has a certain signal-to-interference-plus-noise ratio (SINR). The terms “signal,” “noise,” and “interference” in SINR all have understood meanings to one of ordinary skill in the art. The term “signal” refers to the signal power seen at the receiver of the communication link for the signal transmitted by the transmitter in the wireless communication channel. The transmitted signal is the often broadly called “carrier signal” and used interchangeably with the term “signal” because it carries the actual information that is communicated and to differentiate it from interference signals.

54. The term “noise” refers to the power of the thermal noise at the receiver. The “noise” is typically constant and can be known by the receiver as it primarily depends on the electronic and thermal properties of the receiver circuits.

55. The term “interference” refers to the cumulative power of the signals transmitted by the transmitters of other communication links operating in the same channel that is received at the receiver. In a wireless communication system, the “interference” is variable or changes as other links are created or disappear, move around, or become more (or less) active.

56. Because, the “noise” is fixed (i.e., is a constant bias) while the “interference” is variable and often substantially larger than noise, “interference” is of primary interest to the operation of the communication link. As a result, the terms “signal-to-interference ratio” (SIR or S/I, or C/I, where C stands for “carrier” mentioned above) and “signal-to-interference-plus-noise-ratio” (SINR) can be broadly used interchangeably. Indeed, even under the narrowest possible interpretation where noise is excised from SIR and included in SINR, SIR is strongly correlated with SINR such that a high SIR implies a high SINR and vice versa, when the noise is small. After all, both SINR and SIR (as well as S/I and C/I) are metrics of transmission quality. Moreover, the ‘748 patent on its face recognizes that interference and noise may be considered as one quantity. *See, e.g.,* Ex. 1003 at 9:15-24, with emphasis added (“The interface information is

forwarded to processing block 302 which uses the information to solve the following equation: $H_i S_i + I_i + n_i = y_i$, where S_i , represents the signal for subcarrier (freq. band) i , I_i is the interference for subcarrier i , n_i is the noise associated with subcarrier i , and y_i is the observation for subcarrier i . In the case of 512 subcarriers, i may range from 0 to 511. *The I_i and n_i are not separated and may be considered one quantity.*”). Accordingly, in my opinion, the BRI of “SINR” is “signal-to-interference-plus-noise ratio and related measures such as signal-to-interference ratio (SIR or S/I), carrier-to-interference-plus-noise ratio (C/(I+N)), and carrier-to-interference ratio (C/I).”

IV. LEVEL OF ORDINARY SKILL IN THE ART

57. In my opinion, a person of ordinary skill in the art for this patent would have either a Bachelor’s degree in electrical engineering or a similar degree, with at least three to five years of experience in wireless communication technology, or the equivalent.

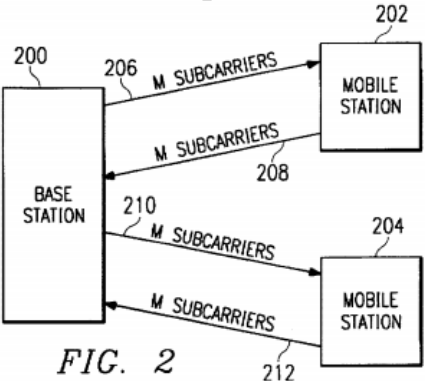
V. INVALIDITY

A. Ground 1: Claims 1, 8, 11-13, 18, 19, 23 and 26-28 are obvious over Frodigh (Ex. 1004) in view of Sollenberger (Ex. 1005)

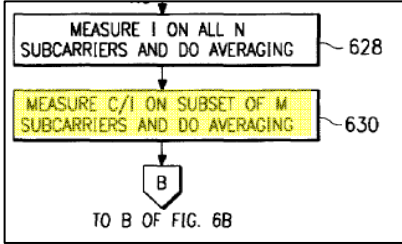
58. In my opinion, the combination of Frodigh and Sollenberger renders obvious claims 1, 8, 11-13, 18, 19, 23 and 26-28 of the ‘212 patent.

1. Claim 1

59. The combination of Frodigh and Sollenberger renders obvious claim 1 of the '212 patent as demonstrated by the below chart.

'212 Patent Claim 1	Disclosure
<p>1. A method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA) comprising:</p>	<p>Frodigh discloses a method for subcarrier selection [“allocation of subcarriers”] for a system employing orthogonal frequency division multiple access (OFDMA)[an “OFDM system” adapted for multiple mobile stations, such as numbers 202 and 204 as shown in Fig. 2].</p> <p>“A <i>method and system of adaptive channel allocation</i>¹ in a frequency division multiplexed system is provided. In the method and system <i>a subset of M subcarriers is chosen</i> from a larger set of N subcarriers available for communications on a link.” Frodigh Abstract; “The present invention provides a method and system of adaptive channel allocation (ACA) in an <i>orthogonal frequency division multiplexed (OFDM) system</i>. The method and system provides an <i>allocation of subcarriers to each link of the OFDM system</i> that lessens co-channel interference between cells of the system.” <i>Id.</i> at 4:25-31; “[T]he invention provides a method and system of adaptive channel allocation for an OFDM system. Use of the invention will enhance the performance of OFDM systems into which it is implemented.” <i>Id.</i> at 15:18-22; Fig. 2:</p>  <p><i>FIG. 2</i></p> <p>See also, e.g., <i>id.</i> at 1:59-2:59, 4:13-22, 4:31-53; Figs. 4-7.</p>
[a][1] a	Frodigh discloses a subscriber [“mobile station”] measuring channel

¹ Unless otherwise noted, all emphasis in this declaration is added.

<p>subscriber unit measuring channel and interference information for a plurality of subcarriers</p>	<p>and interference information [“signal quality (C/I” and “interference level (I)”] for a plurality of subcarriers [“subset of M subcarriers,” “all N available subcarriers”].</p> <p>“As communications take place on the link, <i>signal quality (C/I) measurements on the subcarriers of the subset of M subcarriers and interference (I) measurements on the subcarriers of the group of N subcarriers are periodically performed.</i> The C/I and I measurements are then used to reconfigure the subset of M subcarriers to reduce co-channel interference on the link.” Frodigh Abstract; “As communications take place, <i>the signal quality level (C/I) of the subcarriers within the subset of M subcarriers, and the interference level (I) of all N available subcarriers is periodically measured.</i> These C/I and I measurement results are reported to the system.” <i>Id.</i> at 4:56-60; “Referring now to FIG. 6A, therein is shown a flow diagram illustrating the steps performed by a <i>mobile station</i> as the link receiver during the ACA process of the alternative embodiment of the invention.” <i>Id.</i> at 13:5-8; Fig. 6A (detail):</p>  <pre> graph TD 628[MEASURE I ON ALL N SUBCARRIERS AND DO AVERAGING] --> 630[MEASURE C/I ON SUBSET OF M SUBCARRIERS AND DO AVERAGING] 630 --> B{B} B --> 6B[TO B OF FIG. 6B] </pre> <p><i>See also, e.g., id.</i> at 3:35-65, 5:10-25, 10:2-7, 10:53-11:7, 13:5-12, 14:10-15; claims 2, 3, 20-22; and Figs. 4 and 6.</p>
<p>[a][2] based on pilot symbols received from a base station;</p>	<p>Sollenberger discloses a subscriber [“wireless station”] measuring channel and interference information [“measured power of a particular pilot frequency,” “signal to interference ratio”] for a plurality of subcarriers [“wireless stations”] based on pilot symbols [“pilot signals”] from a base station.</p> <p>“The base station is one of a plurality of base stations and the wireless station is associated with the base station. In response to the paging message, <i>a level of each of a plurality of pilot frequency signals is detected at the wireless station.</i> Each <i>pilot frequency</i> corresponds to a downlink traffic channel and is <i>transmitted by base stations</i> to which the downlink traffic channel</p>

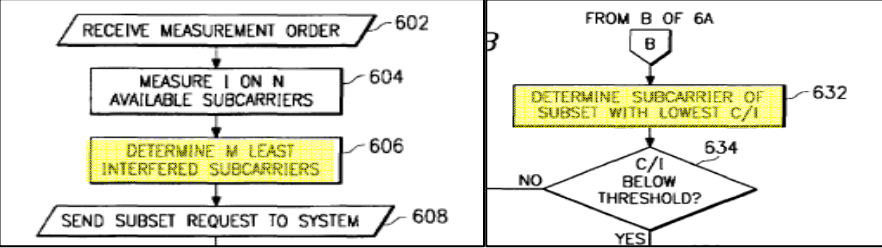
is assigned.” Sollenberger at Abstract.

“In response to the paging message, a level of each of a plurality of pilot frequency signals is detected at the wireless station. Each pilot frequency signal corresponds to a downlink traffic channel and is transmitted by base stations to which the downlink traffic channel is assigned.” Sollenberger at 6:63-66; “According to the invention, a *wireless station*, such as a mobile station or wireless terminal, *performs interference measurements for determining acceptable channels*, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets for delivery to the wireless station. The *wireless station scans a pilot signal frequency band* using fast Fourier transform (FFT) technique for detecting *pilot signals* that respectively correspond to channels that are currently being used for downlink transmission. A feedback channel is then used for informing a base station of acceptable channels. To avoid more than one wireless station in the same cell from selecting the same acceptable channel, a list of more than one acceptable channel is provided by the wireless station.” *Id.* at 7:60-8:7.

“When a wireless station (WS) receives a paging message from a base station (BS) indicating that the base station has received packets for downlink transmission to the wireless station, the wireless station scans pilot frequency signals at 11 for idle channels based on the priority order, starting with the channel having the highest priority ranking. A channel, as used herein, is defined to be a particular timeslot of a particular carrier frequency and is designated as (timeslot, carrier frequency).” *Id.* at 8:31-39.

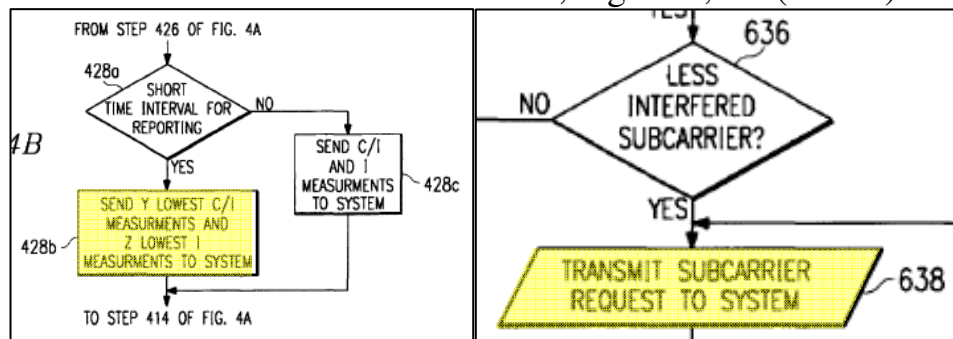
“According to the invention, the *power measured for each respective pilot frequency signal corresponds to an interference level on the channel corresponding to the pilot frequency signal* that is caused by downlink transmissions that are actively using the channel. Flow continues to step 22 where, the interference is measured on the downlink channel having priority order j. At step 23, it is determined whether the *signal to interference ratio (SIR) measured for the channel* having priority order j is greater than a predetermined threshold by comparing the power of the pilot frequency signal corresponding to j to a predetermined threshold.”

	<p><i>Id.</i> at 9:6-18.</p> <p>“If the <i>measured power of a particular pilot frequency signal</i> is less than the predetermined threshold, flow continues to step 24 where the channel corresponding to the particular pilot frequency signal is added to the list of acceptable channels.” <i>Id.</i> at 9:25-29.</p>
<p>[b] the subscriber unit selecting a set of candidate subcarriers ;</p>	<p>Frodigh discloses the subscriber unit [“mobile station”] selecting a set of candidate subcarriers [“candidate replacement subcarriers”].</p> <p>“[A]n initial subset of M subcarriers is chosen from a larger group of N subcarriers that are available for communications on each separate link of the OFDM system. The number M depends on the data rate of the particular link and may vary between the links of the system. The subset of M subcarriers is then used to carry communications on the link. As communications take place, the signal quality level (C/I) of the subcarriers within the subset of M subcarriers, and the interference level (I) of all N available subcarriers is periodically measured. These C/I and I measurement results are reported to the system. During communications on the link the system determines from the C/I and I measurements if a more preferred unused subcarrier which would give better signal reception on the link than a subcarrier of the set of M is available in the cell within 65 which the link exists. If it is determined that a more preferred unused subcarrier exists, the system reconfigures the subset of M subcarriers to include the unused subcarrier. In a second aspect of the invention, <i>a mobile station as link receiver transmits only a limited set of measurement results</i> to the system at certain select reporting intervals rather than all measurement results. <i>The transmitted limited set of measurement results comprises a select number of the lowest C/I measurement results and a select number of the lowest I measurement results.</i> The transmission of the limited set of results reduces the use of uplink system signaling resources.” Frodigh at 4:50-5:9.</p> <p>“In an alternative embodiment of the invention a mobile station as link receiver periodically measures the signal quality level (C/I) of the subcarriers within the subset of M subcarriers, and the interference level (I) of all N available subcarriers. <i>The mobile station then determines candidate replacement subcarriers for the link based on the C/I and I measurements,</i> and transmits a subcarrier request message to the system requesting that the candidate subcarrier be</p>

	<p>assigned to replace a subcarrier of the link. The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.” <i>Id.</i> at 5:10-20; Figs. 6A, 6B (details):</p>  <p>“If it is determined that the measurement period involves a short time interval for reporting measurement results the process moves to step 428b, where the mobile station transmits the C/I measurements for the Y worst quality subcarriers of the subset of M subcarriers, where $Y < M$, and the I measurements for the Z least interfered of the N subcarriers to the system, where $Z < N$. <i>The values of Y and Z are chosen to allow adequate information for effective ACA while minimizing signaling traffic.</i>” <i>Id.</i> at 11:31-40.</p> <p>“In an alternative embodiment of the invention, a mobile station as link receiver transmits request messages <i>requesting a certain subset of M subcarriers</i>, or requesting replacements for the M subcarriers, to be used on the link.” <i>Id.</i> at 12:57-60; 3:35-4:22; 9:9-12, 11:12-42, 12:57-13:21; 14:17-40; 16:52-17:13; Fig. 4-7.</p>
<p>[c] the subscriber unit providing feedback information on the set of candidate subcarriers to the base station;</p>	<p>Frodigh discloses the subscriber [“mobile station”] providing feedback information [“limited set of measurement results”] on the set of candidate subcarriers to the base station</p> <p>“In a second aspect of the invention, <i>a mobile station as link receiver transmits only a limited set of measurement results</i> to the system at certain select reporting intervals rather than all measurement results. <i>The transmitted limited set of measurement results comprises a select number of the lowest C/I measurement results and a select number of the lowest I measurement results.</i> The transmission of the limited set of results reduces the use of uplink system signaling resources.” Frodigh at 5:1-9.</p> <p>“The mobile station then determines candidate replacement subcarriers for the link based on the C/I and I measurements, and <i>transmits a subcarrier request message to the system requesting that the candidate subcarrier be assigned to replace a subcarrier of the</i></p>

link. The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.” *Id.* at 5:14-20.

“In an alternative embodiment of the invention, *a mobile station* as link receiver *transmits request messages requesting a certain subset of M subcarriers*, or requesting replacements for the M subcarriers, to be used on the link.” *Id.* at 12:57-60; Figs. 4B, 6B (details):



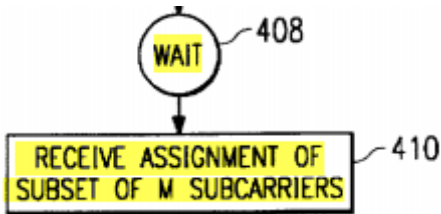
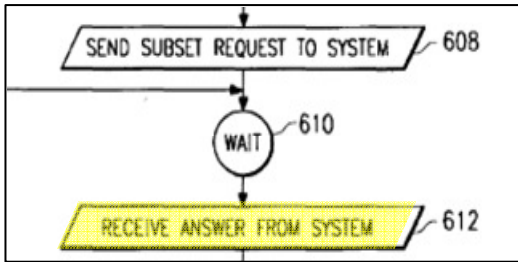
See also, e.g., *id.* at 3:35-4:22, 4:25-49, 7:29-50, 10:2-7, 11:12-42, 12:57-13:21; 14:17-40, 17:12-40; Fig. 4-7.

Sollenberger also discloses the subscriber unit [“wireless station”] providing feedback information on the set of candidate subcarriers to the base station [the information sent via the “feedback channel”].

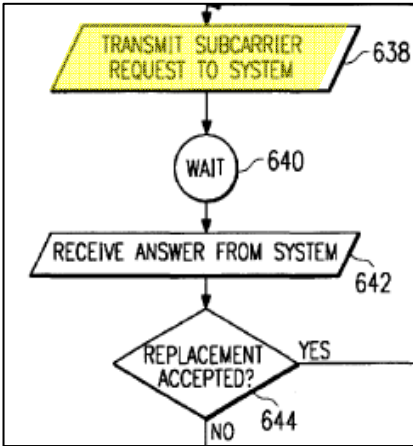
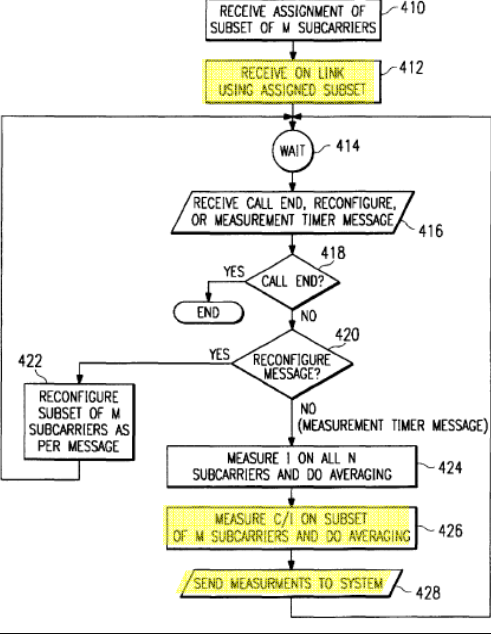
“According to the invention, a wireless station. . . *performs interference measurements for determining acceptable channels*, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets for delivery to the wireless station. The wireless station scans a pilot signal frequency band using fast Fourier transform (FFT) technique for detecting pilot signals that respectively correspond to channels that are currently being used for downlink transmission. *A feedback channel is then used for informing a base station of acceptable channels.* To avoid more than one wireless station in the same cell from selecting the same acceptable channel, *a list of more than one acceptable channel is provided by the wireless station.*” Sollenberger at 7:60-8:7.

[d] the subscriber unit receiving an indication

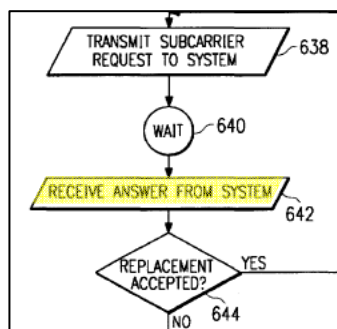
Frodigh discloses the subscriber unit [“mobile station,” which may be a “link receiver”] receiving an indication [“subcarrier accepted or subcarrier rejected message,” “channel assignment message”] of subcarriers of the set of subcarriers selected by the base station for use by the subscriber unit.

<p>of subcarriers of the set of subcarriers selected by the base station for use by the subscriber unit; and</p>	<p><i>“The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.</i> If a subcarrier accepted message is received, the mobile station reconfigures the subset of M subcarriers to contain the candidate replacement subcarrier. If the subcarrier is rejected, the mobile station transmits a subcarrier request message requesting a new candidate subcarrier.” Frodigh at 5:17-25.</p> <p>“Referring again to FIG. 4A, the link receiver which has been in the wait state at 408 now moves to step 410 <i>and receives the channel assignment message assigning the subset of M subcarriers to the link.</i> Next, the process moves to step 412 as the link receiver begins receiving on the link using the assigned subset of M subcarriers.” <i>Id.</i> at 10:37-42; Fig. 4A (detail):</p>  <pre> graph TD 408((WAIT)) --> 410[RECEIVE ASSIGNMENT OF SUBSET OF M SUBCARRIERS] </pre> <p>“If <i>the link receiver is a mobile station</i> in a downlink the substeps shown in FIG. 4B may be used to reduce signaling traffic as the results are transmitted to the system over the uplink via the base station.” <i>Id.</i> at 11:13-16.</p> <p>“Referring now to FIG. 6A, at Step 612 <i>the mobile station receives a subset accepted message or subcarrier rejection message</i> transmitted from the system. If a subset acceptance message is received, the process moves to Step 620 where the link receiver begins receiving using the assigned subset.” <i>Id.</i> at 13:47-51; <i>see also id.</i> at 4:32-49, 6:63-7:13, 10:22-26, 9:7-10; Figs. 4-7; Fig. 6A (detail):</p>  <pre> graph TD 608[/SEND SUBSET REQUEST TO SYSTEM/] --> 610((WAIT)) 610 --> 612[/RECEIVE ANSWER FROM SYSTEM/] </pre>
<p>[e][1] the subscriber</p>	<p>Frodigh, discloses the subscriber unit [“mobile station”] submitting updated feedback information [“signal quality (C/I) measurements</p>

<p>unit submitting updated feedback information, after being allocated the set of subcarriers to be allocated an updated set of subcarriers, and thereafter</p>	<p>on the subcarriers of the subset of M subcarriers and interference (I) measurements on the subcarriers of the group of N subcarriers are periodically performed”], after being allocated the set of subcarriers [“the process steps shown in FIGS. 4A, 4B and 5 will be repeated until the call ends”] to be allocated an updated set of subcarriers [“C/I and I measurements are then used to reconfigure the subset of M subcarriers”].</p> <p>“If, however, a less interfered subcarrier does exist, a more preferred subcarrier exists and the process moves to Step 638. At Step 638 <i>the mobile station transmits a subcarrier request message to the system requesting the least interfered subcarrier not in the subset of M subcarriers as a replacement for the subcarrier with the lowest C/I</i>. The process within the mobile station now moves to the wait state of Step 640 and the process flow moves to Step 708 of FIG. 7.” Frodigh at 14:27-35.</p> <p>“The <i>process continues as long as a call is ongoing</i> and communications on the link continue. The link receiver will next move from the wait state at step 408 upon receiving an input and <i>the process steps shown in FIGS. 4A, 4B and 5 will be repeated until the call ends</i> and a call end signal is received by the link transmitter, link receiver and ACA processing portion of the system.” <i>Id.</i> at 12:50-56.</p> <p>“A method and system of <i>adaptive channel allocation</i> in a frequency division multiplexed system is provided. . . . As communications take place on the link, <i>signal quality (C/I) measurements on the subcarriers of the subset of M subcarriers and interference (I) measurements on the subcarriers of the group of N subcarriers are periodically performed. The C/I and I measurements are then used to reconfigure the subset of M subcarriers</i> to reduce co-channel interference on the link.” <i>Id.</i> Abstract; 11:54-12:49, 14:10-15:12; Figs. 5-7; Figs. 4B, 6A (details):</p>
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<p>[e][2] the subscriber unit receiving another indication of the updated set of subcarriers.</p>	<p>Frodigh discloses the subscriber unit [“mobile station”] receiving another indication of the updated set of subcarriers [“C/I and I measurements are then used to reconfigure the subset of M subcarriers,” the mobile stations “Receive Answer From System” regarding allocation].</p> <p>“The <i>process continues as long as a call is ongoing</i> and communications on the link continue. The link receiver will next move from the wait state at step 408 upon receiving an input and <i>the process steps shown in FIGS. 4A, 4B and 5 will be repeated until the call ends</i> and a call end signal is received by the link transmitter, link receiver and ACA processing portion of the system.” Frodigh at 12:50-56.</p> <p>“A method and system of <i>adaptive channel allocation</i> in a frequency division multiplexed system is provided. . . . As communications take place on the link, signal quality (C/I) measurements on the subcarriers of the subset of M subcarriers and interference (I) measurements on the subcarriers of the group of N subcarriers are <i>periodically performed. The C/I and I measurements are then used to reconfigure the subset of M subcarriers</i> to reduce co-channel interference on the link.” <i>Id.</i> at Abstract.</p> <p>“If it is determined that <i>a more preferred unused subcarrier exists,</i></p>	

the system reconfigures the subset of M subcarriers to include the unused subcarrier.” Id. at 4:65-67; 11:54-12:49, 14:10-15:12; Figs. 4-5, 7, Fig. 6B (detail):



Frodigh Teaches an OFDMA System as Recited in Claim 1

60. Frodigh teaches an OFDMA system according to the ‘212 patent. As explained in the ‘212 patent, “[o]rthogonal frequency division multiple access (OFDMA) is another method for multiple access, using the basic format of OFDM. In OFDMA, multiple subscribers simultaneously use different subcarriers, in a fashion similar to frequency division multiple access....” Ex. 1003, ‘212 patent at 2:39-43. Frodigh teaches an OFDM system adapted for multiple mobile stations. Ex. 1004, Frodigh at 4:25-31; Fig. 2, 202 and 204. Frodigh also teaches that the multiple mobile stations use different subcarriers at the same time. Ex. 1004, Frodigh at 7:51-63; Fig. 2, 206, 208, 210, 212. One of ordinary skill in the art would therefore understand that the OFDM system of Frodigh is an OFDMA system in accordance with the ‘212 patent.

Obvious to Combine Sollenberger's Use of Pilot Symbols to Measure Channel Quality as Recited in Claim 1 into Frodigh's System of Adaptive Channel Allocation

61. To the extent that Frodigh is found not to expressly disclose that pilot symbols transmitted by a base station are used for measuring channel quality, Sollenberger expressly discloses this element through its discussion of “pilot frequency symbols” to determine signal to interference ration information. Ex. 1005, Sollenberger at 9:6-18.

62. I submit that it would have been obvious to one of ordinary skill in the art to combine Frodigh with Sollenberger, and a person skilled in the art would have been motivated to do so, for at least five reasons. First, the ‘212 patent on its face acknowledges that the use of pilot symbols for determining channel quality was a well-known prior art technology. Ex. 1003, ‘212 patent, 9:12-15 (“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.”). Based on this admission, a person of ordinary skill in the art would have understood that such pilot symbols would be an effective way to implement the channel monitoring described in Frodigh. Frodigh alone would thus render obvious all claim elements involving measuring pilot symbols to determine channel quality. A person of ordinary skill in the art would also think to, and be motivated to, combining

Frodigh with the teachings of specific references that have strong teachings of pilot symbols in the context of adaptive channel allocation, such as Sollenberger.

63. Second, one of ordinary skill in the art would understand that combining Frodigh with Sollenberger would have been a use of a known technique to try to improve a similar device in the same way and thus obvious to try. Specifically, it would have been obvious to one skilled in the art to improve the teachings of Frodigh with Sollenberger to provide Frodigh with the effective technique for measuring channel quality taught in Sollenberger, as well as any other features of benefit to an adaptive channel allocation scheme.

64. Third, one of ordinary skill in the art would understand that combining Frodigh and Sollenberger unites old elements without changing their respective functions. Specifically, the combination of Frodigh's adaptive channel allocation system with Sollenberger's system for measuring channel quality would not require changes to either's functionality. Using Sollenberger's technique for measuring channel quality would not require any change in Frodigh's adaptive channel allocation functionality. Similarly, Sollenberger's technique would not request any changed functionality when combined with Frodigh's adaptive channel allocation system, as that is the very context in which Sollenberger's technique arises. The elements would be therefore used exactly as taught in each patent.

65. Fourth, one of ordinary skill in the art would understand that modifying Frodigh with the teachings of Sollenberger would have been a predictable variation of a work in the same field of endeavor. Indeed, one skilled in the art would have been able to readily implement the variation. In particular, as both Frodigh and Sollenberger are both directed towards adaptive channel allocation systems using OFDM technology, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations, a person of ordinary skill in the art would understand the features of Sollenberger to be applicable to Frodigh. It is common sense and obvious to one of ordinary skill in the art that a pilot symbol-based system for measuring channel quality in an adaptive channel allocation system would have ready application to another adaptive channel allocation system which also relies on measures of channel quality.

66. Fifth, one of ordinary skill in the art would understand that combining the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. In particular, one of ordinary skill in the art would have understood that by December of 1999—one year prior to the earliest application to which the ‘212 patent could possibly claim benefit—the wireless revolution was already well underway, and as such, the market would have both incentivized and demanded the combining of adaptive channel

allocation systems like Frodigh with effective technology for channel quality determination like those set forth in Sollenberger.

2. Claims 8 and 11-13

67. The combination of Frodigh and Sollenberger renders obvious claims 9 and 11-13 of the '212 patent as demonstrated by the below chart.

'212 Patent Claim 8		Disclosure
8. The method defined in claim 1 further comprising the base station selecting the subcarriers from the set of candidate subcarriers based on additional information available to the base station.		Frodigh discloses the base station selecting the subcarriers from the set of candidate subcarriers based on additional information available to the base station [whether certain subcarriers are “reserved within the system for special uses;” how “use effects transmission in neighboring cells.”] <i>“Certain subcarriers</i> may not be available for use in the cell, for example, if they are being used by another mobile station or, <i>if they have been reserved within the system for special uses. The availability of the M subcarrier may also be determined as to how their use effects transmissions in neighboring cells.</i> The ACA is <i>designed to allow flexibility</i> to the system operators in making these decisions.” Frodigh at 13:30-36; <i>See also, e.g., id.</i> at 3:51-56, 12:39-49, 14:50-54; claims 1, 6, and 9.
'212 Patent Claim 11		Disclosure
11. The method defined in claim 1 wherein the indication of subcarriers is received		I have been informed that this claim has been found invalid because “the indication” is indefinite due to antecedent basis failure. My read <i>for purposes of this IPR only</i> is that it is a reference to “an indication.” Frodigh the indication of subcarriers [“subcarrier assignment”] is received via a downlink control channel [“DDCH,” “PCCH”]. <i>“The system includes a dedicated control channel (DCCH) that is both an uplink and downlink channel</i> for transmitting control information for handovers, long term <i>channel allocation</i>

via a downlink control channel.	<i>information</i> , long term power control information and measurement messages and measurement results. The system also includes a <i>physical control channel (PCCH) that is both an uplink and downlink channel for transmitting short term channel allocation information</i> , short term power control information, measurement messages and measurement results.” Frodigh at 7:29-38. “In the described embodiment the <i>DCCH and PCCH channels</i> may be used on both the uplink and <i>downlink to transfer measurement results or subcarrier assignment messages</i> between a mobile station and the system. <i>The use of control channels to carry such information is known to those skilled in the art.</i> ” <i>Id.</i> at 9:40-5, 16-36.
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'212 Patent Claim 12	Disclosure
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12. The method defined in claim 1 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.	<p>Frodigh discloses the plurality of subcarriers comprises all subcarriers allocable by a base station [“all subcarrier frequencies available to the system”].</p> <p>“The set of subcarrier frequencies allocated to each communications link is <i>chosen from all subcarrier frequencies available to the system.</i>” Frodigh at 3:7-9; “As communications take place, the signal quality level (C/I) of the subcarriers within the subset of M subcarriers, and the interference level (I) of <i>all N available subcarriers is periodically measured.</i> These C/I and I measurement results are reported to the system.” <i>Id.</i> at 4:56-60; “<i>The set of N subcarriers may include all subcarriers of the system.</i> Alternatively, the set of N subcarriers may be a set less in number than the total number of subcarriers available but greater in number than the number of carriers in the subset of M subcarriers.” <i>Id.</i> at 7:45-50; <i>See also, e.g., id</i> at 5:10-15, and 9:66-10:2.</p>
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'212 Patent Claim 13	Disclosure
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13. The method defined in claim 1 wherein providing feedback information	<p>Sollenberger discloses providing feedback information [“Transmits the list”] that comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers [“a list of preferred traffic channels based on a priority order of traffic channels and on detected levels of the pilot frequency signals;” the list of the first L acceptable channels].</p> <p>“The wireless station <i>generates a list of preferred traffic channels based on a priority order of traffic channels and on detected levels</i></p>
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<p>comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers.</p>	<p><i>of the pilot frequency signals</i>, and <i>transmits the list to the associated base station</i>. A downlink traffic channel is assigned for downlink transmitting the received data packet to the wireless station based on the list of preferred traffic channels and updates a channel priority order list at the base station.” Sollenberger at Abstract.</p> <p>“The wireless station <i>generates a list of preferred traffic channels based on a priority order of the downlink traffic channels for wireless stations communicating with the base station and on detected levels of the pilot frequency signals</i>, and <i>transmits the list to the associated base station</i>. A downlink traffic channel is assigned for downlink transmitting the received data packet to the wireless station based on the list of preferred traffic channels. A channel list buffer at the base station updates a priority order list for wireless stations communicating with the base station.” <i>Id.</i> at 6:66-7:9.</p> <p>“The wireless station selects <i>the first L acceptable channels and sends a feedback message to the base station providing the list of L acceptable channels for the wireless station</i>. Upon receiving all acceptable channel lists from all wireless stations having a pending channel assignment, the base station assigns channels based on the received lists of acceptable channels.” <i>Id.</i> at 8:40-46; Figs. 1, 10.</p>
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Obvious to Combine Sollenberger’s Arbitrarily Ordering the Set of Candidate Subcarriers as Clusters of Subcarriers as Recited in Claim 13 into Frodigh’s System of Adaptive Channel Allocation

68. As I already explained above, it would have been obvious to combine Frodigh with Sollenberger. It also would have been obvious to one of ordinary skill in the art that there are multiple reasons for adding Sollenberger’s teaching of providing feedback by arbitrarily ordering the set of candidate subcarriers to the system disclosed in Frodigh.

69. First, one of ordinary skill in the art would understand that combining Frodigh with Sollenberger in this way would have been a use of a known technique

to try to improve a similar device in the same way and thus obvious to try.

Specifically, it would have been obvious to one skilled in the art to improve the teachings of Frodigh with the form of feedback described in Sollenberger, which arises in the same context.

70. Second, one of ordinary skill in the art would understand that combining Frodigh and Sollenberger unites old elements without changing their respective functions. Specifically, combining Frodigh's adaptive channel allocation system with Sollenberger's form of providing feedback would not require changes to either's functionality.

71. Third, one of ordinary skill in the art would understand that modifying Frodigh with the teachings of Sollenberger would have been a predictable variation of a work in the same field of endeavor. Indeed, one skilled in the art would have been able to readily implement the variation. In particular, as both Frodigh and Sollenberger are both directed towards adaptive channel allocation systems using OFDM technology, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations, a person of ordinary skill in the art would understand the features of Sollenberger to be applicable to Frodigh. It is common sense and obvious to one of ordinary skill in the art that a way of providing feedback in one OFDM-based adaptive channel allocation system would have ready application to another adaptive OFDM-based

channel allocation system which also relies on feedback.

72. Fourth, one of ordinary skill in the art would understand that combining the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. In particular, one of ordinary skill in the art would have understood that by December of 1999—one year prior to the earliest application to which the ‘212 patent could possibly claim benefit—the wireless revolution was already well underway, and as such, the market would have both incentivized and demanded the combining of adaptive channel allocation systems like Frodigh with effective technology for providing feedback as forth in Sollenberger.

3. **Claims 18, 19, 23 and 26-28**

73. The combination of Frodigh and Sollenberger renders obvious claims 9 and 11-13 of the ‘212 patent as demonstrated by the below chart.

'212 Patent Claim 18		Disclosure	
18. An apparatus comprising:			
[a] a plurality of subscriber units in a first cell operable to generate feedback information indicating clusters of subcarriers		Frodigh discloses a plurality of subscriber units[“mobile stations”] in a first cell operable to generate feedback information [“CI” and “I” measurement information] indicating clusters of subcarriers desired for use by the plurality of subscriber units [“request messages requesting a certain subset of M subcarriers”]. “With continuing reference to FIG. 1, <i>a plurality of mobile stations</i> M1-M10 may be found within the <i>cells C1-C10</i> . Again, only 10 mobile stations are shown in FIG. 1 but it should be	

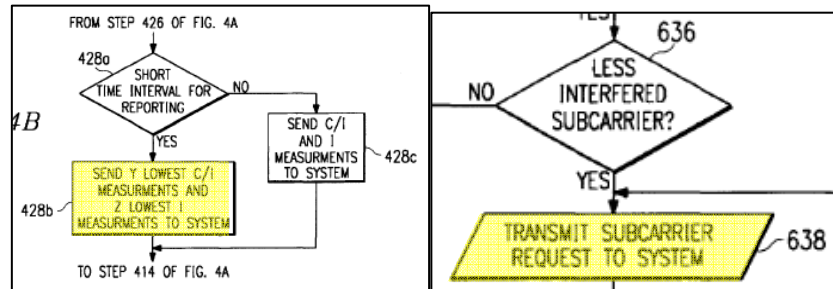
desired for use by the plurality of subscriber units; and

understood that the actual number of mobile stations will be much larger in practice and will invariably greatly exceed the number of base stations.” *Frodigh* at 6:15-20.

“In a second aspect of the invention, *a mobile station as link receiver transmits only a limited set of measurement results* to the system at certain select reporting intervals rather than all measurement results. *The transmitted limited set of measurement results comprises a select number of the lowest C/I measurement results and a select number of the lowest I measurement results.* The transmission of the limited set of results reduces the use of uplink system signaling resources.” *Id.* at 5:1-9.

“The mobile station then determines candidate replacement subcarriers for the link based on the C/I and I measurements, and *transmits a subcarrier request message to the system requesting that the candidate subcarrier be assigned to replace a subcarrier of the link.* The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.” *Id.* at 5:14-20.

“In an alternative embodiment of the invention, a mobile station as link receiver *transmits request messages requesting a certain subset of M subcarriers*, or requesting replacements for the M subcarriers, to be used on the link.” *Id.* at 12:57-60; Figs. 4B, 6B (details):



Id. at Abstract, 11:12-42, 12:57-13:21; 14:17-40, 17:12-40; claims 1, 6, and 9; and Figs. 1 and 4-7.

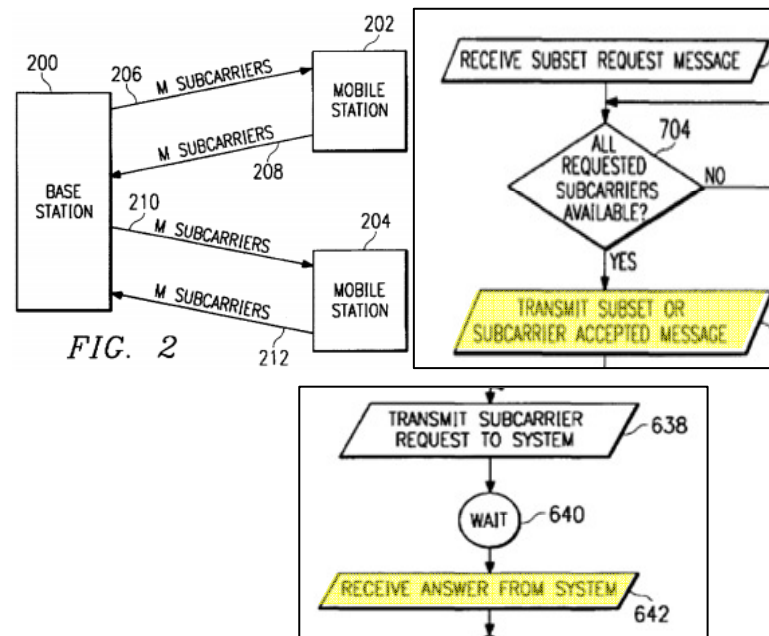
Sollenberger also discloses subscriber units in a first cell [each a “wireless station”] operable to generate feedback information indicating clusters of subcarriers desired for their use [information transmitted on the “feedback channel,” including a list of “more than one acceptable channel”].

	<p>“According to the invention, a wireless station. . . <i>performs interference measurements for determining acceptable channels</i>, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets for delivery to the wireless station. The wireless station scans a pilot signal frequency band using fast Fourier transform (FFT) technique for detecting pilot signals that respectively correspond to channels that are currently being used for downlink transmission. <i>A feedback channel is then used for informing a base station of acceptable channels.</i> To avoid more than one wireless station in the same cell from selecting the same acceptable channel, <i>a list of more than one acceptable channel is provided by the wireless station.</i>” Sollenberger at 7:60-8:7.</p>
<p>[b] a first base station in the first cell, the first base station operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber units;</p>	<p>Frodigh discloses a first base station in the first cell, the first base station operable to allocate OFDMA subcarriers in clusters [“the channel assignment message assigning the subset of M subcarriers to the link”] to the plurality of subscriber units [the “mobile stations” such as those labeled 202 and 204 in Fig. 2].</p> <p>“The radio interface between the mobile station and system is implemented by <i>providing base stations</i> dispersed throughout the coverage area of the system, each capable of radio communication with the mobile stations operating within the system. In a typical cellular telecommunications system <i>each base station of the system controls communications within a certain geographic coverage area termed a cell</i>, and a mobile station which is located within a particular cell communicates with the base station controlling that cell.” <i>Id.</i> at 1:15-24.</p> <p>“The present invention provides a method and system of adaptive channel allocation (ACA) in an <i>orthogonal frequency division multiplexed (OFDM) system</i>. The method and system provides an <i>allocation of subcarriers to each link of the OFDM system</i> that lessens co-channel interference between cells of the system.” <i>Id.</i> at 4:25-31.</p> <p>“Referring again to FIG. 4A, <i>the link receiver</i> which has been in the wait state at 408 now moves to step 410 <i>and receives the channel assignment message assigning the subset of M</i></p>

subcarriers to the link. Next, the process moves to step 412 as the link receiver begins receiving on the link using the assigned subset of M subcarriers.” *Id.* at 10:37-42.

“If *the link receiver is a mobile station* in a downlink the substeps shown in FIG. 4B may be used to reduce signaling traffic as the results are transmitted to the system over the uplink via the base station.” *Id.* at 11:13-16.

“In an alternative embodiment of the invention, *a mobile station as link receiver transmits request messages requesting a certain subset of M subcarriers*, or requesting replacements for the M subcarriers, to be used on the link.” *Id.* at 12:57-60; Fig. 2, 7 (detail), 6B (detail):



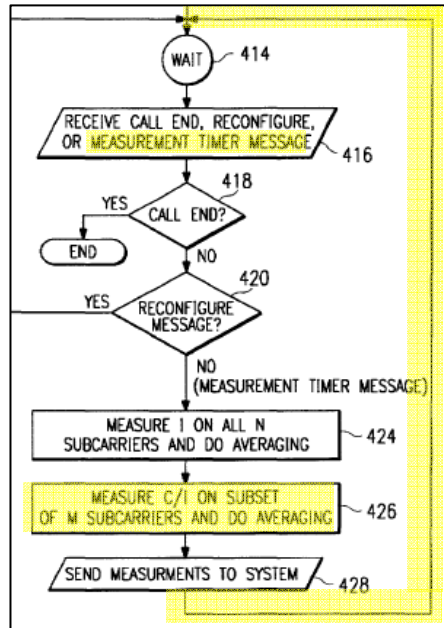
See also, *id.* at 13:47-51; Figs. 1 and 4-7.

[c][1] each of said plurality of subscriber units to measure channel and interference information for the plurality of subcarriers	See claim 1[a][1] above.
[c][2] based on pilot symbols received from the first base station and	See claim 1[a][2] above.
[c][3] at least one of the plurality of subscriber units to select a set of candidate subcarriers from the plurality of subcarriers, and	See claim 1[b] above.

[c][4] said at least one subscriber unit to provide feedback information on the set of candidate subcarriers to the base station and to	See claim 1[c] above.
[c][5] receive an indication of subcarriers from the set of subcarriers selected by the first base station for use by the at least one subscriber unit, and	See claim 1[d] above.
[c][6] wherein the subscriber unit submits updated feedback information after being allocated the set of subscriber units to receive an updated set of subcarriers and thereafter	See claim 1[e][1] above.
[c][7] receives another indication of the updated set of subcarriers.	See claim 1[e][2] above.
'212 Patent Claim 19	Disclosure
19. The apparatus defined in claim 18 wherein each of the plurality of subscriber units continuously monitors reception of the pilot symbols known to the base station and the plurality of subscriber units and measures signal-plus-	<p>Sollenberger discloses each of the plurality of subscriber units [each a “wireless station” such as “a mobile station or wireless terminal”] continuously monitors reception of the pilot symbols known to the base station and the plurality of subscriber units [“pilot signals,” “pilot frequency signals” transmitted by the base station] and measures signal-plus-interference-to-noise ratio (SINR) of each cluster of subcarriers [“interference measurements for determining acceptable channels,” “SIR measurements”].</p> <p>“In response to the paging message, <i>a level of each of a plurality of pilot frequency signals is detected at the wireless station</i>. Each pilot frequency signal corresponds to a downlink traffic channel and <i>is transmitted by base stations</i> to which the downlink traffic channel is assigned.” Sollenberger at 6:63-66.</p> <p>“According to the invention, <i>a wireless station, such as a mobile station or wireless terminal, performs interference measurements for determining acceptable channels</i>, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets for delivery to the wireless station. The wireless station scans a pilot signal frequency band using fast Fourier transform (FFT) technique for <i>detecting pilot signals</i> that respectively correspond to channels that are currently being used for downlink transmission. A feedback channel is then</p>

<p>interference-to-noise ratio (SINR) of each cluster of subcarriers.</p>	<p>used for informing a base station of acceptable channels. To avoid more than one wireless station in the same cell from selecting the same acceptable channel, a list of more than one acceptable channel is provided by the wireless station.” <i>Id.</i> at 7:60-8:7.</p> <p>“When a wireless station (WS) receives a paging message from a base station (BS) indicating that the base station has received packets for downlink transmission to the wireless station, <i>the wireless station scans pilot frequency signals at 11 for idle channels based on the priority order</i>, starting with the channel having the highest priority ranking. A channel, as used herein, is defined to be a particular timeslot of a particular carrier frequency and is designated as (timeslot, carrier frequency).” <i>Id.</i> at 8:31-39.</p> <p>“According to the invention, <i>the power measured for each respective pilot frequency signal corresponds to an interference level on the channel corresponding to the pilot frequency signal that is caused by downlink transmissions that are actively using the channel</i>. Flow continues to step 22 where, the interference is measured on the downlink channel having priority order j. At step 23, it is determined whether the signal to <i>interference ratio (SIR) measured for the channel</i> having priority order j is greater than a predetermined threshold by comparing the power of the pilot frequency signal corresponding to j to a predetermined threshold.” <i>Id.</i> at 9:6-18.</p> <p>“Each base station <i>transmits the pilot frequency signals corresponding to each channel</i> used by the base station so that wireless stations for which new packets are pending can rapidly scan for potential available channels.” <i>Id.</i> at 10:44-47.</p> <p>Frodigh, discloses each of the plurality of subscriber units measures signal-plus-interference-to-noise ratio (SINR)[“C/I measurements”] of each cluster of subcarriers.</p> <p>“As communications take place on the link, signal quality (C/I) measurements on the subcarriers of the subset of M subcarriers and interference (I) <i>measurements on the subcarriers of the group of N subcarriers are periodically performed</i>. The C/I and I measurements are then used to reconfigure the subset of M subcarriers to reduce co-channel interference on the link.” <i>Id.</i> Abstract.</p>
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“The measurement timer *generates a measurement message at periodic intervals informing the link receiver to make measurements*. Each measurement timer signal defines a measurement interval.” *Id.* at 10:57-60; Fig 4A (detail):



“If *the link receiver is a mobile station* in a downlink the substeps shown in FIG. 4B may be used to reduce signaling traffic as the results are transmitted to the system over the uplink via the base station.” *Id.* at 11:13-16.

See also, e.g., Id. at 4:56-60, 5:10-15, 13:62-65; Figs. 4-7.

'212 Patent Claim 23	Disclosure
23. The apparatus defined in claim 18 wherein the base station selects the subcarriers from the set of candidate subcarriers based on additional information available to the base station.	See claim 8 above.
'212 Patent Claim 26	Disclosure
26. The apparatus defined in claim 18 wherein the indication of subcarriers is received via a downlink control channel between the base station and the at least one subscriber unit.	See claim 11 above.
'212 Patent Claim 27	Disclosure
27. The apparatus defined in claim 18 wherein the plurality of	See claim 12

subcarriers comprises all subcarriers allocable by a base station.	above.
'212 Patent Claim 28	Disclosure
28. The apparatus defined in claim 18 wherein the plurality of subscriber units provide feedback information that comprises an arbitrarily ordered set of candidate subcarriers as clusters of subcarriers.	See claim 13 above.

B. Ground 2: Claims 1, 8-13, 15, 18, 19, 23-27 and 29 are obvious over Frodigh (Ex. 1004) in view of Sollenberger (Ex. 1005) and Ritter (Ex. 1006)

74. In my opinion, the combination of Frodigh, Sollenberger and Ritter renders obvious claims 1, 8-13, 15, 18, 19, 23-28 and 29 of the '212 patent as demonstrated by the chart in Section V.A.1 for the teachings of Frodigh and Sollenberger and the below chart for the teachings of Ritter.

'212 Patent Claim 1	Disclosure
1. A method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA) comprising:	<p>Ritter discloses a method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA)[“OFDMA multi-carrier procedure”].</p> <p>“The invention has the goal of providing an improved procedure and radio communication system for allocating radio resources, when using a <i>OFDMA multi-carrier procedure</i>.” Ritter at 4.</p> <p>“By means of the allocation system described the advantages of <i>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</i> and a thereby defined segment of a frequency spectrum. In 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 <i>can be individually changed after the determination of the best suitable segments in each mobile station</i> overseen by a base station and can</p>

	thereby be improved. Another important advantage consists of the fact, that by means of the invention the interferences, especially the critical inter-cell interference in the radio communication systems and the inter-symbol interferences, are considered and compensated for.” <i>Id.</i> at 6.	
'212 Patent Claim 9		Disclosure
9. The method defined in claim 8 wherein the additional information comprises traffic load information on each cluster of subcarriers.	<p>I have been informed that this claim has been found invalid because “each cluster” is indefinite due to antecedent basis failure. My read <i>for purposes of this IPR only</i> is that it is a reference to the "set of candidate subcarriers." Ritter teaches allocation of subcarriers by the base station wherein the additional information comprises traffic load information on each cluster of subcarriers [“capacity utilization of the radio cell”].</p> <p>“The base station sends the mobile station information about the assigned segment. It is assumed in this example, that each mobile station, MS, can be assigned the best suitable segment desired by it. That also depends on the transmission conditions and/or the <i>capacity utilization of the radio cell</i> overseen by the base station, BS, according to presets of the Operation and Maintenance Center, OMC, or the base station control, BSC, for radio resource management.” Ritter at 14; “The change of the segments of the frequency spectrum also considers the transmission conditions (strong impediments and interference) <i>and the utilization capacity of the radio resources (time slots, frequencies, splay code) in the radio cell.</i>” Ritter at 25.</p>	
'212 Patent Claim 10		Disclosure
10. The method defined in claim 9 wherein the traffic load information is provided by a data buffer in the base station.	<p>Ritter discloses that traffic load information is provided by a data buffer [“memory means BSP”] in the base station</p> <p>“The device according to Figure 6 – designed as a base station, BS, or a base station control, BSC – manifests a control means, BSE, <i>with a memory means, BSP</i> Stored in the memory device, BSP, are, among other things, the priority lists with the preferred suitable segments coming from the mobile stations.” Ritter at 24-25, Fig. 6.</p>	
'212 Patent Claim 13		Disclosure

13. The method defined in claim 1 wherein providing feedback information comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers.	<p>Ritter discloses providing feedback information comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers [“suitable segments, i.e., sequence of suitability”].</p> <p>“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 <i>information about several preferred, suitable segments</i>, i.e., about segments Sx, Sy, Sz or Sa, Sb, Sc or Sm, Sn, So for which <i>a sequence of suitability</i> is determined by the mobile station, MS.” Ritter at 19; <i>See also id.</i> at 15-16 (defining each of segments Sx, Sy, Sz, Sa, Sb, Sc, Sm, Sn, So as a plurality of sub-carriers); Sollenberger discussion in Ground 1 above.</p>		
'212 Patent Claim 15		Disclosure	
15. The method defined in claim 1 wherein providing feedback information comprises sequentially ordering candidate clusters.	<p>Ritter discloses providing feedback information that comprises arbitrarily ordering the set of candidate of subcarriers as clusters of subcarriers [“sequence of suitability”].</p> <p>“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 <i>information about several preferred, suitable segments</i>, i.e., about segments Sx, Sy, Sz or Sa, Sb, Sc or Sm, Sn, So for which <i>a sequence of suitability</i> is determined by the mobile station, MS.” Ritter at 19; <i>See also</i> Ritter at 15-16 (defining each of segments Sx, Sy, Sz, Sa, Sb, Sc, Sm, Sn, So as a plurality of sub-carriers).</p>		
'212 Patent Claim 23		Disclosure	
23. The apparatus defined in claim 18 wherein the base station selects the subcarriers from the set of candidate subcarriers based on additional information available to the base station.		See claim 8 above.	
'212 Patent Claim 24		Disclosure	
24. The apparatus defined in claim 23 wherein the additional information comprises traffic load information on each cluster of subcarriers.		See claim 9 above.	

'212 Patent Claim 25	Disclosure
25. The apparatus defined in claim 24 wherein the traffic load information is provided by a data buffer in the base station.	See claim 10 above.
'212 Patent Claim 29	Disclosure
29. The apparatus defined in claim 18 wherein providing feedback information comprises sequentially ordering candidate clusters.	See claim 15 above.

Obvious to Combine Ritter's Use of OFDMA as Recited in Claim 1, Traffic Load Information as Recited in Claims 9 and 10, and Feedback in Sequential Order as Recited in Claim 15 with Frodigh and Sollenberger's System of Adaptive Channel Allocation

75. To the extent that Frodigh in view of Sollenberger are found not to expressly teach the claimed elements relating to OFDMA in claim 1, the use of traffic load information in allocating subcarriers in claims 9 and 10, or providing feedback in the form of a sequential order in claim 15, Ritter clearly teaches these elements. Ex. 1006, Ritter at 6, 15-16, 19, 25. In my opinion, it would have been obvious to one of ordinary skill in the art to combine Ritter with Frodigh and Sollenberger, and a person skilled in the art would have been motivated to do so, for at least the following reasons.

76. First, one of ordinary skill in the art would understand that combining Ritter, Frodigh and Sollenberger would have been a use of a known technique to try to improve a similar device in the same way that would have been obvious to try. Specifically, it would have been obvious to one skilled in the art to improve the teachings of Frodigh and Sollenberger with those of Ritter, as all are adaptive

channel allocation schemes involving OFDM-technology, where the mobile unit measures channel quality and provides that information to a base station as part of the mobile unit selecting suitable channels.

77. Second, one of ordinary skill in the art would understand that combining Ritter, Frodigh and Sollenberger unites old elements without changing their respective functions. For example, applying Ritter's teachings regarding traffic load balancing and/or the particular form of feedback provided by the mobile unit to the base station would not require changes to any system's functionality as compared to that system without the added elements. Frodigh in view of Sollenberger would produce an adaptive channel allocation system using OFDM technology, where the mobile unit measures channel quality and provides feedback to the base station for the purpose of requesting channels, whether or not Ritter's disclosures are added to the system. And Ritter's functionality would not need to be changed to be applied in that context, which is the same context in which Ritter's own disclosures arise.

78. Third, one of ordinary skill in the art would understand that incorporating Frodigh in view of Sollenberger with the teachings of Ritter would have been a predictable variation of a work in the same field of endeavor. Indeed, one skilled in the art would have been able to readily implement the variation. Given that all three systems arise in the same context, adding features

from any one to the others would have been a natural and foreseeable way to vary the technology. It would have been common sense and obvious to one of ordinary skill in the art that the beneficial features of Ritter would be readily applicable to systems as similar to it as Frodigh and Sollenberger.

79. Fourth, one of ordinary skill in the art would understand that combining Ritter with the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. One of ordinary skill in the art would have known that by December of 1999, the wireless revolution was already well underway, and as such, the market would have both incentivized and demanded combining the best features of OFDM-based adaptive channel allocation systems to give the most flexible, robust wireless platform.

C. Ground 3: Claims 1, 8, 11-12, 18, 23 and 26-28 are obvious over Frodigh (Ex. 1004) in view of Chuang (Ex. 1007)

80. In my opinion, the combination of Frodigh and Chuang renders obvious claims 1, 8, 11-12, 18, 23 and 26-28 of the '212 patent as demonstrated by the chart in Section V.A.1 for the teachings of Frodigh and the below chart for the teachings of Chuang.

'212 Patent Claim 1	Disclosure
[a][2] based on pilot symbols	Chuang discloses pilot symbols received from a base station ["pilot signals to permit portables to evaluate downlink interference"], and further that those pilot symbols are used by the subscriber ["portable"] to measure channel and interference information for a plurality of

received from a base station;	subcarriers [“to evaluate downlink interference”]. “A common control frequency, which is frame-synchronized among <i>base stations</i> , provides (1) beacons for portables to locate base-stations and obtain DCA information, (2) broadcast channels for system and alerting information, and (3) <i>pilot signals to permit portables to evaluate downlink interference.</i> ” Chuang Abstract; “The portable makes <i>measurements on the pilots corresponding to the downlinks of the traffic</i> channels on the short list, and it chooses as the final paired communications channel that channel with the lowest measured power. <i>In this manner, both the port and the portable provide significant input into the distributed DCA algorithm to select channels with low interference on both the uplink and downlink.</i> ” Chuang at 708, lines 12-19.
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Obvious to Combine Chuang’s Use of Pilot Symbols to Measure Channel Quality as Recited in Claim 1 into Frodigh’s System of Adaptive Channel Allocation

81. To the extent that Frodigh is found not to expressly disclose that pilot symbols transmitted by a base station are used for measuring channel quality, Chuang expressly discloses this element. Ex. 1007, Chuang at 708, lines 12-19. Moreover, it would have been obvious to one of ordinary skill in the art to combine Frodigh with Chuang for the following reasons.

82. As I discussed above, the ‘212 patent acknowledges that the use of pilot symbols for determining channel quality was a well-known prior art technology. Ex. 1003, ‘212 patent, 9:12-15. A person of ordinary skill in the art would therefore have understood that such pilot symbols would be an effective way to implement the channel monitoring described in Frodigh. Thus, a person of

ordinary skill in the art would think to, and be motivated to, combining Frodigh with the teachings of specific references which have strong teachings of pilot symbols in the context of adaptive channel allocation, such as Chuang.

83. Furthermore, one of ordinary skill in the art would understand that combining Frodigh and Chuang unites old elements without changing their respective functions. The combination of Frodigh's adaptive channel allocation system with Chuang's system for measuring channel quality would not require changes to either's functionality. Using Chuang's technique for measuring quality in Frodigh's adaptive channel allocation functionality would not require any change because Chuang is specifically intended for an adaptive channel allocation system. Thus, the elements would be used exactly as taught in each reference.

84. It also would have been common sense and obvious to one of ordinary skill in the art that a pilot symbol-based system for measuring channel quality in an adaptive channel allocation system would have ready application to another adaptive channel allocation system which also relies on measures of channel quality. This combination would likewise be responsive to commercial pressures for robust wireless systems.

D. Ground 4: Claims 1, 8-12, 15, 18, 23-27 and 29 are obvious over Frodigh (Ex. 1004) in view of Chuang (Ex. 1007) and Ritter (Ex. 1006)

I explained why it would have been obvious to combine Frodigh and

Chuang along with their respective substantive disclosures in Ground 3. I also explained why it would have been obvious to combine Frodigh and Ritter along with their respective substantive disclosures in Ground 2. For the same reasons, it would have been obvious to apply the teachings of Chuang and Ritter to Frodigh, rendering obvious the above-identified claims.

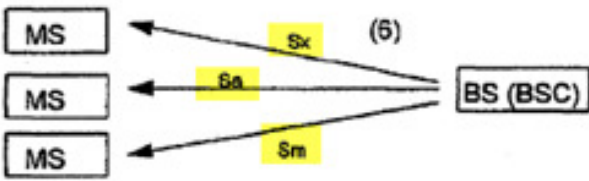
E. Ground 5: Claims 1, 8-13, 15, 18, 19, 23-26 and 29 are obvious over Alamouti (Ex. 1008) in view of Minegishi (Ex. 1009) and Ritter (Ex. 1006)

85. In my opinion, the combination of Alamouti, Minegishi and Ritter renders obvious claims 1, 8-13, 15, 18, 19, 23-26 and 29 of the ‘212 patent as demonstrated by the below chart.

'212 Patent Claim 1	Disclosure
1. A method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA)	<p>Alamouti discloses a method for subcarrier selection [the handset, called an RU, sends “the best meas_rpts channel measurements to the base”] for a system employing orthogonal frequency division multiple access (OFDMA)[a system combining various elements with “OFDM” to “efficiently communicate with many remote stations”].</p> <p><i>See, e.g., Alamouti 5:21-23: “ In one embodiment of the invention, TDD, FDD, TDMA, and OFDM are combined to enable a base station to efficiently communicate with many remote stations.”</i></p> <p><i>See also, e.g., Alamouti at 9:19-46: “FIG. 1 is an architectural diagram of the frequency division duplex (FDD) personal wireless access network (PWAN) system, in accordance with the invention. The system employs the method of the invention that combines time division duplex (TDD), frequency division duplex (FDD), time division multiple access (TDMA), orthogonal frequency division multiplexing (OFDM), spatial diversity, and polarization diversity in various unique combinations.</i></p>

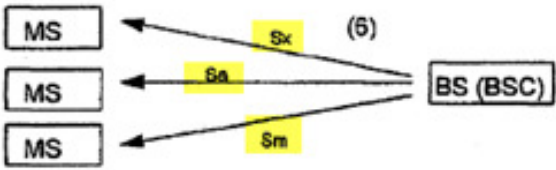
comprising:	<p>FIG. 1 provides an overview of how the invention combines TDD, FDD, TDMA, <i>and OFDM to enable the base station Z to efficiently communicate with many remote stations U, V, W, and X.</i> The base station Z receives a first incoming wireless signal 10 comprising a plurality of first discrete frequency tones F2 that are orthogonal frequency division multiplexed (OFDM) in a first frequency band from the first remote station U during a first time division multiple access (TDMA) interval. The organization of the TDMA intervals is shown in FIG. 1.5, which is discussed in detail below. Then the base station Z receives a second incoming wireless signal 12 comprising a plurality of second discrete frequency tones F4 <i>that are orthogonal frequency division 40 multiplexed (OFDM)</i> in the first frequency band from a second remote station W during the first time division multiple access (TDMA) interval. The first and second stations U and W accordingly have different sets of discrete frequency tones F2 and F4, that are orthogonal frequency division multiplexed.” <i>See also, e.g., at Fig. 1.</i></p>
[a][1] a subscriber unit measuring channel and interference information for a plurality of subcarriers	<p>Alamouti discloses a subscriber unit [RU] measuring channel and interference information [RSSI and SINR information] for a plurality of subcarriers [“some number of channels”].</p> <p><i>See, e.g., Alamouti at 22:55-60: “3.3 Channel Measurements In order for the best channel to be chosen, the RUs must make measurements on some number of channels and report the results to the base station for use in selecting the best channel for an RU when a link is established. These measurements include RSSI and SINR.”</i></p> <p><i>See also, e.g., Alamouti at 23:58-62: “An RU requests a traffic channel from its serving cell. It reports the following measurements as part of traffic establishment: RSSI(1)=-95 dBm, SINRRU(1)=9.3 dB RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.”</i> <i>See also, e.g., Alamouti at 24:23-26: “3.4 Procedure</i></p> <p>1. In idle mode <i>each RU measures the RSSI and SINR of each channel</i> it could potentially operate on and orders them from subjective best to subjective worst.”</p>
[a][2] based on pilot symbols received	<p>Alamouti discloses pilot symbols [“pilot tones” carrying “known data patterns] received from a base station.</p> <p>12:54-64: “Selected tones within each tone set are designated as pilots distributed throughout the frequency band. <i>Pilot tones carry known data patterns that enable an accurate channel estimation.</i> The series</p>

from a base station;	of pilot tones, having known amplitudes and phases, have a known level and are spaced apart by approximately 30 KHz to provide an accurate representation of the channel response (i.e., the amplitude and phase distortion introduced by the communication channel characteristics) over the entire transmission band.”
[b] the subscriber unit selecting a set of candidate subcarriers;	<p>Alamouti discloses the subscriber unit [RU] selecting a set of candidate subcarriers [the RU sends “the best meas_rpts channel measurements to the base ”].</p> <p><i>See, e.g., Alamouti 22:55-60: “3.3 Channel Measurements</i> In order for the best channel to be chosen, <i>the RUs must make measurements on some number of channels and report the results to the base station</i> for use in selecting the best channel for an RU when a link is established. These measurements include RSSI and SINR.”</p> <p><i>See also, e.g., Alamouti at 24:23-46: “3.4 Procedure</i> 1. In idle mode <i>each RU measures the RSSI and SINR of each channel</i> it could potentially operate on and orders them from subjective best to subjective worst. 2. There is a parameter, meas_rpts, which is sent on the broadcast channel of each base stating how many channel measurements an RU will send to the base when a traffic connection is to be established. 3. When a traffic connection is to be established <i>the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.</i>”</p>
[c] the subscriber unit providing feedback information on the set of candidate subcarriers to the base station;	<p>Alamouti discloses the subscriber unit [RU] providing feedback information on the set of candidate subcarriers [RSSI and SINR information “of each channel it could potentially operate on ”] to the base station [base].</p> <p><i>See, e.g., 23:58-62: “An RU requests a traffic channel from its serving cell. It reports the following measurements as part of traffic establishment: RSSI(1)=-95 dBm, SINRRU(1)=9.3 dB RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.”</i></p> <p><i>See also, e.g., Alamouti at 24:31-33: “3. When a traffic connection is to be established the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.”</i></p>
[d] the	Ritter discloses the subscriber unit [“mobile station,” MS”] receiving

<p>subscriber unit receiving an indication of subcarriers of the set of subcarriers selected by the base station for use by the subscriber unit; and</p>	<p>an indication of subcarriers [“information about the allocated segments, S_x, S_a, and S_m”] of the set of subcarriers selected by the base station [“the base station, BS, assigns the segments S_x, S_a and S_m”] for use by the subscriber unit [“selected as the most suitable segments by the mobile station to the three mobile stations, MS”].</p> <p>“In the example cited, <i>the base station, BS, assigns the segments, S_x, S_a and S_m which were selected as the most suitable segments by the mobile station to the three mobile stations, MS.</i> For the case where the desired segment cannot be allocated, one of the other segments is selected which were alternatively chosen by the mobile station, Ms. In a step (6) <i>information about the allocated segments, S_x, S_a, and S_m is sent via the radio interface to the mobile stations, MS</i>, which then use the received new frequency resources in the frequency spectrum for their individual communication links.” Ritter at 19-20; Fig. 3 (detail):</p> 
<p>[e][1] the subscriber unit submitting updated feedback information, after being allocated the set of subcarriers to be allocated an updated set of subcarrier</p>	<p>Minegishi renders obvious the subscriber unit submitting updated feedback information [the mobile stations’ calculated interference levels and priority lists], after being allocated the set of subcarriers to be allocated an updated set of subcarriers [see explanation below this chart].</p> <p><i>See, e.g., Minegishi at 2:65-3:26. “As a result, each of the mobile stations 5-1, 5-2, . . . under the control of the base station 2-1 monitors the reception levels of the traffic channels in the list S1 to determine whether or not each of the reception levels is higher than a predetermined level. Then, each of the mobile stations 5-1, 5-2, . . . selects traffic channels whose reception levels are higher than the predetermined level. Then, each of the mobile stations 5-1, 5-2, . . . calculates the interference levels of the selected traffic channels with the corresponding traffic channels of the other base stations 2-2, 2-3, . . . , so that a priority sequence is given to the selected traffic channels.</i></p> <p>Next, <i>each of the mobile stations 5-1, 5-2, . . . under the control of</i></p>

s, and thereafter	<p><i>the base station 2-1 transmits a priority list S2 of the selected traffic channels</i> along with the mobile station number by using the signal channel to the base station 2-1. Further, the base station 2-1 transmits all the priority lists S2 along with the mobile station numbers to the control station 1" using the control line 3-1.</p> <p>As a result, the control station 1 records all the priority lists received from the base station 2-1, and <i>renews one priority list of traffic channels for the base station 2-1.</i></p> <p>Next, the control station 1 transmits the <i>renewed priority list S3 of traffic channels by using the control line 3-1 to the base station 2-1.</i></p> <p><i>Next, the base station 2-1 transmits a traffic channel list S1 in accordance with the renewed priority list S3 of traffic channels to the mobile stations 5-1, 5-2, . . . under the control of the base station 2-1, thus repeating the above-described operation."</i></p>	
[e][2] the subscriber unit receiving another indication of the updated set of subcarriers.		Minegishi renders obvious the subscriber unit receiving another indication of the updated set of subcarriers [see limitation [e][2] immediately above and explanation below this chart].
'212 Patent Claim 8		Disclosure
8. The method defined in claim 1 further comprising the base station selecting the subcarriers from the set of candidate	<p>Alamouti discloses the base station [base] selecting the subcarriers [channels] from the set of candidate subcarriers [the candidate channels in the set sent by the RU] based on additional information available to the base station [direction of arrival, RSSI and SINR information].</p> <p>Alamouti at 22:36-60: "3.2 Direction of Arrival (DOA) Since the system is dependent on SDMA for increasing capacity, a very important parameter is the DOA for each RU. <i>The channel allocation algorithm needs to know the DOA of every RU involved in an active call and the DOAs of any new RUs.</i> * * *</p> <p>In order for the best channel to be chosen, the RUs must make measurements on some number of channels and report the results to the base station for use in selecting the best channel for an RU when a link is established. These measurements include RSSI and SINR."</p> <p>Alamouti at 23:23-26: "As a first cut it seems that the three pieces of data can be combined into a channel <i>candidacy assessment factor (CAF)</i>. The three desirable situations are: <i>large separation in DOA,</i></p>	

subcarriers based on additional information available to the base station.	<p><i>small RSSI, and high SINR.”</i></p> <p>Alamouti at 24:23-26: “3.4 Procedure 1. In idle mode each RU <i>measures the RSSI and SINR of each channel</i> it could potentially operate on and orders them from subjective best to subjective worst.”</p> <p>Alamouti at 24:34-39: “4. The base uses the channel measurements sent by the RU to compute a CAF for each of <i>the candidate channels in the set sent by the RU.</i></p> <p><i>5. If one or more of the channels in the set which was sent by the RU produces an acceptable CAF then the channel with the best CAF is chosen.”</i></p>	
'212 Patent Claim 9		Disclosure
9. The method defined in claim 8 wherein the additional information comprises traffic load information on each cluster of subcarriers.		See discussion of claim 9 in Ground 2 above.
'212 Patent Claim 10		Disclosure
10. The method defined in claim 9 wherein the traffic load information is provided by a data buffer in the base station.		See discussion of claim 10 in Ground 2 above.
'212 Patent Claim 11		Disclosure
11. The method defined in claim 1 wherein the indication of subcarriers is received via a downlink control	<p>Alamouti the indication of subcarriers [“then the channel with the best CAF is chosen”] is received via a downlink control channel [“Common Link Channel”].</p> <p><i>See, e.g., 12:44-53: “[T]he PWAN system uses overhead tones to establish synchronization and to pass control information between the base station and the remote units. A Common Link Channel (CLC) is used by the base to transmit control information to the Remote Units. A Common Access Channel (CAC) is used to transmit messages from the Remote Unit to the Base. There is one grouping of tones assigned to each channel. These overhead channels are used in common by all of the remote units when they are exchanging control messages with the base station.”</i></p> <p><i>See also, e.g., Alamouti at 24:31-46: “3. When a traffic connection</i></p>	

channel.	<p>is to be established the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.</p> <p>4. The base uses the channel measurements sent by the RU to compute a CAF for each of the candidate channels in the set sent by the RU.</p> <p>5. If one or more of the channels in the set which was sent by the RU produces an acceptable CAF then the channel with the best CAF is chosen.”</p> <p>Ritter discloses that the indication of subcarriers [“information about the allocated segments”] is received via a downlink control channel.</p> <p>“In the example cited, the base station, BS, assigns the segments, S_x, S_a and S_m which were selected as the most suitable segments by the mobile station to the three mobile stations, MS. For the case where the desired segment cannot be allocated, one of the other segments is selected which were alternatively chosen by the mobile station, Ms.</p> <p>In a step (6) information about the allocated segments, S_x, S_a, and S_m is sent via the radio interface to the mobile stations, MS, which then use the received new frequency resources in the frequency spectrum for their individual communication links.” Ritter at 19-20; Fig. 3 (detail):</p> 
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'212 Patent Claim 12		Disclosure
12. The method defined in claim 1 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.	<p>Alamouti discloses the plurality of subcarriers comprises all subcarriers allocable by a base station [“each channel [the RU] could potentially operate on”].</p> <p><i>See also, e.g., Alamouti at 24:24-27: “1. In idle mode each RU measures the RSSI and SINR of each channel it could potentially operate on and orders them from subjective best to subjective worst.”</i></p>	
'212 Patent Claim 13		Disclosure
13. The	Alamouti discloses providing feedback information [“sends the	

method defined in claim 1 wherein providing feedback information comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers.	<p>best meas_rpts channel measurements to the base on the SCAC channel”] that comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers [“the best meas_rpts channel measurements”].</p> <p><i>See, e.g., Alamouti at 24:23-46: “3.4 Procedure</i></p> <p>1. In idle mode <i>each RU measures the RSSI and SINR of each channel it could potentially operate on and orders them from subjective best to subjective worst.</i></p> <p>2. There is a parameter, meas_rpts, which is sent on the broadcast channel of each base stating how many channel measurements an RU will send to the base when a traffic connection is to be established.</p> <p>3. When a traffic connection is to be established <i>the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.</i>”</p>		
'212 Patent Claim 15		Disclosure	
15. The method defined in claim 1 wherein providing feedback information comprises sequentially ordering candidate clusters.	<p>Minegishi discloses providing feedback information comprises sequentially ordering candidate clusters [“a priority sequence is given to the selected traffic channels”].</p> <p><i>See, e.g., Minegishi at 2:65-3:9. “As a result, each of the mobile stations 5-1, 5-2, . . . under the control of the base station 2-1 monitors the reception levels of the traffic channels in the list S1 to determine whether or not each of the reception levels is higher than a predetermined level. Then, each of the mobile stations 5-1, 5-2, . . . selects traffic channels whose reception levels are higher than the predetermined level. Then, each of the mobile stations 5-1, 5-2, . . . calculates the interference levels of the selected traffic channels with the corresponding traffic channels of the other base stations 2-2, 2-3, . . . , so that a priority sequence is given to the selected traffic channels.”</i></p>		
'212 Patent Claim 18		Disclosure	
18. An apparatus comprising:			
[a] a plurality of subscriber	Alamouti discloses a plurality of subscriber units in a first cell [“each RU” which operates in its “serving cell”] operable to generate feedback information [RSSI and SINR; the RU sends the		

<p>units in a first cell operable to generate feedback information indicating clusters of subcarriers desired for use by the plurality of subscriber units; and</p>	<p>best meas_rpts channel measurements to the base] indicating clusters of subcarriers desired for use by the plurality of subscriber units [the RU sends the best meas_rpts channel measurements to the base].</p> <p><i>See, e.g., Alamouti at 24:23-34: “3.4 Procedure</i></p> <ol style="list-style-type: none"> 1. In idle mode <i>each RU measures the RSSI and SINR</i> of each channel it could potentially operate on and orders them from subjective best to subjective worst. 2. There is a parameter, <i>meas_rpts</i>, which is sent on the broadcast channel of each base <i>stating how many channel measurements an RU will send to the base</i> when a traffic connection is to be established. 3. When a traffic connection is to be established <i>the RU sends the best meas_rpts channel measurements to the base</i> on the SCAC channel.” <p>Alamouti at 22:55-60: “3.3 Channel Measurements In order for the best channel to be chosen, <i>the RUs must make measurements on some number of channels and report the results to the base station</i> for use in selecting the best channel for an RU when a link is established. These measurements include RSSI and SINR.”</p> <p><i>See also, e.g., Alamouti at 23:58-62: “An RU requests a traffic channel from its serving cell.</i> It reports the following measurements as part of traffic establishment: RSSI(1)=-95 dBm, SINRRU(1)=9.3 dB RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.”</p>
<p>[b] a first base station in the first cell, the first base station operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber</p>	<p>Alamouti discloses a first base station in the first cell [the Base transmits information to multiple RUs in its cell], the first base station operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber units [the invention “enable[s] the base station Z to efficiently communicate with many remote stations U, V, W, and X”; while taking into account direction of arrival between a new RU and the other active RU's on some number of available clusters, among other factors].</p> <p>Alamouti at 5:21-23: “In one embodiment of the invention, TDD, FDD, TDMA, <i>and OFDM are combined to enable a base station to efficiently communicate with many remote stations.</i>”</p> <p>Alamouti at 9:19-46: “FIG. 1 provides an overview of how the invention combines TDD, FDD, TDMA, and OFDM to <i>enable the</i></p>

units;	<p><i>base station Z to efficiently communicate with many remote stations U, V, W, and X.</i> The base station Z receives a first incoming wireless signal 10 comprising a plurality of first discrete frequency tones F2 that are <i>orthogonal frequency division multiplexed (OFDM) in a first frequency band</i> from the first remote station U during a first time division multiple access (TDMA) interval. The organization of the TDMA intervals is shown in FIG. 1.5, which is discussed in detail below. Then the base station Z receives a second incoming wireless signal 12 comprising a plurality of second discrete frequency tones F4 that are <i>orthogonal frequency division 40 multiplexed (OFDM) in the first frequency band</i> from a second remote station W during the first time division multiple access (TDMA) interval. The first and second stations U and W accordingly have different sets of discrete frequency tones F2 and F4, that are orthogonal frequency division multiplexed.” See also, e.g., Fig. 1.</p> <p>Alamouti at 22:43-47: “Initially a channel allocation algorithm could be devised which simply maximizes the separation of the <i>DOA between a new RU and the other active RU's on some number of available clusters.</i> However, as the number of users on the system increases, there needs to be more information incorporated into the channel selection than just DOA.”</p> <p>Alamouti at 24:37-39: “<i>5. If one or more of the channels in the set which was sent by the RU produces an acceptable CAF then the channel with the best CAF is chosen.</i>”</p> <p>Alamouti at 14:46-63: “1.5.2 Base Transmission Format 1.5.2.1 Base Transmitter Functional Block Diagram 1.5.2.1.1 Traffic Channels (an example) <i>The Base transmits information to multiple RUs in its cell.</i>”</p>
[c][1] each of said plurality of subscriber units to measure channel and interference information for the plurality of subcarriers	See claim 1[a][1] above.
[c][2] based on pilot symbols received from the first base station and	See claim 1[a][2] above.
[c][3] at least one of the plurality of subscriber units to select a set	See claim

of candidate subcarriers from the plurality of subcarriers, and		1[b] above.
[c][4] said at least one subscriber unit to provide feedback information on the set of candidate subcarriers to the base station and to		See claim 1[c] above.
[c][5] receive an indication of subcarriers from the set of subcarriers selected by the first base station for use by the at least one subscriber unit, and		See claim 1[d] above.
[c][6] wherein the subscriber unit submits updated feedback information after being allocated the set of subscriber units to receive an updated set of subcarriers and thereafter		See claim 1[e][1] above.
[c][7] receives another indication of the updated set of subcarriers.		See claim 1[e][2] above.
'212 Patent Claim 19		Disclosure
19. The apparatus defined in claim 18 wherein each of the plurality of subscriber units continuously monitors reception of the pilot symbols known to the base station and the plurality of subscriber units and	<p>Alamouti discloses each of the plurality of subscriber units [each an “RU”] continuously monitoring reception of the pilot symbols known to the base station and the plurality of subscriber units [“pilot tones”] and measures signal-plus-interference-to-noise ratio (SINR) of each cluster of subcarriers [“each RU measures the... SINR of each channel it could potentially operate on and orders them from subjective best to subjective worst”].</p> <p><i>See, e.g., 12:54-64: “Selected tones within each tone set are designated as pilots distributed throughout the frequency band. Pilot tones carry known data patterns that enable an accurate channel estimation. The series of pilot tones, having known amplitudes and phases, have a known level and are spaced apart by approximately 30 KHz to provide an accurate representation of the channel response (i.e., the amplitude and phase distortion introduced by the communication channel characteristics) over the entire transmission band.”</i></p> <p>“An RU requests a traffic channel from its serving cell. It reports the following measurements as part of traffic establishment: RSSI(1)= -95 dBm, SINRRU(1)=9.3 dB</p>	

measures signal-plus-interference-to-noise ratio (SINR) of each cluster of subcarriers.	<p><i>RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.” Alamouti at 23:58-62.</i></p> <p>“3.4 Procedure</p> <p>1. In idle mode <i>each RU measures the RSSI and SINR of each channel it could potentially operate on and orders them from subjective best to subjective worst.</i></p> <p>2. There is a parameter, meas_rpts, which is sent on the broadcast channel of each base stating how many channel measurements an RU will send to the base when a traffic connection is to be established.</p> <p>3. When a traffic connection is to be established the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.” Alamouti at 24:23-33.</p> <p>“3.3 Channel Measurements</p> <p>In order for the best channel to be chosen, the RUs must make measurements on some number of channels and report the results to the base station for use in selecting the best channel for an RU when a link is established. These measurements include RSSI and <i>SINR</i>. Table 3.1 shows a gross look at how received signal strength indicator (RSSI) and <i>signal to interference ratio (SINR) information could be used to assign channels to incoming RUs.</i>” Alamouti at 22:55-63; Table 3.1.</p>	
’212 Patent Claim 23		Disclosure
23. The apparatus defined in claim 18 wherein the base station selects the subcarriers from the set of candidate subcarriers based on additional information available to the base station.		See claim 8 above.
’212 Patent Claim 24		Disclosure
24. The apparatus defined in claim 23 wherein the additional information comprises traffic load information on each cluster of subcarriers.		See claim 9 above.
’212 Patent Claim 25		Disclosure
25. The apparatus defined in claim 24 wherein the traffic load information is provided by a data buffer in the base station.		See claim 10 above

'212 Patent Claim 26		Disclosure
26. The apparatus defined in claim 18 wherein the indication of subcarriers is received via a downlink control channel between the base station and the at least one subscriber unit.	<p>Alamouti discloses wherein the indication of subcarriers [the channel with the best CAF is chosen] is received via a downlink control channel [a Common Link Channel].</p> <p><i>See, e.g., 12:44-53: “[T]he PWAN system uses overhead tones to establish synchronization and to pass control information between the base station and the remote units. A Common Link Channel (CLC) is used by the base to transmit control information to the Remote Units. A Common Access Channel (CAC) is used to transmit messages from the Remote Unit to the Base. There is one grouping of tones assigned to each channel. These overhead channels are used in common by all of the remote units when they are exchanging control messages with the base station.”</i></p> <p>Alamouti at 24:31-46: “<i>5. If one or more of the channels in the set which was sent by the RU produces an acceptable CAF then the channel with the best CAF is chosen.</i>”</p>	
'212 Patent Claim 29		Disclosure
29. The apparatus defined in claim 18 wherein providing feedback information comprises sequentially ordering candidate clusters.	See claim 15 above.	

Claim Limitations [e][1] and [e][2] of Claim 1 are Rendered Obvious by Alamouti Alone or in Combination with Minegishi

86. Alamouti teaches an adaptive channel allocation system that contemplates mobile units measuring channel quality and reporting that information to a base station as part of requesting channel assignment. A person of ordinary skill in the art would have understood by December of 1999 that the conditions encountered by the mobile unit would be changing with a very short time scale, and as such the process of measurement, reporting and assignment

should be repeated for reasons of efficiency, thus satisfying claim limitations [e][1] and [e][2] above. Accordingly, if Alamouti is found not to expressly teach these limitations, Alamouti renders them obvious.

87. Moreover, Minegishi is a representative reference that expressly discloses re-taking measurements on a set of candidate channels after that set is first identified based on channel quality measurements. This disclosure of Minegishi would have further prompted a person of ordinary skill in the art to add the steps of limitations [e][1] and [e][2] to the disclosures of Alamouti.

Obvious to Combine Ritter's Use of OFDMA as Recited in Claim 1, Traffic Load Information as Recited in Claims 9 and 10, Feedback in Sequential Order as Recited in Claim 15 with Alamouti and Minegishi's System of Adaptive Channel Allocation

88. To the extent that Alamouti in view of Minegishi are found not to expressly disclose the use of OFDMA as recited in claim 1, traffic load information as recited in claims 9 and 10, or feedback in sequential order as recited in claim 15, it is my opinion that one of ordinary skill would have been motivated to take the obvious step of adding the disclosures of Ritter to Alamouti and Minegishi for the following reasons.

89. First, one of ordinary skill in the art would understand that combining these references would have been a use of a known technique to try to improve a similar device in the same way that would have been obvious to try. Specifically, it would have been obvious to one skilled in the art to improve the teachings of

Alamouti with the teachings of Minegishi and Ritter, as all three are adaptive channel allocation systems where the mobile units measure channel quality and report it to the base station for the purpose of facilitating channel allocation.

90. Second, one of ordinary skill in the art would understand that combining these references unites old elements without changing their respective functions. For example, applying Ritter's teachings regarding traffic load balancing and/or the particular form of feedback provided by the mobile unit to the base station would not require changes to any system's functionality as compared to that system without the added elements. Alamouti in view of Minegishi would produce an adaptive channel allocation system, where the mobile unit measures channel quality and provides feedback to the base station for the purpose of requesting channels, whether or not Ritter's disclosures are added to the system. Moreover, Ritter's functionality would not need to be changed to be applied in that context because the functionality would be used in the same context in which Ritter's own disclosures arise. Similarly, repeating the channel quality measurements on a set of channels already selected for their high quality in Alamouti or Ritter—as suggested by Minegishi, for example, if not inherent in Alamouti or Ritter—would not change the core functionality of any system. Similarly, Ritter's express teaching of an OFDMA system would not require changes in the adaptive channel allocation functionality as experienced by any

individual mobile device.

91. Third, one of ordinary skill in the art would understand that modifying Alamouti with the teachings of Minegishi and Ritter would have been a predictable variation of a work in the same field of endeavor. Indeed, one skilled in the art would have been able to readily implement the variation. In particular, as each of these references is directed towards adaptive channel allocation systems, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations, a person of ordinary skill in the art would understand the features of each reference to be of relevance to the others. It would have been common sense and obvious to one of ordinary skill in the art that adding features of an adaptive channel allocation system to another adaptive channel allocation system would be beneficial.

92. Fourth, one of ordinary skill in the art would understand that combining these references would have been responsive to the direction and pressures of the marketplace. One of ordinary skill in the art would have known that by December of 1999, the wireless revolution was already well underway, and as such, the market would have both incentivized and demanded the combining features of adaptive channel allocation systems to give the most robust and flexible platform possible.

**Alamouti Renders Obvious All Subcarriers Being Allocable by a Base Station
as Recited in Claim 12.**

93. To the extent Alamouti is found not to expressly teach that the plurality of subcarriers comprises “all subcarriers allocable by a base station” as recited in claim 12, a person of ordinary skill in the art would understand such a feature to be obvious in light of Alamouti. Specifically, a person having ordinary skill in the art would understand that a remote unit could be designed such that it could potentially operate on all subcarriers allocable by a base station, at least in favorable conditions. Indeed, such capability would help to maximize the flexibility of the system as a whole. When the disclosure of Alamouti is applied to such a device, feedback is provided on all subcarriers allocable by a base station, meeting this limitation.

94. Based on the foregoing, it is my opinion that claims 1, 8-13, 15, 18, 19 and 23-29 of the ‘212 patent are invalid.

95. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I understand that willful false statements are punishable by fine or imprisonment or both (18 U.S.C. § 1001).

Executed on November 26, 2014

/Nicholas Bambos/

Respectfully submitted,
Dr. Nicholas Bambos