

**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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**PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,454,212  
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

## TABLE OF CONTENTS

I.	Mandatory Notices.....	1
A.	Real Parties-in-Interest.....	1
B.	Related Matters.....	1
C.	Counsel.....	2
D.	Service Information.....	3
II.	Certification of Grounds for Standing.....	3
III.	Overview of Challenge and Relief Requested.....	3
A.	Prior Art Patents and Printed Publications.....	3
1.	Exhibit 1004 – U.S. Patent No. 5,726,978 (“Frodigh”).....	3
2.	Exhibit 1005 – U.S. Patent No. 6,0952,594 (“Sollenberger”).....	3
3.	Exhibit 1006 – German Patent No. DE 198 00 953 C1 (“Ritter”). .....	4
4.	Exhibit 1007 -- “A pilot based dynamic channel assignment scheme for wireless access TDMA/FDMA systems,” Chuang, J.C.-I.; Sollenberger, N.R.; Cox, D.C., <i>Universal Personal Communications, 1993. Personal Communications: Gateway to the 21st Century. Conference Record., 2nd International Conference</i> , vol. 2, no., pp. 706,712 vol.2, 12-15 (“Chuang”). .....	4
5.	Exhibit 1008 – U.S. Patent No. 5,933,421 (“Alamouti”). .....	4
6.	Exhibit 1009 – U.S. Patent No. 6,072,988 (“Minegishi”). .....	4
B.	Grounds for Challenge .....	5
IV.	Overview of the ‘212 Patent.....	5

V.	Claim Construction.....	6
A.	Arbitrarily Ordering .....	7
B.	Sequentially Ordering.....	8
C.	Pilot Symbol .....	8
D.	SINR .....	8
E.	Preambles .....	9
F.	Broadest Reasonable Construction For Remaining Terms .....	10
VI.	Level of Ordinary Skill in the Art .....	10
VII.	Summary of the Prior Art .....	11
VIII.	Identification of How the Challenged Claims Are Unpatentable .....	12
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).....	13
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).....	36
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) .....	42
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).....	44
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).....	44
IX.	Conclusion .....	60

## TABLE OF AUTHORITIES

### Cases

<i>SAP America, Inc. v. Versata Development Group, Inc.</i> , CBM2012-00001, Paper No. 70 (P.T.A.B. June 11, 2013) .....	6
<i>Ariosa Diagnostics v. Isis Innovation Ltd.</i> , IPR2012-00022, Paper No. 166 (P.T.A.B. Sept. 2, 2014) .....	6
<i>Foursquare Labs Inc. v. Silver State Intellectual Tech., Inc.</i> , IPR2014-00159, Paper No. 13 (P.T.A.B. Aug. 1, 2014) .....	6
<i>Am. Acad. Of Sci. Tech Ctr.</i> , 367 F.3d 1359 (Fed. Cir. 2004) .....	7
<i>Am. Med. Sys., Inc. v. Biolitec, Inc.</i> , 618 F.3d 1354 (Fed. Cir. 2010) .....	10
<i>St. Jude Medical</i> , IPR2013-00041, Paper No. 12.....	10
<i>In re GPAC Inc.</i> , 57 F.3d 1573 (Fed. Cir. 1995).....	11
<i>KSR Int'l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007) .....	<i>passim</i>

### Statutes

§ 103 .....	<i>passim</i>
35 U.S.C. § 314 .....	5
35 U.S.C. § 325 .....	2

### Rules and Other Authorities

37 C.F.R. § 42.22 .....	3, 11
37 C.F.R. § 42.104 .....	3, 14

37 C.F.R. § 42.300 .....	6
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## **I. MANDATORY NOTICES**

### **A. Real Parties-in-Interest**

Kyocera Corporation and Kyocera Communications Inc. (collectively, the “Petitioner”) are the real parties-in-interest.

### **B. Related Matters**

As of the filing date of this petition and to best of Petitioner’s knowledge, the challenged patent is involved in pending *inter partes* review proceedings IPR2014-01408 (filed by BlackBerry Corporation and BlackBerry Limited, together the “BlackBerry Petitioners”) and IPR2014-01525 (filed by Sony Mobile Communications (USA) Inc.). There are two pending continuation applications – 14/294,106 and 14/294,117 – filed on June 2, 2014. The challenged patent is also asserted in the following E.D. Tex. and N.D. Cal. litigation.

<b>E.D. Tex. Case Caption</b>	<b>Nos.</b>
Adaptix, Inc. v. AT&T, Inc.	6:12-cv-00017
Adaptix, Inc. v. Pantech Wireless, Inc.	6:12-cv-00020
Adaptix, Inc. v. Cellco Partnership	6:12-cv-00120
Adaptix, Inc. v. Huawei Techs. Co., Ltd.	6:13-cv-00438, ‘439, ‘440, ‘441
Adaptix, Inc. v. ZTE Corp.	6:13-cv-00443, ‘444, ‘445, ‘446
Adaptix, Inc. v. NEC CASIO Mobile Commc’ns, Ltd.	6:13-cv-00585, ‘922
Adaptix, Inc. v. Pantech Wireless, Inc.	6:13-cv-00778
<b>N.D. Cal. Case Caption</b>	<b>Nos.</b>
Adaptix, Inc. v. BlackBerry Limited (now dismissed, as discussed below)	5:14-cv-01380, ‘386, ‘387
Adaptix, Inc. v. Kyocera Corp.	3:14-cv-02894, ‘895
Adaptix, Inc. v. Apple, Inc.	5:13-cv-01776, ‘1777, ‘2023
Adaptix, Inc. v. AT&T, Inc.	5:13-cv-01778

Adaptix, Inc. v. Cellco Partnership	5:13-cv-01844
Adaptix, Inc. v. Dell, Inc.	5:14-cv-01259
Adaptix, Inc. v. Amazon.com, Inc.	5:14-cv-01379
Adaptix, Inc. v. Sony Mobile Commc'ns, Inc.	5:14-cv-01385
Adaptix, Inc. v. ASUSTek	5:14-cv-03112
Adaptix, Inc. v. HTC Corp.	5:14-cv-02359, '360

This petition presents substantially different arguments than any pending petition for *inter partes* review. No petition has set forth the obviousness combinations explained herein. Some of the art presented in this petition has not been used in any pending petition for any purpose. Moreover, Adaptix has dismissed without prejudice the district court cases filed against the BlackBerry Petitioners “pursuant to a written agreement signed and effective on October 15, 2014.” Ex. 1001, Joint Motion For Dismissal at 1; Ex. 1002, Order Granting Joint Motion. In view of this agreement and dismissal, Kyocera expects the BlackBerry petition will likely be withdrawn or not actively pursued by BlackBerry, further reducing the burden on the Board with regard to petitions against the challenged patent. For all of these reasons, this petition, filed by a different petitioner accused of infringing the challenged patent should proceed. 35 U.S.C. 325(d).

### **C. Counsel**

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#### **II. CERTIFICATION OF GROUNDS FOR STANDING**

Petitioner certifies pursuant to Rule 42.104(a) that the patent for which review is sought is available for *inter partes* review and that Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified in this Petition.

#### **III. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED**

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)-(2), Petitioner challenges claims 1, 8-13, 15, 18, 19 and 23-29 of U.S. Patent No. 7,454,212 (the “‘212 patent” or “the challenged patent,” Ex. 1003).

##### **A. Prior Art Patents and Printed Publications**

Petitioner relies upon the following patents and printed publications.

**1. Exhibit 1004 – U.S. Patent No. 5,726,978 (“Frodigh”).**

Frodigh is prior art under 35 U.S.C. § 102(b) based on its March 10, 1998 issue date. Frodigh was cited during the prosecution of the ‘212 patent.

**2. Exhibit 1005 – U.S. Patent No. 6,0952,594 (“Sollenberger”).**



Sollenberger is prior art under 35 U.S.C. § 102(e) based on its April 30, 1997 filing date. Sollenberger was cited during the prosecution of the ‘212 patent.

**3. Exhibit 1006 – German Patent No. DE 198 00 953 C1 (“Ritter”).**

Ritter is prior art under 35 U.S.C. § 102(b) based on its July 29, 1999 issue date. Citations to Ritter herein refer to the English translation of Ritter which was substantively considered during prosecution of the ‘212 patent. *See, e.g.*, Ex. 1011 at 4 *et seq.*

**4. Exhibit 1007 -- “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”).**

Chuang is prior art under 35 U.S.C. § 102(b) based on its October 1993 publication date. Chuang was not cited during the prosecution of the ‘212 patent. The inventors of Sollenberger are two of the three authors of Chuang.

**5. Exhibit 1008 – U.S. Patent No. 5,933,421 (“Alamouti”).**

Alamouti is prior art under 35 U.S.C. § 102(b) based on its August 3, 1999 issued date. Alamouti was cited during the prosecution of the ‘212 patent.

**6. Exhibit 1009 – U.S. Patent No. 6,072,988 (“Minegishi”).**

Minegishi is prior art under 35 U.S.C. § 102(e) based on its January 22, 1998 filing date. Minegishi was not cited during the prosecution of the ‘212 patent.

## **B. Grounds for Challenge**

Petitioner requests cancelation of the challenged claims under the following statutory grounds:

<b>Ground</b>	<b>Rationale</b>
1	Claims 1, 8, 11-13, 18, 19, 23 and 26-28 are obvious over Frodigh in view of Sollenberger under 35 U.S.C. § 103(a).
2	Claims 1, 8-13, 15, 18, 19, 23-27 and 29 are obvious over Frodigh in view of Sollenberger and Ritter under 35 U.S.C. § 103(a).
3	Claims 1, 8, 11-12, 18, 23 and 26-28 are obvious over Frodigh in view of Chuang under 35 U.S.C. § 103(a).
4	Claims 1, 8-12, 15, 18, 23-27 and 29 are obvious over Frodigh in view of Chuang and Ritter under 35 U.S.C. § 103(a).
5	Claims 1, 8-13, 15, 18, 19, 23-26 and 29 are obvious over Alamouti in view of Minegishi and Ritter under 35 U.S.C. § 103(a).

Section VIII below contains detailed claim charts that demonstrate, for each of the statutory grounds, that there is a reasonable likelihood that Petitioner will prevail with at least one of the challenged claims. *See* 35 U.S.C. § 314(a).

## **IV. OVERVIEW OF THE ‘212 PATENT**

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 ‘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.*

## V. CLAIM CONSTRUCTION

In accordance with 37 C.F.R. § 42.300(b), the challenged claims must be given their broadest reasonable interpretations (“BRI”) in light of the specification. The Board has recognized that although proceedings in a district court are subject to a narrower standard for claim construction, the positions of the parties and the determinations of the court in proceedings with respect to the challenged claims are nonetheless instructive as the Board construes terms. *SAP America, Inc. v. Versata Development Group, Inc.*, CBM2012-00001, Paper No. 70 at 19-24 (P.T.A.B. June 11, 2013). Furthermore, the Board has recognized the incongruity of adopting a narrower construction for the purpose of its review than was adopted in parallel venues that apply a narrower standard: “[W]e find it incongruous to adopt a narrower construction in this proceeding, wherein the claims are construed using the broadest reasonable interpretation standard, than was adopted in *Ariosa Diagnostics*, in which a narrower, *Phillips* construction standard applied.” *Ariosa Diagnostics v. Isis Innovation Ltd.*, IPR2012-00022, Paper No. 166 at 24 (P.T.A.B. Sept. 2, 2014); *Foursquare Labs Inc. v. Silver State Intellectual Tech., Inc.*,

IPR2014-00159, Paper No. 13 at 4 (P.T.A.B. Aug. 1, 2014) (the Board revisited and broadened its previous construction of a term, and further noted that its new construction was “consistent with the district court’s construction of the term”).

Because the standard for claim construction at the PTO is different than that used in litigation, *see In re Am. Acad. Of Sci. Tech Ctr.*, 367 F.3d 1359, 1364, 1369 (Fed. Cir. 2004); MPEP § 2111, Kyocera expressly reserves the right to argue in litigation a different claim construction for any term in the ‘748 patent, as appropriate to that proceeding.

#### **A. Arbitrarily Ordering**

In other litigation involving the ‘212 patent, a court construed the term “arbitrarily order[ed][ing]” to mean “ordering in an order not known by the base station.” Ex. 1010, E.D. Tex. CCO I at 31-32. This is consistent with the ‘212 patent’s specification demonstrating the significance of “arbitrarily ordering” is that identification information must accompany the feedback regarding subcarrier performance because the order of the feedback information is not known to the base station. Ex. 1003, ‘212 patent at 6:3-13 (discussing an embodiment where cluster indices are unnecessary because an order is “known to the base station”); *id.* at 10:57-65 (discussing Fig. 5, “an exemplary format for arbitrary cluster feedback” that includes cluster indices). For these reasons, the BRI of “arbitrarily order[ed][ing]” is “ordering in an order not known by the base station.”

## **B. Sequentially Ordering**

The BRI of the term “sequentially ordering” includes at least “ordering according to a priority (e.g., a priority list).” This construction is based on the specification and the examiner’s BRI while examining the ‘212 application. Ex. 1012, Prosecution History of the ‘212 patent at 100, 141 (pending claim 23, “Priority list includes or is a sequential order.”); Ex. 1003, ‘212 patent at 11:1-3 (“[S]elected clusters can also be ordered in the feedback to indicate priority. In one embodiment, the subscriber may form a priority list of clusters ....”).

## **C. Pilot Symbol**

In other litigation involving the ‘212 patent, a court construed the term “pilot symbols” to mean “symbols, sequences, or signals known to both the base station and subscriber.” Ex. 1013, E.D. Tex. CCO II at 17. Further, the specification of the ‘212 patent is clear that the “pilot symbol” concept includes different types of sequences and pilot signals. Ex. 1003, ‘212 patent at 5:34-36 (“The pilot symbols, often referred to as a sounding sequence or signal, are known to both the base station and the subscribers”). Accordingly, the BRI of “pilot symbol” is “symbols, sequences, or signals known to both the base station and subscriber.”

## **D. SINR**

In other litigation involving the ‘212 patent, a court construed the term “SINR” to mean “signal-to-interference-plus-noise ratio.” Ex. 1010, E.D. Tex.

CCO I at 33. In cellular system, a wireless communication link has a certain signal-to-interference-plus-noise ratio (SINR), where the “signal” refers to the signal power seen at the receiver. Bambos Decl. ¶¶ 53. The “noise” refers to the power of the thermal noise at the receiver, which is typically constant as it primarily depends on the electronic and thermal properties of the link receiver circuits. *Id.* ¶¶ 54. The “interference” refers to the cumulative power, that is received at the link’s receiver, of signals transmitted by the transmitters of other communication links operating in the same channel. *Id.* ¶¶ 55. Because, the “noise” is fixed while the interference is variable and often substantially larger than noise, the terms “signal-to-interference ratio” (SIR or S/I, or C/I, where C stands for “carrier,” which is equivalent to “signal”) and “signal-to-interference-plus-noise-ratio” (SINR) can be broadly used interchangeably. *Id.* ¶¶ 56. Even under the narrowest possible interpretation where noise is excised from SIR and included in SINR, a high SIR implies and is correlated with a high SINR and vice versa, when the noise is small, which is consistent with the fact that both SINR and SIR (as well as S/I and C/I) are metrics of transmission quality. *Id.* Accordingly, 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).” *Id.*

## **E. Preambles**

The preambles of the claims are generally not limiting. *Am. Med. Sys., Inc. v. Biolitec, Inc.*, 618 F.3d 1354, 1358-59 (Fed. Cir. 2010). Although the ‘212 patent specification makes clear that claim preambles should not be limiting, Ex. 1003, ‘212 patent at 3:6-7, the prior art satisfies the preambles as shown below in the claim charts for the specific grounds.

#### **F. Broadest Reasonable Construction For Remaining Terms**

In the context of this proceeding and the prior art relied upon herein, Petitioner submits that all other claim terms are limitations that may be afforded their plain and ordinary meanings, and that further construction of those terms is not necessary in this proceeding. *St. Jude Medical*, IPR2013-00041, Paper No. 12 at 5–6. Other forums require different standards of proof and claim interpretation that do not apply to *inter partes* review. Thus, any interpretation or construction in this Petition, either implicitly or explicitly, should not be viewed as constituting, in whole or in part, Petitioner’s own interpretation or construction, except as regards the broadest reasonable construction of the claims presented.

#### **VI. LEVEL OF ORDINARY SKILL IN THE ART**

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. *Id.* ¶¶ 36-38. The level of ordinary skill in the art is also evidenced by

the references. *See In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (determining that the Board did not err in adopting the approach that the level of skill in the art was best determined by references of record).

## **VII. SUMMARY OF THE PRIOR ART**

Pursuant to 37 C.F.R. § 42.22, Petitioner submits the following statement of material facts:

### **Frodigh (Ex. 1004)**

Frodigh discloses a “method and system of adaptive channel allocation” where a subset of subcarriers is chosen from a larger set of subcarriers available for communications on a link. Ex. 1004, Frodigh at Abstract. The mobile units periodically perform signal quality and interference measurements in support of the adaptive channel allocation functionality. *Id.*

### **Sollenberger (Ex. 1005)**

Sollenberger teaches wireless stations detecting the level of each of a plurality of pilot frequency signals. *Id.* at Abstract. The wireless station generates a list of preferred traffic channels by using the detected levels of these pilot signals, and then transmits the list to the associated base station. *Id.* This information is used for channel assignment. *Id.*; *see also*, Ex. 1005, Sollenberger at 8:40-63.

### **Ritter (Ex. 1006)**

Ritter is an adaptive channel allocation system which uses OFDMA carriers.



Ex. 1006, at 6. In Ritter, each mobile station measures the quality of various segments of the frequency spectrum, determines at least one suitable segment based on the quality measurement, and transmits the appropriate information to the base station. *Id.* at 12-14. The base station then uses that information to assign segments to the mobile station. *Id.* at 12-14.

**Chuang (Ex. 1007)**

Chuang discloses a system for using pilot signals to permit mobile units to evaluate channel interference for the purposes of facilitating an adaptive channel allocation system. Ex. 1007, Chuang at 708, lines 12-19.

**Alamouti (Ex. 1008)**

Alamouti discloses an adaptive channel allocation system wherein the mobile unit measures channel quality and uses that information to make channel assignment requests. Ex. 1008, Alamouti at 24:23-46, 55-60.

**Minegishi (Ex. 1009)**

Minegishi was not considered during prosecution of the '212 patent. Minegishi discloses an adaptive channel allocation system wherein the mobile unit measures channel quality and uses that information to make channel assignment requests. Ex. 1009, Minegishi at 2:65-3:26.

**VIII. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE**

Pursuant to Rule 42.104(b)(4)-(5), the following charts demonstrate that the

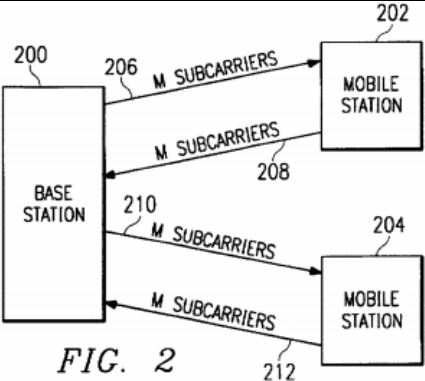
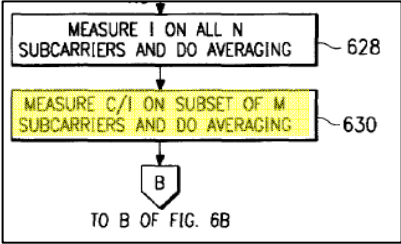
challenged claims are unpatentable.

**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)**

'212 Patent Claim 1	Disclosure
1. A method for subcarrier selection for a system employing orthogonal frequency division multiple access (OFDMA) comprising:	<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]<sup>1</sup>.</p> <p>“A <i>method and system of adaptive channel allocation</i><sup>2</sup> 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>

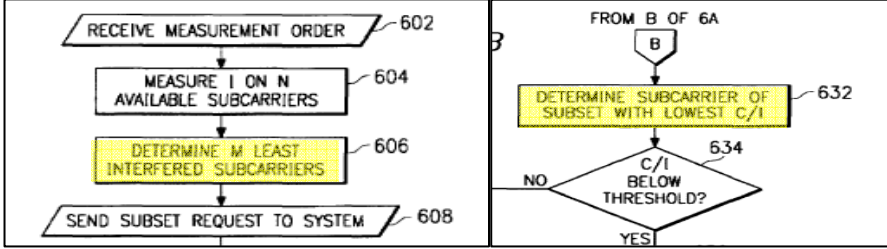
<sup>1</sup>An OFDM system adapted for multiple mobile stations in the manner taught by Frodigh *is* an OFDMA system. Ex. 1003, ‘212 patent at 2:39-43 (“Orthogonal frequency division multiple access (OFDMA) is another method for multiple access, using the basic format of OFDM. In OFDMA, multiple subscribers simultaneously use different subcarriers, in a fashion similar to frequency division multiple access. . .”); Ex. 1012, Bambos Dec. ¶¶ 60.

<sup>2</sup> Unless otherwise noted, all emphasis in this petition is added.

	 <p><b>FIG. 2</b></p> <p>See also, e.g., <i>id.</i> at 1:59-2:59, 4:13-22, 4:31-53; Figs. 4-7.</p>
<p>[a][1] a subscriber unit measuring channel and interference information for a plurality of subcarriers</p>	<p>Frodigh discloses a subscriber [“mobile station”] measuring channel 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, <b><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></b> 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, <b><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></b> 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 <b><i>mobile station</i></b> 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>  <p>See also, e.g., <i>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 is assigned.” Sollenberger at Abstract.</p> <p>“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 <i>wireless station</i>, such as a mobile station or wireless terminal, <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 <i>wireless station scans a pilot signal frequency band</i> using fast Fourier transform (FFT) technique for detecting <i>pilot signals</i> 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.” <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, 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</p>
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	<p>designated as (timeslot, carrier frequency).” <i>Id.</i> at 8:31-39.</p> <p>“According to the invention, the <b><i>power measured for each respective pilot frequency signal corresponds to an interference level on the channel corresponding to the pilot frequency signal</i></b> 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 <b><i>signal to interference ratio (SIR) measured for the channel</i></b> 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>“If the <b><i>measured power of a particular pilot frequency signal</i></b> 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>
[b] the subscriber unit selecting a set of candidate subcarriers ;	<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 CJI and I measurement results are reported to the system. During communications on the link the system determines from the CII 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, <b><i>a mobile station as link receiver transmits only a limited set of measurement results</i></b> to the system at certain select reporting intervals rather than all</p>

	<p>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 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 <math>Y &lt; M</math>, and the I measurements for the Z least interfered of the N subcarriers to the system, where <math>Z &lt; N</math>. <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>
[c] the subscriber	Frodigh discloses the subscriber [“mobile station”] providing feedback information [“limited set of measurement results”] on the set

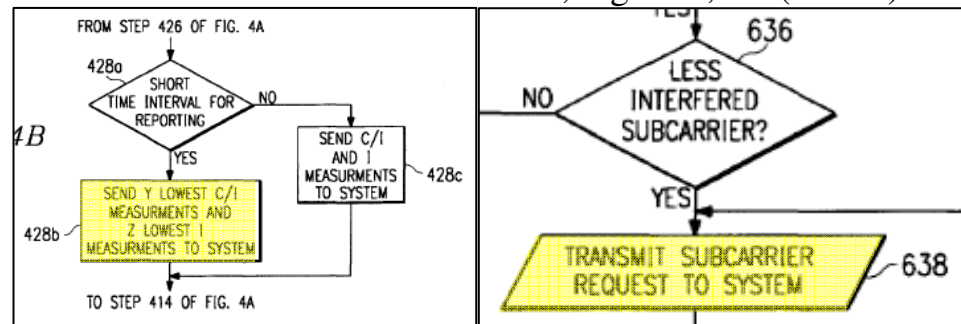
unit providing feedback information on the set of candidate subcarriers to the base station;

of candidate subcarriers to the base station

“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.” Frodigh 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.

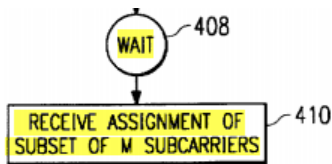
“In an alternative embodiment of the invention, *a mobile station as link receiver transmits request messages requesting a certain subset of M subcarriers*, or requesting replacements for the M subcarriers, to be used on the link.” *Id.* at 12:57-60; Figs. 4B, 6B (details):



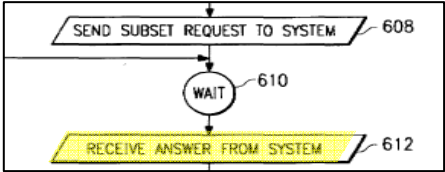
See also, e.g., *id.* at 3:35-4:22, 4:25-49, 7:29-50, 10:2-7, 11:12-42, 12:57-13:21; 14:17-40, 17:12-40; Fig. 4-7.

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”].

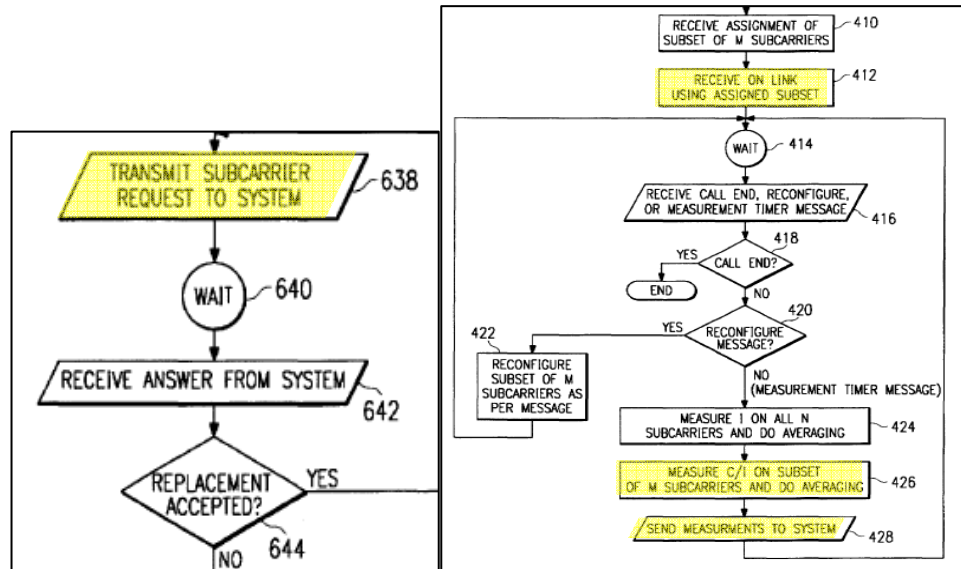
“According to the invention, a wireless station. . . *performs interference measurements for determining acceptable channels*, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets

	<p>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. <b><i>A feedback channel is then used for informing a base station of acceptable channels.</i></b> To avoid more than one wireless station in the same cell from selecting the same acceptable channel, <b><i>a list of more than one acceptable channel is provided by the wireless station.</i></b>” Sollenberger at 7:60-8:7.</p>
<p>[d] 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</p>	<p>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> <p><b><i>“The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.</i></b> 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, <b><i>the link receiver</i></b> which has been in the wait state at 408 now moves to step 410 <b><i>and receives the channel assignment message assigning the subset of M subcarriers to the link.</i></b> 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 408)) --&gt; 410[RECEIVE ASSIGNMENT OF SUBSET OF M SUBCARRIERS 410] </pre> <p><b><i>“If the link receiver is a mobile station</i></b> 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/] --&gt; 610((WAIT))     610 --&gt; 612[/RECEIVE ANSWER FROM SYSTEM/] </pre>
<p>[e][1] the subscriber unit submitting updated feedback information, after being allocated the set of subcarriers to be allocated an updated set of subcarriers, and thereafter</p>	<p>Frodigh, discloses the subscriber unit [“mobile station”] submitting updated feedback information [“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”], 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</i></p>

*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 to reduce co-channel interference on the link.” Id. Abstract; 11:54-12:49, 14:10-15:12; Figs. 5-7; Figs. 4B, 6A (details):*



[e][2] the subscriber unit receiving another indication of the updated set of subcarriers .

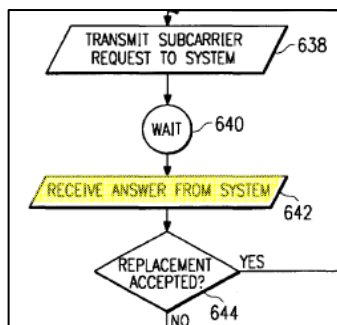
Frodigh discloses the subscriber unit [“mobile station”] receiving another indication of the updated set of subcarriers [“C/I and I measurements are then used to reconfigure the subset of M subcarriers,” the mobile stations “Receive Answer From System” regarding allocation].

“The *process continues as long as a call is ongoing* and communications on the link continue. The link receiver will next move from the wait state at step 408 upon receiving an input and *the process steps shown in FIGS. 4A, 4B and 5 will be repeated until the call ends* 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.

“A method and system of *adaptive channel allocation* 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 *periodically*

*performed. The C/I and I measurements are then used to reconfigure the subset of M subcarriers* to reduce co-channel interference on the link.” *Id.* at Abstract.

“If it is determined that *a more preferred unused subcarrier exists*, 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):



### **Obvious to Combine Sollenberger’s Use of Pilot Symbols to Measure Channel Quality into Frodigh’s System of Adaptive Channel Allocation**

Frodigh and Sollenberger are both directed to systems of adaptive channel allocation using OFDM technology, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations. Ex. 1004, Frodigh (The mobile station measures channel quality on subcarriers and “the mobile station then determines candidate replacement subcarriers for the link based on the C/I and I measurements”); Ex. 1005, Sollenberger (“The wireless station generates a list of preferred traffic channels based on a priority order of traffic channels and on detected levels of the pilot frequency signals, and transmits the list to the associated base station.”). If Frodigh is found not to disclose that pilot symbols transmitted by a base station which are used for measuring channel

quality, Sollenberger expressly discloses this element through its discussion of “pilot frequency symbols” to determine signal to interference ratio information. Ex. 1005, Sollenberger at 9:6-18. In light of such disclosures, 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. Ex. 1012, Bambos Dec. ¶¶ 62.

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.”). As such, by admission of the ‘212 patent itself, 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. Therefore, Frodigh alone would render obvious all claim elements involving measuring pilot symbols to determine channel quality. Moreover, 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 Sollenberger.

Second, combining Frodigh with 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. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 402 (2007). 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. Ex. 1012, Bambos Dec. ¶¶ 63. As explained above, Frodigh and Sollenberger both address the same issue in the exact same field.

Third, combining Frodigh and Sollenberger merely unites old elements with no change in their respective functions. *KSR* at 416. 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. Ex. 1012, Bambos Dec. ¶¶ 64. Frodigh's adaptive channel allocation functionality would not need to be changed merely because it was using Sollenberger's technique for measuring channel quality. *Id.* Nor would Sollenberger's technique have changed functionality due to combination with Frodigh's adaptive channel allocation system, as that is the very context in which Sollenberger's technique arises. *Id.* The elements would be used exactly as taught in each patent.

Fourth, modifying Frodigh with the teachings of Sollenberger would have been a predictable variation of a work in the same field of endeavor. *KSR* at

417. As such, 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. Ex. 1012, Bambos Dec. ¶¶ 65. Mere common sense would suggest 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. *Id.*

Fifth, combining the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. *KSR* at 401-02. 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. Ex. 1012, Bambos Dec. ¶¶ 66.

'212 Patent Claim 8	Disclosure
8. The method defined in claim 1 further	Frodigh discloses the base station selecting the subcarriers from the set of candidate subcarriers based

<p>comprising the base station selecting the subcarriers from the set of candidate subcarriers based on additional information available to the base station.</p>	<p>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.”]</p> <p>“<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.</p>
'212 Patent Claim 11	Disclosure
<p>11. The method defined in claim 1 wherein the indication of subcarriers is received via a downlink control channel.</p>	<p>"The indication" is indefinite due to antecedent basis failure, but Kyocera interprets it as a reference to "an indication" <i>for purposes of this petition only</i>. Frodigh the indication of subcarriers [“subcarrier assignment”] is received via a downlink control channel [“DDCH,” “PCCH”].</p> <p>“The system includes a <i>dedicated control channel (DCCH) that is both an uplink and downlink channel</i> for transmitting control information for handovers, long term <i>channel allocation 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.</p>

'212 Patent Claim 12	Disclosure
<p>12. The method defined in claim 1 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.</p>	<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>”</p> <p>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>
'212 Patent Claim 13	Disclosure
<p>13. The method defined in claim 1 wherein providing feedback information comprises arbitrarily ordering the set of candidate subcarriers as clusters of subcarriers.</p>	<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 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</i></p>



	<p><i>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 into Frodigh’s System of Adaptive Channel Allocation**

As explained above, it would have been obvious to combine Frodigh with Sollenberger. There are further reasons for such a combination with regard to adding Sollenberger’s providing feedback by arbitrarily ordering the set of to the system disclosed in Frodigh, if Frodigh is found not to disclose such limitations.

First, 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 that would have been obvious to try. *KSR* at 402 (2007). 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. *Ex. 1012*, Bambos Dec. ¶¶ 69.

Second, combining Frodigh and Sollenberger merely unites old elements

with no change in their respective functions. *KSR* at 416. Specifically, the combination of Frodigh's adaptive channel allocation system with Sollenberger's form of providing feedback would not require changes to either's functionality. Ex. 1012, Bambos Dec. ¶¶ 70.

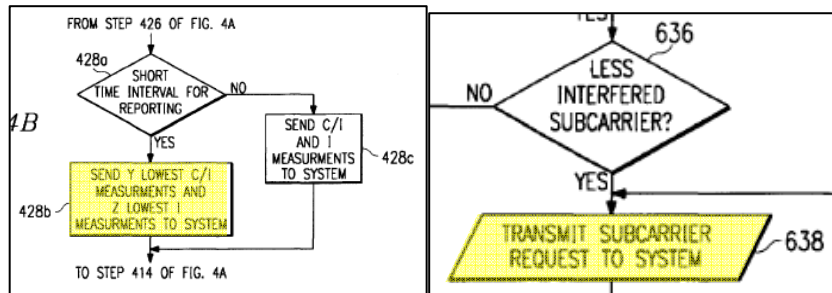
Third, modifying Frodigh with the teachings of Sollenberger would have been a predictable variation of a work in the same field of endeavor. *KSR* at 417. As such, one skilled in the art would have been able to readily implement the variation. In particular, as both Frodigh and Sollenberger are both 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. *See also, e.g.*, Ex. 1012, Bambos Dec. ¶¶ 71. Mere common sense would suggest 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. *See also, e.g.*, Ex. 1012, Bambos Dec. ¶¶ 71.

Fourth, combining the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. *KSR* at 401-02. 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. Ex. 1012, Bambos Dec. ¶¶ 72.

'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 desired for use by the plurality of subscriber units; and	<p>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”].</p> <p>“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 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.</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.” <i>Id.</i> 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 link.</i> The system responds to the subcarrier request message with a subcarrier accepted or subcarrier rejected message.” <i>Id.</i> at 5:14-20.</p> <p>“In an alternative embodiment of the invention, a mobile station as</p>

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”].

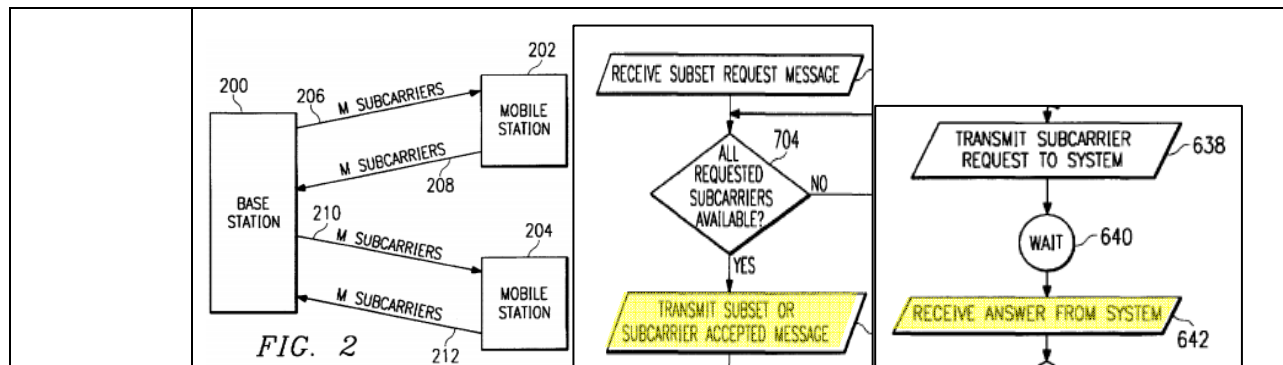
“According to the invention, a wireless station. . . *performs interference measurements for determining acceptable channels*, from the point of view of the wireless station, after the wireless station has been informed by a base station of pending data packets for delivery to the wireless station. The 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.

[b] a first base station in the first cell, the first base station

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].

“The radio interface between the mobile station and system is

<p>operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber units;</p>	<p>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 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.</p> <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>“In an alternative embodiment of the invention, <i>a mobile station as link receiver transmits request messages 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; Fig. 2, 7 (detail), 6B (detail):</p>
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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	<b>Sollenberger</b> 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

<p>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.</p>	<p>[“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 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 <i>the signal to interference ratio (SIR)</i></p>
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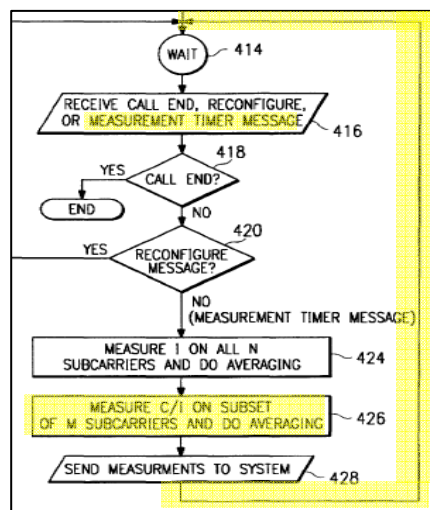
*measured for the channel* having priority order  $j$  is greater than a predetermined threshold by comparing the power of the pilot frequency signal corresponding to  $j$  to a predetermined threshold.” *Id.* at 9:6-18.

“Each base station *transmits the pilot frequency signals corresponding to each channel* used by the base station so that wireless stations for which new packets are pending can rapidly scan for potential available channels.” *Id.* at 10:44-47.

**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.

“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 periodically performed*. The C/I and I measurements are then used to reconfigure the subset of  $M$  subcarriers to reduce co-channel interference on the link.” *Id.* Abstract.

“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



	<p>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><i>See also, e.g., Id.</i> at 4:56-60, 5:10-15, 13:62-65; Figs. 4-7.</p>	
<b>'212 Patent Claim 23</b>		<b>Disclosure</b>
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.
<b>'212 Patent Claim 26</b>		<b>Disclosure</b>
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.
<b>'212 Patent Claim 27</b>		<b>Disclosure</b>
27. The apparatus defined in claim 18 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.		See claim 12 above.
<b>'212 Patent Claim 28</b>		<b>Disclosure</b>
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)**

The following shows Ritter’s disclosure of an OFDMA system:

<b>'212 Patent Claim 1</b>	<b>Disclosure</b>
1. A method for subcarrier selection for a	<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</p>

system employing orthogonal frequency division multiple access (OFDMA) comprising:	<p>radio communication system for allocating radio resources, when using a <b><i>OFDMA multi-carrier procedure</i></b>.” Ritter at 4.</p> <p>“By means of the allocation system described the advantages of <b><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></b> 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 <b><i>can be individually changed after the determination of the best suitable segments in each mobile station</i></b> overseen by a base station and can 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.</p>
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Ground 1 above explains how Frodigh in view of Sollenberger teaches the remaining elements of claim 1, and those of claims 8, 1-13, 18-19, 23 and 27.

**Obvious to Combine Ritter’s Use of Traffic Load Information, Feedback in Sequential Order, and OFDMA with Frodigh and Sollenberger’s System of Adaptive Channel Allocation**

Ritter, like Frodigh and Sollenberger, is directed to a system of adaptive channel allocation using OFDM technology, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations. Ex. 1006, Ritter at 6, 12-14; *see* discussion of Frodigh and Sollenberger in Ground 1 above. If Frodigh in view of Sollenberger is found not to disclose the claimed elements relating the use of traffic load information in allocating subcarriers, or providing feedback in the form of a sequential order, Ritter clearly

teaches these elements, as explained further below. Ex. 1006, Ritter at 15-16, 19, 25. Further, if Frodigh in view of Sollenberger is found not to disclose OFDMA—though they should be, as explained above—Ritter clearly teaches that element as well. Ex. 1006, Ritter at 6. In light of such disclosures, 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 four reasons. Ex. 1012, Bambos Dec. ¶¶ 75.

First, 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. *KSR* at 402. 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. Ex. 1012, Bambos Dec. ¶¶ 76.

Second, combining Ritter, Frodigh and Sollenberger merely unites old elements with no change in their respective functions. *KSR* at 416. 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. Ex. 1012, Bambos Dec. ¶¶ 77. 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. Ex. 1012, Bambos Dec. ¶¶ 77.

Third, 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. *KSR* at 417. As such, 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. Ex. 1012, Bambos Dec. ¶¶ 78. Mere common sense would suggest that the beneficial features of Ritter would be readily applicable to systems as similar to it as Frodigh and Sollenberger. *Id.*

Fourth, combining Ritter with the Frodigh and Sollenberger references would have been responsive to the direction and pressures of the marketplace. *KSR* at 401-02. 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. Ex. 1012, Bambos Dec. ¶¶ 79.

The following shows how Frodigh, Sollenberger and Ritter together render obvious claims 9, 10, 13, 15, 23, 24, 25 and 29:

'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>“Each cluster” is indefinite due to antecedent basis failure, but Kyocera interprets it as referencing the “set of candidate subcarriers” <i>for purposes of this petition only</i>. 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.		<i>See</i> 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.		<i>See</i> 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.

**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)**

Chuang discloses the '212 patent's claimed use of pilot symbols:

'212 Patent Claim 1	Disclosure
[a][2] based on pilot symbols received from a base station;	<p>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 subcarriers ["to evaluate downlink interference"].</p> <p>"A common control frequency, which is frame-synchronized among <b>base stations</b>, provides (1) beacons for portables to locate base-stations and obtain DCA information, (2) broadcast channels for system and alerting information, and (3) <b>pilot signals to permit portables to evaluate downlink interference.</b>" Chuang Abstract; "The portable makes <b>measurements on the pilots corresponding to the downlinks of the traffic</b> channels on the short list, and it chooses as the final paired communications channel that channel with the lowest measured power. <b>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.</b>" Chuang at 708, lines 12-19.</p>

Frodigh discloses the remaining limitations of claim 1, and those of claims 8, 11-12, 18, 23 and 26-28 as set forth in Ground 1 above.

**Obvious to Combine Chuang's Use of Pilot Symbols to Measure Channel Quality into Frodigh's System of Adaptive Channel Allocation**

If Frodigh is found not to disclose that pilot symbols transmitted by a base station which are used for measuring channel quality, it would have been obvious to one of ordinary skill in the art to combine Frodigh with Chuang for the following reasons. Ex. 1012, Bambos Dec. ¶¶ 81. As 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. As such, 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. Thus, a person of ordinary skill in the art would think to, and be motivated to, combine Frodigh with the teachings of references which have strong teachings of pilot symbols in the context of adaptive channel allocation, such as Chuang. Further, combining Frodigh and Chuang merely unites old elements with no change in their respective functions. *KSR* at 416. 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. Ex. 1012, Bambos Dec. ¶¶ 83. Frodigh's adaptive channel allocation functionality would not need to be changed because it was using Chuang's technique for measuring quality—and Chuang is specifically intended for an adaptive channel allocation system—thus the elements would be used exactly as taught in each reference. *Id.*



Common sense would suggest 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. *Id.* at ¶¶ 84. Such a combination would be responsive to commercial pressures for robust wireless systems. *Id.*

**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)**

The substantive disclosures of Frodigh and Chuang, and the obviousness to combine these, is set forth in Ground 3. The substantive disclosures of Frodigh and Ritter, and the obviousness to combine these, is set forth in Ground 2. For all these 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)**

'212 Patent Claim 1	Disclosure
1. A method for subcarrier	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

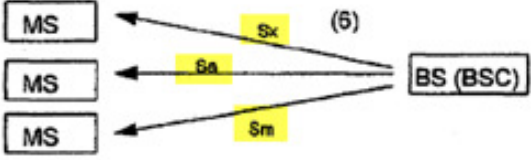
selection for a system employing orthogonal frequency division multiple access (OFDMA) comprising:	<p>“OFDM” to “efficiently communicate with many remote stations”].<sup>3</sup></p> <p><i>See, e.g.,</i> Alamouti 5:21-23: “ In one embodiment of the invention, TDD, FDD, TDMA, and <b><i>OFDM are combined to enable a base station to efficiently communicate with many remote stations.</i></b>”</p> <p><i>See also, e.g.,</i> 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), <b><i>orthogonal frequency division multiplexing (OFDM)</i></b>, spatial diversity, and polarization diversity in various unique combinations.</p> <p>FIG. 1 provides an overview of how the invention combines TDD, FDD, TDMA, and <b><i>OFDM to enable the base station Z to efficiently communicate with many remote stations U, V, W, and X.</i></b> 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 <b><i>that are orthogonal frequency division 40 multiplexed (OFDM)</i></b> 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.,</i> Fig. 1.</p>
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<sup>3</sup>If the preamble is found to be limiting, and if Alamouti’s use of OFDM if found not to satisfy the OFDMA limitation—though neither conclusion would be correct—this limitation is taught by the combination of Ritter and Alamouti for the reasons explained above in Grounds 2; *see also* Ex. 1012, Bambos Dec. ¶¶ 88.

<p>[a][1] a subscriber unit measuring channel and interference information for a plurality of subcarriers</p>	<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</i>  <i>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</i> for use in selecting the best channel for an RU when a link is established. These measurements include <b>RSSI and SINR.</b>”</p> <p><i>See also, e.g., Alamouti at 23:58-62: “An RU requests a traffic channel</i> from its serving cell. <i>It reports the following measurements</i> as part of traffic establishment: <b>RSSI(1)=-95 dBm, SINRRU(1)=9.3 dB RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.</b>” <i>See also, e.g., Alamouti at 24:23-26: “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.”</p>
<p>[a][2] based on pilot symbols received from a base station;</p>	<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. <b>Pilot tones carry known data patterns that enable an accurate channel estimation.</b> 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.”</p>
<p>[b] the subscriber unit selecting a set of candidate subcarriers;</p>	<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></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> <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>
[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 subscriber unit receiving an indication of subcarriers of the set of subcarriers selected by the base station for use	<p>Ritter discloses the subscriber unit [“mobile station,” MS”] receiving an indication of subcarriers [“information about the allocated segments, Sx, Sa, and Sm”] of the set of subcarriers selected by the base station [“the base station, BS, assigns the segments Sx, Sa and Sm”] for use by the subscriber unit [“selected as the most suitable segments by the mobile station to the three mobile stations, MS”].</p> <p><i>“In the example cited, the base station, BS, assigns the segments, Sx, Sa and Sm 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. In a step (6) information about the allocated segments, Sx, Sa, and Sm 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):</i></p>

by the subscriber unit; and	
[e][1] the subscriber unit submitting updated feedback information, after being allocated the set of subcarriers to be allocated an updated set of subcarriers, and thereafter	<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 [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><i>Next, each of the mobile stations 5-1, 5-2, . . . under the control of the base station 2-1 transmits a priority list S2 of the selected traffic channels 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.</i></p> <p><i>As a result, the control station 1 records all the priority lists received from the base station 2-1, and renews one priority list of traffic channels for the base station 2-1.</i></p> <p><i>Next, the control station 1 transmits the 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	Minegishi renders obvious the subscriber unit

receiving another indication of the updated set of subcarriers.	receiving another indication of the updated set of subcarriers [see limitation [e][2] immediately above and explanation below this chart].
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**Claim Limitations [e][1] and [e][2] are Rendered Obvious by Alamouti Alone or in Combination with Minegishi**

Alamouti is 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. Ex. 1012, Bambos Dec. ¶¶ 86. 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. *Id.* As such, Alamouti renders obvious those limitations if it is found not to disclose those limitations expressly. *Id.*

Moreover, Minegishi and similar references expressly disclose re-taking measurements on a set of candidate channels after that set is first identified based on channel quality measurements. *Id.* at ¶¶ 87. As such, 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. *Id.*

**Obvious to Combine Ritter's Use of Traffic Load Information, Feedback in Sequential Order, and OFDMA with Alamouti and Minegishi's System of Adaptive Channel Allocation**

Alamouti, Minegishi and Ritter are all directed to systems of adaptive

channel allocation, where the subscriber units measure channel quality and use that information to request channel allocation to the base stations. Ex. 1008, Alamouti at 24:23-46, 55-60; Ex. 1009, Minegishi at 2:65-3:26; Ex. 1006, Ritter at 6, 12-14. If Alamouti in view of Minegishi is found not to disclose the claimed use of traffic load information, feedback in sequential order and OFRMA, one of ordinary skill would have been motivated to take the obvious step of adding the disclosures of Ritter for the following reasons. Ex. 1012, Bambos Dec. ¶¶ 88.

First, 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. *KSR* at 402. Specifically, it would have been obvious to one skilled in the art to improve the teachings 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. Ex. 1012, Bambos Dec. ¶¶ 89.

Second, combining these references merely unites old elements with no change in their respective functions. *KSR* at 416. 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. Ex. 1012, Bambos Dec. ¶¶ 90. 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. 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. *Id.* 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. And 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.

Third, modifying Alamouti with the teachings of Minegishi and Ritter would have been a predictable variation of a work in the same field of endeavor. *KSR* at 417. As such, 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. *Ex. 1012, Bambos Dec.* ¶¶ 91. Mere common sense would suggest that adding features of an adaptive channel allocation system to

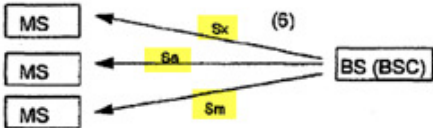


another adaptive channel allocation system would be beneficial. *Id.*

Fourth, combining these references would have been responsive to the direction and pressures of the marketplace. *KSR* at 401-02. 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. *Ex. 1012, Bambos Dec. ¶¶ 92.*

'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	<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 <b><i>Direction of Arrival (DOA)</i></b> Since the system is dependent on SDMA for increasing capacity, a very important parameter is the DOA for each RU. <b><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></b> * * * 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>“As a first cut it seems that the three pieces of data can be combined into a channel <b><i>candidacy assessment factor (CAF)</i></b>. The three desirable situations are: <b><i>large separation in DOA, small RSSI, and high SINR.</i></b>” <i>Id.</i> at 23:23-26.</p> <p>“3.4 Procedure 1. In idle mode each RU <b><i>measures the RSSI and SINR of each channel</i></b> it could potentially operate on and orders them from subjective best to subjective worst.” <i>Id.</i> at 24:23-26:</p> <p>“4. <b><i>The base uses the channel measurements sent by the RU to</i></b></p>

to the base station.	<i>compute a CAF for each of the candidate channels in the set sent by the RU. 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.” Id. at 24:34-39:</i>	
<b>'212 Patent Claim 9</b>		<b>Disclosure</b>
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.
<b>'212 Patent Claim 10</b>		<b>Disclosure</b>
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.
<b>'212 Patent Claim 11</b>		<b>Disclosure</b>
11. The method defined in claim 1 wherein the indication of subcarriers is received via a downlink control channel.	<p><b>Alamouti</b> 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 <b>Common Link Channel (CLC)</b> 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 is to be established the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.</i></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><b>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</b></p>	

	<p><b><i>CAF is chosen.”</i></b></p> <p><b>Ritter</b> 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<sub>x</sub>, S<sub>a</sub> and S<sub>m</sub> 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. In a step (6) <b><i>information about the allocated segments, S<sub>x</sub>, S<sub>a</sub>, and S<sub>m</sub> is sent via the radio interface to the mobile stations, MS</i></b>, 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> 
'212 Patent Claim 12	Disclosure
<p>12. The method defined in claim 1 wherein the plurality of subcarriers comprises all subcarriers allocable by a base station.</p>	<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 <b><i>each channel it could potentially operate on</i></b> and orders them from subjective best to subjective worst.”</i></p>

If the Alamouti disclosure above is found not to teach that the plurality of subcarriers comprises “all subcarriers allocable by a base station,” a person of ordinary skill in the art would understand such a feature to be obvious in light of Alamouti. Ex. 1012, Bambos Dec. ¶¶ 93. 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. *Id.* Indeed, such capability would help to maximize the flexibility of the system as a whole. *Id.* 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. *Id.*

'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>Alamouti discloses providing feedback information [“sends the 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>Alamouti at 24:23-46: “3.4 Procedure 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> 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>
'212 Patent Claim 15	Disclosure
15. The method defined in claim 1 wherein providing feedback information comprises sequentially	<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</i></p>

ordering candidate clusters.	<i>5-1, 5-2, . . . calculates the interference levels of the selected traffic channels</i> with the corresponding traffic channels of the other base stations 2-2, 2-3, . . . , <i>so that a priority sequence is given to the selected traffic channels.</i> ”		
'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 desired for use by the plurality of subscriber units;	<p>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 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> 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> <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.” <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>		
[b] and a first base station in the first cell, the	<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”;</p>		

<p>first base station operable to allocate OFDMA subcarriers in clusters to the plurality of subscriber units;</p>	<p>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 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.” <i>See also, e.g., Fig. 1.</i></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>
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[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	<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>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 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</p>	

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 .	<p>amplitude and phase distortion introduced by the communication channel characteristics) over the entire transmission band.”</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 <i>RSSI(2)=-95 dBm, SINRRU(2)=4.5 dB.</i>” Alamouti at 23:58-62.</p> <p>“3.4 Procedure 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> 2. There is a parameter, meas_rpts, which is sent on the broadcast channel of each base station 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 the RU sends the best meas_rpts channel measurements to the base on the SCAC channel.” <i>Id.</i> at 24:23-33; “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 <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>” <i>Id.</i> 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>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. <b>A Common Link Channel (CLC) is used by the base to transmit control information to the Remote Units.</b> 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.”; 24:31-46: “<b>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.</b>”</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.

## IX. CONCLUSION

For the foregoing reasons, Petitioner asks that *inter partes* review of the ‘212 patent be instituted and that claims 1, 8-13, 15, 18, 19 and 23-29 be rejected.

Respectfully Submitted,

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## **EXHIBIT APPENDIX**

Exhibit 1001 – Joint Motion For Dismissal in N.D. Cal. Case Nos. 5:14-cv-01380-PSG, 5:14-cv-01386-PSG, 5:14-01387-PSG (“Joint Motion For Dismissal”)

Exhibit 1002 – Order Granting Joint Motion in N.D. Cal. Case Nos. 5:14-cv-01380-PSG, 5:14-cv-01386-PSG, 5:14-01387-PSG (“Order Granting Joint Motion”)

Exhibit 1003 – U.S. Patent No. 7,454,212 (for *inter partes* review)

Exhibit 1004 – U.S. Patent No. 6,726,978 (“Frodigh”)

Exhibit 1005 – U.S. Patent No. 6,0952,594 (“Sollenberger”)

Exhibit 1006 – Certified Translation of German Patent No. DE 198 00 953 C1 (“Ritter”)

Exhibit 1007 – “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”)

Exhibit 1008 – U.S. Patent No. 5,933,421 (“Alamouti”)

Exhibit 1009 – U.S. Patent No. 6,072,988 (“Minegishi”)

Exhibit 1010 – Memorandum Opinion and Order on Claim Construction in E.D. Tex. Case Nos. 6:12CV17, 6:12CV20 and 6:12CV120 (“E.D. Tex. CCO I”)

Exhibit 1011 – File History of U.S. Patent No. 7,454,212 (excerpts)

Exhibit 1012 – Declaration of Dr. Nicholas Bambos (“Bambos Dec”)

Exhibit 1013 – Memorandum Opinion and Order on Claim Construction in E.D. Tex. Case Nos. 6:13CV438, 6:13CV439, 6:13CV440, 6:13CV441, 6:13CV443, 6:13CV444, 6:13CV445 and 6:13CV446 (“E.D. Tex. CCO II”)

Exhibit 1014 – Curriculum Vitae for Dr. Nicholas Bambos

**CERTIFICATE OF SERVICE**

I hereby certify that, on November 26, 2014, I caused a true and correct copy of the foregoing Petition for *Inter Partes Review* of U.S. Patent No. 7,454,212 **with Exhibits 1001-1014** to be served via FedEx 2Day delivery on the following:

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