IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Niedzwiecki, Joshua D. Group Art Unit:

Serial No. Examiner:

Filed: Herein Atty. Dkt. No: 20060108-US

For: MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

To: Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Fm: 22500

Dear Honorable Commissioner:

TRANSMITTAL COVER SHEET

This is an express request to begin national examination procedures, pursuant to 35 U.S.C. 371, of International Application No. PCT/US2009/058409. Submitted herewith are:

4 pages Transmittal Letter To The United States Designated/Elected Office Concerning a Filing Under 35 U.S.C. 371,

5 pages Application Data Sheet,

17 pages copy of original PCT specification, claims and abstract,

8 pages copy of original PCT drawings, and

1 page executed Declaration of Inventorship.

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Respectfully submitted,

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 20060108-US |
|---|---|---|
| | Application Number | |
| Title of Invention | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS | |

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| **Title of the Invention** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS | | |
| **Attorney Docket Number** | 20060108-US | **Small Entity Status Claimed** | ☐ |
| **Application Type** | Nonprovisional | | |
| **Subject Matter** | Utility | | |
| **Suggested Class (if any)** | | **Sub Class (if any)** | |
| **Suggested Technology Center (if any)** | | | |
| **Total Number of Drawing Sheets (if any)** | 8 | **Suggested Figure for Publication (if any)** | 1C |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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| Prior Application Status | | | Remove |
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| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
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| PCT/US2009/058409 | non provisional of | 61/100461 | 2008-09-26 |

| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 20060108-US |
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| Organization Name | BAE Systems Information and Electronic Systems Integration Inc. | | |
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## Signature:

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| **Signature** | /Vernon C. Maine, Reg. No. 37,389/ | | | Date (YYYY-MM-DD) | 2010-05-13 |
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| First Name | Vernon | Last Name | Maine | Registration Number | 37389 |

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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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# MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

Inventors:
Joshua D. Niedzwiecki
Branson P. Hombs

## RELATED APPLICATIONS

**[0001]** This application claims the benefit of U.S. Provisional Applications No. 61/100,461, filed September 26, 2008, which is herein incorporated by reference in its entirety for all purposes.

## STATEMENT OF GOVERNMENT INTEREST

**[0002]** This invention was made with United States Government support under Contract No. HROOll-05-C-0064 awarded by the Defense Advanced Research Projects Agency (DARPA). The United States Government has certain rights in this invention.

## FIELD OF THE INVENTION

**[0003]** The invention relates to digital communication systems, and more particularly to ad hoc wireless multiuser digital communication systems.

## BACKGROUND OF THE INVENTION

**[0004]** In digital communications, it is often desirable for a plurality of users, or "nodes" to communicate over a shared, multiuser network, rather than relying on point-to-point communication. While point-to-point communication offers the advantage of guaranteed, dedicated access to a communication medium, and consequent high communication speeds, implementation costs for a point-to-point communication system can be prohibitively high, scalability is typically difficult, and configuration can be burdensome.



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**[0005]** Shared, multiuser networks allow a plurality of users, or "nodes," to share a common communication medium, thereby reducing costs and enhancing scalability and ease of configuration. Of course, a significant disadvantage of shared medium networks as compared to point-to-point networks is that they are much more limited in traffic capacity, due to the requirement that only one node transmit information on the shared communication medium at any given time. If more than one node attempts to transmit at the same time, a so-called "collision" occurs, whereby the transmitted information is unintelligible, and must be re-transmitted.

**[0006]** Shared networks are typically either "managed" or "ad hoc." In a managed network, a central controller or "access point" manages use of the shared communication medium, thereby minimizing collisions and managing recovery from any collisions that do occur. In an "ad hoc" network, all nodes are treated equally, and must negotiate directly with each other so as to coordinate use of the shared communication medium, avoid collisions, and recover from collisions. Typical examples of ad hoc digital networks include Ethernet networks and wireless "802.11b" networks.

**[0007]** The decentralized nature of ad hoc networks makes them suitable for a variety of applications. They are naturally robust, since no single node is vital to the network, and they are easy to scale, since configuration requirements are typically minimal, and deployment is usually quick and automatic.

**[0008]** However, due to the lack of a central controller, ad hoc networks must use special protocols so as to avoid and recover from collisions. One commonly used protocol is the Carrier Sense Multiple Access protocol, or CSMA. In this approach, each node monitors the network so as to sense if any communication traffic is present. A node only attempts to transmit information when no traffic is detected. Collision avoidance can be further enhanced in wired networks by using a CSMA/CD protocol, which adds "Collision Detection" to the basic CSMA protocol. In CSMA/CD, a transmitting node monitors the network while it is



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transmitting, halts transmission if a packet collision is detected, and then repeats the attempt at a later time.

**[0009]** However, it is typically not possible for collision detection to be used in a wireless network, since it is generally not possible for a wireless node to monitor the network while it is transmitting. Hence, it is not generally possible for a wireless node to directly detect collisions during transmission, making it impossible for a wireless network to use collision detection protocols such as CSMA/CD. Also, due to distances and intervening structures, it may not be possible for a specific node in a wireless network to detect signals from all other wireless nodes on the network. The likelihood of inadvertent collisions in wireless ad hoc networks is therefore much greater than for wired networks.

**[0010]** So as to enhance avoidance of collisions on a wireless ad hoc network, a "Collision Avoidance" protocol such as CSMA/CA can be used. In the CSMA/CA approach, after determining that no traffic appears to be present on the network, a transmitting node first sends a signal to all other nodes instructing them not to transmit, and then transmits its packet of information. CSMA/CA can be further enhanced by the exchange of a Request to Send (RTS) packet sent by the sender, and a Clear to Send (CTS) packet sent in reply by the intended receiver. These packets serve to alert all nodes within range of the sender, the receiver, or both, to keep quiet for the duration of the main packet. This is known as the IEEE 802.11 RTS/CTS exchange.

**[0011]** As mentioned above, a significant disadvantage of shared medium networks as compared to point-to-point networks is that shared networks are much more limited in traffic capacity, due to the requirement that only one node transmit information on the shared communication medium at any given time. This requirement can be relaxed somewhat by using one or more so-called "spread-spectrum" technologies to "spread" the shared communications medium into a plurality of separately usable communications channels.



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**[0012]** For example, Frequency Division Multiple Access, or FDMA technology, provides for transmissions to occur in different frequency bands on the shared communications medium. Filters are then used to isolate the transmissions on the separate frequency channels, allowing for simultaneous information transmission on each of the frequency-separated channels. Of course, FDMA requires an increased communication bandwidth, and so is limited in wireless applications according to bandwidth allocations.

**[0013]** Time Division Multiple Access, or TDMA, divides time into available channel "slots." Nodes transmit in rapid succession, one after the other, in a repeating cycle, each node using its own time slot. This approach accelerates communication rates by minimizing the overhead required by negotiation protocols such as CSMA.

**[0014]** Code Division Multiple Access, or CDMA, allows a limited degree of shared use of a communications channel, wherein different nodes transmit using different encoding schemes that can be distinguished from each other by the receiving nodes.

**[0015]** Specifically in the case of wireless networks, Spatial Division Multiple Access, or SDMA, can also be used. One example of SDMA is the division of a geographic region into communication "cells" in a typical cellular telephone network.

**[0016]** Depending on the circumstances, some or all of the above spread-spectrum technologies can be combined so as to yield a further increase in communication speed. In general, however, even when spread-spectrum technologies are employed, the communication speed of a shared ad hoc wireless network is still significantly limited due to the requirement that only one node transmit over a single communication channel at any given time, and due to the added overhead of the various protocols that are used to avoid and/or recover from packet collisions.



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## SUMMARY OF THE INVENTION

**[0017]** A method is claimed that employs multiuser detection (MUD) technology so as to allow a plurality of nodes to transmit simultaneously over a shared communication channel in a wireless ad hoc digital network. The communication capacity of the wireless ad hoc network is thereby increased by up to an order of magnitude or more.

**[0018]** The details of various multiuser detection analysis methods are presented in references cited below, and are incorporated herein by reference. Fundamentally, MUD technology distinguishes, or "demodulates," overlapping digital signals by capitalizing on differences in certain signal parameters, including analog signal parameters, that are applicable to the digital signals, such as, but not limited to, relative time delay, signal amplitude, and signal phase. In a wireless network, all of these parameters will be affected by the relative distances between nodes, as well as by the presence of any intervening buildings or other structures or environmental anomalies that affect, attenuate, and/or reflect the signals. Multiple interfering signals can be distinguished using MUD technology, so long as the signal parameters for each of the overlapping signals are known, or can be accurately estimated.

**[0019]** In the present invention, each node on the shared wireless network is equipped with a MUD detector, and a plurality of nodes is allowed to transmit packets simultaneously on the same communication channel. Each transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel, such as may be created using frequency division multiple access (FDMA) or time division multiple access (TDMA) technology. The parameter-estimating symbol patterns allow the receiving nodes to easily and accurately estimate MUD-relevant parameters for each of the transmitting nodes, where typical MUD-relevant parameters may include amplitude, phase, relative carrier frequency offset, and rough time delay. Bandwidth can be conserved by using relatively low data-rate parameter channels, since a high rate of data



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transmission is not required for the parameter-estimating symbol patterns. In some embodiments, each transmitting node also transmits other information on the unshared dedicated parameter channel, such as identifying information (node "ID") and spreading code type.

**[0020]** In some embodiments, the total number of parameter channels, or "slots," corresponds to the maximum number of nodes that are allowed to transmit simultaneously on the main communication channel. In these embodiments, when a node wishes to transmit a packet, it first seeks an unoccupied parameter slot. Once an unoccupied slot is found, the node transmits its parameter-estimating symbol patterns at a low rate on the available parameter slot while simultaneously transmitting its packet at a high rate on the main communication channel.

**[0021]** By providing only a limited number of parameter slots, this approach serves to limit and control the number of nodes that can attempt to simultaneously transmit packets on the main communication channel, thereby preventing overburdening of the communication channel. No other network traffic detection is required, nor is any effort made to avoid collisions on the main communication channel. In fact, it is assumed that, in general, other nodes will be transmitting their packets simultaneously, and the MUD-equipped receiving nodes will be able to use the signal parameters estimated using the separately transmitted parameter-estimating symbol patterns to demodulate the packets upon detection.

**[0022]** In various embodiments, spread-spectrum technology is further employed to divide the main communication channel into a plurality of spread communication channels, each of which can be used simultaneously by a plurality of transmitting nodes.

**[0023]** Both the communication channels and the signal parameter channels may be provided using any of the spread-spectrum technologies known in the art, such as TDMA, FDMA, CDMA, or SDMA. In addition to the parameter-estimating symbol patterns, the parameter channels can also



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be used to transmit other node-specific information, such as carrier offsets, spreading code type(s), and node ID's.

**[0024]** The features and advantages described herein are not all-inclusive and, in particular, many additional features and advantages will be apparent to one of ordinary skill in the art in view of the drawings, specification, and claims. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and not to limit the scope of the inventive subject matter.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** Figure 1A is a functional diagram illustrating a single packet transmission on a shared, ad hoc, wireless, multiuser digital communication network of the prior art;

**[0026]** Figure 1B is a functional diagram illustrating a packet collision due to simultaneous transmission by two nodes on the network of Figure 1A;

**[0027]** Figure 1C is a functional diagram illustrating successful simultaneous transmission of a plurality of packets on a shared, ad hoc, wireless, multiuser digital communication network using an embodiment of the present invention;

**[0028]** Figure 2A is a time-flow diagram illustrating use of a prior art collision avoidance protocol to avoid collisions and recover therefrom;

**[0029]** Figure 2B is a time-flow diagram illustrating simultaneous transmission of packets according to an embodiment of the present invention;

**[0030]** Figure 3 is a graph illustrating FDMA spreading of a shared communication medium into a main communication channel and a plurality of parameter channels, according to an embodiment of the present invention;

**[0031]** Figure 4 is a flow diagram illustrating steps followed by a transmitting node in the embodiment of Figure 3; and



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**[0032]** Figure 5 is a flow diagram illustrating steps followed by a receiving node in the embodiment of Figure 3.

## DETAILED DESCRIPTION

**[0033]** In Figure 1A, a typical wireless ad hoc communication system of the prior art is illustrated, wherein four "nodes" 100, 102, 104, 106 are in communication through a wireless 802.11b network. For simplicity, the nodes are depicted as desktop computers in Figure 1A, but it is understood that each node can represent any network compatible device, such as a laptop computer, a mobile phone, a PDA, and such like. Figure 1A specifically illustrates a packet 108 being sent by one of the nodes 100 to another node 102. No other communication is attempted on the network during transmission of the packet 108, and the packet 108 is received successfully by the second node 102. However, the communication rate is slow, because the other nodes 104, 106 must refrain from transmitting until the packet 108 transmitted by the first node 100 is received by the second node 102.

**[0034]** Figure 1B illustrates the network of Figure 1A, wherein two of the nodes 100, 104 have attempted to transmit packets 110, 112 simultaneously to a third node 106. A "collision" has occurred whereby the third node 106 is unable to make any use of the two transmitted packets, since they overlap and cannot be distinguished from one another. Retransmission of the packets 110 112 will be needed so as to successfully deliver both packets 110, 112. Similar collisions will occur any time two nodes attempt to simultaneously transmit packets, whether or not the packets are directed to the same receiving node. Even if a collision avoidance protocol is used, such as CSMA/CA, excessive distance and/or an intervening structure between the two transmitting nodes 100, 104 may prevent them from directly detecting each other and avoiding the collision. And even if the 802.11b RTS/CTS packet exchange protocol serves to prevent the collision, significant loss of communication rate will still occur due to the requirement that only one node transmit at a time, and due to the overhead required by the CSMA/CA and RTS/CTS collision avoidance protocols.



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**[0035]** In one embodiment of the invention, each node on a shared wireless network is equipped with a MUD detector, and a plurality of nodes is allowed to transmit packets simultaneously on the same communication channel. Any of several MUD solutions can be implemented for this purpose. See for example patent application US 11/035,311 and US patents US 6,999,498, US 6,981,203, US 6,967,598, US 6,947,506, US 6,839,390, US 6,831,574 and US 6,704,376, all of which are incorporated herein by reference for all purposes. MUD technology distinguishes, or "demodulates," overlapping digital signals by capitalizing on differences in certain signal parameters that are applicable to the digital signals, such as, but not limited to, analog signal parameters that may include signal amplitude, signal phase, and relative time delay. In a wireless network, all of these parameters will be affected by the relative distances between nodes, as well as by the presence of any intervening buildings or other structures, or any environmental anomalies that affect, attenuate and/or reflect the signals. Multiple signals can be distinguished using MUD technology, so long as the signal parameters for each of the overlapping signals are known, or can be accurately estimated.

**[0036]** Figure 1C illustrates another embodiment of the present invention. The illustrated embodiment is similar to the network of Figure 1A and Figure 1B, but includes MUD detection implemented on each of the nodes 100, 102, 104, 106. In this embodiment, a spread-spectrum technology (not illustrated) is used to provide at least three separate, low-rate parameter channels. Three of the nodes 100, 102, 104 have each acquired one of these parameter channels, and are transmitting parameter-estimating symbol patterns on the parameter channels while simultaneously transmitting data packets 114, 116, 118 to a fourth node 106. In some embodiments, each transmitting node also transmits other information on the unshared dedicated parameter channel, such as identifying information (node "ID") and spreading code type. Because the parameter channels are dedicated, no collisions occur between the symbol patterns transmitted on them. In some embodiments, the transmit amplitude used for sending information on the parameter channels is higher than the amplitude used for transmitting information

on the main communication channel. So long as the receiving nodes know what the relative scale factor is, then signal parameters can still be accurately estimated, and the higher transmit amplitudes will allow for better signal-to-noise ratios and more accurate estimation of the signal parameters. In other embodiments, a random hopping pattern is included in the spread-spectrum technology that moves the parameter channels to different frequencies at predetermined times, which for some embodiments is based on a GPS clock time. The random-hopping pattern causes these embodiments to be resistant to jamming of the parameter channels.

**[0037]** The MUD detector included with the fourth node 106 is able to use the parameter-estimating symbol patterns to accurately estimate the signal parameters for the three transmitting nodes 114, 116, 118, and using the estimated parameters the fourth node 106 is able to demodulate the three packets 114, 116, 118 and receive all of them. Retransmission is not needed, and a high communication rate is achieved.

**[0038]** For simplicity, the nodes are depicted as desktop computers in Figure 1C, but it is understood that each node can represent any network compatible device, such as a laptop computer, a mobile phone, a PDA, and such like. It is also understood that the simultaneously transmitted packets do not necessarily need to be addressed to a common receiving node, but can be transmitted to any combination of receiving nodes.

**[0039]** Figure 2A is a time-flow diagram that illustrates the sharing of a common communication medium in a typical prior-art wireless 802.11b communication network. The horizontal bands in the diagram represent the activity of each of four nodes 200 communicating on the network. When a packet 202 is transmitted from node 1 to node 2, considerable overhead is required both before 204 and after 206 transmission of the main packet 208. During all of this time, the other nodes on the network must wait before attempting to transmit information. While the RTS/CTS protocol prevents most collisions between main



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packets, collisions 208 do occur between the RTS packets. This causes added delay and re-transmission, and leads to a lengthy required time T 212 for transmission of the six illustrated packets.

**[0040]** Figure 2B is a time flow diagram that illustrates the sharing of a common wireless communication medium in an embodiment of the present invention. No collision prevention protocols 204, 206 are required, and information packets 208 can be transmitted simultaneously. The result is that a larger number of data packets (eight are illustrated) can be communicated in a shorter amount of time 214.

**[0041]** Figure 3 is a graph illustrating an embodiment in which FDMA spreading is used to spread a shared communication medium into a main communication channel 300 and a plurality of parameter channels 302. The main communication channel 300 is a high rate channel and so requires a wide frequency bandwidth. The plurality of parameter channels 302 or "slots" are clustered together in a narrow range of frequencies 302. In Figure 3, several of the slots are occupied, and it can be seen that they are generally carrying signals of different amplitudes, corresponding to varying distances to the transmitting nodes, and also to the effects of intervening buildings and other obstacles that attenuate and/or reflect the transmitted signals. Some of the slots are unoccupied, and are available 304 for additional nodes to acquire and use while transmitting. When all of the slots are occupied, no additional nodes can transmit, thus effectively limiting the number of nodes that can transmit simultaneously.

**[0042]** Figure 4 is a flow diagram that illustrates the steps followed by a node that is seeking to transmit a packet on the network of Figure 3. The node first detects the traffic on the parameter channels 400 to determine if any slots are available 402. If not, then the node waits 404 and continues to monitor the parameter channels 400. If a slot is available, the node acquires one of the available parameter channels 406 and transmits a parameter-estimating symbol



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pattern 408 on the available signal channel while simultaneously transmitting the packet 410 on the main communication channel.

**[0043]** Figure 5 is a flow diagram that illustrates the steps followed by a node that is seeking to receive a packet on the network of Figure 3. The receiving node first acquires and detects all traffic on the parameter channels 500. The number of transmitting nodes can be determined directly from the number of slots that are occupied 502. The signal parameters for each of the transmitting nodes, including amplitude, phase, and relative time delay, can then be estimated 504 from the parameter-estimating symbol patterns transmitted on the parameter channels. In some embodiments other information is transmitted on the parameter channels, such as main channel frequency offset and transmitting node ID. The estimated parameters are then provided to the MUD detector 506, so that the overlapping information packets that are simultaneously received 508 can be demodulated by the MUD detector 510 and individually received.

**[0044]** The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of this disclosure. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.



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# CLAIMS

What is claimed is:

1. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:

providing a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

2. The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.

3. The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.

4. The method of claim 1, wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.

5. The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.

6. The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.



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7. The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.

8. The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.

9. The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.

10. The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

11. The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.

12. The method of claim 1, further comprising requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

13. The method of claim 1, wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies.

14. The method of claim 13, wherein the parameter channels are shifted according to a random hopping pattern.

15. The method of claim 14, wherein the random hopping pattern is based on a GPS clock timebase.

16. The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.

17. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared



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communication channel of a wireless ad-hoc digital network, the method comprising:

using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

18. The method of claim 17, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

19. A method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising:

using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes; and

detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

20. The method of claim 19, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.



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**Media Access Control Protocol for Multiuser Detection Enabled Ad-Hoc Wireless Communications**

## ABSTRACT OF THE DISCLOSURE

**[0045]** A method is disclosed for increasing the communication capacity of a shared ad-hoc wireless channel by using multiuser detection (MUD) to distinguish overlapping information transmitted simultaneously by a plurality of nodes. The transmitting nodes simultaneously provide parameter-estimating signals over separate, unshared, low-rate parameter channels generated using orthogonal frequencies, spread spectrum technology, or time multiplexing. Receiving nodes use these separate, non-overlapping parameter-estimating signals to estimate MUD-required signal parameters such as amplitude, phase, and frequency offset, thereby enabling use of lower complexity MUD receivers, because the parameters are not estimated in the presence of other interference. Node ID, spreading code type, and/or other information can also be transmitted over the parameter channels. Limiting the number of parameter channels can limit the maximum number of transmitting nodes. Amplitudes of parameter channel transmissions can be greater than communication channel transmissions by a known ratio. Parameter channels can be frequency-hopped for jam-resistance.



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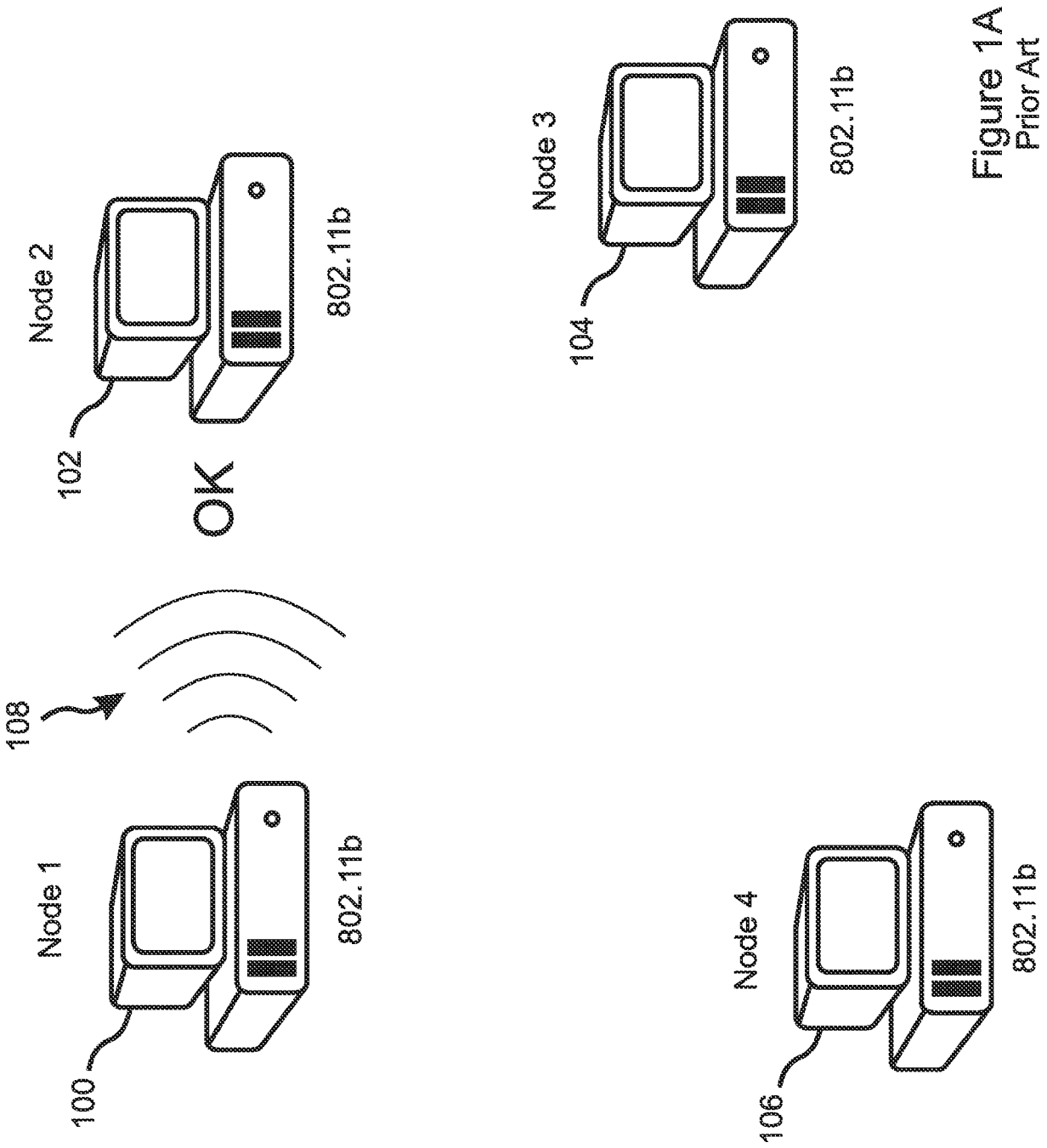



Figure 1A
Prior Art

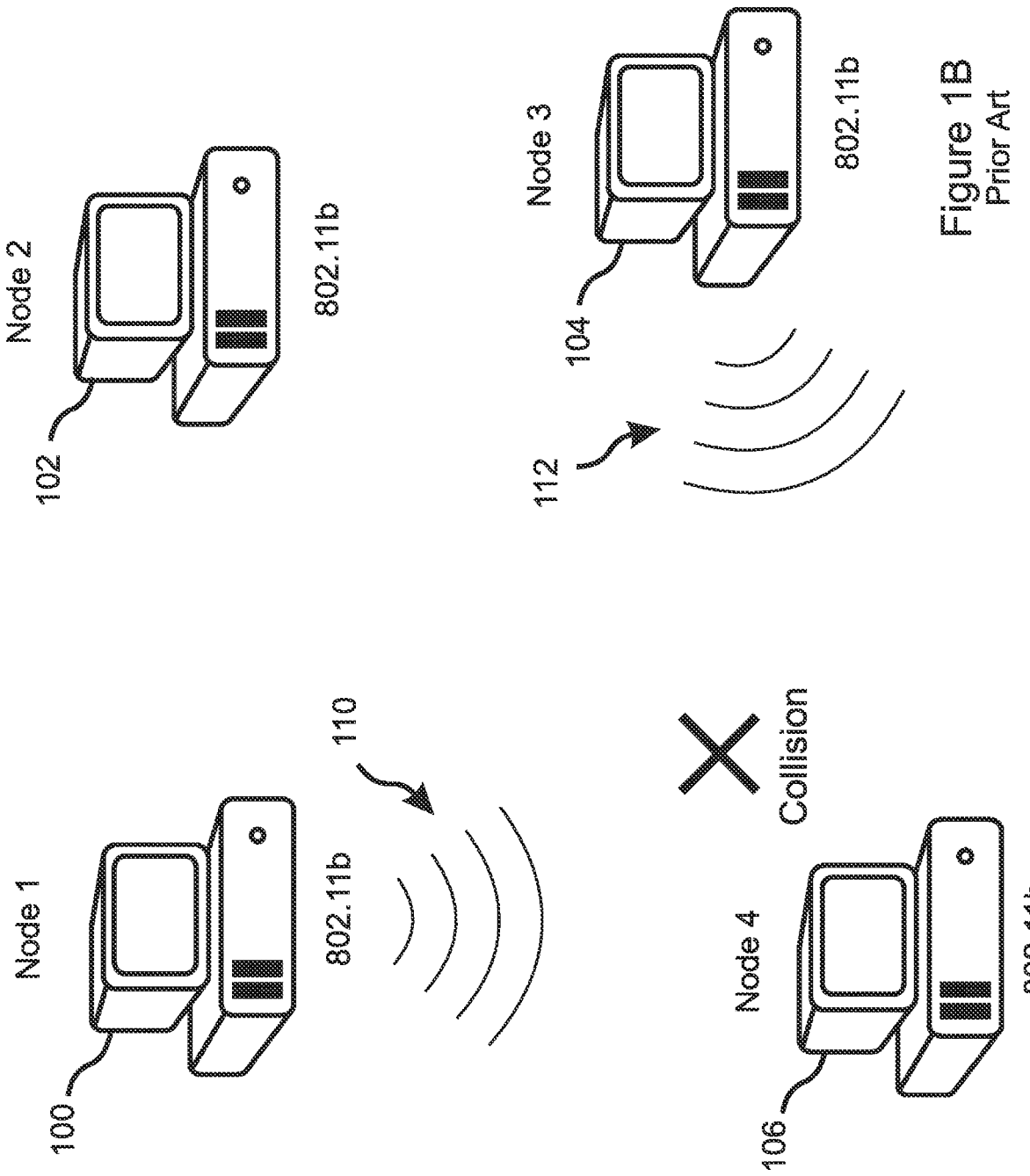



Figure 1B
Prior Art

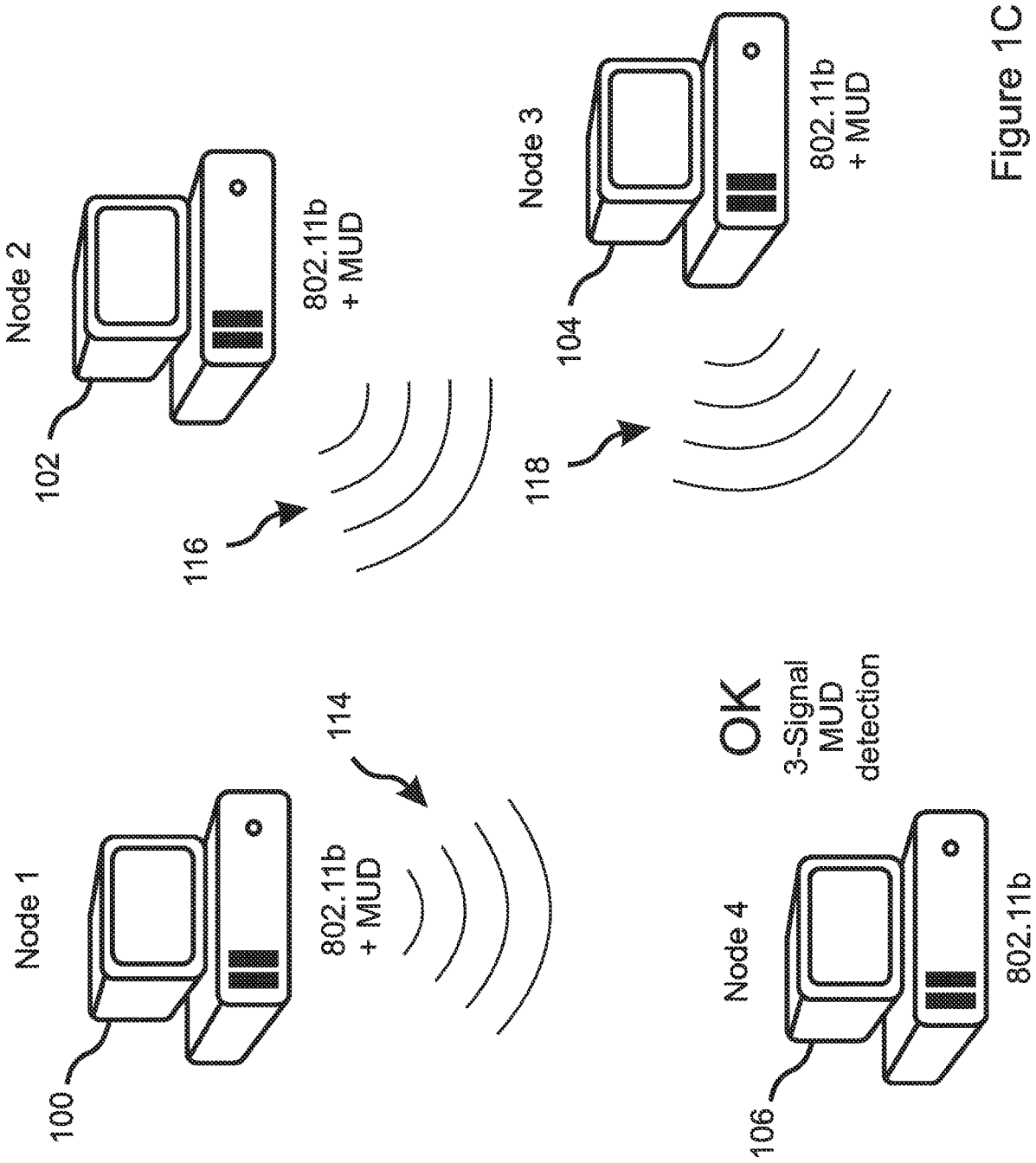

Node 1
100
802.11b
+ MUD
114
Node 2
102
802.11b
+ MUD
116
Node 3
104
802.11b
+ MUD
118
Node 4
106
802.11b
+ MUD
OK
3-Signal
MUD
detection

Figure 1C

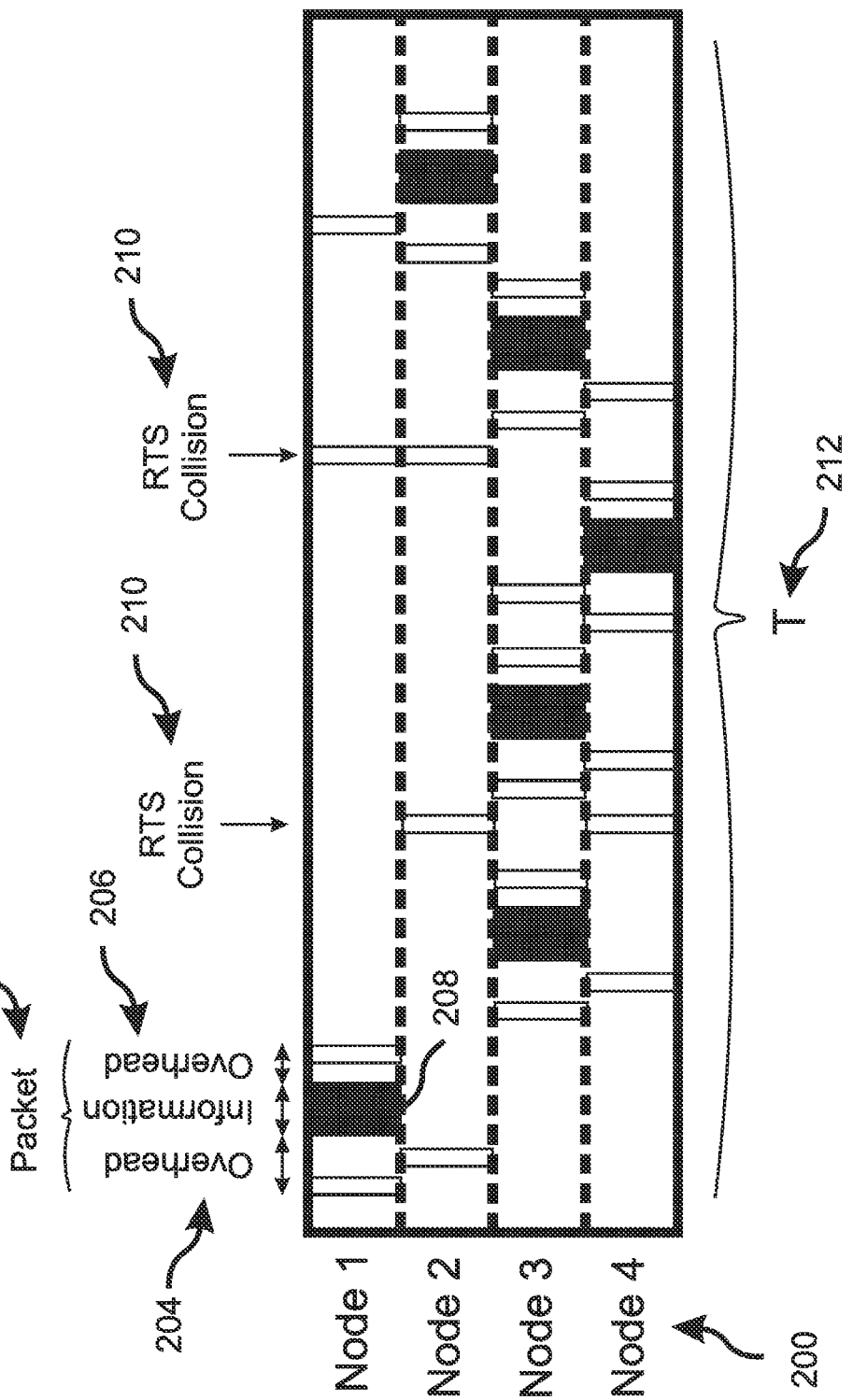



Figure 2A
Prior Art

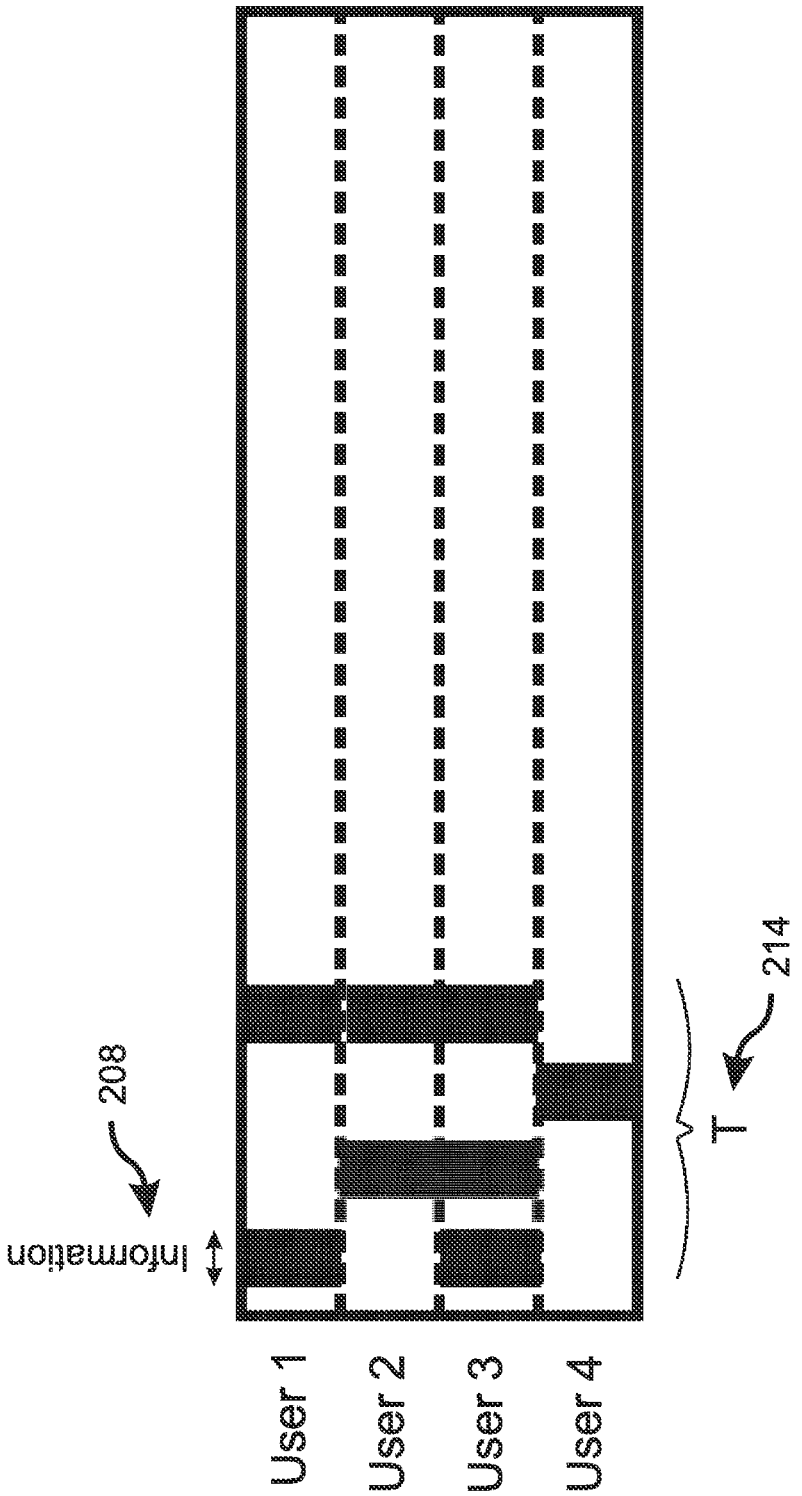



Figure 2B

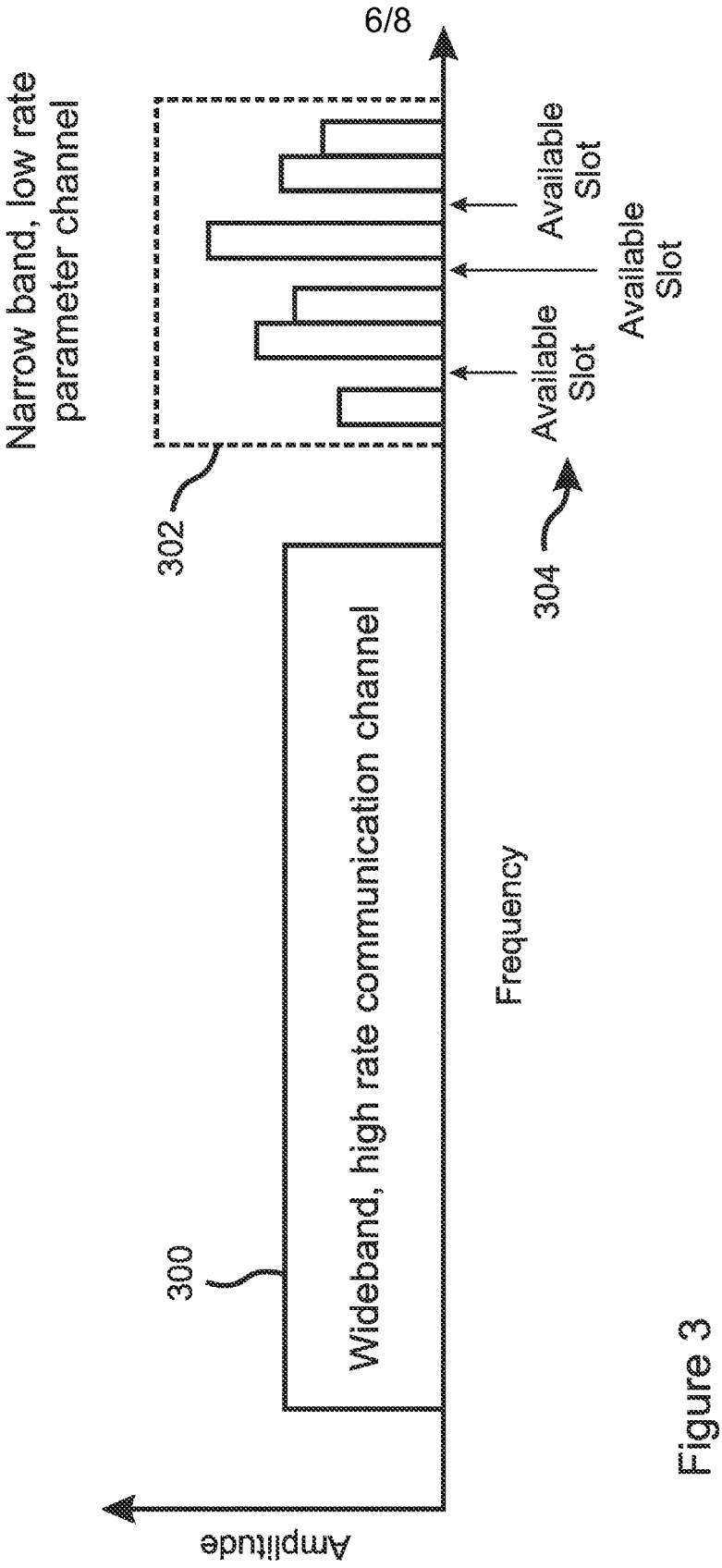

Narrow band, low rate parameter channel
302
Available Slot
Available Slot
Available Slot
304
Wideband, high rate communication channel
300
Frequency
Amplitude

Figure 3

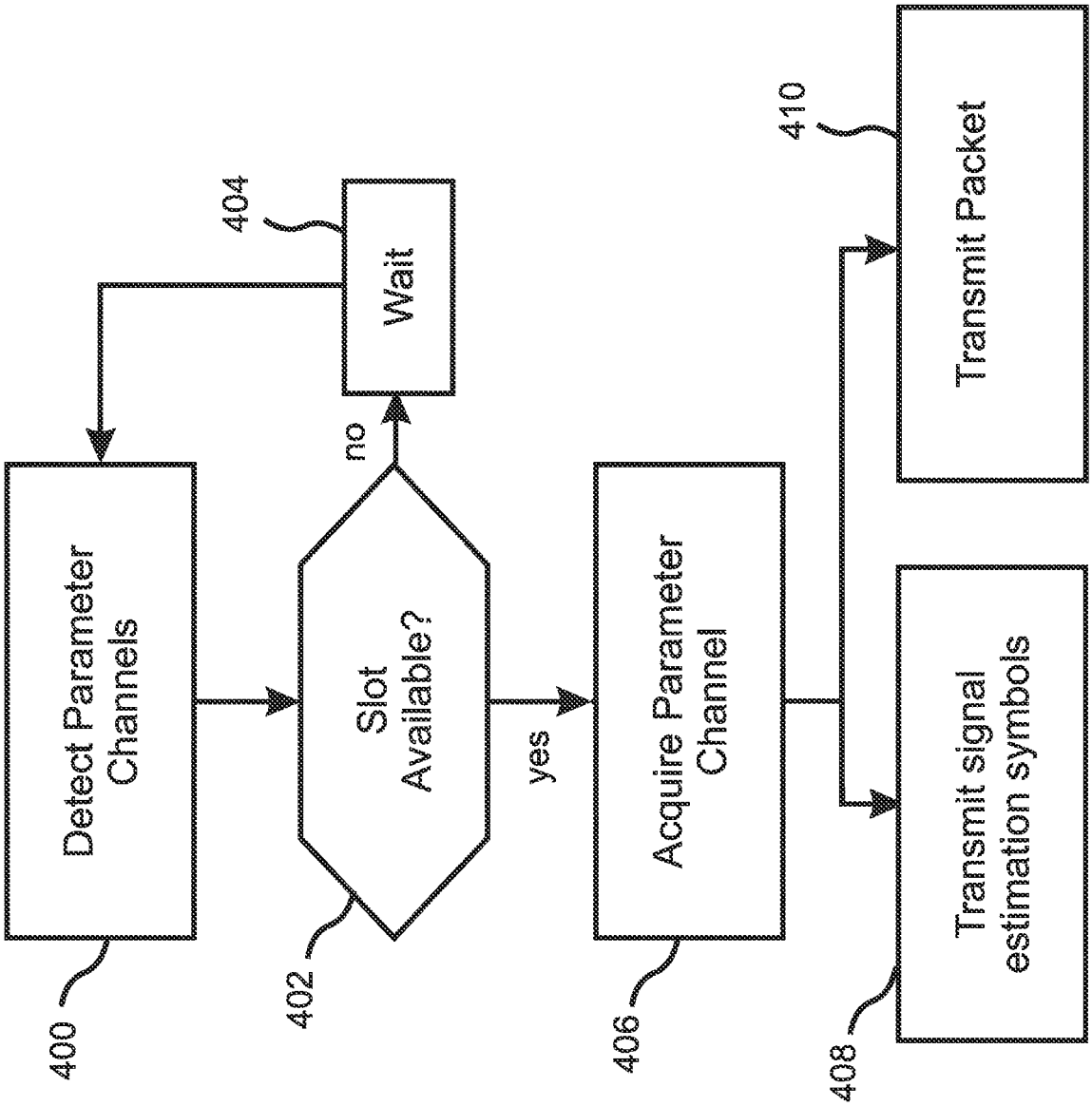

Detect Parameter Channels
400
Slot Available?
402
no
yes
Wait
404
Acquire Parameter Channel
406
Transmit signal estimation symbols
408
Transmit Packet
410

Figure 4

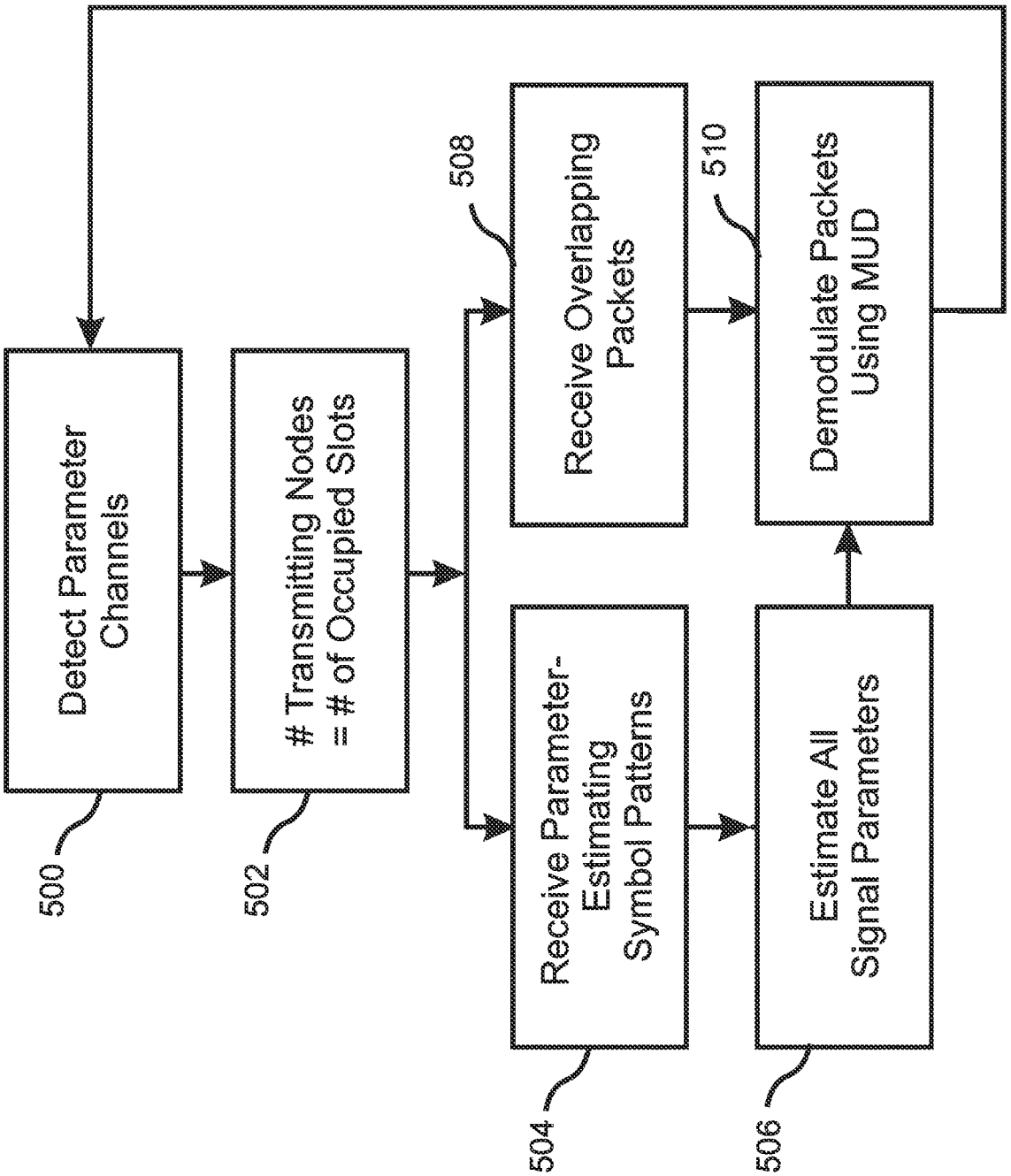

Detect Parameter Channels
# Transmitting Nodes = # of Occupied Slots
Receive Overlapping Packets
Demodulate Packets Using MUD
Receive Parameter-Estimating Symbol Patterns
Estimate All Signal Parameters
500
502
504
506
508
510

Figure 5

**Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)**

*The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.*

**Declaration of inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv)) for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ . . . . . (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications: . . . . . .

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

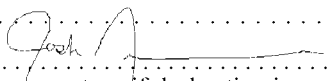
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**Name**: Joshua D. Niedzwiecki

Residence: Manchester NH 03104 USA
(city and either US state, if applicable, or country)

Mailing Address: 34 Hickory St, Manchester NH 03103 USA

Citizenship: US

Inventor's Signature:  Date: 9/26/09
(if not contained in the request, or if declaration is corrected or added under Rule 26*ter* after the filing of the international application. The signature must be that of the inventor, not that of the agent)

(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26*ter* after the filing of the international application)

**Name**: Brandon P. Hombs

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(city and either US state, if applicable, or country)

Mailing Address: 15 Whitewood Lane, Merrimack, NH 03054 USA

Citizenship: US

Inventor's Signature: Brandon Hombs (esignature) Date: 9/26/09
(if not contained in the request, or if declaration is corrected or added under Rule 26*ter* after the filing of the international application. The signature must be that of the inventor, not that of the agent)

(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26*ter* after the filing of the international application)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

PTO-1390 (Rev. 09-08)
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# TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

| ATTORNEY'S DOCKET NUMBER | |
|---|---|
| 20060108-US | |
| U.S. APPLICATION NO. (If known, see 37 CFR 1.5) | |

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |
|---|---|---|
| PCT/US2009/058409 | 2009.09.25 (2009 SEP 25) | 2008.09.26 (2008 SEP 26) |

TITLE OF INVENTION
MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMU

APPLICANT(S) FOR DO/EO/US
Joshua D. Niedzwiecki; Brandon P. Hombs

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☑ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☑ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☑ The US has been elected (Article 31).
5. ☑ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☑ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☑ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☑ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☑ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11 to 20 below concern document(s) or information included:**

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A preliminary amendment.
14. ☑ An Application Data Sheet under 37 CFR 1.76.
15. ☐ A substitute specification.
16. ☐ A power of attorney and/or change of address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821- 1.825.
18. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering information, preparing, and submitting the completed form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

| U.S. APPLICATION NO. (if known, see 37 CFR 1.5) | INTERNATIONAL APPLICATION NO. | ATTORNEY'S DOCKET NUMBER |
|---|---|---|
| | PCT/US2009/058409 | 20060108-US |

20. Other items or information:

| The following fees have been submitted | CALCULATIONS | PTO USE ONLY |
|---|---|---|
| 21. ☑ Basic national fee (37 CFR 1.492(a)) ..... **$330** | $ 330 | |
| 22. ☑ Examination fee (37 CFR 1.492(c))<br>If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0**<br>All other situations ..... **$220** | $ 220 | |
| 23. ☑ Search fee (37 CFR 1.492(b))<br>If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0**<br>Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ..... **$100**<br>International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ..... **$430**<br>All other situations ..... **$540** | $ 100 | |
| **TOTAL OF 21, 22 and 23 =** | 650 | |

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)).
The fee is **$270** for each additional 50 sheets of paper or fraction thereof.

| Total Sheets | Extra Sheets | Number of each additional 50 or fraction thereof (round **up** to a whole number) | RATE | |
|---|---|---|---|---|
| - 100 = | /50 = | | x **$270** | $ 0 |

| | | |
|---|---|---|
| Surcharge of **$130.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)). | $ 0 | |

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | | |
|---|---|---|---|---|---|
| Total claims | 20 - 20 = | 0 | x **$ 52** | $ 0 | |
| Independent claims | 3 - 3 = | 0 | x **$220** | $ 0 | |
| MULTIPLE DEPENDENT CLAIM(S) (if applicable) | | | + **$390** | $ 0 | |
| | | | **TOTAL OF ABOVE CALCULATIONS =** | $ 650 | |
| ☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½. | | | | 0 | |
| | | | **SUBTOTAL =** | $ 650 | |
| Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). + | | | | $ 0 | |
| | | | **TOTAL NATIONAL FEE =** | $ 650 | |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property + | | | | $ 0 | |
| | | | **TOTAL FEES ENCLOSED =** | $ 650 | |
| | | | **Amount to be refunded:** | $ | |
| | | | **Amount to be charged** | $ | |

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☑ Please charge my Deposit Account No. 190130 in the amount of $ 650.00 to cover the above fees.

c. ☑ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 190130.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

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**NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.**

SEND ALL CORRESPONDENCE TO:

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BAE SYSTEMS
PO BOX 868
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UNITED STATES

/Vernon C. Maine, Reg. No. 37,389/
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Vernon C. Maine
NAME
37,389
REGISTRATION NUMBER

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Filer:** | Vernon Carl Maine/Debra Stengel |
| **Attorney Docket Number:** | 20060108-US |

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| National Stage Fee | 1631 | 1 | 330 | 330 |
| Natl Stage Search Fee - U.S. was the ISA | 1641 | 1 | 100 | 100 |
| National Stage Exam - all other cases | 1633 | 1 | 220 | 220 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
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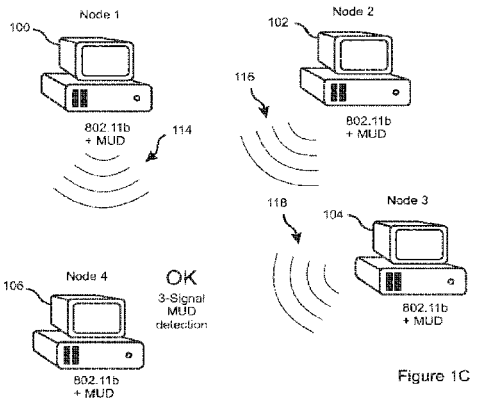



Figure 1C

(57) **Abstract**: Increasing the communication capacity of a shared ad-hoc wireless channel by using MUD to distinguish overlapping information transmitted simultaneously by a plurality of nodes. The transmitting nodes simultaneously provide parameter-estimating signals over separate, unshared, low-rate parameter channels generated using orthogonal frequencies, spread spectrum technology, or time multiplexing. Receiving nodes use these separate, non-overlapping parameter-estimating signals to estimate MUD-required signal parameters such as amplitude, phase, and frequency offset, thereby enabling use of lower complexity MUD receivers, because the parameters are not estimated in the presence of other interference. Node ID, spreading code type, and/or other information can also be transmitted over the parameter channels. Limiting the number of parameter channels can limit the maximum number of transmitting nodes. Amplitudes of parameter channel transmissions can be greater than communication channel transmissions by a known ratio. Parameter channels can be frequency-hopped for jam-resistance.

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# MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

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## RELATED APPLICATIONS

**[0001]** This application claims the benefit of U.S. Provisional Applications No. 61/100,461, filed September 26, 2008, which is herein incorporated by reference in its entirety for all purposes.

## STATEMENT OF GOVERNMENT INTEREST

**[0002]** This invention was made with United States Government support under Contract No. HROOll-05-C-0064 awarded by the Defense Advanced Research Projects Agency (DARPA). The United States Government has certain rights in this invention.

## FIELD OF THE INVENTION

**[0003]** The invention relates to digital communication systems, and more particularly to ad hoc wireless multiuser digital communication systems.

## BACKGROUND OF THE INVENTION

**[0004]** In digital communications, it is often desirable for a plurality of users, or "nodes" to communicate over a shared, multiuser network, rather than relying on point-to-point communication. While point-to-point communication offers the advantage of guaranteed, dedicated access to a communication medium, and consequent high communication speeds, implementation costs for a point-to-point communication system can be prohibitively high, scalability is typically difficult, and configuration can be burdensome.

**[0005]** Shared, multiuser networks allow a plurality of users, or "nodes," to share a common communication medium, thereby reducing costs and enhancing scalability and ease of configuration. Of course, a significant disadvantage of shared medium networks as compared to point-to-point networks is that they are much more limited in traffic capacity, due to the requirement that only one node transmit information on the shared communication medium at any given time. If more than one node attempts to transmit at the same time, a so-called "collision" occurs, whereby the transmitted information is unintelligible, and must be re-transmitted.

**[0006]** Shared networks are typically either "managed" or "ad hoc." In a managed network, a central controller or "access point" manages use of the shared communication medium, thereby minimizing collisions and managing recovery from any collisions that do occur. In an "ad hoc" network, all nodes are treated equally, and must negotiate directly with each other so as to coordinate use of the shared communication medium, avoid collisions, and recover from collisions. Typical examples of ad hoc digital networks include Ethernet networks and wireless "802.11b" networks.

**[0007]** The decentralized nature of ad hoc networks makes them suitable for a variety of applications. They are naturally robust, since no single node is vital to the network, and they are easy to scale, since configuration requirements are typically minimal, and deployment is usually quick and automatic.

**[0008]** However, due to the lack of a central controller, ad hoc networks must use special protocols so as to avoid and recover from collisions. One commonly used protocol is the Carrier Sense Multiple Access protocol, or CSMA. In this approach, each node monitors the network so as to sense if any communication traffic is present. A node only attempts to transmit information when no traffic is detected. Collision avoidance can be further enhanced in wired networks by using a CSMA/CD protocol, which adds "Collision Detection" to the basic CSMA protocol. In CSMA/CD, a transmitting node monitors the network while it is



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transmitting, halts transmission if a packet collision is detected, and then repeats the attempt at a later time.

**[0009]** However, it is typically not possible for collision detection to be used in a wireless network, since it is generally not possible for a wireless node to monitor the network while it is transmitting. Hence, it is not generally possible for a wireless node to directly detect collisions during transmission, making it impossible for a wireless network to use collision detection protocols such as CSMA/CD. Also, due to distances and intervening structures, it may not be possible for a specific node in a wireless network to detect signals from all other wireless nodes on the network. The likelihood of inadvertent collisions in wireless ad hoc networks is therefore much greater than for wired networks.

**[0010]** So as to enhance avoidance of collisions on a wireless ad hoc network, a "Collision Avoidance" protocol such as CSMA/CA can be used. In the CSMA/CA approach, after determining that no traffic appears to be present on the network, a transmitting node first sends a signal to all other nodes instructing them not to transmit, and then transmits its packet of information. CSMA/CA can be further enhanced by the exchange of a Request to Send (RTS) packet sent by the sender, and a Clear to Send (CTS) packet sent in reply by the intended receiver. These packets serve to alert all nodes within range of the sender, the receiver, or both, to keep quiet for the duration of the main packet. This is known as the IEEE 802.11 RTS/CTS exchange.

**[0011]** As mentioned above, a significant disadvantage of shared medium networks as compared to point-to-point networks is that shared networks are much more limited in traffic capacity, due to the requirement that only one node transmit information on the shared communication medium at any given time. This requirement can be relaxed somewhat by using one or more so-called "spread-spectrum" technologies to "spread" the shared communications medium into a plurality of separately usable communications channels.



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**[0012]** For example, Frequency Division Multiple Access, or FDMA technology, provides for transmissions to occur in different frequency bands on the shared communications medium. Filters are then used to isolate the transmissions on the separate frequency channels, allowing for simultaneous information transmission on each of the frequency-separated channels. Of course, FDMA requires an increased communication bandwidth, and so is limited in wireless applications according to bandwidth allocations.

**[0013]** Time Division Multiple Access, or TDMA, divides time into available channel "slots." Nodes transmit in rapid succession, one after the other, in a repeating cycle, each node using its own time slot. This approach accelerates communication rates by minimizing the overhead required by negotiation protocols such as CSMA.

**[0014]** Code Division Multiple Access, or CDMA, allows a limited degree of shared use of a communications channel, wherein different nodes transmit using different encoding schemes that can be distinguished from each other by the receiving nodes.

**[0015]** Specifically in the case of wireless networks, Spatial Division Multiple Access, or SDMA, can also be used. One example of SDMA is the division of a geographic region into communication "cells" in a typical cellular telephone network.

**[0016]** Depending on the circumstances, some or all of the above spread-spectrum technologies can be combined so as to yield a further increase in communication speed. In general, however, even when spread-spectrum technologies are employed, the communication speed of a shared ad hoc wireless network is still significantly limited due to the requirement that only one node transmit over a single communication channel at any given time, and due to the added overhead of the various protocols that are used to avoid and/or recover from packet collisions.



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## SUMMARY OF THE INVENTION

**[0017]** A method is claimed that employs multiuser detection (MUD) technology so as to allow a plurality of nodes to transmit simultaneously over a shared communication channel in a wireless ad hoc digital network. The communication capacity of the wireless ad hoc network is thereby increased by up to an order of magnitude or more.

**[0018]** The details of various multiuser detection analysis methods are presented in references cited below, and are incorporated herein by reference. Fundamentally, MUD technology distinguishes, or "demodulates," overlapping digital signals by capitalizing on differences in certain signal parameters, including analog signal parameters, that are applicable to the digital signals, such as, but not limited to, relative time delay, signal amplitude, and signal phase. In a wireless network, all of these parameters will be affected by the relative distances between nodes, as well as by the presence of any intervening buildings or other structures or environmental anomalies that affect, attenuate, and/or reflect the signals. Multiple interfering signals can be distinguished using MUD technology, so long as the signal parameters for each of the overlapping signals are known, or can be accurately estimated.

**[0019]** In the present invention, each node on the shared wireless network is equipped with a MUD detector, and a plurality of nodes is allowed to transmit packets simultaneously on the same communication channel. Each transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel, such as may be created using frequency division multiple access (FDMA) or time division multiple access (TDMA) technology. The parameter-estimating symbol patterns allow the receiving nodes to easily and accurately estimate MUD-relevant parameters for each of the transmitting nodes, where typical MUD-relevant parameters may include amplitude, phase, relative carrier frequency offset, and rough time delay. Bandwidth can be conserved by using relatively low data-rate parameter channels, since a high rate of data



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transmission is not required for the parameter-estimating symbol patterns. In some embodiments, each transmitting node also transmits other information on the unshared dedicated parameter channel, such as identifying information (node "ID") and spreading code type.

**[0020]** In some embodiments, the total number of parameter channels, or "slots," corresponds to the maximum number of nodes that are allowed to transmit simultaneously on the main communication channel. In these embodiments, when a node wishes to transmit a packet, it first seeks an unoccupied parameter slot. Once an unoccupied slot is found, the node transmits its parameter-estimating symbol patterns at a low rate on the available parameter slot while simultaneously transmitting its packet at a high rate on the main communication channel.

**[0021]** By providing only a limited number of parameter slots, this approach serves to limit and control the number of nodes that can attempt to simultaneously transmit packets on the main communication channel, thereby preventing overburdening of the communication channel. No other network traffic detection is required, nor is any effort made to avoid collisions on the main communication channel. In fact, it is assumed that, in general, other nodes will be transmitting their packets simultaneously, and the MUD-equipped receiving nodes will be able to use the signal parameters estimated using the separately transmitted parameter-estimating symbol patterns to demodulate the packets upon detection.

**[0022]** In various embodiments, spread-spectrum technology is further employed to divide the main communication channel into a plurality of spread communication channels, each of which can be used simultaneously by a plurality of transmitting nodes.

**[0023]** Both the communication channels and the signal parameter channels may be provided using any of the spread-spectrum technologies known in the art, such as TDMA, FDMA, CDMA, or SDMA. In addition to the parameter-estimating symbol patterns, the parameter channels can also



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be used to transmit other node-specific information, such as carrier offsets, spreading code type(s), and node ID's.

**[0024]** The features and advantages described herein are not all-inclusive and, in particular, many additional features and advantages will be apparent to one of ordinary skill in the art in view of the drawings, specification, and claims. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and not to limit the scope of the inventive subject matter.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** Figure 1A is a functional diagram illustrating a single packet transmission on a shared, ad hoc, wireless, multiuser digital communication network of the prior art;

**[0026]** Figure 1B is a functional diagram illustrating a packet collision due to simultaneous transmission by two nodes on the network of Figure 1A;

**[0027]** Figure 1C is a functional diagram illustrating successful simultaneous transmission of a plurality of packets on a shared, ad hoc, wireless, multiuser digital communication network using an embodiment of the present invention;

**[0028]** Figure 2A is a time-flow diagram illustrating use of a prior art collision avoidance protocol to avoid collisions and recover therefrom;

**[0029]** Figure 2B is a time-flow diagram illustrating simultaneous transmission of packets according to an embodiment of the present invention;

**[0030]** Figure 3 is a graph illustrating FDMA spreading of a shared communication medium into a main communication channel and a plurality of parameter channels, according to an embodiment of the present invention;

**[0031]** Figure 4 is a flow diagram illustrating steps followed by a transmitting node in the embodiment of Figure 3; and



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**[0032]** Figure 5 is a flow diagram illustrating steps followed by a receiving node in the embodiment of Figure 3.

## DETAILED DESCRIPTION

**[0033]** In Figure 1A, a typical wireless ad hoc communication system of the prior art is illustrated, wherein four "nodes" 100, 102, 104, 106 are in communication through a wireless 802.11b network. For simplicity, the nodes are depicted as desktop computers in Figure 1A, but it is understood that each node can represent any network compatible device, such as a laptop computer, a mobile phone, a PDA, and such like. Figure 1A specifically illustrates a packet 108 being sent by one of the nodes 100 to another node 102. No other communication is attempted on the network during transmission of the packet 108, and the packet 108 is received successfully by the second node 102. However, the communication rate is slow, because the other nodes 104, 106 must refrain from transmitting until the packet 108 transmitted by the first node 100 is received by the second node 102.

**[0034]** Figure 1B illustrates the network of Figure 1A, wherein two of the nodes 100, 104 have attempted to transmit packets 110, 112 simultaneously to a third node 106. A "collision" has occurred whereby the third node 106 is unable to make any use of the two transmitted packets, since they overlap and cannot be distinguished from one another. Retransmission of the packets 110 112 will be needed so as to successfully deliver both packets 110, 112. Similar collisions will occur any time two nodes attempt to simultaneously transmit packets, whether or not the packets are directed to the same receiving node. Even if a collision avoidance protocol is used, such as CSMA/CA, excessive distance and/or an intervening structure between the two transmitting nodes 100, 104 may prevent them from directly detecting each other and avoiding the collision. And even if the 802.11b RTS/CTS packet exchange protocol serves to prevent the collision, significant loss of communication rate will still occur due to the requirement that only one node transmit at a time, and due to the overhead required by the CSMA/CA and RTS/CTS collision avoidance protocols.



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**[0035]** In one embodiment of the invention, each node on a shared wireless network is equipped with a MUD detector, and a plurality of nodes is allowed to transmit packets simultaneously on the same communication channel. Any of several MUD solutions can be implemented for this purpose. See for example patent application US 11/035,311 and US patents US 6,999,498, US 6,981,203, US 6,967,598, US 6,947,506, US 6,839,390, US 6,831,574 and US 6,704,376, all of which are incorporated herein by reference for all purposes. MUD technology distinguishes, or "demodulates," overlapping digital signals by capitalizing on differences in certain signal parameters that are applicable to the digital signals, such as, but not limited to, analog signal parameters that may include signal amplitude, signal phase, and relative time delay. In a wireless network, all of these parameters will be affected by the relative distances between nodes, as well as by the presence of any intervening buildings or other structures, or any environmental anomalies that affect, attenuate and/or reflect the signals. Multiple signals can be distinguished using MUD technology, so long as the signal parameters for each of the overlapping signals are known, or can be accurately estimated.

**[0036]** Figure 1C illustrates another embodiment of the present invention. The illustrated embodiment is similar to the network of Figure 1A and Figure 1B, but includes MUD detection implemented on each of the nodes 100, 102, 104, 106. In this embodiment, a spread-spectrum technology (not illustrated) is used to provide at least three separate, low-rate parameter channels. Three of the nodes 100, 102, 104 have each acquired one of these parameter channels, and are transmitting parameter-estimating symbol patterns on the parameter channels while simultaneously transmitting data packets 114, 116, 118 to a fourth node 106. In some embodiments, each transmitting node also transmits other information on the unshared dedicated parameter channel, such as identifying information (node "ID") and spreading code type. Because the parameter channels are dedicated, no collisions occur between the symbol patterns transmitted on them. In some embodiments, the transmit amplitude used for sending information on the parameter channels is higher than the amplitude used for transmitting information

on the main communication channel. So long as the receiving nodes know what the relative scale factor is, then signal parameters can still be accurately estimated, and the higher transmit amplitudes will allow for better signal-to-noise ratios and more accurate estimation of the signal parameters. In other embodiments, a random hopping pattern is included in the spread-spectrum technology that moves the parameter channels to different frequencies at predetermined times, which for some embodiments is based on a GPS clock time. The random-hopping pattern causes these embodiments to be resistant to jamming of the parameter channels.

**[0037]** The MUD detector included with the fourth node 106 is able to use the parameter-estimating symbol patterns to accurately estimate the signal parameters for the three transmitting nodes 114, 116, 118, and using the estimated parameters the fourth node 106 is able to demodulate the three packets 114, 116, 118 and receive all of them. Retransmission is not needed, and a high communication rate is achieved.

**[0038]** For simplicity, the nodes are depicted as desktop computers in Figure 1C, but it is understood that each node can represent any network compatible device, such as a laptop computer, a mobile phone, a PDA, and such like. It is also understood that the simultaneously transmitted packets do not necessarily need to be addressed to a common receiving node, but can be transmitted to any combination of receiving nodes.

**[0039]** Figure 2A is a time-flow diagram that illustrates the sharing of a common communication medium in a typical prior-art wireless 802.11b communication network. The horizontal bands in the diagram represent the activity of each of four nodes 200 communicating on the network. When a packet 202 is transmitted from node 1 to node 2, considerable overhead is required both before 204 and after 206 transmission of the main packet 208. During all of this time, the other nodes on the network must wait before attempting to transmit information. While the RTS/CTS protocol prevents most collisions between main



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packets, collisions 208 do occur between the RTS packets. This causes added delay and re-transmission, and leads to a lengthy required time T 212 for transmission of the six illustrated packets.

**[0040]** Figure 2B is a time flow diagram that illustrates the sharing of a common wireless communication medium in an embodiment of the present invention. No collision prevention protocols 204, 206 are required, and information packets 208 can be transmitted simultaneously. The result is that a larger number of data packets (eight are illustrated) can be communicated in a shorter amount of time 214.

**[0041]** Figure 3 is a graph illustrating an embodiment in which FDMA spreading is used to spread a shared communication medium into a main communication channel 300 and a plurality of parameter channels 302. The main communication channel 300 is a high rate channel and so requires a wide frequency bandwidth. The plurality of parameter channels 302 or "slots" are clustered together in a narrow range of frequencies 302. In Figure 3, several of the slots are occupied, and it can be seen that they are generally carrying signals of different amplitudes, corresponding to varying distances to the transmitting nodes, and also to the effects of intervening buildings and other obstacles that attenuate and/or reflect the transmitted signals. Some of the slots are unoccupied, and are available 304 for additional nodes to acquire and use while transmitting. When all of the slots are occupied, no additional nodes can transmit, thus effectively limiting the number of nodes that can transmit simultaneously.

**[0042]** Figure 4 is a flow diagram that illustrates the steps followed by a node that is seeking to transmit a packet on the network of Figure 3. The node first detects the traffic on the parameter channels 400 to determine if any slots are available 402. If not, then the node waits 404 and continues to monitor the parameter channels 400. If a slot is available, the node acquires one of the available parameter channels 406 and transmits a parameter-estimating symbol



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pattern 408 on the available signal channel while simultaneously transmitting the packet 410 on the main communication channel.

**[0043]** Figure 5 is a flow diagram that illustrates the steps followed by a node that is seeking to receive a packet on the network of Figure 3. The receiving node first acquires and detects all traffic on the parameter channels 500. The number of transmitting nodes can be determined directly from the number of slots that are occupied 502. The signal parameters for each of the transmitting nodes, including amplitude, phase, and relative time delay, can then be estimated 504 from the parameter-estimating symbol patterns transmitted on the parameter channels. In some embodiments other information is transmitted on the parameter channels, such as main channel frequency offset and transmitting node ID. The estimated parameters are then provided to the MUD detector 506, so that the overlapping information packets that are simultaneously received 508 can be demodulated by the MUD detector 510 and individually received.

**[0044]** The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of this disclosure. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.



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# CLAIMS

What is claimed is:

1. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:

providing a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

2. The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.

3. The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.

4. The method of claim 1, wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.

5. The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.

6. The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.



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7. The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.

8. The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.

9. The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.

10. The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

11. The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.

12. The method of claim 1, further comprising requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

13. The method of claim 1, wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies.

14. The method of claim 13, wherein the parameter channels are shifted according to a random hopping pattern.

15. The method of claim 14, wherein the random hopping pattern is based on a GPS clock timebase.

16. The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.

17. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared



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communication channel of a wireless ad-hoc digital network, the method comprising:

using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

18. The method of claim 17, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

19. A method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising:

using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes; and



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detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

20. The method of claim 19, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.



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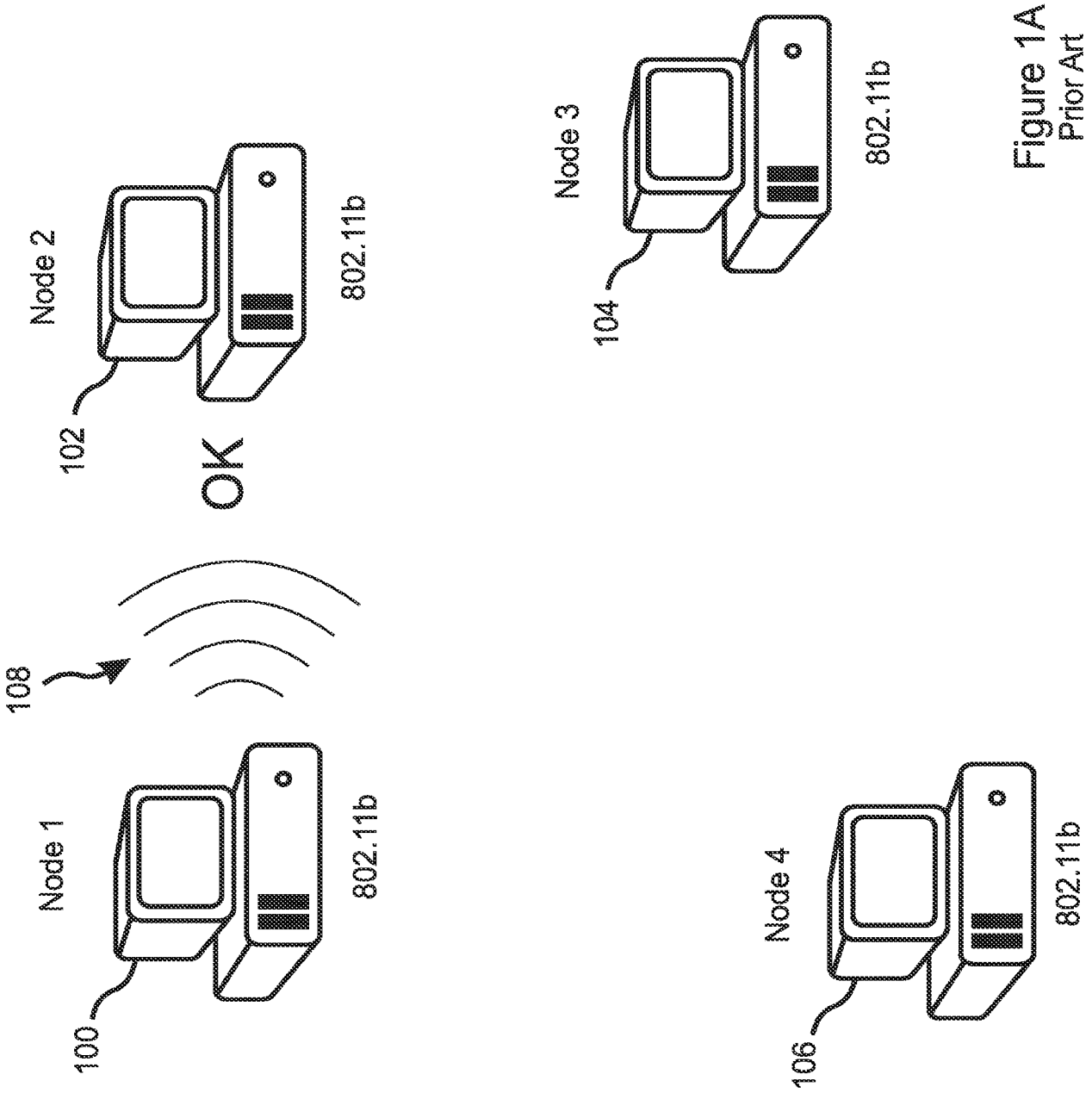



Figure 1A
Prior Art

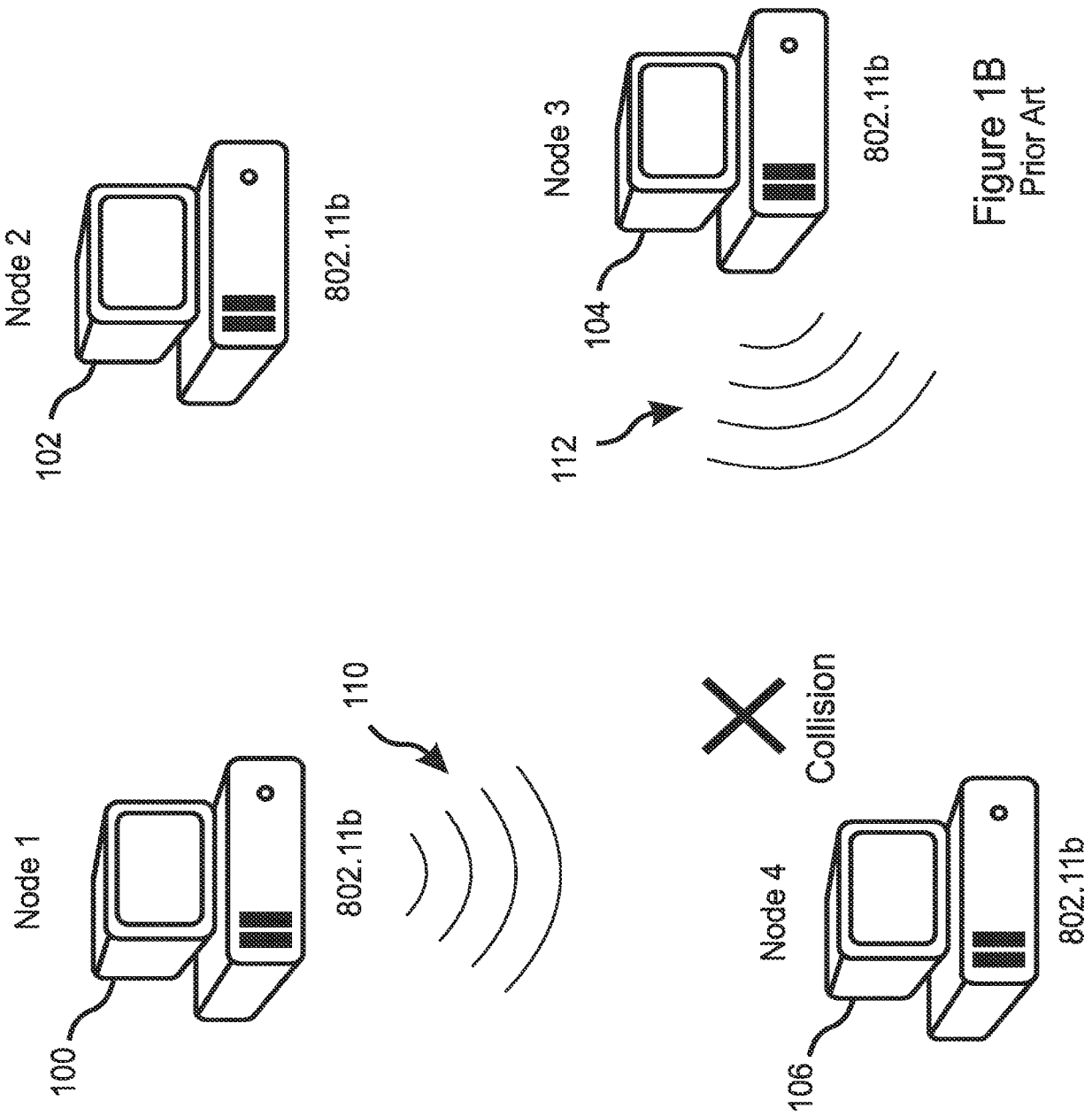



Figure 1B
Prior Art

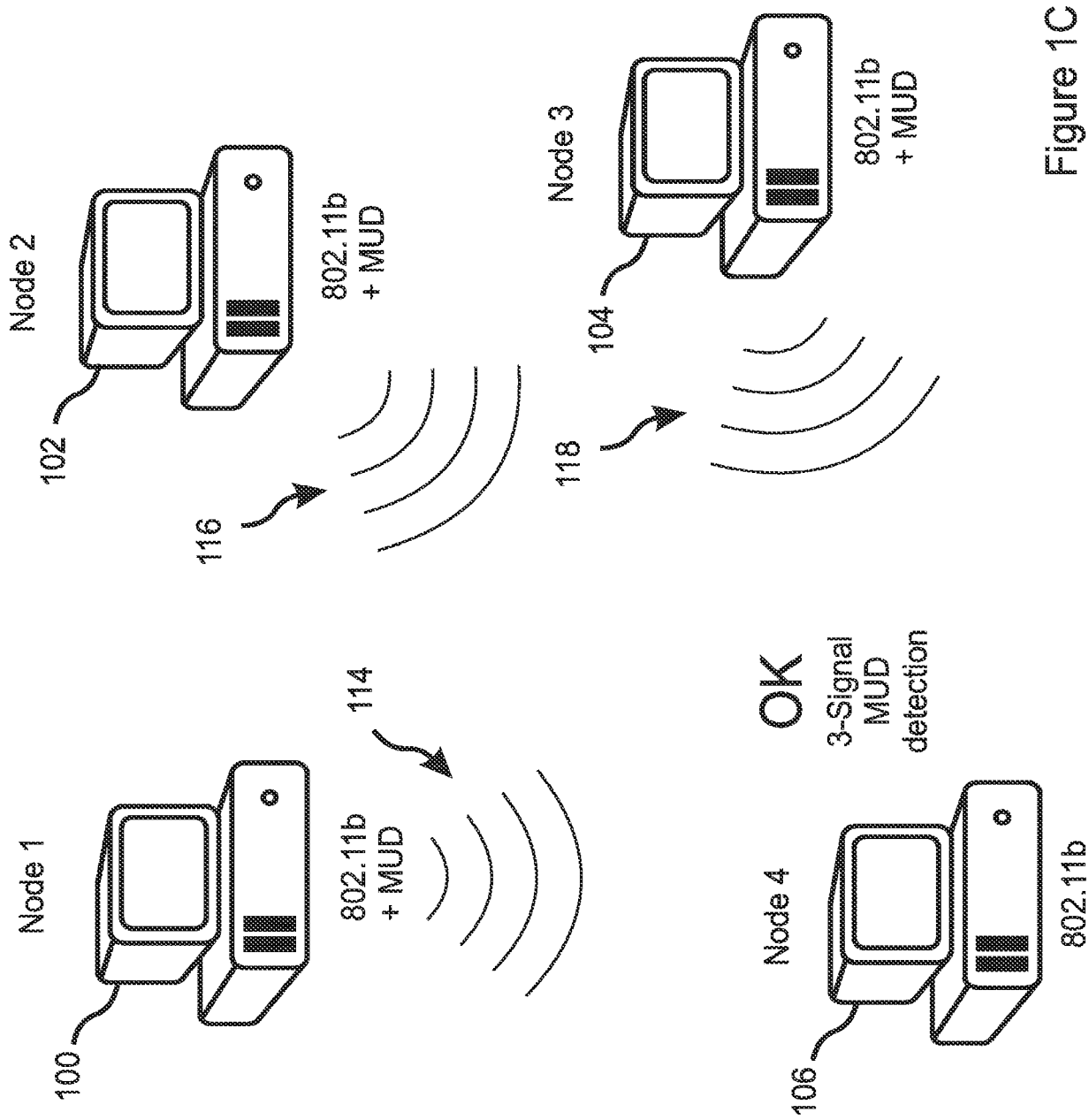

Node 1
100
802.11b
+ MUD
114
Node 2
102
802.11b
+ MUD
116
Node 3
104
802.11b
+ MUD
118
Node 4
106
802.11b
+ MUD
OK
3-Signal
MUD
detection

Figure 1C

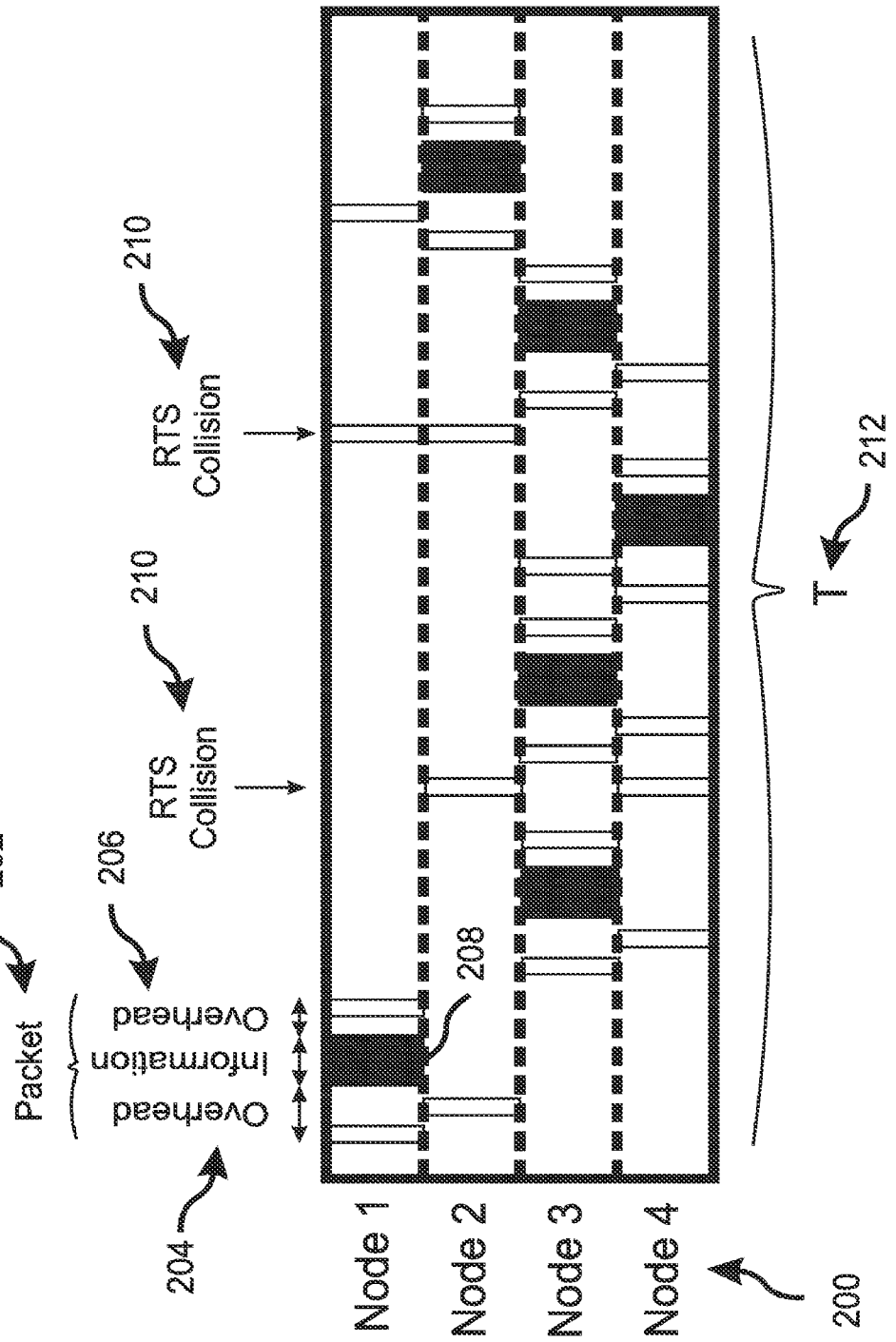



Figure 2A
Prior Art

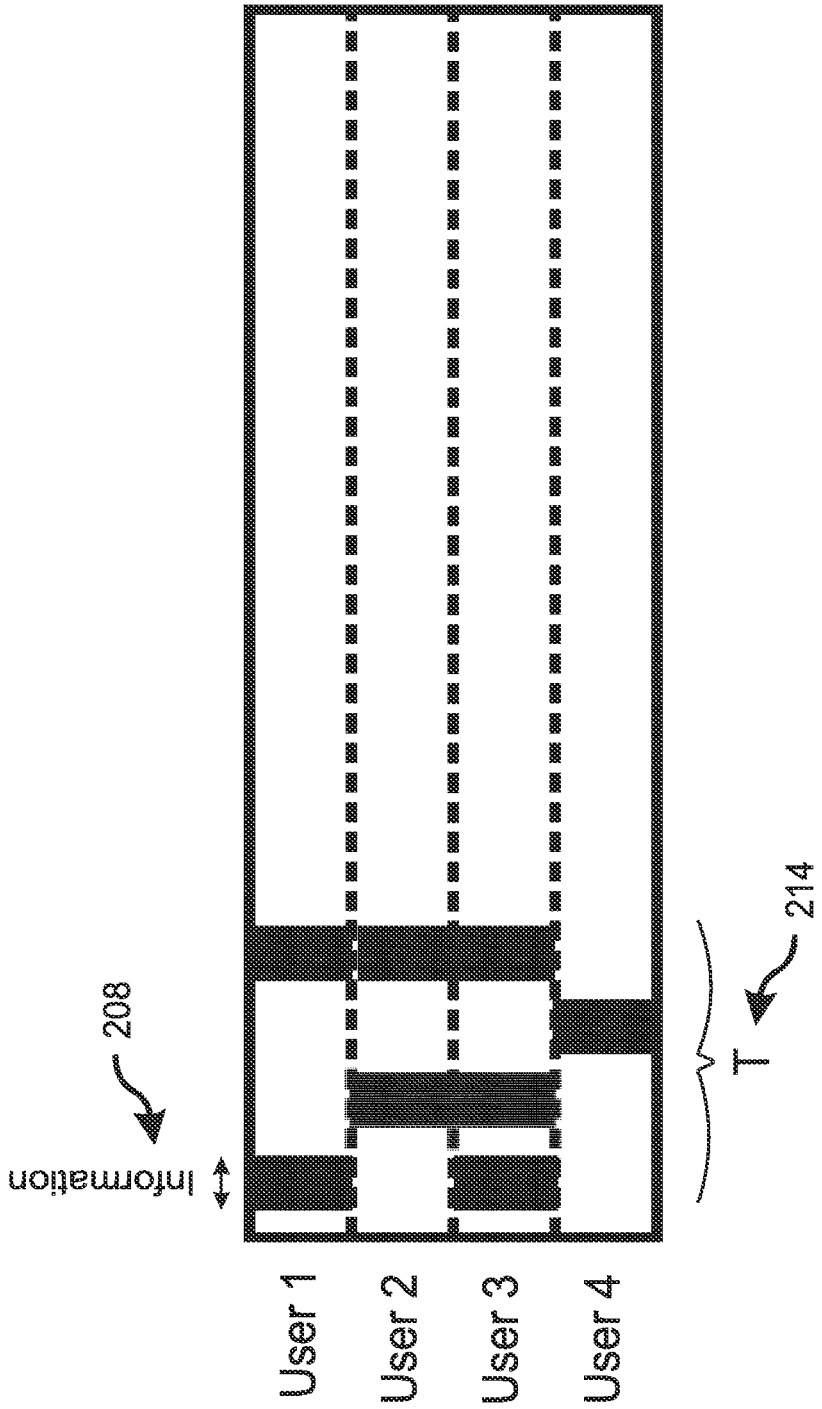



Figure 2B

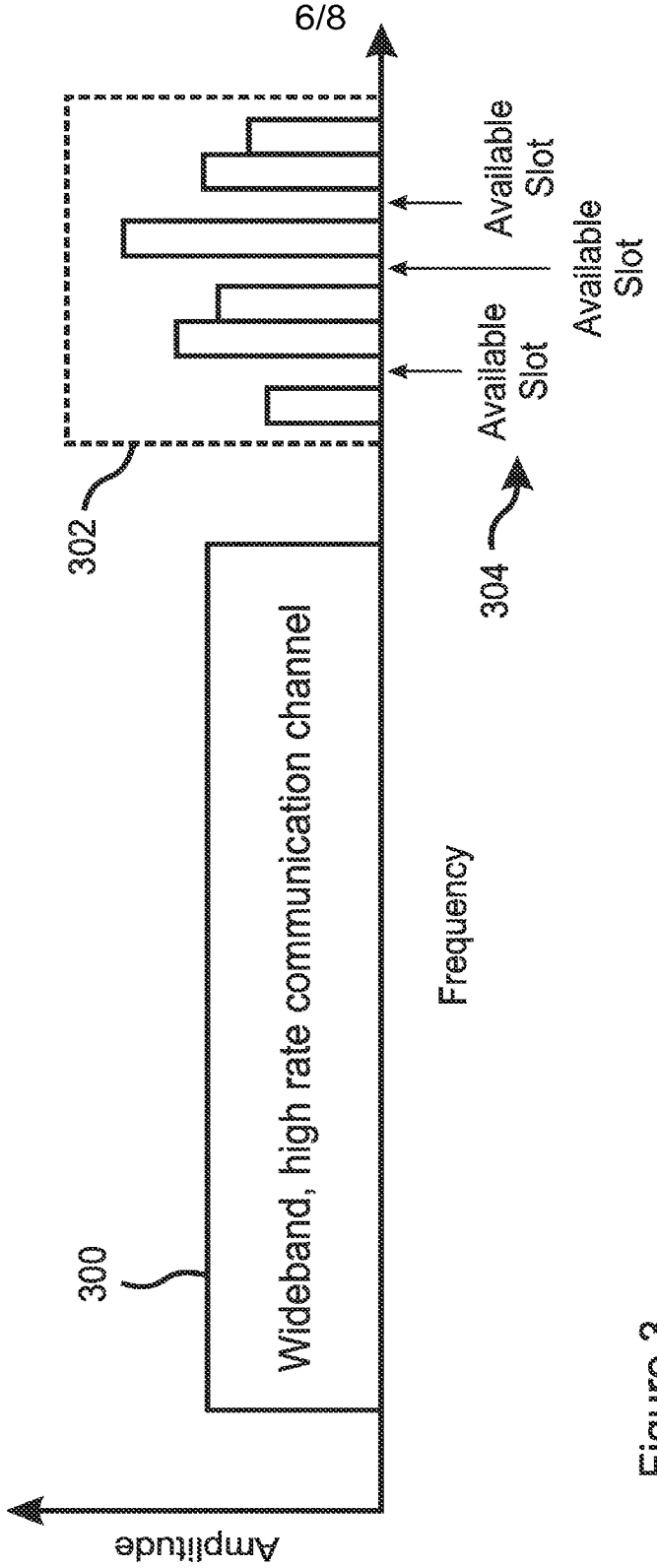

Narrow band, low rate parameter channel
302
Available Slot
Available Slot
Available Slot
304
Wideband, high rate communication channel
300
Frequency
Amplitude

Figure 3

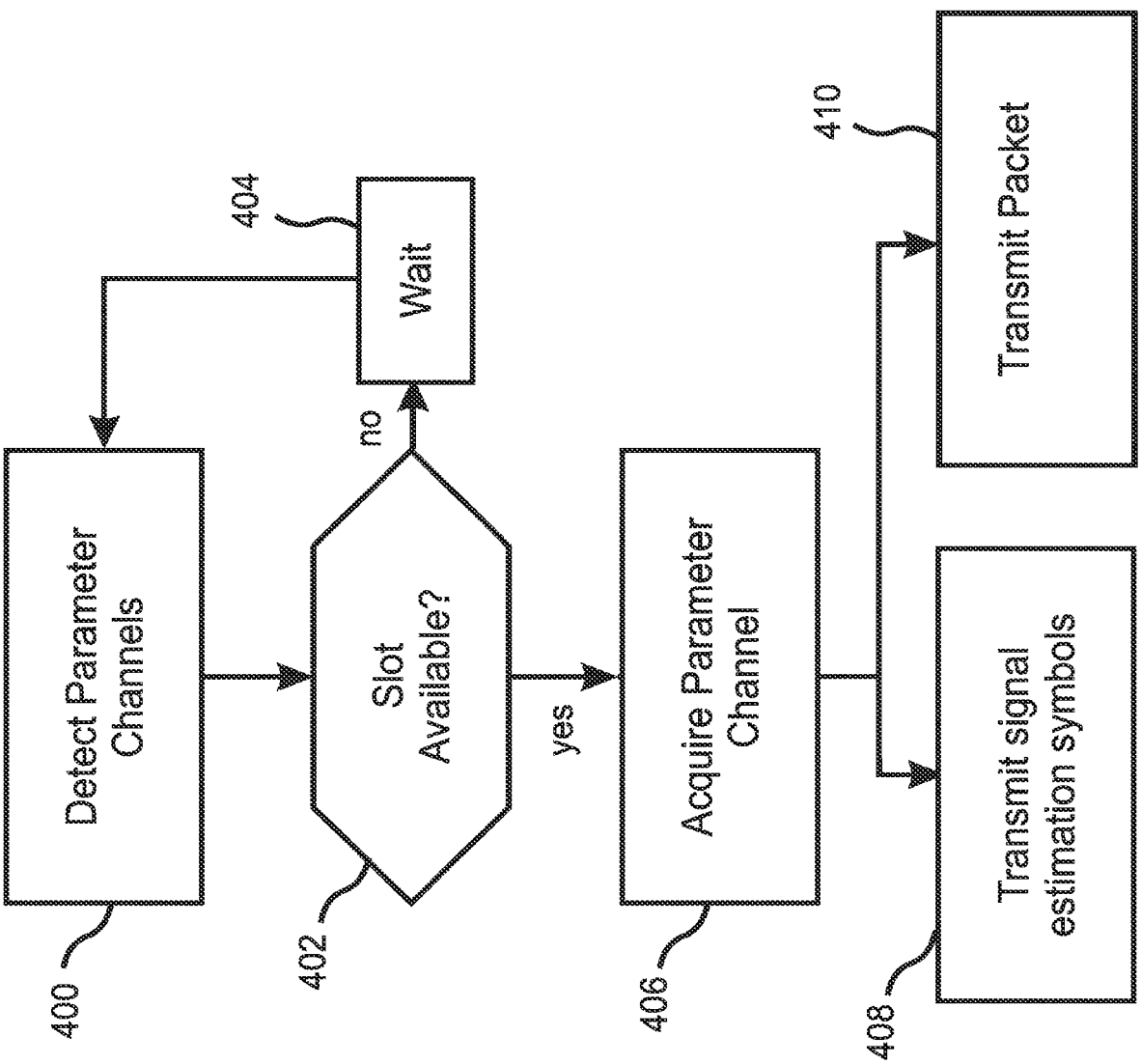

Detect Parameter Channels
400
Slot Available?
402
no
Wait
404
yes
Acquire Parameter Channel
406
Transmit signal estimation symbols
408
Transmit Packet
410

Figure 4

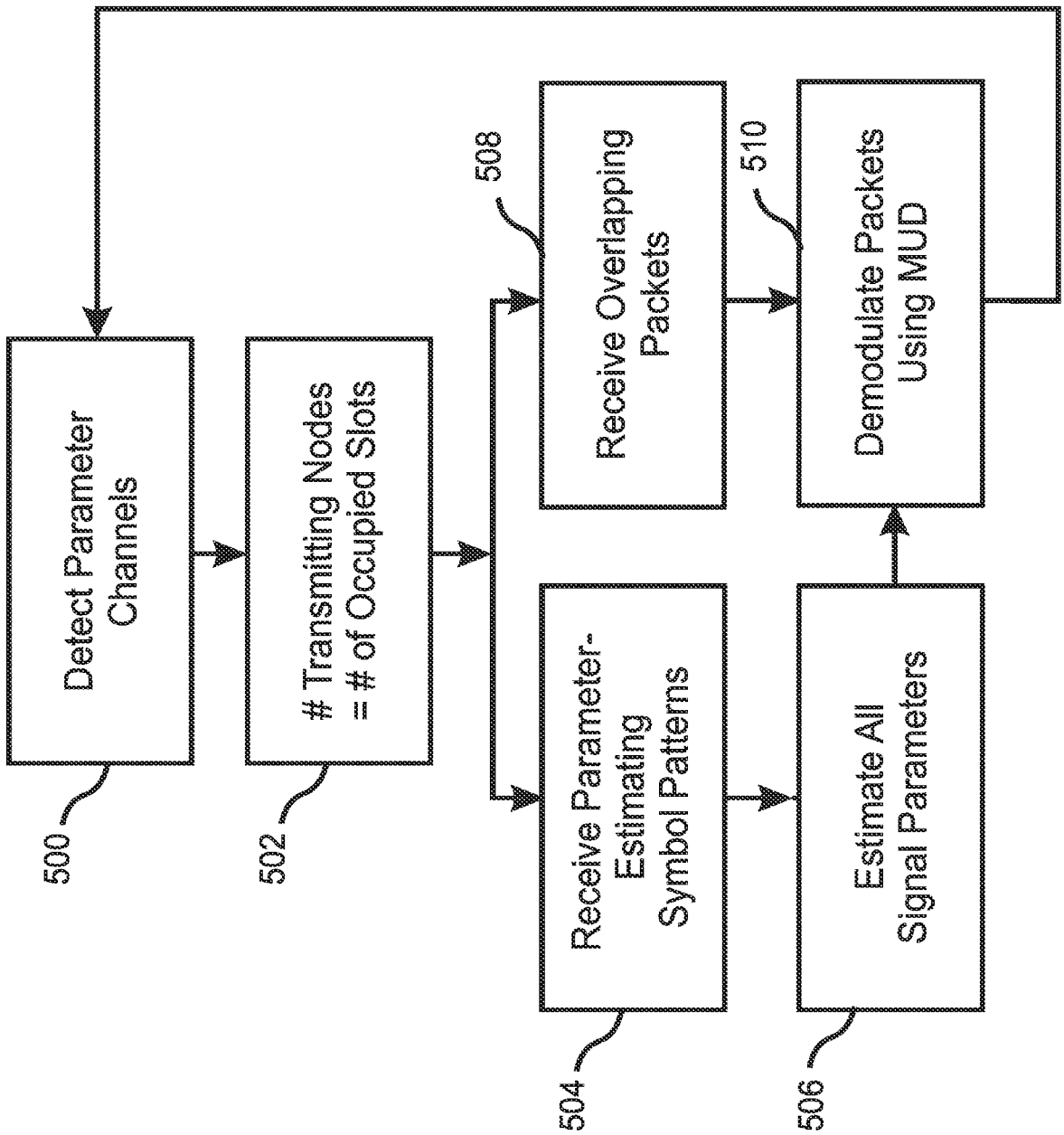

Detect Parameter Channels
# Transmitting Nodes = # of Occupied Slots
Receive Parameter-Estimating Symbol Patterns
Receive Overlapping Packets
Estimate All Signal Parameters
Demodulate Packets Using MUD
500
502
504
506
508
510

Figure 5

# Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US2009/058409

International filing date: 25 September 2009 (25.09.2009)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 61/100,461
Filing date: 26 September 2008 (26.09.2008)

Date of receipt at the International Bureau: 16 March 2010 (16.03.2010)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

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**APPLICATION NUMBER:** ***61/100,461***
**FILING DATE:** ***September 26, 2008***
**RELATED PCT APPLICATION NUMBER:** ***PCT/US09/58409***

**THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS** ***US61/100,461***

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Doc Code: **TR.PROV**
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This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

### Inventor(s)

Inventor 1 — Remove

| Given Name | Middle Name | Family Name | City | State | Country i |
|---|---|---|---|---|---|
| Joshua | D. | Niedzwiecki | Manchester | NH | US |

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| Brandon | P. | Hombs | Merrimack | NH | US |

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

| | |
|---|---|
| **Title of Invention** | Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications |
| Attorney Docket Number (if applicable) | 20060108 PRO |

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Direct all correspondence to (select one):

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Applicant claims small entity status under 37 CFR 1.27

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| | | | | | |
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| Signature | /Daniel J. Long/ | | | Date (YYYY-MM-DD) | 2008-09-26 |
| First Name | Daniel | Last Name | Long | Registration Number (If appropriate) | 29404 |

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| **Application Number:** | 61100461 |
| **International Application Number:** | |
| **Confirmation Number:** | 2728 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D NIEDZWIECKI |
| **Customer Number:** | 22500 |
| **Filer:** | Daniel J. Long/Nancy Young |
| **Filer Authorized By:** | Daniel J. Long |
| **Attorney Docket Number:** | 20060108PRO |
| **Receipt Date:** | 26-SEP-2008 |
| **Filing Date:** | |
| **Time Stamp:** | 15:46:41 |
| **Application Type:** | Provisional |

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| 1 | Specification | 20060108-spec.pdf | 1304131<br>561f97ee521035f060557cf49eb9d6f6c8795cfd | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Claims | 20060108-claim.pdf | 90030<br>a6b8c456382c7637da26a2911670fa0e5a26157b | no | 1 |
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| 3 | Abstract | 20060108-abstract.pdf | 87177<br>f5e64ddf9f01ecc32f52e41075f4eb12f9d9e76f | no | 1 |
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| 4 | Drawings-only black and white line drawings | 20060108-drawings.pdf | 385044<br>870f7eafedcd5a9d1efb3cecd058f87a4927fa38 | no | 3 |
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| 6 | Fee Worksheet (PTO-06) | fee-info.pdf | 29769<br>87424cdf5d7ae705eb9978b74b3dc7dfdda9acc6 | no | 2 |
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Abstract

In a method for operating an Ad-Hoc wireless multiuser detection based system wherein a low note access channel is employed, whereby key signal parameters of all active users on the channel is obtained.



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## Claims

What is claimed is:

1. In a method for operating an Ad-Hoc wireless multiuser detection based system wherein a low note access channel is employed, whereby key signal parameters of all active users on the channel is obtained.



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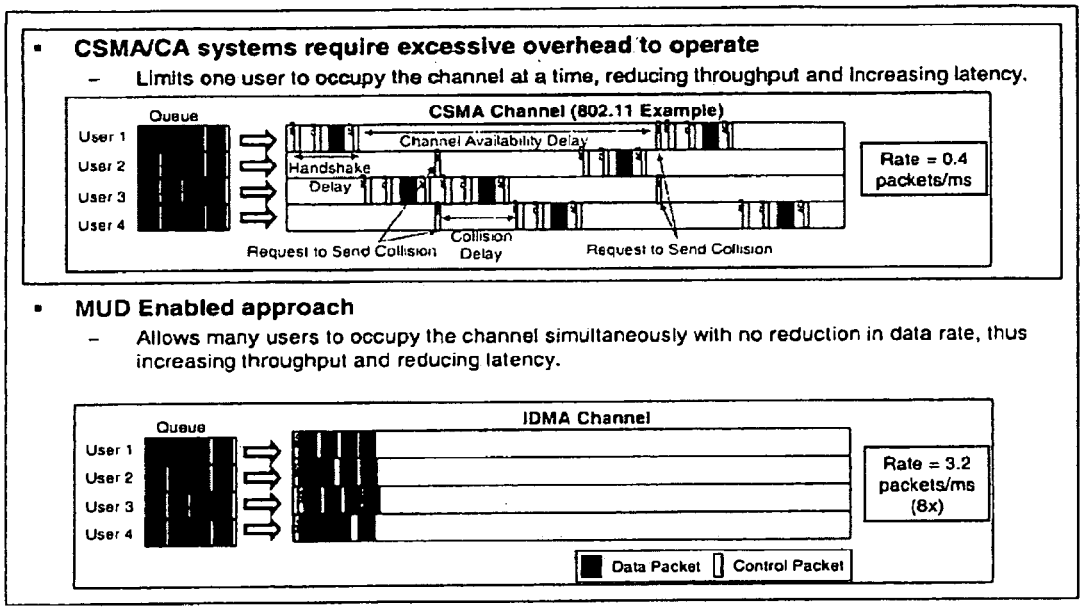



Fig. 1



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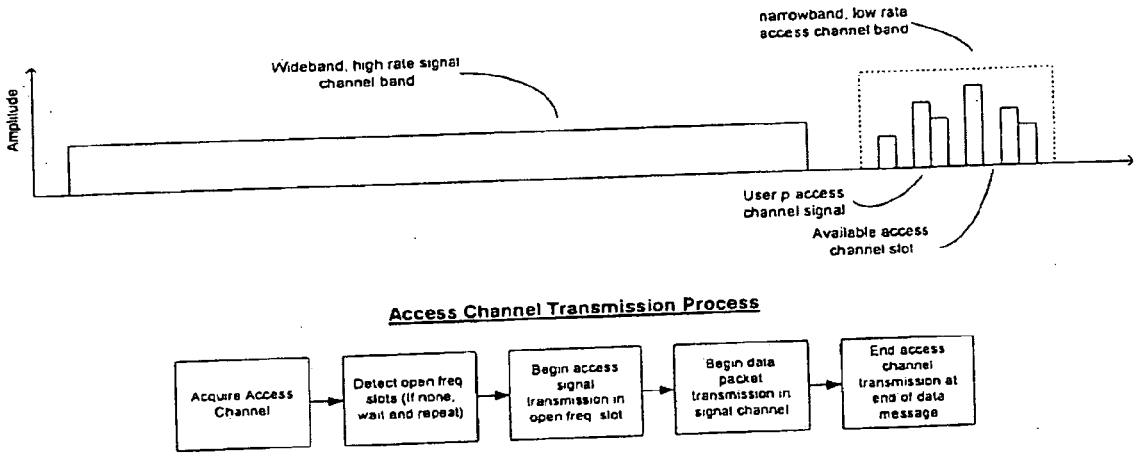



Fig. 2



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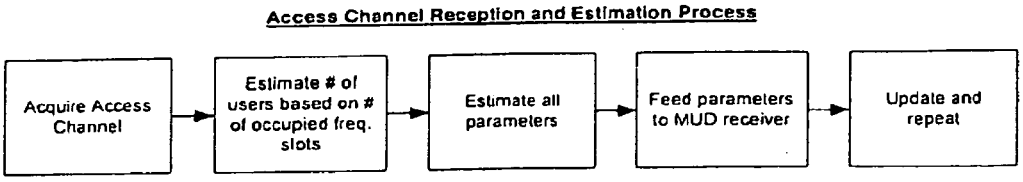



Fig. 3



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# MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

## Statement of Government Interest

This invention was made with United States Government support under Contract No. HR0011-05-C-0064 awarded by the Defense Advanced Research Projects Agency (DARPA). The United States Government has certain rights in this invention.

## Background of the Invention

1. Field of the Invention.

The present invention relates to multiuser detection and more particularly to the use of multiuser detection in enabled Ad-hoc wireless communications.

2. Brief Description of Prior Developments.

Multiuser detection (MUD) is an important receiver technology for detecting desired signals from interference and noise. A MUD receiver can be used to jointly demodulate 10-channel interfering digital signals. In general, MUD refers to the detection of data in non-orthogonal multiplexes, MUD processing increases the number of information hits available per chip or signaling dimension for interference related systems.

A need exists for a way to accomplish media access and parameter estimation for Ad-hoc wireless multiuser detection based systems.

## Summary of Invention

According to the method of the present invention, media access and parameter estimation for Ad-Hoc wireless multiuser detection based systems is accomplished by including a low rate access channel where users can obtain key signal parameters of all active users on the channel. This method allows for accurate parameter estimation necessary for the multiuser detector to operate.



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## Brief Description of the Drawings

The present invention is further described with reference to the accompanying drawings wherein:

Fig. 1 is a schematic drawing showing an example of potential gains that can be achieved by means of the present invention; and

Figs. 2 and 3 are schematic drawings showing a preferred embodiment of the method of the present invention.

## Detailed Description of the Preferred Embodiment

In Ad-Hoc wireless communications today a common method for avoiding interference between users on the network is to use a carrier sense multiple access (CSMA) protocol. In this case only one user can use the channel at a time and is only allowed to use the channel after sending a request to send announcement over the channel and obtaining a clear to send respond from the desired recipient. This is the approach that is employed in the 802.11b standard today. This approach does not efficiently utilize the available channel capacity due to the large delays each user experiences when transmitting a message because of the requirement to avoid interference. One technique to combat this is to use multiuser detection receivers at each node that are capable of demodulating multiple interfering signals even in overloaded scenarios (when there are more users than available spreading dimensions). With this type of approach one can achieve drastic improvements in system capacity as measured by total network throughout by eliminating the CSMA protocol and handshaking. In this case users are allowed to interfere with each other so each user can transmit when they want. Fig. 1 illustrates an example of the potential gains that can be achieved. In this example all of the users occupy the same bandwidth.



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The problem that arises in the later case, where users are allowed to interfere. In this case, the interference is mitigated through using a multiuser detector at each receiver. However, for the MUD receiver to operate properly, the signal parameters of each user interfering with each other must be either know or accurately estimated. These parameters include relative time delay, carrier offset, amplitude, phase multipath channel response, spreading code type and user ID. In the presence of large numbers of interferers, especially in overloaded scenarios these parameters can be difficult to estimate, especially in an Ad-Hoc network where there is no central controller telling each user when and what to transmit.

To eliminate this problem we propose a novel solution that includes defining a narrow band, low data rate access channel (narrow relative to the signal bandwidth) that is separate from the signal channel. This access channel can be designed using any available multiple access scheme, for example, TDMA, FDMA, CDMA and CSMA. Each active user will transmit a symbol pattern that allows the other users on the network to easily estimate that user's amplitude, phase, relative carrier offset and rough time delay. It can also contain user ID information and spreading code type. This will allow all users in the network to accurately estimate all the necessary parameters that the MUD requires to operate correctly.

One embodiment of the invention is to use the FDMA approach for the access channel as illustrated in Fig. 2. The access channel is configured to accommodate up to K frequency slots where K is the maximum number of users that the network will allow to interfere with each other. Anytime a user is transmitting on the signal channel they are required to first listen to the access channel to determine who else is already on the network. This is accomplished by estimating how many frequency slots are occupied in the access channel. The new user then selects an available frequency slot on the access channel and transmits a low data rate signal on that channel the entire time he is sending data on the signal channel. As part of this design we also propose the option to increase the transmit amplitude used for sending access channel information as compared to the actual signal information. As long as the receivers know what the relative scale factor is it will allow for higher SNR decreasing the estimator variance on each parameter. Another option is to generate a random hopping pattern that the network uses (possibly



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based on a GPS clock time base that allows the access channel to more to different frequencies, thus making it more jam resistant. Figs. 2 and 3 illustrate this invention.

It is important to note that though there is increase bandwidth requirements needed for the access channel there is still a large net gain in total network throughout because many more signals are allowed to simultaneously occupy this signal channel.

While the present invention has been described in connection with the preferred embodiments of the various figures, it is to be understood that other similar embodiments may be used or modifications or additions may be made to the described embodiment for performing the same function of the present invention without deviating therefrom. Therefore, the present invention should not be limited to any single embodiment, but rather construed in breadth and scope in accordance with the recitation of the appended claims.



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**Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)**

*The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.*

**Declaration of inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv)) for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ . . . . . (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications: . . . . . .

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

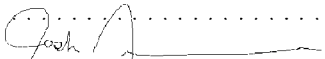
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**Name:** Joshua D. Niedzwiecki

Residence: Manchester NH 03104 USA
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Mailing Address: 34 Hickory St, Manchester NH 03103 USA

Citizenship: US

Inventor's Signature: 
(if not contained in the request, or if declaration is corrected or added under Rule 26*ter* after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: 9/26/09
(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26*ter* after the filing of the international application)

**Name:** Brandon P. Hombs

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Citizenship: US

Inventor's Signature: Brandon Hombs (esignature)
(if not contained in the request, or if declaration is corrected or added under Rule 26*ter* after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: 9/26/09
(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26*ter* after the filing of the international application)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| In re Application of: | Niedzwiecki, Joshua D. | Group Art Unit: |
| Serial No. | 12/742,686 | Examiner: |
| Filed: | May 13, 2010 | Atty. Dkt. No: 20060108-US |

For: MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

To: Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Fm: 22500

Dear Commissioner:

PRELIMINARY AMENDMENT

The Applicant has timely enclosed herein: 5 pages preliminary amendment. Please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Remarks/Arguments begin on page 5 of this paper.

DEPOSIT ACCOUNT **190130** AUTHORIZATION – The Office is hereby authorized to charge the required fee, and any deficiency or credit any overpayment in the fees to the above deposit account, owned by BAE SYSTEMS Information and Electronic Systems Integration Inc. an authorized signator for which is Kevin M. Perkins, V.P. & Company Counsel, and for whom the undersigned are authorized agents.



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## AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning at page 1, line 6 (in the list of inventors), with the following rewritten paragraph:

-- ~~Branson~~ Brandon P. Hombs --

Please insert the following new paragraphs after paragraph [0024]:

-- One general aspect of the present invention is a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network. The method includes providing a plurality of parameter channels on the network in addition to the shared communication channel, requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel, detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes, and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

In some embodiments, providing a plurality of parameter channels includes using channel-spreading technology. And in some of these embodiments the channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.

In various embodiments, requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.

In some embodiments the parameter-estimating signal is a parameter-estimating symbol pattern. In other embodiments the at least one unique signal parameter includes

signal amplitude. In yet other embodiments the at least one unique signal parameter includes a signal phase. In still other embodiments the at least one unique signal parameter includes a signal carrier frequency offset. And in still other embodiments the at least one unique signal parameter includes a signal relative time delay.

Various embodiments further include requiring each transmitting node to transmit node identifying information on the unshared parameter channel. And some embodiments further include requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.

Certain embodiments further include requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

In some embodiments the parameter channels are randomly shifted over time between a plurality of wireless frequencies. In other embodiments the parameter channels are shifted according to a random hopping pattern. In still other embodiments the random hopping pattern is based on a GPS clock timebase. And in certain embodiments the parameter channels are low in communication rate compared to the shared communication channel.

Another general aspect of the present invention is a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network. The method includes using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel, requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel, detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a

signal phase for each of the transmitting nodes, and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

Some embodiments further include requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

Yet another general aspect of the present invention is a method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network. The method includes using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel, requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel, detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes, and detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

Some embodiments further include requiring each transmitting node to transmit node identifying information on the unshared parameter channel. --

## REMARKS/ARGUMENTS

The paragraphs added to the specification herein are prose recitations of the claims as filed. No new matter has been added.

Applicant believes that the application is in conditions for allowance, and respectfully requests that such action be taken.

Respectfully submitted,

**/ Douglas P. Burum, Reg. No. 65,019/**

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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 7671410 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 22500 |
| **Filer:** | Douglas Peter Burum/Debra Stengel |
| **Filer Authorized By:** | Douglas Peter Burum |
| **Attorney Docket Number:** | 20060108-US |
| **Receipt Date:** | 25-MAY-2010 |
| **Filing Date:** | |
| **Time Stamp:** | 09:33:37 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 20060108-US_Preliminary_Amendment_Final.pdf | 95503<br>dfec230bd84d718670e627cd04c9088b7e4f583b | yes | 5 |

| | Multipart Description/PDF files in .zip description | | |
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| | **Document Description** | **Start** | **End** |
| | Preliminary Amendment | 1 | 1 |
| | Specification | 2 | 4 |
| | Applicant Arguments/Remarks Made in an Amendment | 5 | 5 |
| **Warnings:** | | | |
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**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

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Substitute for Form PTO-875

| Application or Docket Number | Filing Date | ☐ To be Mailed |
|---|---|---|
| 12/742,686 | 05/13/2010 | |

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY ☐ RATE ($) | SMALL ENTITY ☐ FEE ($) | OR | OTHER THAN SMALL ENTITY RATE ($) | OTHER THAN SMALL ENTITY FEE ($) |
|---|---|---|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | | | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | | OR | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | | | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT 05/25/2010

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE ($) | SMALL ENTITY ADDITIONAL FEE ($) | OR | OTHER THAN SMALL ENTITY RATE ($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 20 | Minus | ** 20 | = 0 | X $ = | | OR | X $52= | 0 |
| Independent (37 CFR 1.16(h)) | * 3 | Minus | ***3 | = 0 | X $ = | | OR | X $220= | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) | | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | | OR | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | | OR | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

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Legal Instrument Examiner:
/DORIS m. BURNS/

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**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | NIEDZWIECKI, Joshua D. |
| Art Unit | |
| Examiner Name | |
| Attorney Docket Number | 20060108-US |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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| | 1 | 6947502 | B2 | 2005-09-20 | Taylor et al. | |

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| | 1 | 20060114826 | A1 | 2006-06-01 | Brommer | |
| | 2 | 20060140259 | A1 | 2006-06-29 | Dunyak et al. | |
| | 3 | 20070087756 | A1 | 2007-04-19 | Hoffberg | |
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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | NIEDZWIECKI, Joshua D. |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 20060108-US |

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|---|---|---|---|
| | 1 | PCT Search Report dated 23 April 2010 of PCT Application No. PCT/US2009/058409 filed 25 September 2009, 9 pages | ☐ |
| | 2 | SO, Jungmin et al., A MULTI-CHANNEL MAC PROTOCOL FOR AD HOC WIRELESS NETWORKS, Technical Report January 2003 University of Illinois at Urbana-Champaign, 14 pages | ☐ |
| | 3 | WU, Shih-Lin et al., A NEW MULTI-CHANNEL MAC PROTOCOL WITH ON-DEMAND CHANNEL ASSIGNMENT FOR MULTI-HOP MOBILE AD HOC NETWORKS, 2000, pgs 232-237, IEEE 1087-4089/00 | ☐ |
| | 4 | CHEN, Huimin et al., A NEW MULTI-CHANNEL MAC PROTOCOL WITH POWER CONTROL FOR AD HOC NETWORKS, 2006, 4 pages, IEEE Proceedings of the 20th International Conference on Advanced Information Networking and Applications (AINA'06) | ☐ |
| | 5 | JIN, Kyu-Tae, MULTI-CODE MAC FOR MULTI-HOP WIRELESS AD HOC NETWORKS, 2002, pgs 1100-1104, IEEE 0-7803-7467-3/02 | ☐ |

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**EXAMINER SIGNATURE**

| Examiner Signature | | Date Considered | |
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | NIEDZWIECKI, Joshua D. |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 20060108-US |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Douglas P. Burum, Reg. No. 65,019/ | Date (YYYY-MM-DD) | 2010-10-06 |
|---|---|---|---|
| Name/Print | Douglas P. Burum | Registration Number | 65019 |

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
DOUGLAS P. BURUM
VERN MAINE & ASSOCIATES
PO BOX 3445
NASHUA, NH 03061-3445

# PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 23 APR 2010 |
| Applicant's or agent's file reference<br>20060108-PCT | **FOR FURTHER ACTION** See paragraphs 1 and 4 below |
| International application No.<br>PCT/US 09/58409 | International filing date *(day/month/year)*<br>25 September 2009 (25.09.2009) |
| Applicant BAE SYSTEMS INFORMATION AND ELECTRONIC SYSTEMS INTEGRATION INC. | |

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   **Filing of amendments and statement under Article 19:**
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   **When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   **Where?** Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 8270

   **For more detailed instructions,** see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

| | |
|---|---|
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/220 (January 2004) *(See notes on accompanying sheet)*

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference 20060108-PCT | FOR FURTHER ACTION | see Form PCT/ISA/220 as well as, where applicable, item 5 below. |
|---|---|---|
| International application No. PCT/US 09/58409 | International filing date *(day/month/year)* 25 September 2009 (25.09.2009) | (Earliest) Priority Date *(day/month/year)* 26 September 2008 (26.09.2008) |
| Applicant BAE SYSTEMS INFORMATION AND ELECTRONIC SYSTEMS INTEGRATION INC. | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☐ the text is approved as submitted by the applicant.

   ☒ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 1C

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 09/58409

**Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)**

Increasing the communication capacity of a shared ad-hoc wireless channel by using MUD to distinguish overlapping information transmitted simultaneously by a plurality of nodes. The transmitting nodes simultaneously provide parameter-estimating signals over separate, unshared, low-rate parameter channels generated using orthogonal frequencies, spread spectrum technology, or time multiplexing. Receiving nodes use these separate, non-overlapping parameter-estimating signals to estimate MUD-required signal parameters such as amplitude, phase, and frequency offset, thereby enabling use of lower complexity MUD receivers, because the parameters are not estimated in the presence of other interference. Node ID, spreading code type, and/or other information can also be transmitted over the parameter channels. Limiting the number of parameter channels can limit the maximum number of transmitting nodes. Amplitudes of parameter channel transmissions can be greater than communication channel transmissions by a known ratio. Parameter channels can be frequency-hopped for jam-resistance.

Form PCT/ISA/210 (continuation of first sheet (3)) (July 2009)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 09/58409

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04W 40/00 (2010.01)
USPC - 455/445
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC - 455/445

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 455/3.01, 403, 445, 450, 509, 510 (keyword limited - see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWest (PGPB, USPT, EPAB, JPAB); Google,
Search terms used: ad, hoc, ad-hoc, network, carrier, sense, multiple, access, CSMA, wireless, collision, node, user, transmit, simultaneously, same, time, shared, channel, multi, user, multi, detection, MUD, terminal, parameter, channel, estimat, amplitude, phase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>—<br>Y | US 2006/0114826 A1 (Brommer) 01 June 2006 (01.06.2006), para [0007], [0011], [0015], [0041], [0052]-[0054], [0079]-[0092], [0140] | 1-11, 13, 14, 16-20<br>—<br>12, 15 |
| Y | US 2006/0140259 A1 (Dunyak et al.) 29 June 2006 (29.06.2006), para [0087] | 12 |
| Y | US 2007/0087756 A1 (Hoffberg) 19 April 2007 (19.04.2007), para [0535] | 15 |
| A | US 6,947,502 B2 (Taylor et al.) 20 September 2005 (20.09.2005), entire document | 1 - 20 |
| A | US 2008/0095121 A1 (Shattil) 24 April 2008 (24.04.2008), entire document | 1 - 20 |

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 07 April 2010 (07.04.2010) | 23 APR 2010 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/210 (second sheet) (July 2009)

# PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DOUGLAS P. BURUM
VERN MAINE & ASSOCIATES
PO BOX 3445
NASHUA, NH 03061-3445

# PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| Date of mailing *(day/month/year)* | 23 APR 2010 |
|---|---|

| Applicant's or agent's file reference | FOR FURTHER ACTION |
|---|---|
| 20060108-PCT | See paragraph 2 below |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/US 09/58409 | 25 September 2009 (25.09.2009) | 26 September 2008 (26.09.2008) |

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04W 40/00 (2010.01)
USPC - 455/445

Applicant BAE SYSTEMS INFORMATION AND ELECTRONIC SYSTEMS INTEGRATION INC.

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| Name and mailing address of the ISA/US | Date of completion of this opinion | Authorized officer: |
|---|---|---|
| Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | 07 April 2010 (07.04.2010) | Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/237 (cover sheet) (July 2009)

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US 09/58409

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

      ☐ on paper

      ☐ in electronic form

   b. (time)

      ☐ in the international application as filed

      ☐ together with the international application in electronic form

      ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Form PCT/ISA/237 (Box No. I) (July 2009)

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US 09/58409

**Box No. V** **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 12, 15 | YES |
| | Claims | 1-11, 13, 14, 16-20 | NO |
| Inventive step (IS) | Claims | None. | YES |
| | Claims | 1 - 20 | NO |
| Industrial applicability (IA) | Claims | 1 - 20 | YES |
| | Claims | None. | NO |

2. Citations and explanations:

Claims 1-11, 13, 14 and 16-20 lack novelty under PCT Article 33(2) as being anticipated by US 2006/0114826 A1 (Brommer).

Regarding claim 1, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel, para [0011], [0015]), the method comprising: providing a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

Regarding claim 2, Brommer teaches wherein said providing a plurality of parameter channels comprises using channel-spreading technology (access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0092]).

Regarding claim 3, Brommer teaches wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA (CDMA, para [0092]).

Regarding claim 4, Brommer teaches wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel (two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]).

Regarding claim 5, Brommer teaches wherein the parameter-estimating signal is a parameter-estimating symbol pattern (a bank of decoders receives a recovered symbol stream for each of the multiple users output by the MUD module, para [0086]).

Regarding claim 6, Brommer teaches wherein the at least one unique signal parameter comprises signal amplitude (parameter estimation module estimates amplitudes, para [0084]).

Regarding claim 7, Brommer teaches wherein the at least one unique signal parameter includes a signal phase (parameter estimation module estimates phases, para [0084]).

Regarding claim 8, Brommer teaches wherein the at least one unique signal parameter includes a signal carrier frequency offset (FSK offset frequency, para [0054]).

Regarding claim 9, Brommer teaches wherein the at least one unique signal parameter includes a signal relative time delay (parameter estimation module estimates the relative received timing offsets, para [0084]).

Regarding claim 10, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

Regarding claim 11, Brommer teaches requiring each transmitting node to transmit spreading code type information on the unshared parameter channel (spread spectrum techniques are used, para [0052]).

--CONTINUED IN SUPPLEMENTAL BOXES--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/58409

**Supplemental Box**

**In case the space in any of the preceding boxes is not sufficient.**
Continuation of:

Box No. V. 2. Citations and explanations:

Regarding claim 13, Brommer teaches wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies (frequency hopping communication technique, para [0041], [0052], [0054]).

Regarding claim 14, Brommer teaches wherein the parameter channels are shifted according to a random hopping pattern (frequency hopping communication technique, para [0041], [0052], [0054]).

Regarding claim 16, Brommer teaches wherein the parameter channels are low in communication rate compared to the shared communication channel (the transmitted informational data stream is impressed upon a much higher rate data stream, para [0007], [0055]).

Regarding claim 17, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

Regarding claim 18, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

Regarding claim 19, Brommer teaches method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel (the modem uses a any one of a number of access schemes, including FDMA which provides multiple channels for communication where the multiple channels are divided by frequency, hence frequency division multiple access (FDMA), para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

Regarding claim 20, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

--CONTINUED ON NEXT PAGE--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/58409

**Supplemental Box**

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Box No. V. 2. Citations and explanations:

Claim 12 lacks an inventive step under PCT Article 33(3) as being obvious over Brommer, in view of US 2006/0140259 A1 to Dunyak et al. (hereinafter 'Dunyak').

Regarding claim 12, Brommer fails to teach requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio. Dunyak teaches requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio (for each channel, if the power is determined to exceed a threshold, its amplitude is estimated as the ratio of its power to the pilot power, para [0087]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Brommer to include requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio, as taught by Dunyak, for the advantage of a more precisely monitor the channels.

Claim 15 lacks an inventive step under PCT Article 33(3) as being obvious over Brommer, in view of US 2007/0087756 A1 (Hoffberg).

Regarding claim 15, Brommer fails to teach wherein the random hopping pattern is based on a GPS clock timebase. Hoffberg teaches wherein the random hopping pattern is based on a GPS clock timebase (frequency hopping, where a demodulator tracks the hop frequency sequence and time synchronization may be effected by using the timing functions of a GPS receiver, para [0535]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Brommer to include wherein the random hopping pattern is based on a GPS clock timebase, as taught by Hoffberg, in order to to provide a central time reference for the hopping pattern.

Claims 1 - 20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (July 2009)

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 8568156 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 22500 |
| **Filer:** | Douglas Peter Burum/Debra Stengel |
| **Filer Authorized By:** | Douglas Peter Burum |
| **Attorney Docket Number:** | 20060108-US |
| **Receipt Date:** | 06-OCT-2010 |
| **Filing Date:** | |
| **Time Stamp:** | 11:47:24 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Filed (SB/08) | US_IDS_Form__SB_08a_After_1-30-10.pdf | 614775<br>84194cb4cd2bd74dbdabe85cf7fb37a9fbcc649e | no | 4 |

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| **Warnings:** | |
| **Information:** | |



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| 2 | NPL Documents | 20060108-PCT_SearchReport.pdf | 484743<br>5673cb25dade1774c80c6869335cd52960b48659 | no | 9 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | NPL Documents | 1_JungminSo_Multi-channel_MAC_Protocol_for_Ad_Hoc.pdf | 155528<br>a2c8494f560210bb830e665c7ab6bbd5efc1b3d1 | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | NPL Documents | 2_Shih-Lin_Wu_New_Multi-Channel_MAC_Protocol.pdf | 1247799<br>4f310722ee73c10a584d9035fc027406bbfb0016 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | NPL Documents | 4_Kyu-Tae_Jin_MULTI-CODE_MAC_FOR_MULTI-HOP_WIRELESS_AD_HOC_NETWORKS.pdf | 331087<br>7e0de4ff8297c1bd8bd5ad5e80e4635d12d0217e | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | NPL Documents | 3_Huimin_Chen_New_Multi-channel_MAC_Protocol_with_Power.pdf | 359545<br>761c9de1aa1224fd4b418c6b8c07d2ba4c618338 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 3193477 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

# MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

(FOR USE WITH FORM PTO-875)

SERIAL NO. 12/742686

FILING DATE

APPLICANT(S)

## CLAIMS

| | AS FILED | | AFTER 1ST AMENDMENT | | AFTER 2ND AMENDMENT | |
|---|---|---|---|---|---|---|
| | IND. | DEP. | IND. | DEP. | IND. | DEP. |
| 1 | 1 | | | | | |
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| TOTAL IND. | 3 | ⬇ | | ⬇ | | ⬇ |
| TOTAL DEP. | 17 | ⬅ | | ⬅ | | ⬅ |
| TOTAL CLAIMS | 20 | | | | | |

| | AS FILED | | AFTER 1ST AMENDMENT | | AFTER 2ND AMENDMENT | |
|---|---|---|---|---|---|---|
| | IND. | DEP. | IND. | DEP. | IND. | DEP. |
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| TOTAL IND. | | ⬇ | | ⬇ | | ⬇ |
| TOTAL DEP. | | ⬅ | | ⬅ | | ⬅ |
| TOTAL CLAIMS | | | | | | |

PTO - 1360 (REV. 04/2007)

U.S. DEPARTMENT of COMMERCE
Patent and Trademark Office



INTEL-1002

## PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 2, 2008

Application or Docket Number: 12/742686

### CLAIMS AS FILED - PART I

| | (Column 1) | (Column 2) | SMALL ENTITY RATE | SMALL ENTITY FEE | OR | LARGE ENTITY RATE | LARGE ENTITY FEE |
|---|---|---|---|---|---|---|---|
| U.S. NATIONAL STAGE FEES | | | | | | | |
| BASIC FEE | $330/ $165 | | BASIC FEE | | OR | BASIC FEE | 330 |
| EXAMINATION FEE | $220/ $110 | | EXAM. FEE | | | EXAM. FEE | 220 |
| SEARCH FEE | $430/ $215 | | SEARCH FEE | | | SEARCH FEE | 100 |
| FEE FOR EXTRA SPEC. PGS. | minus 100 = | / 50 = | X $ 135 = | | | X $ 270 = | |
| TOTAL CHARGEABLE CLAIMS | 20 minus 20 = | | X $ 26 = | | OR | X $ 52 = | |
| INDEPENDENT CLAIMS | 3 minus 3 = | | X $ 110 = | | OR | X $ 220 = | |
| MULTIPLE DEPENDENT CLAIM PRESENT | | ☐ | + $ 195 = | | OR | + $ 390 = | |
| * If the difference in column 1 is less than zero, enter "0" in column 2 | | | TOTAL | | OR | TOTAL | 650 |

### CLAIMS AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE | SMALL ENTITY ADDITIONAL FEE | OR | OTHER THAN SMALL ENTITY RATE | OTHER THAN SMALL ENTITY ADDITIONAL FEE |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total | | Minus | ** | | X $ 26 = | | OR | X $ 52 = | |
| | Independent | | Minus | *** | | X $ 110 = | | OR | X $ 220 = | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | | ☐ | + $ 195 = | | OR | + $ 390 = | |
| | | | | | | TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE | ADDITIONAL FEE | OR | RATE | ADDITIONAL FEE |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total | | Minus | ** | | X $ 26 = | | OR | X $ 52 = | |
| | Independent | | Minus | *** | | X $ 110 = | | OR | X $ 220 = | |
| | FIRST PRESENTATION OF MULTIPLE-DEPENDENT CLAIM | | | | ☐ | + $ 195 = | | OR | + $ 390 = | |
| | | | | | | TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '20', enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '3', enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| U.S. APPLICATION NUMBER NO. | FIRST NAMED APPLICANT | ATTY. DOCKET NO. |
|---|---|---|
| 12/742,686 | Joshua D Niedzwiecki | 20060108-US |

22500
BAE SYSTEMS
PO BOX 868
NASHUA, NH 03061-0868

| INTERNATIONAL APPLICATION NO. | |
|---|---|
| PCT/US09/58409 | |
| I.A. FILING DATE | PRIORITY DATE |
| 09/25/2009 | 09/26/2008 |

**CONFIRMATION NO. 7845**
**371 ACCEPTANCE LETTER**

*OC000000044552006*

Date Mailed: 11/19/2010

## NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

| | |
|---|---|
| 05/13/2010 | 05/13/2010 |
| DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS | DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS |

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Copy of the International Application filed on 05/13/2010
- Copy of the International Search Report filed on 05/13/2010
- Preliminary Amendments filed on 05/13/2010
- Information Disclosure Statements filed on 10/06/2010
- Oath or Declaration filed on 05/13/2010
- Request for Immediate Examination filed on 05/13/2010
- U.S. Basic National Fees filed on 05/13/2010
- Priority Documents filed on 05/13/2010
- Specification filed on 05/13/2010
- Claims filed on 05/13/2010
- Abstracts filed on 05/13/2010
- Drawings filed on 05/13/2010



FORM PCT/DO/EO/903 (371 Acceptance Notice)



INTEL-1002

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

TONI M HOOD

Telephone: (571) 272-3654

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | | 650 | 20060108-US | 20 | 3 |

**CONFIRMATION NO. 7845**

22500
BAE SYSTEMS
PO BOX 868
NASHUA, NH 03061-0868

**FILING RECEIPT**

*OC000000044552005*

Date Mailed: 11/19/2010

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Applicant(s)**

Joshua D Niedzwiecki, Manchester, NH;
Brandon P Hombs, Merrimack, NH;

**Assignment For Published Patent Application**

BAE Systems Information and Electronic Systems Integration Inc., Nashua, NH

**Power of Attorney:** The patent practitioners associated with Customer Number 22500

**Domestic Priority data as claimed by applicant**

This application is a 371 of PCT/US09/58409 09/25/2009
which claims benefit of 61/100,461 09/26/2008

**Foreign Applications**

**If Required, Foreign Filing License Granted:** 11/17/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/742,686**

**Projected Publication Date:** 03/03/2011

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

**Preliminary Class**

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

## LICENSE FOR FOREIGN FILING UNDER

## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | 20060108-US |

**CONFIRMATION NO. 7845**

22500
BAE SYSTEMS
PO BOX 868
NASHUA, NH 03061-0868

**PUBLICATION NOTICE**

*OC000000046314662*

**Title:**MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

**Publication No.**US-2011-0051674-A1
**Publication Date:**03/03/2011

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

## POWER OF ATTORNEY FOR PATENT APPLICATIONS

Under CFR § 3.73(b), Collision Technology, LLC, a corporation, hereby certifies that it is the Assignee of the entire right, title, and interest in and to the patent applications listed below. Each of the patent applications listed below is assigned to Collision Technology, LLC. As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the Assignee was submitted for recordation pursuant to 37 CFR 3.11 as shown in the Reel/Frame numbers listed below.

| **Filing Date** | **Application Serial No.; Patent No. (if issued)** | **Title** | **Reel/Frame** |
|---|---|---|---|
| 10/03/2003 | 10/678,203; 6,831,574 | MULTI-TURBO MULTI-USER DETECTOR | 014073/0269<br>026190/0812 |
| 04/05/2004 | 10/818,536; 6,967,598 | REDUCED COMPLEXITY MULTI-TURBO MULTI-USER DETECTOR | 014525/0140<br>026190/0812 |
| 03/24/2005 | 10/529,019; 7,599,346 | BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM | 016520/0107<br>026190/0812<br>026193/0661 |
| 08/27/2009 | 12/548,502 | BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM | 026190/0812 |
| 02/03/2004 | 10/486,004; 7,486,722 | BANDWIDTH EFFICIENT CABLE NETWORK MODEM | 013771/0874<br>014405/0749<br>026190/0812<br>026193/0661 |
| 02/11/2004 | 10/486,871; 7,245,673 | WINDOWED MULTIUSER DETECTION | 013816/0233<br>015656/0249<br>026190/0812<br>026193/0661 |
| 12/21/2004 | 10/497,556; 7,126,533 | DIRECTION-FINDING FOR MULTIPLE COCHANNEL SOURCES | 014737/0931<br>013824/0323<br>026190/0812<br>026193/0661 |
| 04/19/2005 | 10/531,772; 7,463,703 | JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR | 015999/0543<br>026190/0812<br>026193/0661 |
| 10/15/2008 | 12/251,571; 7,590,203 | JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR | 021690/0566<br>026190/0812 |
| 10/15/2008 | 12/251,575; 7,583,757 | JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR | 021690/0608<br>026190/0812 |
| 06/25/2009 | 12/491,332; 7,920,651 | JOINT SYMBOL, AMPLITUDE, AND RATE | 022879/0419<br>026190/0812 |



INTEL-1002

| | | | |
|---|---|---|---|
| | | ESTIMATOR | |
| 12/23/2003 | 10/482,599; 7,428,261 | CROSS-SYSTEM INTERFERENCE CANCELLATION FOR MULTICARRIER CDMA AND OFDM | 013823/0522<br>014271/0189<br>026190/0812<br>026193/0661 |
| 12/01/2005 | 11/291,883; 7,593,473 | TREE STRUCTURED MULTICARRIER MULTIPLE ACCESS SYSTEMS | 016887/0516<br>026190/0812 |
| 12/01/2005 | 11/292,233; 7,817,754 | M-ALGORITHM WITH PRIORITIZED USER ORDERING | 017098/0162<br>026190/0812 |
| 04/10/2006 | 11/400,922; 7,783,110 | SEMICOHERENT CHANNEL ESTIMATOR | 017623/0177<br>026190/0812 |
| 08/10/2006 | 11/463,877; 7,613,228 | M-ALGORITHM MULTIUSER DETECTOR WITH CORRELATION BASED PRUNING | 018151/0479<br>026190/0812 |
| 09/15/2006 | 11/532,125; 7,593,492 | COMBINATIONAL HYBRID TURBO-MUD | 018272/0171<br>026190/0812 |
| 08/12/2009 | 12/539,691 | METHOD FOR SIMULTANEOUS DETECTION OF A PLURALITY OF RFID TAGS USING MULTIUSER DETECTION | 023099/0858<br>026190/0812 |
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| | | DETECTION ENABLED WIRELESS MOBILE AD HOC NETWORKS | |
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The undersigned, acting as the Assignee, hereby revokes all prior powers of attorney, if applicable, and appoints the practitioners associated with the customer number 79683 as my/our attorney(s) or agent(s) to prosecute the patent(s) and/or patent application(s) and transact all business in the United States Patent and Trademark Office connected therewith.

By: _____ Date: 8/13/2011

Jared Fry

Member, Collision Technology, LLC



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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 10732428 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 22500 |
| **Filer:** | Justin Robert Nifong |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | 20060108-US |
| **Receipt Date:** | 15-AUG-2011 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 08:14:26 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| 1 | Power of Attorney | POA_Collision_OliveLawGroup_20110812.pdf | 3476082<br>a15fd5bbebf4103df873fa8db61954b90f35cfba | no | 6 |
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**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | 20060108-US |

**CONFIRMATION NO. 7845**

79683
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

**POA ACCEPTANCE LETTER**

*OC000000049432650*

Date Mailed: 08/24/2011

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/15/2011.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/gbien-aime/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | 20060108-US |

**CONFIRMATION NO. 7845**

**POWER OF ATTORNEY NOTICE**

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PO BOX 868
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NASHUA, NH 03061-0868

*OC000000049432642*

Date Mailed: 08/24/2011

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/15/2011.

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/gbien-aime/

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**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | Joshua D. Niedzwiecki |
| Art Unit | 2473 |
| Examiner Name | Kwang Bin Yao |
| Attorney Docket Number | 234/16 UTIL |

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| | 1 | 7245673 | B2 | 2007-07-17 | MacLeod | |

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| | 1 | 20020070845 | A1 | 2002-06-13 | Reisinger et al. | |

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|---|---|---|---|---|---|---|---|---|
| | 1 | 2000-252918 | JP | A | 2000-09-14 | OKI Electric Ind. Co. Ltd.; Iochi Hitoshi | | ☒ |
| | 2 | 2000-71843 | WO | A2 | 2000-11-30 | Siemens AG; Schneider et al. | | ☒ |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2473 |
| | Examiner Name | Kwang Bin Yao |
| | Attorney Docket Number | 234/16 UTIL |

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | JP Office Action dated November 29, 2011 against JP Patent Application No. 2009-098246; translation by Meisei International Patent Firm | ☒ |
| | 2 | EP Office Action dated January 18, 2011 against (related) EP Patent Application No. 03817679.8; BAE Systems Information and Electronic Systems Integrations, Inc. (Applicant) | ☒ |
| | 3 | BAINES, S.J. et al., "Double window multi-user detection for asynchronous DS-CDMA", IEEE 1996, Electronic Letters, 11/21/96, Vol. 32, No. 24, pp. 2199-2201. | ☒ |
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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2473 |
| | Examiner Name | Kwang Bin Yao |
| | Attorney Docket Number | 234/16 UTIL |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Bentley J. Olive/ | Date (YYYY-MM-DD) | 2012-05-30 |
|---|---|---|---|
| Name/Print | Bentley J. Olive | Registration Number | 44,985 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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## CLAIMS

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[Claim(s)]

[Claim 1]In each of a discrete transmission period a base station polls two or more terminals, and according [ a terminal ] to polling. It is an updating method of said transmission power initial value of said terminal in a radio communications system which transmits with a transmission power initial value first, and amends transmission power according to a command from a base station after it, An updating method of a transmission power initial value memorizing transmission power of a terminal of the past transmission period, and calculating a transmission power initial value of the next transmission period from the past transmission power.

[Claim 2]When making a transmission period of T and transmission start time $t_x+jT$ (j is arbitrary integers) into $S_j$ for a cycle of a transmission period. The transmission power last value Pe ($S_{-1}$) of the past transmission period $S_{-1}$, $S_{-2}$, ---$S_{-n}$ (n is a positive



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integer), Pe ($S_{-2}$) and ---Pe ($S_{-n}$) are memorized, respectively, [Pe($S_{-1}$)+Pe ($S_{-2}$) --- +Pe ($S_{-n}$)] An updating method of the transmission power initial value according to claim 1 calculating a moving average deviation of the past transmission power last value by /n, and making this moving average deviation into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 3]When making a transmission period of T and transmission start time $t_x$+jT (j is arbitrary integers) into $S_j$ for a cycle of a transmission period, The last transmission power initial value Pi ($S_{-1}$) and the transmission power last value Pe ($S_{-1}$) of transmission period $S_{-1}$ are memorized, and it is axPi($S_{-1}$)+(1-a) xPe ($S_{-1}$) (0<=a<1). An updating method of the transmission power initial value according to claim 1 are alike, calculating index weighting average value of Pi ($S_{-1}$) and Pe ($S_{-1}$) more, and making this index weighting average value into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 4]An updating method of the transmission power initial value according to claim 2 or 3 memorizing the transmission power last value Pe ($S_{-1}$) of the last transmission period $S_{-1}$, and making this Pe ($S_{-1}$) into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 5]When making into $S_j$ a transmission period which are T and time t=$t_x$+jT (j is arbitrary integers) about a cycle of a transmission period, Transmission power average value Pa of the past transmission period $S_{-1}$, $S_{-2}$, ---$S_{-n}$ (n is a positive integer) ($S_{-1}$), It memorizes respectively in quest of Pa ($S_{-2}$) and ---Pa ($S_{-n}$), [Pa($S_{-1}$)+Pa ($S_{-2}$) --- +Pa ($S_{-n}$)] An updating method of the transmission power initial value according to claim 1 calculating a moving average deviation of the past transmission power average value by /n, and making this moving average deviation into the transmission power initial



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value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 6]An updating method of the transmission power initial value according to claim 2 or 5 detecting speed of change of a propagation path and deciding a value of said n according to speed of change of said propagation path by supervising change of a transmission power instantaneous value in the past transmission period.

[Claim 7]When making a transmission period of T and transmission start time $t_0$+jT (j is arbitrary integers) into $S_j$ for a cycle of a transmission period, while memorizing the transmission power initial value Pi ($S_{-1}$) of the last transmission period $S_{-1}$, It memorizes in quest of transmission power average value Pa ($S_{-1}$) of the last transmission period $S_{-1}$, and is axPi($S_{-1}$)+(1−a) xPa ($S_{-1}$) (0<=a<1).

An updating method of the transmission power initial value according to claim 1 are alike, calculating index weighting average value of Pi ($S_{-1}$) and Pa ($S_{-1}$) more, and making this index weighting average value into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 8]An updating method of the transmission power initial value according to claim 5 or 7 memorizing in quest of transmission power average value Pa ($S_{-1}$) of the last transmission period $S_{-1}$, and making this Pa ($S_{-1}$) into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[Claim 9]An updating method of the transmission power initial value according to claim 3 or 7 detecting speed of change of a propagation path and deciding a value of said a according to speed of change of a propagation path by supervising change of a transmission power instantaneous value in the past transmission period.

[Claim 10]When making a transmission period of T and transmission start time $t=t_0$+jT (j is arbitrary integers) into $S_j$ for a cycle of a transmission period, while memorizing



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the transmission power last value Pe ($S_{-1}$) of the last transmission period $S_{-1}$, Transmission power average value Pa of the past transmission period $S_{-1}$, $S_{-2}$, ---$S_{-n}$ (n is a positive integer) ($S_{-1}$), It memorizes respectively in quest of Pa ($S_{-2}$) and ---Pa ($S_{-n}$). Speed of change of a propagation path is detected by supervising change of a transmission power instantaneous value in the past transmission period, According to speed of change of a propagation path, [ whether the last transmission power last value Pe ($S_{-1}$) is made into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following, and ] In deciding whether to set a moving average deviation of the past transmission power average value to Pi ($S_0$) and setting a moving average deviation to Pi ($S_0$). An updating method of the transmission power initial value according to claim 1 deciding a value of n according to speed of change of a propagation path, and calculating a moving average deviation by [Pa($S_{-1}$)+Pa ($S_{-2}$) --- +Pa ($S_{-n}$)] / n.

[Claim 11]When making a transmission period of T and transmission start time $t_x$+jT (j is arbitrary integers) into $S_j$ for a cycle of a transmission period, While memorizing the last transmission power initial value Pi ($S_{-1}$) and the transmission power last value Pe ($S_{-1}$) of transmission period $S_{-1}$, It memorizes in quest of transmission power average value Pa ($S_{-1}$) of the last transmission period $S_{-1}$, Speed of change of a propagation path is detected by supervising change of a transmission power instantaneous value in the past transmission period, According to speed of change of a propagation path, [ whether the last transmission power last value Pe ($S_{-1}$) is made into the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following, and ] It decides whether to set the last transmission power initial value Pi ($S_0$) and index weighting average value of last transmission power average value Pa ($S_0$) to Pi ($S_0$). In setting



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index weighting average value to Pi ($S_0$), according to speed of change of a propagation path, it decides a value of a, and it is axPi($S_0$)+(1-a) xPa ($S_0$) (0<=a<1). An updating method of the transmission power initial value according to claim 1 are alike and calculating index weighting average value more.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]In each of the discrete transmission period this invention polls the terminal of plurality [ base station ], and according [ a terminal ] to polling, It transmits with a transmission power initial value first, It is related with the updating method of said transmission power initial value of said terminal in radio communications systems, such as a CDMA (Code Division Multiple Access: code division multiplexing) system which amends transmission power according to the command from a base station after it.

[0002]

[Description of the Prior Art]The CDMA system which polls is constituted by the terminal A of N (=LxM) individual, and the one base station B, for example like drawing 1.

Multiplex [ of the N terminals A ] is carried out at a time to L each of the M polling groups GP.

Like [ drawing 2 ], the base station B polls the one group GP to every time slot S, and



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carries out CDMA communication to the L terminals A of the group GP.

[0003]In a CDMA system, in order to maintain communication quality, it is necessary to control the transmission power of the terminal A so that the received power in the base station B becomes a reference electrode value. The transmission slot from time $t=t_k+jT$ (as for the arbitrary integers from 1 to M and j, in k, arbitrary integers and T are transmission slot cycles) to $t=t_k+jT+deltat$ (deltat is the length of a transmission slot and $deltat<T$) of the terminal A is made into $S_j$. In transmission slot $S_j$, after the transmission power of the terminal A is set as the initial value Pi with the terminal A at transmission slot time-of-onset $t=t_k+jT$, sequential control of it is carried out by the base station B to transmission slot end time $t=t_k+jT+deltat$.

[0004]In the terminal A of drawing 3, and the block diagram of the base station B, if the terminal A is polled from the base station B, it will set the transmission power P as the initial value Pi at transmission slot time-of-onset $t=t_k+jT$, and will transmit the spread modulating signal of send data to the base station B with the transmission power initial value Pi.

[0005]The base station B generates the power-controls mark for controlling the transmission power of the terminal A, and transmits the spread modulating signal of this power-controls mark to the terminal A so that it may ask for the displacement (received power displacement) from the reference electrode value of the received power value of a spread modulating signal and this received power displacement may become small. The base station B transmits a power-controls mark one by one to transmission slot end time $t=t_k+jT+deltat$, after receiving the spread modulating signal transmitted with the transmission power initial value Pi.

[0006]The terminal A amends the transmission power P one by one to transmission



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slot end time $t=t_0+jT+deltat$ according to the power-controls mark recovered from the received spread modulating signal, after transmitting with the transmission power initial value Pi.

[0007]Thus, in transmission slot $S_j$, only the first transmission power initial value Pi is set up with the terminal A, and the transmission power P after it is controlled by the base station B according to received power displacement.

[0008]By the way, the propagation loss of a propagation path is changed in time by phasing or shadowing. If the received power of the base station B is changed by change of this propagation path, communication quality will deteriorate. In transmission slot $S_j$, the received power value of the base station B turns into a value near a reference electrode value, and can compensate change of a propagation path with the period by which the transmission power P is controlled according to received power displacement. However, in the period which transmits with the transmission power initial value Pi, if the transmission power initial value Pi is not set up so that the terminal A may compensate change of a propagation path, communication quality deteriorates.

[0009]In the following explanation, the median of an ideal transmission power instantaneous value and an ideal transmission power instantaneous value is called the ideal transmission power median for the instantaneous value of the ideal transmission power with which the momentary fluctuation of a propagation path is compensated thoroughly. The median of the time t is a value to which the probability that the ideal transmission power instantaneous value of the time t of one day will become larger than the median, and the probability which becomes smaller than the median become equal, when the cycle of the time profile of an ideal transmission power instantaneous



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value is 24 hours per day.

[0010]Drawing 17 is a figure explaining the updating method of the conventional transmission power initial value. In a training period the updating method of the transmission power initial value of drawing 17. The transmission power P of the terminal A is controlled according to the power-controls mark which transmitted training data to the base station B from the terminal A, and was transmitted from the base station B, and a training value is calculated from the transmission power P of a training period in the terminal A, and let this training value be the transmission power initial value Pi. A training value is average value of the transmission power P of a training period, for example. In the method of drawing 17, the transmission power initial value Pi is not updated, but the same transmission power initial value Pi is used by each transmission slot until training is carried out next.

[0011]

[Problem to be solved by the invention]In order to make into a transmission power electric power initial value the training value which is average value of the ideal transmission power instantaneous value of a training period, there are the following two problems in the technology of the ****** former [ deer ].

[0012]Drawing 18 is a figure explaining the 1st problem of conventional technology. Like drawing 18, when the fluctuation period of an ideal transmission power instantaneous value is longer than the transmission slot cycle T, it is desirable to make the transmission power initial value Pi follow an ideal electric power instantaneous value. However, in conventional technology, since the training value which is average value of the ideal transmission power instantaneous value of a training period is made into the transmission power initial value Pi of each



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transmission slot, the transmission power initial value Pi does not follow an ideal transmission power instantaneous value.

[0013]Drawing 19 is a figure explaining the 2nd problem of conventional technology. When the fluctuation period of an ideal transmission power instantaneous value is longer than the transmission slot cycle T, it is desirable to make the transmission power initial value Pi follow the ideal electric power median. However, in conventional technology, since the training value is made into the transmission power initial value Pi of each transmission slot, even if the ideal transmission power median has change, the transmission power initial value Pi does not follow the ideal transmission power median like drawing 19. Even if there is no change in the ideal transmission power median, when the fluctuation period of an ideal transmission power instantaneous value is not longer enough than a training period, A training value turns into value [ median / ideal transmission power ] shifted, and the transmission power initial value Pi of each transmission slot turns into value [ median / ideal transmission power ] shifted.

[0014]This invention is made in order to solve the above-mentioned conventional problem, and an object of this invention is to provide the updating method of the transmission power initial value which can update a transmission power initial value according to change of a propagation path.

[0015]

[Means for solving problem]In order to attain the above-mentioned purpose the updating method of the transmission power initial value of this invention, In each of the discrete transmission period a base station polls two or more terminals, and according [ a terminal ] to polling, It is an updating method of said transmission power



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initial value of said terminal in the radio communications system which transmits with a transmission power initial value first, and amends transmission power according to the command from a base station after it. The transmission power of the terminal of the past transmission period is memorized, and the transmission power initial value of the next transmission period is calculated from the past transmission power.

[0016]

[Mode for carrying out the invention]Before describing an embodiment of the invention, polling of a CDMA (Code Division Multiple Access: code division multiplexing) system is explained.

[0017]Drawing 1 is a block diagram of the CDMA system of polling. The CDMA system of drawing 1 is constituted by the terminal A ($A_1$~$A_N$) of N (= LxM) individual, and the one base station B. The polling group number of this CDMA system is M, and a terminal multiplexed number is L. Multiplex [ of N terminal $A_1$ – the $A_N$ ] is carried out at a time to M each [ L ] of polling group $GP_1$ – $GP_M$.

[0018]Drawing 2 is a figure explaining the polling method of the CDMA system of drawing 1. In drawing 2, S (t1+jT) (j is arbitrary integers) is a time slot from time t=t1+jT to t=t1+jT+deltat, and is a polling slot (transmission slot of terminal $A_1$ – $A_L$) of polling group $GP_1$. S (tM+jT) is a time slot from time t=tM+jT to t=tM+jT+deltat, and is a polling slot (transmission slot of terminal $A_{N-L+1}$ – $A_N$) of polling group $GP_M$. deltat is the length of a time slot, T is a cycle of the transmission slot of the one terminal A, and it is T=Mxdeltat.

[0019]In the time slot S (t1+T), the base station B polls group $GP_1$, CDMA communication of it is carried out to terminal $A_1$ – $A_L$, it polls group $GP_2$ in the following time slot S (t2+T), and communicates with terminal $A_{L+1}$ – $A_{2L}$. Hereafter, in



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the slots S (t3+T)–S (tM+T), group $GP_3$ – $GP_M$ are polled one by one, and it communicates with terminal $A_{2L+1}$ – $A_N$, and in the slot S (t1), group $GP_1$ is polled again and it communicates with terminal $A_1$ – $A_L$.

[0020]Drawing 3 is the terminal A of the CDMA system of drawing 1, and a block diagram of the base station B. The terminal A is provided with the following in drawing 3.

The input terminal 1 of send data.

Modulation part 2a.

Power amplification section 3.

The demodulation section 4a, the decoding section 8, and the power controller 9.

The base station B is provided with the following.

Demodulation section 4b.

The output terminal 5 of received data.

Power measurement part 6.

The coding part 7 and modulation part 2b.

[0021]In the terminal A, the modulation part 2a. By giving digital modulation, such as PSK (Phase Shift Keying) abnormal conditions or the FSK (Frequency Shift Keying) abnormal conditions, to the send data inputted from the input terminal 1, (A carrier signal is modulated with the above-mentioned send data), A digital modulation signal is generated, by performing diffusion modulation by a spread code series to this digital modulation signal further, a spread modulating signal is generated and this spread modulating signal is sent to the power amplification section 3. The power amplification section 3 transmits the above-mentioned spread modulating signal to the base station



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B with the transmission power P by amplifying the above-mentioned spread modulating signal by the gain G decided according to gain control signal V from the power controller 9.

[0022]In the base station B, the demodulation section 4b restores to a digital modulation signal by performing spread demodulation by a spread code series to the received spread modulating signal, By furthermore performing digital demodulation, such as an PSK recovery and FSK demodulation, to this digital modulation signal, it restores to received data (it corresponds to the send data from the terminal A), and these received data are sent to the output terminal 5 and the power measurement part 6. The power measurement part 6 measures a received power value from the inputted received data, asks for the displacement (received power displacement) from the reference electrode value of this received power value, and sends this received power displacement to the coding part 7.

[0023]The coding part 7 generates the control code C, and sends it to modulation part 2b. This control code C is a polling control code or a power-controls mark. A polling control code is for polling the terminal A and notifying a transmission slot to the terminal A. A power-controls mark is for controlling the transmission power of the terminal A according to received power displacement in a transmission slot. Modulation part 2b gives digital modulation, such as PSK modulation or the FSK abnormal conditions, to the inputted control code C (a carrier signal is modulated with the above-mentioned power-controls mark C), performs diffusion modulation by a spread code series to this digital modulation signal further, and transmits this spread modulating signal to the terminal A.

[0024]In the terminal A, the demodulation section 4a restores to a digital modulation



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signal by performing spread demodulation by a spread code series to a spread modulating signal, By furthermore performing digital demodulation, such as an PSK recovery and FSK demodulation, to this digital modulation signal, it restores to the control code C and this control code C is sent to the decoding section 8.

[0025]The decoding section 8 decodes the inputted control code C to control data D, and sends it to the power controller 9. Control data D is the polling control data D1 which is decode data of a polling control code, or the power control data D2 which is decode data of a power-controls mark.

[0026]The gain G of the power amplification section 3 supports gain control signal V linearly, and the transmission power P supports the gain G of the power amplification section 3 linearly. Therefore, the transmission power P corresponds to gain control signal V linearly.

[0027]By recognizing the timing of a transmission slot with the polling control data D1, and making gain control signal V into the initial value Vi at the time of a transmission slot start, the power controller 9 sets the transmission power P as the initial value Pi, and starts transmission. If the power control data D2 is inputted into a transmission slot, according to this power control data D2, gain control signal V will be changed and the transmission power P will be amended. If a transmission slot is completed, transmission power P will be set to 0 by gain control signal V, and transmission will be ended.

[0028]Thus, in transmission slot $S_j$ from time $t=t_s+jT$ (j is arbitrary integers) to $t=t_s+jT+deltat$, The transmission power initial value Pi which is the transmission power P of the beginning ($t=t_s+jT$) of the terminal A, It is set up with the terminal A, and after the terminal A receives a power-controls mark first, the transmission power P of the



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terminal A by the time of the end of a slot ($t=t_x+jT+deltat$) is controlled by the base station B according to received power displacement.

[0029]The 1st embodiment drawing 4 is a figure explaining the updating method of the transmission power initial value of a 1st embodiment. In drawing 4, $S_j$ is a transmission slot from time $t=t_x+jT$ to $t=t_x+jT+deltat$. Pi ($S_j$) is a transmission power initial value of transmission slot $S_j$, and is the transmission power P until transmission power amendment is started from time $t=t_x+jT$. Pe ($S_j$) is the transmission power last value of transmission slot $S_j$, and is sending end time $t=t_x+jT+deltat$ or the transmission power P in front of that.

[0030]The updating method of the transmission power initial value of a 1st embodiment memorizes the transmission power last value Pe ($S_{-1}$) of the last transmission slot $S_{-1}$, and makes this Pe ($S_{-1}$) the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[0031]Drawing 5 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 1st embodiment. In drawing 5, a gain control signal initial value and Ve of a gain control signal for the control data (the polling control data D1 or power control data D2) and V to which D was transmitted from the base station B to control the gain of the power amplification section 3, and Vi are the gain control signal last values.

[0032]The gain control signal last value Ve of Vi ($S_j$) and transmission slot $S_j$ is set to Ve ($S_j$) for the gain control signal initial value Vi of transmission slot $S_j$. The gain control signal initial value Vi ($S_j$) is gain control signal [ until transmission power amendment is started from time $t=t_x+jT$ ] V. The gain control signal last value Ve ($S_j$) is sending end time $t=t_x+jT+deltat$ or gain control signal [ in front of that ] V. Gain control



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signal V corresponds to the transmission power P linearly. The gain control signal last value Ve ($S_j$) corresponds to the transmission power initial value Pi ($S_j$), and the gain control signal last value Ve ($S_j$) is equivalent to the transmission power last value Pe ($S_j$).

[0033]The power controller 9 of drawing 5 is provided with the following.

Gain control part 11.

Last value selecting part 12.

The gain control part 11 and the last value selecting part 12 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0034]In transmission slot $S_{-1}$, the last value selecting part 12 memorizes the gain control signal last value Ve ($S_{-1}$), and sends this Ve ($S_{-1}$) to the gain control part 11 as the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following.

[0035]The gain control part 11 sets the transmission power P as the initial value Pi ($S_0$) (=Pe ($S_{-1}$)) by making gain control signal V into the initial value Vi ($S_0$) (=Ve ($S_{-1}$)) at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$). If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.



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[0036]Like drawing 4, when the fluctuation period of an ideal transmission power instantaneous value is longer than the transmission slot cycle T, it is desirable to make the transmission power initial value Pi ($S_0$) follow an ideal transmission power instantaneous value.

[0037]According to this 1st embodiment, since the transmission power last value Pe ($S_{-1}$) of the last transmission slot $S_{-1}$ is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, the transmission power initial value Pi ($S_0$) follows an ideal transmission power instantaneous value. Therefore, the 1st problem of the above-mentioned conventional technology is solvable.

[0038]Thus, according to a 1st embodiment, in the terminal A, the transmission power last value Pe ($S_{-1}$) of the last transmission slot $S_{-1}$ is memorized, By making this Pe ($S_{-1}$) into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, a transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0039]The 2nd embodiment drawing 6 is a figure explaining the updating method of the transmission power initial value of a 2nd embodiment. As for $S_j$ in drawing 6, the transmission power initial value of transmission slot $S_j$ and Pe ($S_j$) of the transmission slot from time $t=t_k+jT$ to $t=t_k+jT+deltat$ and Pi ($S_j$) are the transmission power last values of transmission slot $S_j$.

[0040]The updating method of the transmission power initial value of a 2nd embodiment. The transmission power last value Pe ($S_{-1}$) of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$ (n is a positive integer), Pe ($S_{-2}$) and ---Pe ($S_{-n}$) are memorized, respectively, and it is $Pi(S_0)=Pen=[+Pe(S_{-n})]/n$ about the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. --- (1) [ $Pe(S_{-1})+Pe(S_{-2})$ --- ]



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It is alike and asks more. That is, the transmission power moving average deviation Pen is calculated from the past transmission power last value Pe ($S_{-1}$), Pe ($S_{-2}$), and —Pe ($S_{-n}$), and this moving average deviation Pen is made into the following transmission power initial value Pi ($S_0$). In this 2nd embodiment, the special case where the last value number n is set to n= 1 is equivalent to a 1st embodiment of the above.

[0041]Drawing 7 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 2nd embodiment. As for control data (the polling control data D1 or power control data D2) and V, in drawing 7, a gain control signal initial value and Ve of a gain control signal and Vi are [ D ] the gain control signal last values. Ven is the gain control signal moving average deviation calculated as the gain control signal initial value Vi.

[0042]The power controller 9 of drawing 7 is provided with the following.

Gain control part 21.

Last value selecting part 22.

Moving-average-arithmetic part 23.

The gain control part 21 and the last value selecting part 22 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0043]In transmission slot $S_j$, the last value selecting part 22 holds the gain control signal last value Ve ($S_j$), and sends this gain control signal last value Ve ($S_j$) to the moving-average-arithmetic part 23.



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[0044]The moving-average-arithmetic part 23 The gain control signal last value Ve ($S_{-1}$) of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$, Ve ($S_{-2}$) and ---Ve ($S_{-n}$) are memorized, respectively, and it is Vi($S_0$) =Ven =[+Pe($S_{-n}$)]/n about the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following. --- (2) [ Ve($S_{-1}$)+Ve ($S_{-2}$) --- ]

It is alike, and asks more and this gain control signal initial value Vi ($S_0$) is sent to the gain control part 21.

[0045]The gain control part 21 sets the transmission power P as the initial value Pi ($S_0$) of the above-mentioned (1) formula by making gain control signal V into the initial value Vi ($S_0$) of the above-mentioned (2) formula at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$) of the above-mentioned (1) formula. If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0046]When the fluctuation period of an ideal transmission power instantaneous value is shorter than the transmission slot cycle T, it is [ like / drawing 6 ] desirable to make the transmission power initial value Pi ($S_0$) follow the ideal transmission power median.

[0047]In this 2nd embodiment, the transmission power last value Pe ($S_{-1}$) of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$, The transmission power moving average deviation Pen is calculated from Pe ($S_{-2}$) and ---Pe ($S_{-n}$), and this Pen is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. The



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transmission power moving average deviation Pen will turn into a value approximated to the ideal transmission power median, if the last value number n is an appropriate value according to the length of the fluctuation period of an ideal transmission power instantaneous value. According to a 1st embodiment of the above, when the ideal transmission power median is changed like to drawing 6, the transmission power initial value Pi may shift from the ideal transmission power median greatly. However, in this 2nd embodiment, even if it changes the ideal transmission power median like to drawing 6, the transmission power initial value Pi does not shift from the ideal transmission power median greatly, and is followed at the ideal transmission power median. That is, the 2nd problem of the above-mentioned conventional technology is solvable. In a 2nd embodiment, it is necessary to increase the last value number n, so that the fluctuation period of an ideal transmission power instantaneous value is long. The transmission power median flattery sensitivity of the transmission power initial value Pi becomes high, so that there is little last value number n.

[0048]According to a 2nd embodiment, in the terminal A Thus, the transmission power last value Pe ($S_{-1}$) of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$, By memorizing Pe ($S_{-2}$) and ---Pe ($S_{-n}$), respectively, calculating the moving average deviation of the past transmission power last value, and making this moving average deviation into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, A transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0049]The transmission power initial value updating method of a 3rd embodiment [ 3rd ] of an embodiment, The last transmission power initial value Pi ($S_{-1}$) and the transmission power last value Pe ($S_{-1}$) of transmission slot $S_{-1}$ are memorized. About



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the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following, it is $Pi(S_0) = Pea = a \times Pi(S_{-1}) + (1-a) \times Pe(S_{-1})$ --- (3)

It is alike and asks more. That is, the transmission power index weighting average value Pea is calculated from the last transmission power initial value Pi ($S_{-1}$) and the transmission power last value Pe ($S_{-1}$), and this transmission power index weighting average value Pea is made into the following transmission power initial value Pi ($S_0$). In the above-mentioned (3) formula, a is an oblivion coefficient and is $0 <= a < 1$. In this 3rd embodiment, the special case where the oblivion coefficient a is set to a= 0 is equivalent to a 1st embodiment of the above.

[0050]Drawing 8 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 3rd embodiment. In drawing 8, D is control data (the polling control data D1 or power control data D2), V is a gain control signal, Vi is a gain control signal initial value, and Ve is the gain control signal last value. Vea is the gain control signal index weighting average value calculated as the gain control signal initial value Vi.

[0051]The power controller 9 of drawing 8 is provided with the following.

Gain control part 31.

Last value selecting part 32.

Index weighting averaging operator part 33.

The gain control part 31 and the last value selecting part 32 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.



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[0052]In the last transmission slot $S_{-1}$, the last value selecting part 32 holds the gain control signal last value Ve ($S_{-1}$), and sends this Ve ($S_{-1}$) to the index weighting averaging operator part 33.

[0053]The index weighting averaging operator part 33 has memorized the last gain control signal initial value Vi ($S_{-1}$) and the gain control signal last value Ve ($S_{-1}$) of transmission slot $S_{-1}$. About the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following, it is $Vi(S_0) = Vea = axVi(S_{-1}) + (1-a) xVe (S_{-1})$. --- (4)
It is alike and asks more, and while memorizing this gain control signal initial value Vi ($S_0$), it sends to the gain control part 31.

[0054]The gain control part 31 sets the transmission power P as the initial value Pi ($S_0$) of the above-mentioned (1) formula by making gain control signal V into the initial value Vi ($S_0$) of the above-mentioned (4) formula at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$) of the above-mentioned (1) formula. If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0055]When the fluctuation period of an ideal transmission power instantaneous value is shorter than the transmission slot cycle T, it is desirable to make the transmission power initial value Pi ($S_0$) follow the ideal transmission power median.

[0056]In this 3rd embodiment, the transmission power index weighting average value Pea is calculated from the last transmission power initial value Pi ($S_{-1}$) and the



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transmission power last value Pe ($S_{-1}$) of transmission slot $S_{-1}$. This Pea is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. The transmission power index weighting average value Pea will turn into a value approximated to the ideal transmission power median, if the oblivion coefficient a is an appropriate value according to the length of the fluctuation period of an ideal transmission power instantaneous value. Therefore, even if it changes the ideal transmission power median, the transmission power initial value Pi does not shift from the ideal transmission power median greatly, and follows the ideal transmission power median. That is, the 2nd problem of the above-mentioned conventional technology is solvable. In a 3rd embodiment, it is necessary to enlarge the oblivion coefficient a, so that the fluctuation period of an ideal transmission power instantaneous value is long. The transmission power median flattery sensitivity of the transmission power initial value Pi becomes high, so that the oblivion coefficient a is made small.

[0057]In this 3rd embodiment, although a transmission power initial value is calculated by an index weighting averaging operator, the circuit structure of the index weighting averaging operator part 33 is smaller than the moving-average-arithmetic part 23 of a 2nd embodiment of the above. Therefore, circuit structure of the terminal A can be made smaller than a 2nd embodiment of the above.

[0058]Thus, according to a 3rd embodiment, in the terminal A, the last transmission power initial value Pi ($S_{-1}$) and the transmission power last value Pe ($S_{-1}$) of transmission slot $S_{-1}$ are memorized, By calculating the index weighting average value of Pi ($S_{-1}$) and Pe ($S_{-1}$), and making this index weighting average value into the following transmission power initial value Pi ($S_0$), a transmission power initial value can be updated so that it may correspond to change of a propagation path.



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[0059]The updating method of the transmission power initial value of a 4th embodiment [ 4th ] of an embodiment. In either of a 2nd or 3rd embodiment of the above, the speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission slot. According to the speed of change of a propagation path, the last value number n of moving average arithmetic or the oblivion coefficient a of an index weighting averaging operator is decided. When n= 1 or a= 0 is used, it becomes the same as a 1st embodiment of the above. That is, according to the speed of change of a propagation path, the last value number n or the oblivion coefficient a is changed, and a 1st, 2nd, or 3rd embodiment of the above is realized.

[0060]Drawing 9 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 4th embodiment. As for control data (the polling control data D1 or power control data D2) and V, in drawing 9, a gain control signal initial value and Ve of a gain control signal and Vi are [ D ] the gain control signal last values. E is a propagation path detection signal for notifying the speed of change of a propagation path. n is the last value number of the above (1) and (2) types, and a is an oblivion coefficient of the above (3) and (4) types. Ven is a gain control signal moving average deviation of the above-mentioned (2) formula, and Vea is the gain control signal index weighting average value of the above-mentioned (4) formula.

[0061]The last value number n when calculating the gain control signal initial value Vi ($S_j$) (therefore, transmission power initial value Pi ($S_j$)) of transmission slot $S_j$ is set to n ($S_j$), and the oblivion coefficient a is set to a ($S_j$).

[0062]The power controller 9 of drawing 9 is provided with the following.



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Gain control part 41.

Transmission power Monitoring Department 42.

Averaging operator control section 43.

The last value selecting part 44 and the averaging operator part 45.

The gain control part 41, the transmission power Monitoring Department 42, and the last value selecting part 44 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0063]The last value selecting part 44 is the last value selecting part 22 of drawing 7, or the last value selecting part 32 of drawing 8. The averaging operator part 45 is the moving-average-arithmetic part 23 of drawing 7, or the index weighting averaging operator part 33 of drawing 8.

[0064]The transmission power Monitoring Department 42 supervises change of the instantaneous value of the transmission power P by supervising change of the instantaneous value of gain control signal V in transmission slot $S_j$. The speed of change of a propagation path is detected from change of the instantaneous value of the transmission power P, and a propagation path detection signal notifies the speed of change of this propagation path to the averaging operator control section 43. In the period when the transmission power P is controlled by the base station B in transmission slot $S_j$, change of the instantaneous value of the transmission power P is followed at change of an ideal transmission power instantaneous value. Change of an ideal transmission power instantaneous value follows change of a propagation path.



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Therefore, the speed of change of a propagation path is detectable by supervising change of the instantaneous value (instantaneous value of gain control signal V) of the transmission power P. For example, the maximal value number or the minimal value number of the transmission power P of transmission slot $S_j$ is counted, and these number is sent to the averaging operator control section 43 by a propagation path detection signal. In this case, change of a propagation path will be quick, so that there is much maximal value number or minimal value number.

[0065]According to the speed of change of the propagation path in the last transmission slot $S_{-1}$, or the speed of change of the propagation path in two or more past transmission slots, the averaging operator control section 43 determines the last value number n ($S_0$) or the oblivion coefficient a ($S_0$), and notifies it to the averaging operator part 45. Like drawing 6, change (change of an ideal transmission power instantaneous value) of a propagation path is set as n ($S_0$)>=2 and a($S_0$) > 0, when quick. Like drawing 4, in being late, change (change of an ideal transmission power instantaneous value) of a propagation path is set as n($S_0$) = 1 and a($S_0$) = 0, and becomes the same as the power controller 9 of a 1st embodiment of the above.

[0066]The averaging operator part 45 carries out moving average arithmetic of the above-mentioned (2) formula with the last value number n ($S_0$) notified from the averaging operator control section 43, and calculates the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following. Or the index weighting operation of the above-mentioned (4) formula is carried out by the oblivion coefficient a ($S_0$) notified from the averaging operator control section 43, and the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following is calculated. And the calculated gain control signal initial value Vi ($S_0$) is sent to the gain control part 41.



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[0067]The gain control part 41 sets the transmission power P as the initial value Pi ($S_0$) by making gain control signal V into the initial value Vi ($S_0$) into which it was inputted from the averaging operator part 45 at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$). If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0068]In this 4th embodiment, the speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission period, Since he is trying to decide the last value number n of moving average arithmetic, or the oblivion coefficient a of an index weighting averaging operator according to the speed of change of a propagation path. A 1st embodiment of the above, a 2nd embodiment of the above, or a 1st embodiment of the above and a 3rd embodiment of the above can be properly used according to the speed (the length of the fluctuation period of an ideal transmission power instantaneous value) of change of a propagation path. Thereby, the transmission power initial value Pi follows the ideal transmission power median, when change (change of an ideal transmission power instantaneous value) of a propagation path is quick, and when late, it follows an ideal transmission power instantaneous value. Therefore, the 1st problem and 2nd problem of the above-mentioned conventional technology are solvable.

[0069]Thus, in [ according to a 4th embodiment ] either of a 2nd or 3rd embodiment of



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the above. The speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission slot. According to the speed of change of a propagation path, by deciding the last value number n of moving average arithmetic, or the oblivion coefficient a of an index weighting averaging operator, a transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0070]The 5th embodiment drawing 10 is a figure explaining the updating method of the transmission power initial value of a 5th embodiment. In drawing 10, $S_j$ is a transmission slot from time $t=t_k+jT$ to $t=t_k+jT+deltat$, and Pi ($S_j$) is a transmission power initial value of transmission slot $S_j$. Pa ($S_j$) is the transmission power slot average value of transmission slot $S_j$, and is the average value from time $t=t_k+jT$ to $t=t_k+jT+deltat$ of the instantaneous value of the transmission power P.

[0071]The updating method of the transmission power initial value of a 5th embodiment is memorized in quest of transmission power average value Pa ($S_{-1}$) of the last transmission slot $S_{-1}$, and makes this Pa ($S_{-1}$) the transmission power initial value Pi ($S_0$) of transmission period $S_0$ of the following.

[0072]Drawing 11 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 5th embodiment. As for control data (the polling control data D1 or power control data D2) and V, in drawing 11, a gain control signal and Vi of D are gain control signal initial values. Va is gain control signal slot average value.

[0073]The gain control signal average value Va of transmission slot $S_j$ is set to Va ($S_j$). The gain control signal slot average value Va ($S_j$) is average value from time $t=t_k+jT$ to $t=t_k+jT+deltat$ of the instantaneous value of gain control signal V, and corresponds to



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transmission power slot average value Pa ($S_j$).

[0074]The power controller 9 of drawing 11 is provided with the following.

Gain control part 51.

Slot averaging part 52.

The gain control part 51 and the slot averaging part 52 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0075]In transmission slot $S_{-1}$, the slot averaging part 52 calculates the gain control signal slot average value Va ($S_{-1}$), and sends this Ve ($S_{-1}$) to the gain control part 51 as the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following.

[0076]The gain control part 51 sets the transmission power P as the initial value Pi ($S_0$) (=Pa ($S_{-1}$)) by making gain control signal V into the initial value Vi ($S_0$) (=Va ($S_{-1}$)) at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$). If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0077]According to this 5th embodiment, transmission power average value Pa ($S_{-1}$) of the last transmission slot $S_{-1}$ is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. Like drawing 10, when the fluctuation period of



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an ideal transmission power instantaneous value is shorter enough than transmission slot length deltat, Since the slot average value of an ideal transmission power instantaneous value resembles the ideal transmission power median, transmission power slot average value Pa ($S_{-1}$) becomes the value approximated to the ideal transmission power median in transmission slot $S_{-1}$. Therefore, when the fluctuation period of an ideal transmission power instantaneous value is shorter enough than transmission slot length deltat, even if it changes the ideal transmission power median like drawing 10, the transmission power initial value Pi does not shift from the ideal transmission power median greatly, and follows the ideal transmission power median. That is, the 2nd problem of the above-mentioned conventional technology is solvable.

[0078]Thus, according to a 5th embodiment, in the terminal A, it memorizes in quest of transmission power average value Pa ($S_{-1}$) of the last transmission slot $S_{-1}$, By making this Pa ($S_{-1}$) into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, it can respond to change of a propagation path.

[0079]The 6th embodiment drawing 12 is a figure explaining the updating method of the transmission power initial value of a 6th embodiment. As for $S_j$, in drawing 12, the transmission power initial value of transmission slot $S_j$ and Pa ($S_j$) of the transmission slot from time $t=t_k+jT$ to $t=t_k+jT+$deltat and Pi ($S_j$) are the transmission power slot average value of transmission slot $S_j$.

[0080]The transmission power initial value updating method of a 6th embodiment, Transmission power average value Pa of the past transmission period $S_{-1}$, $S_{-2}$, —$S_{-n}$ (n is a positive integer) ($S_{-1}$). It memorizes respectively in quest of Pa ($S_{-2}$) and —Pa ($S_{-n}$), and they are $Pi(S_0)$ =Pan =[Pa($S_{-1}$)+Pa ($S_{-2}$) — +Pa ($S_{-n}$)] / n about the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. — (5)



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It is alike and asks more. That is, the transmission power moving average deviation Pan is calculated from the past transmission power slot average value Pa ($S_{-1}$) and Pa ($S_{-2}$) and ---Pa ($S_{-n}$), and this transmission power moving average deviation Pan is made into the following transmission power initial value Pi ($S_0$). In this 6th embodiment, the special case where the slot average value number n is set to n= 1 is equivalent to a 5th embodiment of the above.

[0081]Drawing 13 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 6th embodiment. As for control data (the polling control data D1 or power control data D2) and V, in drawing 13, a gain control signal initial value and Va of a gain control signal and Vi are [ D ] gain control signal slot average value. Van is a gain control signal moving average deviation.

[0082]The power controller 9 of drawing 13 is provided with the following.

Gain control part 61.

Slot averaging part 62.

Moving-average-arithmetic part 63.

The gain control part 61 and the slot averaging part 62 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0083]In transmission slot $S_j$, the slot averaging part 62 calculates the gain control signal slot average value Va ($S_j$), and sends this Va ($S_j$) to the moving-average-arithmetic part 63.



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[0084]The moving-average-arithmetic part 63 The gain control signal average value Va ($S_{-1}$) of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$, Va ($S_{-2}$) and ---Va ($S_{-n}$) are memorized, respectively, and they are Vi($S_0$) =Van =[Va($S_{-1}$)+Va ($S_{-2}$) --- +Pa ($S_{-n}$)] / n about the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following. --- (6)

It is alike, and asks more and this gain control signal initial value Vi ($S_0$) is sent to the gain control part 61.

[0085]The gain control part 61 sets the transmission power P as the initial value Pi ($S_0$) of the above-mentioned (5) formula by making gain control signal V into the initial value Vi ($S_0$) of the above-mentioned (6) formula at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$) of the above-mentioned (1) formula. If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0086]In this 6th embodiment, transmission power slot average value Pa of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$ ($S_{-1}$), The transmission power moving average deviation Pan is calculated from Pa ($S_{-2}$) and ---Pa ($S_{-n}$), and this Pan is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. When, as for transmission power slot average value Pa, the fluctuation period of an ideal transmission power instantaneous value becomes comparatively long (about the half of for example, transmission slot length deltat), it stops approximating transmission



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power slot average value Pa to the ideal transmission power median. However, the transmission power moving average deviation Pan will turn into a value approximated to the ideal transmission power median, if the slot average value number n is an appropriate value according to the length of the fluctuation period of an ideal transmission power instantaneous value. Therefore, even if it changes the ideal transmission power median, the transmission power initial value Pi does not shift from the ideal transmission power median greatly, and follows the ideal transmission power median. That is, the 2nd problem of the above-mentioned conventional technology is solvable.

[0087]In a 6th embodiment, it is necessary to increase the slot average value number n, so that the fluctuation period of an ideal transmission power instantaneous value is long. However, if the slot average value number n is increased, the transmission power median flattery sensitivity of the transmission power initial value Pi will become blunt. Therefore, this 6th embodiment (in the case of n>=2) can follow the ideal transmission power median, even if the fluctuation period of an ideal transmission power instantaneous value is long, but flattery sensitivity becomes blunt rather than a 5th embodiment (in the case of n= 1) of the above.

[0088]In a 6th embodiment, since the transmission power moving average deviation Pan is calculated from transmission power slot average value Pa, the appropriate value of n becomes small rather than the case where the transmission power moving average deviation Pan is calculated from the transmission power last value Pa. Therefore, flattery sensitivity can be made higher than a 2nd embodiment of the above.

[0089]According to a 6th embodiment, in the terminal A Thus, transmission power



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average value Pa of the past transmission slot $S_{-1}$, $S_{-2}$, ---$S_{-n}$ ($S_{-1}$), It memorizes respectively in quest of Pa ($S_{-2}$) and ---Pa ($S_{-n}$), By calculating the moving average deviation of the past transmission power slot average value, and making this moving average deviation into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, a transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0090]The updating method of the transmission power initial value of a 7th embodiment [ 7th ] of an embodiment. While memorizing the transmission power initial value Pi ($S_{-1}$) of the last transmission slot $S_{-1}$, it memorizes in quest of transmission power average value Pa ($S_{-1}$) of the last transmission slot $S_{-1}$ --- $Pi(S_0) = Paa$

$= a \times Pi(S_{-1}) + (1-a) \times Pa(S_{-1})$ --- (7)

It is alike and asks more. That is, the transmission power index weighting average value Paa is calculated from the last transmission power initial value Pi ($S_{-1}$) and transmission power slot value Pa ($S_{-1}$), and this transmission power index weighting average value Paa is made into the following transmission power initial value Pi ($S_0$). In this 7th embodiment, the special case where the oblivion coefficient a is set to a= 0 is equivalent to a 5th embodiment of the above.

[0091]Drawing 14 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 7th embodiment. As for control data (the polling control data D1 or power control data D2) and V, in drawing 14, a gain control signal initial value and Va of a gain control signal and Vi are [ D ] gain control signal slot average value. Vaa is gain control signal index weighting average value.

[0092]The power controller 9 of drawing 14 is provided with the following.



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Control voltage generation part 71.

Slot averaging part 72.

Moving-average-arithmetic part 73.

The gain control part 71 and the slot averaging part 72 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0093]In the last transmission slot $S_{-1}$, the slot averaging part 72 calculates the gain control signal slot average value Va ($S_{-1}$), and sends this Va ($S_{-1}$) to the index weighting averaging operator part 73.

[0094]The index weighting averaging operator part 73 has memorized the last gain control signal initial value Vi ($S_{-1}$) and the gain control signal slot average value Va ($S_{-1}$) of transmission slot $S_{-1}$. About the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following, it is $Vi(S_0) = Vaa = axVi(S_{-1}) + (1-a) \times Va(S_{-1})$. --- (8) It is alike and asks more, and while memorizing this gain control signal initial value Vi ($S_0$), it sends to the gain control part 71.

[0095]The gain control part 71 sets the transmission power P as the initial value Pi ($S_0$) of the above-mentioned (7) formula by making gain control signal V into the initial value Vi ($S_0$) of the above-mentioned (8) formula at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$) of the above-mentioned (1) formula. If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P



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will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0096]In this 7th embodiment, the transmission power index weighting average value Paa is calculated from the transmission power initial value Pi ($S_{-1}$) of the last transmission slot $S_{-1}$, and transmission power slot average value Pa ($S_{-1}$). This Paa is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following. This transmission power index weighting average value Paa will turn into a value approximated to the ideal transmission power median, if the oblivion coefficient a is an appropriate value according to the length of the fluctuation period of an ideal transmission power instantaneous value. Therefore, even if it changes the ideal transmission power median, the transmission power initial value Pi does not shift from the ideal transmission power median greatly, and follows the ideal transmission power median. That is, the 2nd problem of the above-mentioned conventional technology is solvable.

[0097]In a 7th embodiment, it is necessary to enlarge the oblivion coefficient a, so that the fluctuation period of an ideal transmission power instantaneous value is long. However, if the oblivion coefficient a is increased, the transmission power median flattery sensitivity of the transmission power initial value Pi will become blunt. Therefore, this 7th embodiment (in the case of na>0) can follow the ideal transmission power median, even if the fluctuation period of an ideal transmission power instantaneous value is long, but flattery sensitivity becomes blunt rather than a 5th embodiment (in the case of a= 0) of the above.

[0098]In a 7th embodiment, since the transmission power index weighting average



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value Paa is calculated from transmission power slot average value Pa, the appropriate value of a becomes small rather than the case where the transmission power index weighting average value Paa is calculated from the transmission power last value Pe. Therefore, flattery sensitivity can be made higher than a 3rd embodiment of the above.

[0099]In a 7th embodiment, although a transmission power initial value is calculated by an index weighting averaging operator, the circuit structure of the index weighting averaging operator part 73 is smaller than the moving-average-arithmetic part 63 of a 6th embodiment of the above. Therefore, circuit structure of the terminal A can be made smaller than a 6th embodiment of the above.

[0100]Thus, according to a 7th embodiment, in the terminal A, the last transmission power initial value Pi ($S_{-1}$) and transmission power slot value Pa ($S_{-1}$) of transmission slot $S_{-1}$ are memorized. By calculating the index weighting average value of Pi ($S_{-1}$) and Pe ($S_{-1}$), and making this index weighting average value into the following transmission power initial value Pi ($S_0$), a transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0101]The transmission power initial value updating method of an 8th embodiment [ 8th ] of an embodiment. In a 6th or 7th embodiment of the above, the speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission slot, According to the speed of change of a propagation path, the slot average value number n of moving average arithmetic or the oblivion coefficient a of an index weighting averaging operator is decided. When n= 1 or a= 0 is used, it becomes the same as a 5th embodiment of the above. That is, according to the speed of change of a propagation path, the slot



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average value value number n or the oblivion coefficient a is changed, and a 5th, 6th, or 7th embodiment of the above is realized.

[0102]Drawing 15 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of an 8th embodiment. As for a gain control signal and Vi, in drawing 15, D is [ control data (the polling control data D1 or power control data D2) and V / gain control signal slot average value and E of a gain control signal initial value and Va ] propagation path detection signals. n is the slot average value number of the above (5) and (6) types, and a is an oblivion coefficient of the above (7) and (8) types. Van is a gain control signal moving average deviation of the above-mentioned (6) formula, and Vaa is the gain control signal index weighting average value of the above-mentioned (8) formula.

[0103]n ($S_j$) and the oblivion coefficient a are set to a ($S_j$) for the slot average value number n when calculating the gain control signal initial value Vi ($S_j$) (therefore, transmission power initial value Pi ($S_j$)) of transmission slot $S_j$.

[0104]The power controller 9 of drawing 15 is provided with the following.

Control voltage generation part 81.

Transmission power Monitoring Department 82.

Average slot number deciding part 83.

The slot averaging part 84 and the averaging operator part 85.

The gain control part 81, the transmission power Monitoring Department 82, and the slot averaging part 84 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$)



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of transmission slot $S_j$ is also the same.

[0105]In transmission slot $S_j$, the slot averaging part 84 calculates the gain control signal slot average value Va ($S_j$), and sends this Va ($S_j$) to the averaging operator part 85.

[0106]The transmission power Monitoring Department 82 is the same as the transmission power Monitoring Department 42 of drawing 9. By supervising change of the instantaneous value of gain control signal V in transmission slot $S_j$, change of the instantaneous value of the transmission power P is supervised, the speed of change of a propagation path is detected from change of the instantaneous value of the transmission power P, and a propagation path detection signal notifies the speed of change of this propagation path to the averaging operator control section 83.

[0107]According to the speed of change of the propagation path in the last transmission slot $S_{j-1}$, or the speed of change of the propagation path in two or more past transmission slots, the averaging operator control section 83 determines the slot average value number n ($S_0$) or the oblivion coefficient a ($S_0$), and notifies it to the averaging operator part 85. In the case of $n(S_0) = 1$ or $a(S_0) = 0$, it becomes the same as the power controller 9 of a 5th embodiment of the above.

[0108]According to the slot average value number n ($S_0$) notified from the averaging operator control section 83, the averaging operator part 85 carries out moving average arithmetic of the above-mentioned (6) formula like the moving-average-arithmetic part 63 of drawing 13, and calculates the gain control signal moving average deviation Van. Or according to the oblivion coefficient a ($S_0$) notified from the averaging operator control section 83, the index weighting operation of the above-mentioned (8) formula is carried out like the index weighting averaging



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operator part 73 of drawing 14, and the gain control signal index weighting average value Vaa is calculated. And the calculated gain control signal moving average deviation Van or the gain control signal index weighting average value Vaa is sent to the gain control part 81 as the gain control signal initial value Vi ($S_0$) of transmission slot $S_0$ of the following.

[0109]The gain control part 81 sets the transmission power P as the initial value Pi ($S_0$) by making gain control signal V into the initial value Vi ($S_0$) into which it was inputted from the averaging operator part 85 at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$). If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0110]In this 8th embodiment, the speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission period. Since he is trying to decide the slot average value number n of moving average arithmetic, or the oblivion coefficient a of an index weighting averaging operator according to the speed of change of a propagation path, A 5th embodiment of the above, a 6th embodiment of the above, or a 5th embodiment of the above and a 7th embodiment of the above can be properly used according to the speed (the length of the fluctuation period of an ideal transmission power instantaneous value) of change of a propagation path. Thereby, the ideal transmission power median can be



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followed more nearly promptly than a 6th or 7th embodiment of the above with high precision than a 5th embodiment of the above (by high flattery sensitivity).

[0111]Thus, in [ according to an 8th embodiment ] either of a 6th or 7th embodiment of the above, The speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission slot, According to the speed of change of a propagation path, by deciding the slot average value number n of moving average arithmetic, or the oblivion coefficient a of an index weighting averaging operator, a transmission power initial value can be updated so that it may correspond to change of a propagation path.

[0112]The transmission power initial value updating method of a 9th embodiment [ 9th ] of an embodiment, The speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value in the past transmission slot, According to the speed of change of a propagation path, [ whether the last transmission power last value Pe ($S_{-1}$) is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, and ] It decides whether to set the value (either the transmission power moving average deviation Van of the above-mentioned (5) formula, or the transmission power index weighting average value Vaa of the above-mentioned (7) formula) by an averaging operator to Pi ($S_0$). In setting the value by an averaging operator to Pi ($S_0$), according to the speed of change of a propagation path, it decides the slot average value number n or the oblivion coefficient a. When n= 1 or a= 0 is used, it becomes the same as a 5th embodiment of the above. In making the last transmission power last value into the following transmission power initial value, it becomes the same as a 1st embodiment of the above. That is, it enables it to choose a 1st embodiment of the above to which the



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next carries out transmission power initial value Pi ($S_0$) of the last transmission power last value Pe ($S_{-1}$) in an 8th embodiment of the above. Therefore, according to the speed of change of a propagation path, a 1st, 5th, and 8th embodiment of the above or a 1st, 5th, and 7th embodiment of the above is realized.

[0113]Drawing 16 is a block diagram of the power controller 9 of the terminal A which applied the updating method of the transmission power initial value of a 9th embodiment. D in drawing 16 Control data (the polling control data D1 or power control data D2), As for V, a gain control signal initial value and Ve a gain control signal and Vi The gain control signal last value, As for Va, a propagation path detection signal and n gain control signal slot average value and E The above (5) and the slot average value number of (6) types, As for the above (7) and the oblivion coefficient of (8) types, and Van, the gain control signal moving average deviation of the above-mentioned (6) formula and Vaa of a are the gain control signal index weighting average value of the above-mentioned (8) formula. F is a select signal for reporting whether to make whether to make the gain control signal last value Ve into the gain control signal initial value Vi, the gain control signal moving average deviation Van, or the gain control signal index weighting average value Vaa into the gain control signal initial value Vi.

[0114]The power controller 9 of drawing 16 is provided with the following.

Gain control part 91.

Transmission power Monitoring Department 92.

Average slot number deciding part 93.

The slot averaging part 94, the averaging operator part 95, the last value selecting part 96, and the selector 97.

The gain control part 91, the transmission power Monitoring Department 92, and the



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last value selecting part 96 recognize the timing of transmission slot $S_j$ with the polling control data D1 from the base station B. Although operation of the power controller 9 when updating the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ is explained below, the updating operation of the transmission power initial value Pi ($S_j$) of transmission slot $S_j$ is also the same.

[0115]In transmission slot $S_j$, the slot averaging part 94 calculates the gain control signal slot average value Va ($S_j$), and sends this gain control signal slot average value Va ($S_j$) to the averaging operator part 95.

[0116]In transmission slot $S_j$, the last value selecting part 96 holds the gain control signal last value Ve ($S_j$), and sends this gain control signal last value Ve ($S_j$) to the selector 97.

[0117]The transmission power Monitoring Department 92 is the same as the transmission power Monitoring Department 42 of drawing 9. By supervising change of the instantaneous value of gain control signal V in transmission slot $S_j$, change of the instantaneous value of the transmission power P is supervised, the speed of change of a propagation path is detected from change of the instantaneous value of the transmission power P, and a propagation path detection signal notifies the speed of change of this propagation path to the averaging operator control section 93.

[0118]The averaging operator control section 93 The speed of change of the propagation path in the last transmission slot $S_{j-1}$, Corresponding [ or ] to the speed of change of the propagation path in two or more past transmission slots, . [ whether the last transmission power last value Pe ($S_{j-1}$) is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, and ] It decides whether to make into the following transmission power initial value Pi ($S_0$) the value (either the gain



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control signal moving average deviation Van or the gain control signal index weighting average value Vaa) calculated by the averaging operator part 95, and select signal F notifies this to the selector 97. In making the value of the averaging operator part 95 into the following transmission power initial value Pi ($S_0$), ********** of the slot average value number n ($S_0$) or the oblivion coefficient a ($S_0$) is decided, and it notifies to the averaging operator part 95. In the case of $n(S_0) = 1$ or $a(S_0) = 0$, it becomes the same as the power controller 9 of a 5th embodiment of the above.

[0119]According to the slot average value number n ($S_0$) notified from the averaging operator control section 93, the averaging operator part 95 carries out moving average arithmetic of the above-mentioned (6) formula like the moving-average-arithmetic part 63 of drawing 13, and calculates the gain control signal moving average deviation Van. Or according to the oblivion coefficient a ($S_0$) notified from the averaging operator control section 93, the index weighting operation of the above-mentioned (8) formula is carried out like the index weighting averaging operator part 73 of drawing 14, and the gain control signal index weighting average value Vaa is calculated. And either the calculated gain control signal moving average deviation Van or the gain control signal index weighting average value Vaa is sent to the selector 97.

[0120]According to select signal F from the averaging operator control section 93, the selector 97. The transmission power last value Pe ($S_{-1}$) or the value (either the gain control signal moving average deviation Van or the gain control signal index weighting average value Vaa) calculated by the averaging operator part 95 is sent to the gain control part 91 as the following transmission power initial value Pi ($S_0$).

[0121]The gain control part 91 sets the transmission power P as the initial value Pi



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($S_0$) by making gain control signal V into the initial value Vi ($S_0$) into which it was inputted from the selector 97 at the time of the start of transmission slot $S_0$. Thereby, the terminal A starts transmission with the transmission power initial value Pi ($S_0$). If the power control data D2 is inputted after a transmission start, gain control signal V will be fluctuated according to this power control data D2, and the transmission power P will be amended so that an ideal transmission power instantaneous value may be followed. Transmission power P is set to 0 by lowering gain control signal V at the time of the end of transmission slot $S_0$. Thereby, the terminal A suspends transmission.

[0122]The speed of change of a propagation path is detected and it enables it to choose the 8th either 1st embodiment of the above or embodiment of the above in this 9th embodiment according to the speed of change of a propagation path by supervising change of the transmission power instantaneous value in the past transmission period. That is, it enables it to choose a 1st, 5th, and 6th embodiment of the above, or a 1st, 5th, and 7th embodiment of the above according to the speed of change of a propagation path. Thereby, the transmission power initial value Pi follows the ideal transmission power median, when change (change of an ideal transmission power instantaneous value) of a propagation path is quick, and when late, it follows an ideal transmission power instantaneous value. Therefore, the 1st problem and 2nd problem of the above-mentioned conventional technology are solvable. When an 8th embodiment of the above is chosen, the ideal transmission power median can be followed more nearly promptly than a 6th or 7th embodiment of the above with high precision than a 5th embodiment of the above (by high flattery sensitivity).

[0123]Thus, according to a 9th embodiment, the speed of change of a propagation path is detected by supervising change of the transmission power instantaneous value



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in the past transmission slot, According to the speed of change of a propagation path. [ whether the last transmission power last value Pe ($S_{-1}$) is made into the transmission power initial value Pi ($S_0$) of transmission slot $S_0$ of the following, and ] It decides whether to set to Pi ($S_0$) the value (either the transmission power moving average deviation Pan of the above-mentioned (5) formula, or the transmission power index weighting average value Paa of the above-mentioned (7) formula) calculated by the averaging operator. When setting the value by an averaging operator to Pi ($S_0$), a transmission power initial value can be updated by deciding the slot average value number n or the oblivion coefficient a according to the speed of change of a propagation path so that it may correspond to change of a propagation path.

[0124]

[Effect of the Invention]As explained above, according to this invention, it is effective in the ability to update a transmission power initial value so that it may correspond to change of a propagation path by memorizing the transmission power of the terminal of the past transmission period, and calculating the transmission power initial value of the next transmission period from the past transmission power.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a block diagram of the CDMA system of polling.

[Drawing 2]It is a figure explaining the polling method of the CDMA system of drawing 1.



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[Drawing 3]They are a terminal of the CDMA system of drawing 1, and a block diagram of a base station.

[Drawing 4]It is a figure explaining the updating method of the transmission power initial value of a 1st embodiment of this invention.

[Drawing 5]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 1st embodiment of this invention.

[Drawing 6]It is a figure explaining the updating method of the transmission power initial value of a 2nd embodiment of this invention.

[Drawing 7]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 2nd embodiment of this invention.

[Drawing 8]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 3rd embodiment of this invention.

[Drawing 9]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 4th embodiment of this invention.

[Drawing 10]It is a figure explaining the updating method of the transmission power initial value of a 5th embodiment of this invention.

[Drawing 11]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 5th embodiment of this invention.

[Drawing 12]It is a figure explaining the updating method of the transmission power



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initial value of a 6th embodiment of this invention.

[Drawing 13]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 6th embodiment of this invention.

[Drawing 14]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 7th embodiment of this invention.

[Drawing 15]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of an 8th embodiment of this invention.

[Drawing 16]It is a block diagram of the power controller of the terminal which applied the updating method of the transmission power initial value of a 9th embodiment of this invention.

[Drawing 17]It is a figure explaining the updating method of the conventional transmission power initial value.

[Drawing 18]It is a figure explaining the 1st problem of conventional technology.

[Drawing 19]It is a figure explaining the 2nd problem of conventional technology.

[Explanations of letters or numerals]

A terminal, B base station, three power amplification sections, nine power controllers, 11, 21, 31, 41, 51, 61, 71 and 81, 91 gain control parts, 12, 22, 32, 44, and 96 A last value selecting part, and 23 and 63 Moving-average-arithmetic part, 33 and 73 [ A slot averaging part and 97 / Selector. ] An index weighting averaging operator part, 42, 82, 92 transmission-power Monitoring Department, and 43, 83 and 93 An averaging operator control section, and 45, 85 and 95 An averaging operator part, and 52, 62, 72,



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84 and 94



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Abstract:

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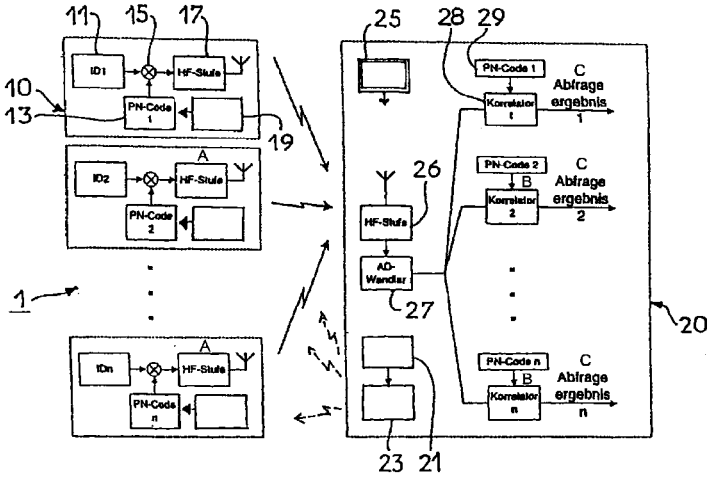
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*[Fortsetzung auf der nächsten Seite]*

(54) Title: METHOD AND ARRAY FOR REMOTE ACCESS CONTROL

(54) Bezeichnung: VERFAHREN UND ANORDNUNG ZUR FERN-ZUGANGSSTEUERUNG




A,17,26... HF STAGE
27... A/D CONVERTER
B,28... CORRELATOR
C... INTERROGATION RESULT

(57) Abstract: The invention relates to a method for remote access control using an array (1) having a transceiver (20). According to the invention, the transceiver emits an interrogation signal simultaneously activating all access code emitters. All access code emitters receiving said interrogation signal emit their specific access code signal thereafter in a substantially simultaneous manner and the transceiver separates the simultaneously received access code signals based on a characteristic contained in said signals.

*[Fortsetzung auf der nächsten Seite]*

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*Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.*

**(57) Zusammenfassung:** Verfahren zur Fern-Zugangssteuerung mittels einer Anordnung (1) mit einer Sender-/Empfänger-Einheit (20), durch die Sender-/Empfänger-Einheit ein alle Zugangscodegeber gleichzeitig aktivierendes Abfragesignal ausgegeben wird und alle dieses Abfragesignal empfangenden Zugangscodegeber danach im wesentlichen gleichzeitig ihre spezifischen Zugangscodesignale aussenden und die Sender-/Empfänger-Einheit eine Separierung der gleichzeitig empfangenen Zugangscodesignale aufgrund eines diesen aufgeprägten Charakteristikums ausführt.



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Beschreibung

# Verfahren und Anordnung zur Fern-Zugangssteuerung

Die Erfindung betrifft ein Verfahren zur Fern-Zugangssteuerung nach dem Oberbegriff des Anspruchs 1 sowie eine Anordnung zur Durchführung dieses Verfahrens.

Elektronische Zugangssteuersysteme haben in den letzten Jahren in verschiedenen Bereichen eine überraschend schnelle und weite Verbreitung gefunden. Die Funktionalität solcher Systeme wird ständig weiter ausgebaut. So haben sich im Automobilbau die klassischen Funkschließsysteme, die anfangs nur die Bedeutung einer (von vielen Autofahrern als überflüssig erachteten) Komfortfunktion hatten, inzwischen zu komplexen Systemen gewandelt, über die nicht nur der Zugang zum Fahrzeuginnenraum erreicht wird, sondern über die zudem Fahrzeugfunktionen gesteuert werden. Die Benutzerauthentifikation erfolgt dabei durch die Übermittlung eines Zugangscodes, und zwar bei modernen Systemen per Funk. Perspektivisch ist auch vorgesehen, neben dem Zugangscode benutzerspezifische Daten zu übertragen, die für die Steuerung bestimmter Funktionen benötigt werden.

Fortgeschrittene Zugangssteuersysteme dieser Art, die inzwischen in PKW der Oberklasse in der Praxis eingesetzt werden, realisieren das Prinzip "Passive Entry" in Anordnungen mit einer Sender-/Empfänger-Einheit im Fahrzeug und einer Mehrzahl von Chipkarten, die den Besitzer des Fahrzeugs, dessen Ehefrau oder andere Personen zum Zugang und zur Inbetriebnahme des Fahrzeugs befähigen. Diese Chipkarten sind nicht untereinander identisch, sondern individualisiert. Das liegt unter anderem darin begründet, daß bestimmte Fahrzeugfunktionen (beispielsweise Sitz- und Spiegelverstellung) aufgrund von auf der Chipkarte gespeicherten nutzerspezifischen Daten ausgeführt werden sollen. Zudem spielen Sicherheits- und Dokumentationserwägungen hierbei eine Rolle.



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Die erwähnten Chipkarten realisieren speziell das Prinzip des "Passive Entry" bzw. "Passive Go", dessen Kern darin besteht, daß die Zugangscodegeber (Chipkarten) bei Annäherung an das Fahrzeug von einer darin befindlichen Sender-/Empfänger-Einheit aktiviert bzw. abgefragt werden und daraufhin einen Zugangscode an diese aussenden. Um das Fahrzeug benutzen zu können, ist ein Mitführen der Chipkarte am Körper ausreichend. Für den Fahrzeugzutritt findet eine bidirektionale Kommunikation zwischen Fahrzeug und Chipkarte statt. Beispielsweise kommuniziert die Sender-/Empfänger-Einheit im Fahrzeug mit der Chipkarte über induktive Antennen, die in den Türen und dem Kofferraum bzw. Stoßfänger untergebracht sind. Diese Antennen werden auf einem 125 kHz-Träger angesteuert, während die Chipkarten ihre Antwort an das Fahrzeug (nach derzeitigem Stand der Technik) im sogenannten ISM-Frequenzbereich bei 433 MHz absetzen. Eine Berührung des Türgriffs bei einem gesicherten Fahrzeug bewirkt die Ausgabe eines Abfragesignals über die in der entsprechenden Tür angeordnete induktive Antenne, woraufhin die am Körper mitgeführte Chipkarte ein Zugangscodesignal (Authentifikationssignal) über Funk an das Fahrzeug sendet. Ergibt sich im Ergebnis der Auswertung des Zugangscodes dessen Gültigkeit, so wird das Fahrzeug über die Zentralverriegelungspumpe entsichert. In ähnlicher Weise läuft der Vorgang der Sicherung des Fahrzeugs beim Aussteigen, das Starten des Fahrzeugs (über einen Tiptaster im Bedienungsbereich initiiert) und die Ausführung weiterer Funktionen ab.

Zumindest beim ersten Abfragevorgang, in dessen Ergebnis der Zugang zum Fahrzeug gewährt oder verweigert wird, muß die fahrzeugseitige Sender-/Empfänger-Einheit grundsätzlich sämtliche für das Fahrzeug zugelassenen Chipkarten ansprechen, um festzustellen, ob mit einer von diesen - und mit welcher - der Zugang zum Fahrzeug begehrt wird. Diese Abfragen und/oder die Antworten erfolgen nach dem Stand der Technik sequentiell: Entweder werden die Zugangscodegeber (auch als "ID-



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Geber" bezeichnet) sequentiell aktiviert und abgefragt, oder die ID-Geber antworten auf ein gemeinsames "Wecksignal" sequentiell in ihnen zugewiesenen Zeitschlitzen.

Für den gesamten Ansprechvorgang und die Auswertung der eingehenden Antwort bzw. Antworten bis hin zur Aktivierung des Öffnungsmechanismus steht gemäß den Spezifikationen der Fahrzeughersteller nur eine geringe Zeitspanne (typisch 200 ms) zur Verfügung, da der Nutzer nicht wahrnehmen soll, daß zwischen der Basisstation im Fahrzeug und seiner Chipkarte ein umfangreicherer Datenaustausch stattfindet, und da ihm keine spürbare Wartezeit für die Gewährung des Zugangs zugemutet werden soll. Speziell mit zunehmendem Umfang der seitens der Zugangscode- bzw. ID-Geber zu übermittelnden Informationen wird die Summation der Antwortzeiten zunehmend kritisch für die Einhaltung dieses Zeitlimits.

Der Erfindung liegt daher die Aufgabe zugrunde, ein Verfahren zur Fern-Zugangssteuerung der gattungsgemäßen Art sowie eine Anordnung zur Durchführung dieses Verfahrens anzugeben, mit denen der Verfahrensablauf ohne wesentliche Erhöhung des technischen Aufwandes und der Kosten deutlich beschleunigt werden kann.

Diese Aufgabe wird hinsichtlich ihres Verfahrensaspektes durch ein Verfahren mit den Merkmalen des Anspruchs 1 und hinsichtlich ihres Anordnungsaspektes durch eine Anordnung mit den Merkmalen des Anspruchs 5 gelöst.

Die Erfindung schließt den wesentlichen Gedanken ein, beide Phasen des Kommunikationsvorganges zwischen der Fahrzeugeinheit und den potentiell anzusprechenden Zugangscodegebern parallel ablaufen zu lassen, indem die Zugangscodegeber durch ein gemeinsames Abfragesignal angesprochen werden und zeitlich parallel antworten, wobei ihren Sendesignalen ein Charakteristikum aufgeprägt wird, welches die zeitlich parallele Verarbeitung in der Fahrzeugeinheit ermöglicht.



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In einer bevorzugten Ausführung besteht dieses Charakteristikum in einer spezifischen Spreizspektrum-Sequenz, mit der der Zugangscode die Daten im ID-Geber (der Chipkarte) verarbeitet wird/werden. Auf seiten der Fahrzeugeinheit sind entsprechende Mittel zur Entspreizung des empfangenen gespreizten Daten- bzw. Zugangscodesignals vorgesehen. Da für die einzelnen Zugangscodegeber unterschiedliche Spreizsequenzen zur Aufprägung auf den Zugangscode vorzusehen sind, müssen fahrzeugseitig sämtliche zugelassenen Spreizsequenzen vorhanden sein. Damit wird es erforderlich, mindestens Teile der fahrzeugseitigen Empfängereinheit als zueinander parallele Komponenten auszuführen. Da es sich bei den in Rede stehenden Systemen aber nicht um niedrigpreisige Systeme handelt und der potentiell erzielbare Gebrauchswertvorteil im Vordergrund steht, ist dieser Aufwand grundsätzlich vertretbar - zumal er durch geeignete Wahl des Spreizcodierungsverfahrens gering gehalten werden kann.

Unter diesem Blickwinkel ist das DSSS(Direct Sequence Spread Spectrum)-Verfahren besonders geeignet, da hierbei nur ein HF-Empfangsteil (Front-End) benötigt wird und der Mehraufwand für die verschiedenen Empfangsstrecken sich auf das Basisband, d.h. den Bereich der digitalen Signalverarbeitung, beschränkt, wo er durch Einsatz spezifischer höchstintegrierter Schaltungen minimiert werden kann. Auch senderseitig können bei den verschiedenen ID-Gebern identische HF-Baugruppen verwendet werden, lediglich bei der Erzeugung des gespreizten Datensignals im Basisband (softwaremäßig realisierbar) werden unterschiedliche Spreizsequenzen verwendet.

Grundsätzlich kann aber auch die Anwendung anderer Spreizspektrum-Verfahren sinnvoll sein, beispielsweise die Anwendung des sogenannten "Chirp"-Verfahrens, bei dem im Verlauf eines Datenttelegramms eine Erhöhung bzw. eine Absenkung der Trägerfrequenz erfolgt, die im Empfänger durch eine Empfangssignalverarbeitung mittels zeitvarianter Filter (Oberflächen-



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wellenfilter) berücksichtigt wird. Da hierfür multiple Filterstrukturen im HF-Bereich benötigt werden, ist der empfängerseitige Aufwand grundsätzlich etwas höher - auch hier wirken sich aber technologische Fortschritte speziell bei der Herstellung von Oberflächenwellenfiltern auf Keramiksubstraten kostendämpfend aus. Ebenso läßt sich das Verfahren mittels Frequency Hopping Spread Spektrum-Verfahren bewerkstelligen. Hier steht eine große Anzahl möglicher Übertragungskanäle auf verschiedenen Frequenzen zur Verfügung, die senderseitig - wieder unter Maßgabe einer Spreizsequenz - angesprungen werden. Mittels Korrelation lassen sich im Empfänger wieder die Signale verschiedener Sender trennen.

Eine Anordnung zur Durchführung des vorgeschlagenen Verfahrens umfaßt - wie sich grundsätzlich schon aus den obigen Erläuterungen ergibt - eine Mehrzahl von Zugangscodegebern, die neben einem Speicher für den eigentlichen Zugangscode einen weiteren Speicher für das zusätzliche Charakteristikum, beispielsweise einen für jeden einzelnen Zugangscodegeber spezifischen Spreizcode, und eine zu dessen Aufprägung dienende Multiplikator- bzw. Modulatorstufe aufweisen, sowie eine Sender-/Empfänger-Einheit (Fahrzeugeinheit) zur Abfrage der einzelnen Zugangscodegeber und zur Auswertung eines oder mehrerer auf das Abfragesignal hin übermittelter, geberspezifisch individualisierter Zugangscodesignale. Die Fahrzeugeinheit weist eine der Anzahl der zugelassenen Zugangscodegeber entsprechende Anzahl von Speicherbereichen für deren Charakteristika (Spreizcodes) sowie eine entsprechende Anzahl von Filter- oder Korrelatorkomponenten zur Verarbeitung der Empfangssignale mit den gespeicherten Charakteristika auf. Es versteht sich, daß die Fahrzeugeinheit zudem einen Abfragesignalgenerator und -sender aufweist und daß die Zugangscodegeber einen auf diesen abgestimmten Abfragesignalempfänger haben, der die übrigen Komponenten der Zugangscodegeber bei Empfang eines Abfragesignals aktiviert.



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Vorteile und Zweckmäßigkeiten der Erfindung ergeben sich im übrigen aus den Unteransprüchen sowie der nachfolgenden Beschreibung eines Ausführungsbeispiels sowie grundsätzlicher Zusammenhänge zum Verständnis der vorgeschlagenen Lösung anhand der Figuren. Von diesen zeigen:

Fig. 1 ein Funktions-Blockschaltbild einer Gesamtanordnung gemäß einer Ausführungsform der Erfindung,

Fig. 2 eine zusammenhängende Darstellung zur Erläuterung der Erzeugung eines gespreizten Datensignals sowie der Modulation des Trägers mit diesem in einem Zugangscodegeber gemäß einer Ausführungsform der Erfindung,

Fig. 3 ein Funktions-Blockschaltbild zur Erläuterung der empfängerseitigen Verarbeitung des gemäß Fig. 2 senderseitig erzeugten Zugangscodesignals,

Fig. 4 eine Darstellung zur Erläuterung des Prinzips der Spreizsequenzverarbeitung und

Fig. 5 eine gegenüber Fig. 1 für die Anwendung eines speziellen Algorithmus modifizierte Anordnung.

Fig. 1 zeigt eine "Passive Entry"-Zugangssteueranordnung 1, die mehrere ID-Geber 10 und eine Fahrzeugeinheit 20 umfaßt, in Form eines fragmentarischen Funktions-Blockschaltbildes, das nur die im Zusammenhang mit der Ausführung der Erfindung wesentlichen Funktionskomponenten zeigt.

Jeder ID-Geber 10 umfaßt einen Datenspeicher 11, in dem ein geberspezifischer Code ID1, ID2, ... IDn gespeichert ist, welcher neben dem eigentlichen Zugangscode nutzerspezifische Daten des Besitzers umfaßt. Weiterhin umfaßt jeder ID-Geber einen PN-Codespeicher 13, in dem jeweils ein für diesen Geber charakteristischer Spreizcode gespeichert ist. In einer in der Figur als Multiplikator symbolisierten Spreizcode-



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Verarbeitungsstufe 15 jedes ID-Gebers 10 wird dem jeweiligen Zugangs- und Nutzercode der für diesen ID-Geber spezifizierte Spreizcode aufgeprägt, und in einer der Spreizcode-Verarbeitungsstufe 15 nachgeordneten HF-Stufe 17 erfolgt in an sich bekannter Weise eine HF-Verarbeitung zu einem Sendesignal, welches über eine (nicht bezeichnete) HF-Antenne abgestrahlt wird. Weiterhin weist jeder ID-Geber 10 einen Abfragesignalempfänger 19 auf, der bei Empfang eines Abfragesignals die oben genannten Komponenten zur Ausgabe eines Antwortsignals aktiviert. Die hier gewählte vereinfachte Blockdarstellung ist so zu verstehen, daß der Abfragesignalempfänger 19 einen Controller zur Ablaufsteuerung der Ausgabe eines Antwortsignals umfaßt; Details der Funktionskomplexe Abfragesignalempfang und Antwortsignalsteuerung sind an sich bekannt und bedürfen daher hier keiner genaueren Erläuterung. Der im Zusammenhang mit der Ausführung der Erfindung wesentliche Ablauf der Signalverarbeitung im ID-Geber 10 ist in Fig. 2 und der zugehörigen Beschreibung weiter unten genauer erläutert.

Die Fahrzeugeinheit 20 umfaßt einen Abfragesignalgenerator 21 und einen mit dessen Ausgang verbundenen Abfragesignalsender 23 zur Erzeugung des Abfragesignals. Bestehende Systeme benutzen für dieses Abfragesignal relativ niedrige Frequenzen (z.B. 125 kHz, induktive Übertragung), um eine genaue Eingrenzung des Wirkungsbereichs des Abfragesignals zu erreichen, das Signal wird durch (hier nicht gezeigte) Antennen in Karosserieteilen eines Fahrzeugs übertragen. Prinzipiell ist jedoch jede beliebige Übertragungsstrecke für dieses Abfragesignal denkbar. Auch insoweit ist die Funktion der Zugangssteueranordnung 1 an sich bekannt und bedarf keiner genaueren Erläuterung. Wesentlich ist, daß durch einen Mikrocontroller 25 der Fahrzeugeinheit 20 bei Erhalt eines entsprechenden Auslösesignals (beispielsweise von einem Taster am Türgriff des Fahrzeugs) die Erzeugung eines einzelnen, allgemeingültigen Abfragesignals für alle ID-Geber 10 durch den Abfragesignalgenerator 21 veranlaßt und zugleich eine Parallelverarbeitung der daraufhin eingehenden Antwortsignale der ID-Geber



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gesteuert wird. Die Antwortsignale werden wiederum in an sich bekannter Weise über eine (nicht bezeichnete) HF-Antenne empfangen, in einer HF-Stufe 26 HF-seitig verarbeitet und einem der HF-Stufe nachgeschalteten A/D-Wandler 27 digitalisiert. Im Anschluß an die Digitalisierung erfolgt - wie in der Figur zu erkennen ist - eine Parallelverarbeitung in einer der Anzahl n der zugelassenen ID-Geber 10 entsprechenden Anzahl von Korrelatorstufen 28, wo jeweils eine Entspreizung mit dem bei der senderseitigen Spreizung angewandten, in der Fahrzeugeinheit in einem fahrzeugseitigen Spreizcodespeicher 29 abgelegten Spreizcode erfolgt. Dieser Vorgang ist nochmals in Fig. 3 und weiter unten in der Beschreibung skizziert. In dessen Ergebnis stehen die in Fig. 1 als "Abfrageergebnis 1", "Abfrageergebnis 2" bzw. "Abfrageergebnis n" bezeichneten entspreizten Zugangs- und Nutzercodes ID1, ID2 bzw. IDn der im Abfragebereich der Fahrzeugeinheit 20 liegenden und ein Antwortsignal übermittelnden ID-Geber zur weiteren Verarbeitung und Prüfung in an sich bekannter Weise bereit, wobei die Bereitstellung erfindungsgemäß gleichzeitig erfolgt und dadurch die Zugangscode-Verarbeitung beschleunigt wird. Das in Fig. 1 dargestellte Verfahren der digitalen Signalverarbeitung (DSP) stellt das grundlegende Prinzip der bevorzugten Ausführung dar. Der DSP-Algorithmus läßt sich im Rahmen der Rechenkapazität modifizieren, um applikationsspezifische Optimierungen vorzunehmen. Beispielsweise ließe sich der Dynamikbereich durch Verfahren wie "Multiuser Detection of CDMA by Iterated Soft-Cancellation (Turbo Multiuser Detection)" erweitern. In der einschlägigen Literatur finden sich viele Ansätze für solche Optimierungs-Möglichkeiten.

Die digitale Signalverarbeitung läßt sich in diesem Fall im allgemeinen nicht mehr in einzelne unabhängige Zweige aufteilen. Die in Fig. 1 skizzierte Anordnung hätte dann die in Fig. 5 gezeigte Form einer modifizierten Anordnung 1' mit einem DSP-Verarbeitungsblock 28/29' zur parallelen digitalen Verarbeitung des Empfangssignals. Fig. 5 bedarf in Anbetracht der obigen Erläuterung von Fig. 1 keines weiteren Kommentars.



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Fig. 2 illustriert die einzelnen Stufen der Erzeugung eines gespreizten Datensignals (Zugangs- und Nutzercode), die in vorteilhafter Weise im logischen bzw. digitalen Verarbeitungsbereich der ID- bzw. Zugangscodegeber 10 stattfindet. Zunächst wird mittels eines rückgekoppelten Schieberegisters SR und einer Additionsstufe ADD auf im oberen Teil von Fig. 2 skizzierte Weise aus einem Taktsignal "Clock" ein Spreizcode "PN-Signal" erzeugt. Anschließend erfolgt eine multiplikative Verknüpfung des hierbei erhaltenen Spreizcodes mit dem eigentlichen Datensignal in der bereits in Fig. 1 gezeigten Verarbeitungsstufe 15. Der Signalverlauf des Datensignals, des Spreizcodes und des gespreizten Datensignals ist - an einem vereinfachten Beispiel - in den drei Timingdiagrammen im mittleren Bereich von Fig. 2 dargestellt.

Im unteren Bereich der Fig. 2 ist der letzte Schritt einer BPSK-Modulation eines HF-Trägers mit dem im Mikrocontroller MC gewonnenen gespreizten Datensignal in einem BPSK-Modulator MOD zur Gewinnung eines Sendesignals dargestellt.

In Fig. 3 ist (wiederum in Form einer Prinzipskizze) dargestellt, wie das Empfangssignal der Fahrzeugeinheit 20 (Fig. 1) in einem einfachen Empfangsteil ("Front-End") R einer Filterung in einer Filterstufe F und einer weiteren Verarbeitung in einem dieser nachgeordneten Abwärts-Mischer M unterzogen wird, bevor das Signal in einem A/D-Wandler AD (entsprechend Block 27 in Fig. 1) einer Digitalisierung unterzogen und in der logischen Verarbeitungsstufe DSP, die zugleich das Abtastsignal für den A/D-Wandler AD liefert, einer logischen Verarbeitung unter Synchronisation, Korrelation und Demodulation zur Rückgewinnung des Zugangs- und Nutzercodes unterzogen wird.

In Fig. 4 ist an einem Beispiel eine Spreizcode-Verarbeitung etwas näher skizziert, wie sie bei der hier erläuterten Zugangssteueranordnung 1 senderseitig in den Verarbeitungsstufen 15 der ID-Geber 10 ausgeführt wird und der empfängersei-



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tig eine entsprechende Entspreizung in den Korrelatorstufen 29 der Fahrzeugeinheit 20 entspricht.

Vereinfachend wird angenommen, daß der zu übertragende Zugangscode durch ein Folge a(n) von Bits gegeben sei, die einen zeitlichen Abstand bzw. eine Symboldauer T haben. Weiter wird angenommen, daß diese Symboldauer T gleich dem zeitlichen Abstand $T_b$ zweier Quellensymbole sei und a(n) aus bipolaren Werten +1, -1 gebildet sei, die mit gleicher Wahrscheinlichkeit auftreten sollen. Der Spreizvorgang umfaßt in der Modell-Darstellung folgende Schritt: Zunächst wird durch Aufwärtstastung mit dem Spreizfaktor L die Folge ã(k) erzeugt. Dies geschieht durch Einfügen von (L-1) Nullen im Abstand der Chipdauer $T_c$ zwischen jeweils zwei Werten von a(n). Die Zuordnung der Spreizsequenz zu den einzelne Bits wird in diesem Modell als Filterung der aufwärtsgetasteten Bitfolge ã(k) mit einem FIR-Filter verstanden. Die Filterkoeffizienten dieses FIR-Filters sind die L bipolaren Elemente der (im Kasten in der ersten Zeile der Fig. 4 gezeigten) Spreizsequenz b. Die bei der Spreizung entstehende Folge x(k) ist nun durch die Spreizsequenz geprägt. Ein D/A-Wandler wandelt die Folge x(k) in eine Folge $x_0(t)$ von Diracimpulsen im zeitlichen Abstand $T_c$, und darauf folgt eine Impulsformung mit einer frei wählbaren Impulsform zu einem Sendesignal $s_0(t)$, das sich mathematisch als Ergebnis einer Faltung von $x_0(t)$ und der inversen Fouriertransformierten des Frequenzganges bei der Impulsformung darstellt. (Dieses Modell schließt in vereinfachender Weise der Darstellung keine Modulation auf eine Trägerfrequenz ein.)

Die Ausführung der Erfindung ist nicht auf das beschriebene Beispiel und die gegebenen Erläuterungen beschränkt, sondern ebenso in einer Vielzahl von Abwandlungen möglich.



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Patentansprüche

1. Verfahren zur Fern-Zugangssteuerung, insbesondere zur Funk-Zugangssteuerung zum Innenraum und/oder zur Aktivierung von Betriebsfunktionen eines Kraftfahrzeuges, mittels einer Anordnung (1) mit einer Sender-/Empfänger-Einheit (20) zur Aussendung eines Abfragesignals und zum Empfang von Zugangscodesignalen und einer mit der Sender-/Empfänger-Einheit verbundenen Auswertungseinheit zur Auswertung empfangener Zugangscodesignale und zur Ausgabe eines Zugangsfreigabe- oder -sperrsignals in Abhängigkeit vom Auswertungsergebnis und einer Mehrzahl von Zugangscodegebern (10) zum Empfang des Abfragesignals und zur Aussendung jeweils eines spezifischen Zugangscodesignals in Reaktion auf den Empfang des Abfragesignals,
d a d u r c h g e k e n n z e i c h n e t, daß
durch die Sender-/Empfänger-Einheit ein alle Zugangscodegeber gleichzeitig aktivierendes Abfragesignal ausgegeben wird und alle dieses Abfragesignal empfangenden Zugangscodegeber danach im wesentlichen gleichzeitig ihre spezifischen Zugangscodesignale aussenden, wobei die Sender-/Empfänger-Einheit eine Separierung der gleichzeitig empfangenen Zugangscodesignale aufgrund eines diesen aufgeprägten Charakteristikums ausführt.

2. Verfahren nach Anspruch 1,
d a d u r c h g e k e n n z e i c h n e t, daß
die Zugangscodesignale in den Zugangscodegebern (10) mit unterschiedlichen Spreizsequenzen einer Spreizspektrum-Verarbeitung unterzogen und in der Sender-/Empfänger-Einheit (20) mit jeweils einer entsprechenden inversen Spreizsequenz entspreizt werden.

3. Verfahren nach Anspruch 1 oder 2,
d a d u r c h g e k e n n z e i c h n e t, daß
für die Spreizspektrum-Verarbeitung in den Zugangscodegebern (10) das DSSS-Verfahren, insbesondere unter Nutzung zueinan-



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der orthogonaler Spreizsequenzen als Charakteristikum, und in der Sender-/Empfänger-Einheit (20) eine Entspreizung im Basisband durch digitale Signalverarbeitung angewandt wird.

4. Verfahren nach Anspruch 2,
d a d u r c h g e k e n n z e i c h n e t, daß
für die Spreizspektrum-Verarbeitung in den Zugangscodegebern (10) eine Chirpsequenz- oder FH-Verarbeitung und in der Sender-/Empfänger-Einheit eine entsprechende laufzeitabhängige Filterung im HF-Abschnitt bzw. FH-Entspreizung angewandt wird.

5. Anordnung zur Durchführung des Verfahrens nach einem der vorangehenden Ansprüche, welche aufweist:
eine Sender-/Empfänger-Einheit (20) mit einem Abfragesignalgeber (21, 23) zur Erzeugung und Aussendung des Abfragesignals und einem Empfänger (26 bis 29) zum Empfang der Zugangscodesignale, wobei mindestens in einem Abschnitt des Empfängers Mittel (28, 29) zur parallelen Verarbeitung mehrerer empfangener Zugangscodesignale gemäß dem diesen aufgeprägten Charakteristikum vorgesehen sind, und
eine Mehrzahl von Zugangscodegebern (10) mit einer Empfangs- und Aktivierungseinheit (19) zum Empfang des Abfragesignals und zur Steuerung der Ausgabe des jeweiligen Zugangscodesignals, einem Speicherbereich (13) zur Speicherung des dem Zugangscode aufzuprägenden Charakteristikums und einer Sendestufe (17), die eine Verarbeitungseinheit (15) zur Aufprägung des gespeicherten Charakteristikums auf den Zugangscode aufweist.

6. Anordnung nach Anspruch 5,
d a d u r c h g e k e n n z e i c h n e t, daß
der Abfragesignalgeber (21, 23) der Sender-/Empfänger-Einheit (20) und die Empfangs- und Aktivierungseinheiten (19) der Zugangscodegeber (10) zur induktiven Signalübertragung, insbesondere bei einer Trägerfrequenz von 125 kHz, ausgebildet sind.



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7. Anordnung nach Anspruch 5 oder 6,
d a d u r c h g e k e n n z e i c h n e t, daß
der Empfänger (26 bis 29) der Sender-/Empfänger-Einheit und die Sendestufen (17) der Zugangscodegeber Mittel zu einer UHF-Funkübertragung, insbesondere bei 433 oder 868 MHz, aufweisen.

8. Anordnung nach einem der Ansprüche 5 bis 7,
d a d u r c h g e k e n n z e i c h n e t, daß
der Empfänger (26 bis 29) der Sender-/Empfänger-Einheit Abschnitte (28) zur parallelen Verarbeitung verschiedener Zugangscodesignale im Basisband, insbesondere Mittel zur Direct-Sequence-Spreizung eines entsprechend gespreizten Zugangscodesignals, aufweist.

9. Anordnung nach einem der Ansprüche 5 bis 7,
d a d u r c h g e k e n n z e i c h n e t, daß
der Empfänger der Sender-/Empfänger-Einheit Abschnitte zur parallelen Verarbeitung verschiedener Zugangscodesignale in der HF-Stufe, insbesondere zeitvariante Filterkomponenten zur Entspreizung von Chirp-gespreizten Zugangscodesignalen, aufweist.



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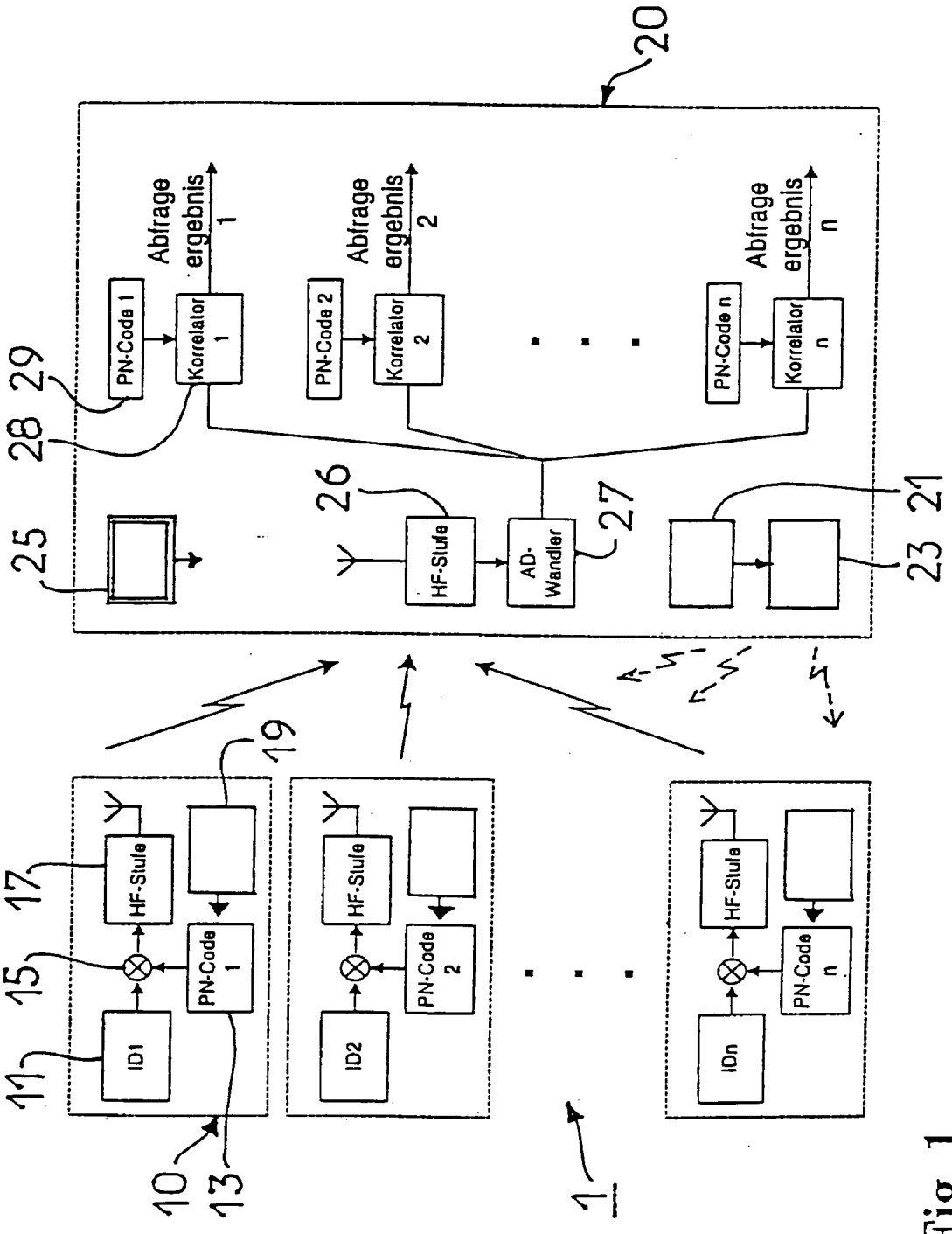


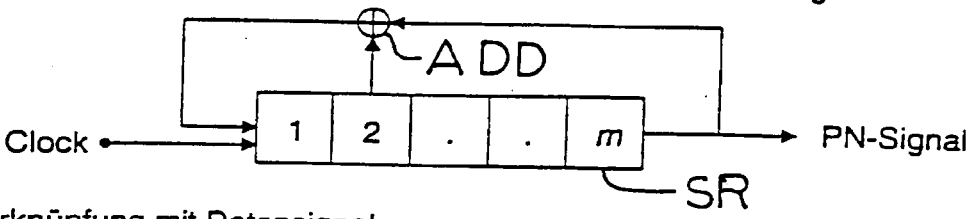

Fig. 1



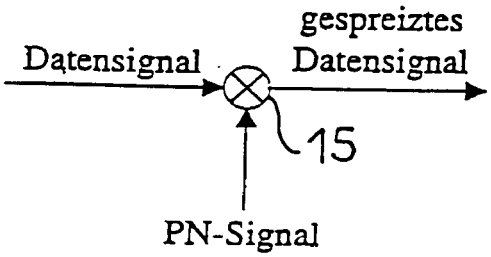
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Erzeugung des gespreizten Datensignals bereits im Microcontroller:

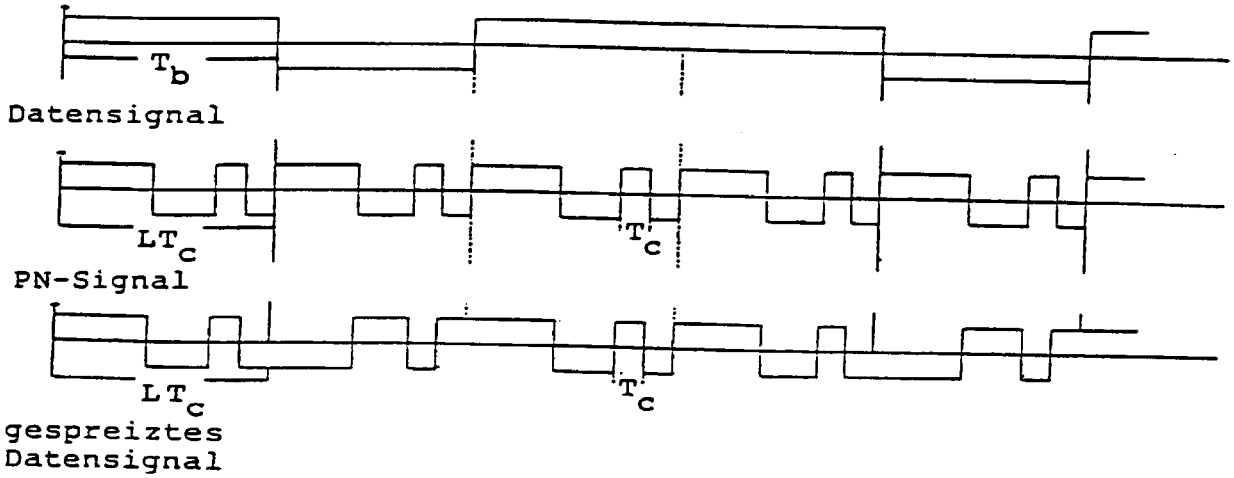
1. Erzeugung der PN-Sequenz mittels rückgekoppeltem Schieberegister




2. XOR-Verknüpfung mit Datensignal




Signalverlauf (für m=3):




$T_b$: Bitperiode L: Spreizfaktor (hier = 7)

$T_c$: Chipperiode

BPSK (Bi-Phase-Shift-Keying)-Modulation des Trägers mit gespreiztem Datensignal

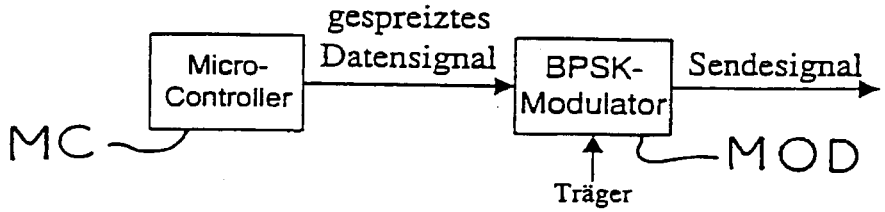



**Fig. 2**



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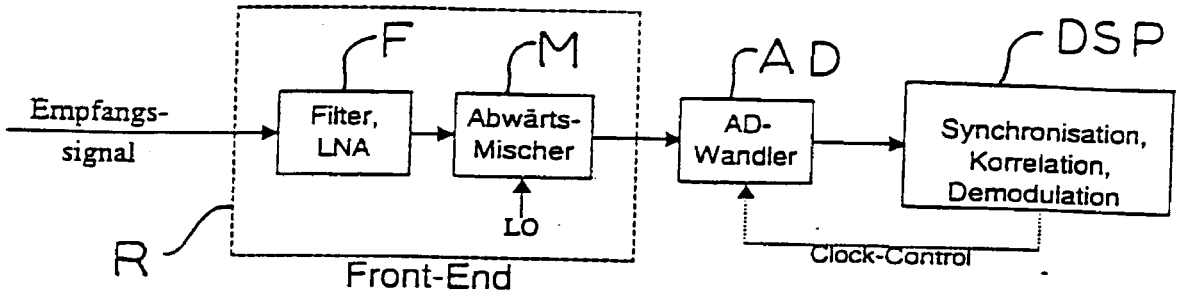



Fig. 3

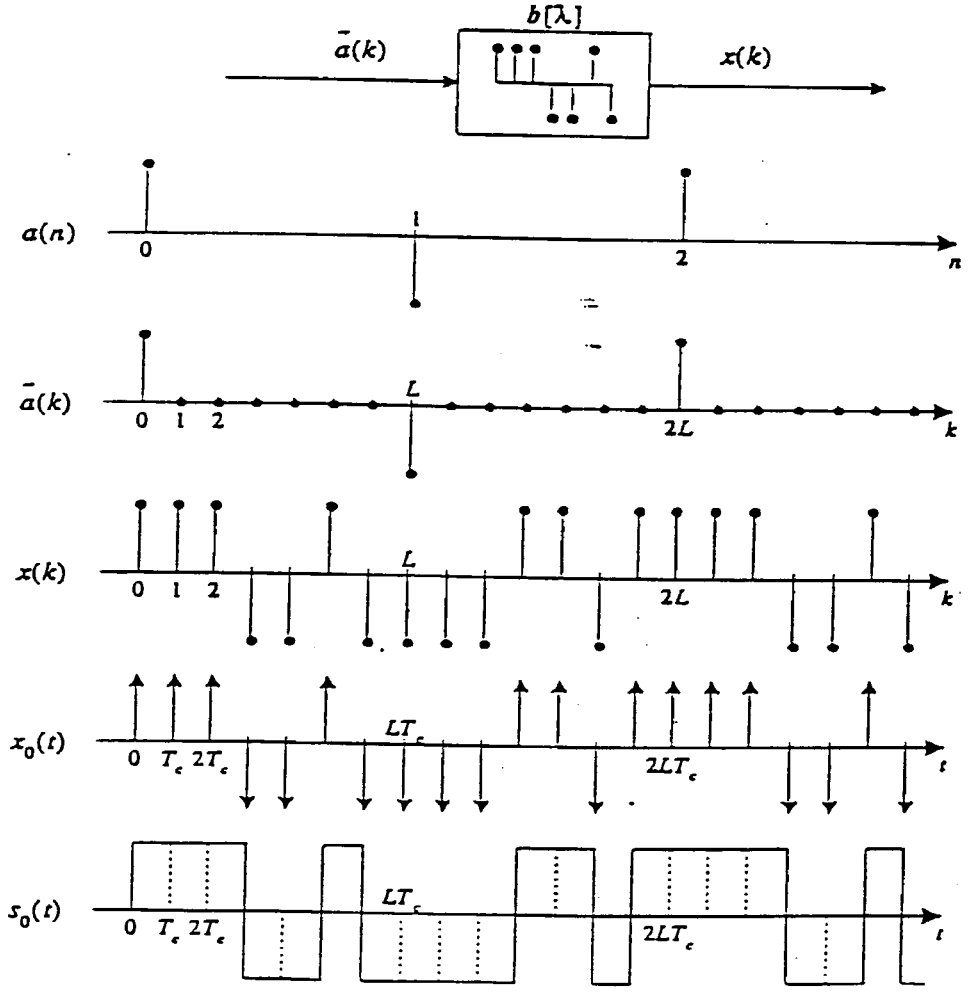



Fig. 4



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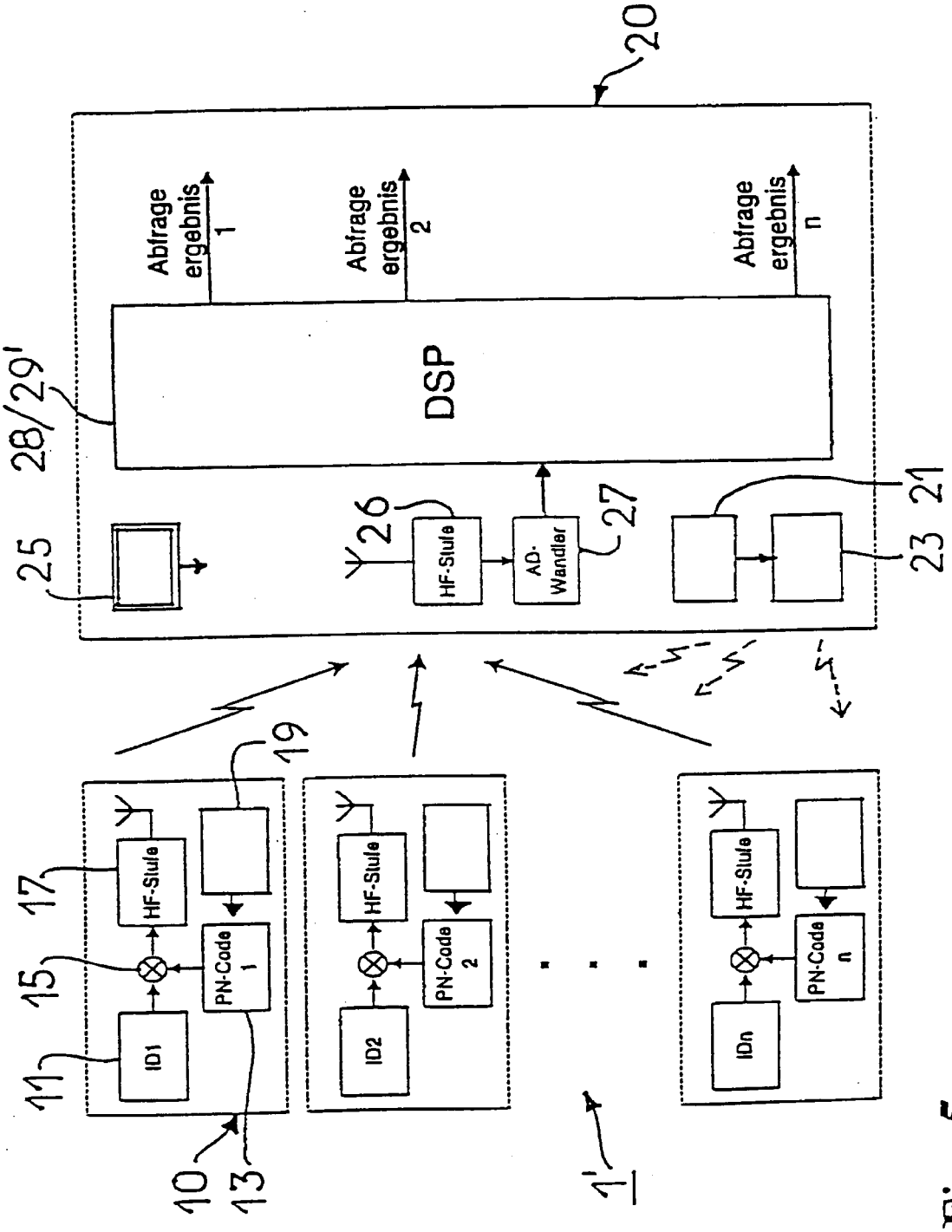



Fig. 5



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| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 79683 |
| **Filer:** | Justin Robert Nifong/Joan Sadler |
| **Filer Authorized By:** | Justin Robert Nifong |
| **Attorney Docket Number:** | 234/16 UTIL |
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| **Time Stamp:** | 12:04:56 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

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| 3 | Foreign Reference | WO0071843A2Schneider.pdf | 809175<br>97b34a1ba6b35f26dbd6c16dab4d1d39f00c3ed6 | no | 20 |
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| 6 | Non Patent Literature | NPL3_Baines.pdf | 982379<br>df4e35d58c7c773953fddb168118e8765426897b | no | 3 |
| **Warnings:** | | | | | |
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| 7 | Non Patent Literature | NPL4_Damnjanovic.pdf | 163008<br>b4e1729f8043639ca1fbb37da8c4031e9a88005c | no | 3 |
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| 8 | Non Patent Literature | NPL5_Wang.pdf | 341666<br>417cda8f9b4fdd3769b97bf1c5cf5ad780ea3984 | no | 8 |
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| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | Joshua D. Niedzwiecki |
| Art Unit | 2479 |
| Examiner Name | Kenan Cehic |
| Attorney Docket Number | 234/16 UTIL |

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| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2479 |
| | Examiner Name | Kenan Cehic |
| | Attorney Docket Number | 234/16 UTIL |

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | U.S. Non-Final Office Action mailed 1/17/2013 for related application 13/090435 filed 4/20/11, references cited herein. | ☒ |

If you wish to add additional non-patent literature document citation information please click the Add button Add

**EXAMINER SIGNATURE**

| Examiner Signature | | Date Considered | |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2479 |
| | Examiner Name | Kenan Cehic |
| | Attorney Docket Number | 234/16 UTIL |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Bentley J. Olive/ | Date (YYYY-MM-DD) | 2013-01-17 |
|---|---|---|---|
| Name/Print | Bentley J. Olive | Registration Number | 44985 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 14727075 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 79683 |
| **Filer:** | Bentley J. Olive/Joan Sadler |
| **Filer Authorized By:** | Bentley J. Olive |
| **Attorney Docket Number:** | 234/16 UTIL |
| **Receipt Date:** | 17-JAN-2013 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 15:09:37 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | 234-16-Suppl-IDS.pdf | 612312<br>adfeb1aa6e858166f48b1fe122531f6311504f79 | no | 4 |

| | |
|---|---|
| **Warnings:** | |
| **Information:** | |



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| | | | | | |
|---|---|---|---|---|---|
| 2 | Non Patent Literature | 13090435-NFOA-2013-01-17.pdf | 588395<br>2549c1d7ffe523dfe9e7dc553337e37e1d194122 | no | 16 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | | **Total Files Size (in bytes):** | 1200707 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/80 (11-08)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

# POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 114420

*OR*

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

| Name | Registration Number | Name | Registration Number |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 114420

*OR*

| | | | |
|---|---|---|---|
| ☐ Firm or Individual Name | | | |
| Address | | | |
| City | | State | Zip |
| Country | | | |
| Telephone | | Email | |

Assignee Name and Address:

Collision Communications, Inc.
20 Depot Street, Suite 2A
Peterborough, NH 03458

**A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.**

**SIGNATURE of Assignee of Record**

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

| | | | |
|---|---|---|---|
| Signature | | Date | 4/10/2013 |
| Name | Jared Fry | Telephone | (857) 222-0690 |
| Title | Co-Chairman, Collision Communications, Inc. | | |

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 15577907 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 79683 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | 234/16 UTIL |
| **Receipt Date:** | 22-APR-2013 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 15:12:52 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | C116US_373_Statement_And_POA.pdf | 213284<br>d727af00e950c45dd8de6ffb0fc827032f3c3d00 | yes | 3 |



INTEL-1002

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Assignee showing of ownership per 37 CFR 3.73. | 1 | 2 |
| | Power of Attorney | 3 | 3 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 213284 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

Patent
Attorney Docket No.: C116/US

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| In re Patent Application of: | Customer No.: 114420 |
| Inventor: Joshua D. Niedzwiecki | Confirmation Number: 7845 |
| Application Number: 12/742,686 | Group Art Unit: 2473 |
| Filed: 9/25/2009 | Examiner: Kenan Cehic |

For: Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**STATEMENT UNDER 37 CFR 3.73(b)**

IN ACCORDANCE WITH 37 CFR 3.71(a), PROSECUTION OF THE PRESENT APPLICATION SHALL BE CONDUCTED BY THE ASSIGNEE, TO THE EXCLUSION OF THE INVENTOR(S).

Applicant, **Collision Communications, Inc.**, a Limited Liability Company, states that it is:

1. ☑ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title, and interest
   (The extent (by percentage) of its ownership interest is _____%)

in the patent application identified above by virtue of an assignment from the inventor(s) to the current assignee as follows:

1. From: **Inventor(s)** To: **BAE Systems Information And Electronic Systems Integration Inc.**
   The document was recorded in the United States Patent and Trademark Office at Reel / Frame: **024673 / 0287**, or for which a copy thereof is attached.
2. From: **BAE Systems Information And Electronic Systems Integration Inc.** To: **Collision Technology LLC**
   The document was recorded in the United States Patent and Trademark Office at Reel / Frame: **026190 / 0812**, or for which a copy thereof is attached.

Additional documents in the chain of title are listed on a supplemental sheet.
As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to the Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature: _____ Date: 4/19/13
Theodosios Thomas
Reg. No. 45159, Patent Counsel, Phone No. 919-233-1942 x-203

**STATEMENT UNDER 37 CFR 3.73(c)**

(Supplemental Sheet)

3. From: **Collision Technology LLC** To: **Collision Communications, Inc.**

The document was recorded in the United States Patent and Trademark Office at Reel / Frame: **028490 / 0285**, or for which a copy thereof is attached.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US |

**CONFIRMATION NO. 7845**

114420
Collision Communications, Inc.
5400 Trinity Road
Suite 303
Raleigh, NC 27607

**POA ACCEPTANCE LETTER**

*OC000000060704928*

Date Mailed: 04/26/2013

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/22/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/tnnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | 234/16 UTIL |

**CONFIRMATION NO. 7845**

79683
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

**POWER OF ATTORNEY NOTICE**

*OC000000060704890*

Date Mailed: 04/26/2013

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/22/2013.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/tnnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 05/29/2013

Collision Communications, Inc.
5400 Trinity Road
Suite 303
Raleigh, NC 27607

| EXAMINER | |
|---|---|
| CEHIC, KENAN | |
| ART UNIT | PAPER NUMBER |
| 2479 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 05/29/2013 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 12/742,686 | NIEDZWIECKI ET AL. | |
| | Examiner | Art Unit | |
| | KENAN CEHIC | 2479 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 May 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on _____ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1-11,13,14, 16-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Brommer (US 2006/0114826 A1).

For claim 1, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel, para [0011], [0015]), the method compdsing: providing a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said



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parameter channel (a polling signal corresponds to a particular terminal out of a first set'of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 2, Brommer teaches wherein said providing a plurality of parameter channels comprises using channel-spreading technology (access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0092]).

For claim 3, Brommer teaches wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA (CDMA, para [0092]).

For claim 4, Brommer teaches wherein requiting each transmitting node to transmit a parameter-estimating signal includes requiting each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared



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communication channel (two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]).

For claim 5, Brommer teaches wherein the parameter-estimating signal is a parameter-estimating symbol pattern (a bank of decoders receives a recovered symbol stream for each of the multiple users output by the MUD module, para [0086]).

For claim 6, Brommer teaches wherein the at least one unique signal parameter comprises signal amplitude (parameter estimation module estimates amplitudes, para [0084]).

For claim 7, Brommer teaches wherein the at least one unique signal parameter includes a signal phase (parameter estimation module estimates phases, para [0084]).

For claim 8, Brommer teaches wherein the at least one unique signal parameter includes a signal carrier frequency offset (FSK offset frequency, para [0054]).

For claim 9, Brommer teaches wherein the at least one unique signal parameter includes a signal relative time delay (parameter estimation module estimates the relative received timing offsets, para [0084]).

For claim 10, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, pare [0084]).

For claim 11, Brommer teaches requiting each transmitting node to transmit spreading code type information on the unshared parameter channel (spread spectrum techniques are used, para [0052]).



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For claim 13, Brommer teaches wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies (frequency hopping communication technique, para [0041], [0052], [0054]).

For claim 14, Brommer teaches wherein the parameter channels are shifted according to a random hopping pattern (frequency hopping communication technique, para [0041], [0052], [0054]).

For claim 16, Brommer teaches wherein the parameter channels are low in communication rate compared to the shared communication channel (the transmitted informational data stream is impressed upon a much higher rate data stream, para [0007], 10055]).

For claim 17, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared



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communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled tenminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 18, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

For claim 19, Brommer teaches method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network (modem with a



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multiuser detection module that can simultaneously demodulate and recover multiple wiralessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel (the modem uses a any one of a number of access schemes, including FDMA which provides multiple channels for communication where the multiple channels are divided by frequency, hence frequency division multiple access (FDMA), para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carder offset frequency for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which



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protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 20, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:



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1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brommer (US 2006/0114826 A1) in view of Dunyak et al. (US 200610140259 A1).

Brommer does not explicitly discuss the following:

For claim 12, requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

Dunyak from the same or similar field of endeavor discloses the following features:

For claim 12, Dunyak discloses requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel for each channel, if the power is determined to exceed a threshold, its amplitude is estimated as the ratio of its power to the pilot power, para [0087]), the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio for each channel, if the power is determined to exceed a threshold, its amplitude is estimated as the ratio of its power to the pilot power, para [0087]).



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It would have been obvious to one of the ordinary skill in the art at the time of the invention to modify / combine the features of Brommer by using the above recited features, as taught by Dunyak, in order to provide techniques for canceling MAI that can be practically implemented while still providing effective and adequate cancellation (see Dunyak sections 0010-12). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the method of Brommer to include requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio, as taught by Dunyak, for the advantage of a more precisely monitor the channels.

3. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brommer (US 2006/0114826 A1) in view of Hoffberg et al. (US 2007/0087756 A1).

Brommer does not explicitly discuss the following:

For claim 15, wherein the random hopping pattern is based on a GPS clock timebase.

Hoffberg from the same or similar field of endeavor discloses the following features:

For claim 15, Hoffberg discloses wherein the random hopping pattern is based on a GPS clock timebase (frequency hopping, where a demodulator tracks the hop frequency



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sequence and time synchronization may be effected by using the timing functions of a GPS receiver, para [0535]).

It would have been obvious to one of the ordinary skill in the art at the time of the invention to modify / combine the features of Brommer by using the above recited features, as taught by Hoffberg, in order to provide a system, utilizing game theory, which is controlled by providing incentives and disincentives for various behaviors and actions seeking to promote an efficient outcome for the system as a whole, given the external constraints, wherein each agent then maximizes its own state based on its own value function, in light of the incentives and disincentives, resulting in an optimal network (see Hoffberg sections 0073-74). It would have been obvious to a person of ordinary skill in the art at the time of the applicant's invention to modify the method of Brommer to include wherein the random hopping pattern is based on a GPS clock timebase, as taught by Hoffberg, in order to to provide a central time reference for the hopping pattern.

## *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENAN CEHIC whose telephone number is (571)270-3120. The examiner can normally be reached on Monday through Friday 8:00-5:30.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Chriss can be reached on (571) 272-1774. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kenan Cehic/

Examiner, Art Unit 2479

/KWANG B YAO/

Supervisory Patent Examiner, Art Unit 2473



INTEL-1002

| Notice of References Cited | Application/Control No. 12/742,686 | Applicant(s)/Patent Under Reexamination NIEDZWIECKI ET AL. | |
|---|---|---|---|
| | Examiner KENAN CEHIC | Art Unit 2479 | Page 1 of 1 |

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| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
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| * | B | US-2006/0114826 A1 | 06-2006 | Brommer, KarlD | 370/230 |
| * | C | US-2007/0087756 A1 | 04-2007 | Hoffberg, Steven M. | 455/450 |
| | D | US- | | | |
| | E | US- | | | |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | Joshua D. Niedzwiecki |
| Art Unit | 2479 |
| Examiner Name | Kenan Cehic |
| Attorney Docket Number | 234/16 UTIL |

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| | 1 | 20110051674 | A1 | 2011-03-03 | Niedzwiecki et al. | |
| | 2 | 20060215611 | A1 | 2006-09-28 | Nakagawa et al. | |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Application Number | 12742686 |
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| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2479 |
| | Examiner Name | Kenan Cehic |
| | Attorney Docket Number | 234/16 UTIL |

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| | 1 | U.S. Non-Final Office Action mailed 1/17/2013 for related application 13/090435 filed 4/20/11, references cited herein. | ☒ |

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| Examiner Signature | /Kenan Cehic/ | Date Considered | 05/28/2013 |
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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2479 |
| | Examiner Name | Kenan Cehic |
| | Attorney Docket Number | 234/16 UTIL |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Bentley J. Olive/ | Date (YYYY-MM-DD) | 2013-01-17 |
|---|---|---|---|
| Name/Print | Bentley J. Olive | Registration Number | 44985 |

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| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
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| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

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| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 09/05/2012 | | | | | | | | |
| | 1 | ✓ | | | | | | | | |
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| Class | Subclass | Date | Examiner |
| 370 | 310-350 | 9/5/2012 | kc |

| SEARCH NOTES | | |
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| Search Notes | Date | Examiner |
| Inventorship and east text search | 09/05/2012 | kc |

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| | |
|---|---|
| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | NIEDZWIECKI, Joshua D. |
| Art Unit | |
| Examiner Name | |
| Attorney Docket Number | 20060108-US |

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| | 1 | 6947502 | B2 | 2005-09-20 | Taylor et al. | |

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| | 2 | 20060140259 | A1 | 2006-06-29 | Dunyak et al. | |
| | 3 | 20070087756 | A1 | 2007-04-19 | Hoffberg | |
| | 4 | 20080095121 | A1 | 2008-04-24 | Shattil | |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | NIEDZWIECKI, Joshua D. |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 20060108-US |

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|---|---|---|---|
| | 1 | PCT Search Report dated 23 April 2010 of PCT Application No. PCT/US2009/058409 filed 25 September 2009, 9 pages | ☐ |
| | 2 | SO, Jungmin et al., A MULTI-CHANNEL MAC PROTOCOL FOR AD HOC WIRELESS NETWORKS, Technical Report January 2003 University of Illinois at Urbana-Champaign, 14 pages | ☐ |
| | 3 | WU, Shih-Lin et al., A NEW MULTI-CHANNEL MAC PROTOCOL WITH ON-DEMAND CHANNEL ASSIGNMENT FOR MULTI-HOP MOBILE AD HOC NETWORKS, 2000, pgs 232-237, IEEE 1087-4089/00 | ☐ |
| | 4 | CHEN, Huimin et al., A NEW MULTI-CHANNEL MAC PROTOCOL WITH POWER CONTROL FOR AD HOC NETWORKS, 2006, 4 pages, IEEE Proceedings of the 20th International Conference on Advanced Information Networking and Applications (AINA'06) | ☐ |
| | 5 | JIN, Kyu-Tae, MULTI-CODE MAC FOR MULTI-HOP WIRELESS AD HOC NETWORKS, 2002, pgs 1100-1104, IEEE 0-7803-7467-3/02 | ☐ |

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**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 4 | ((BRANDON) near2 (HOMBS)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:43 |
| L2 | 20 | ((JOSHUA) near2 (NIEDZWIECKI)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:43 |
| L3 | 52153 | 370/310-350.ccls. and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:45 |
| L4 | 0 | (("20060114826") or ("20060140259") or ("20070067756")).PN. | USPAT; USOCR | OR | OFF | 2012/09/05 18:46 |
| L5 | 3 | (("20060114826") or ("20060140259") or ("20070067756")).PN. | US-PGPUB; USPAT; USOCR | OR | OFF | 2012/09/05 18:46 |
| L6 | 21 | 370/310-350.ccls. and pilot channels same fdma | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:21 |
| L7 | 2 | 370/310-350.ccls. and pilot channels with (estimat$5 or measur$5) (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| L8 | 3 | 370/310-350.ccls. and pilot channels with (estimat$5 or measur$5) adj2 (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| L9 | 3 | 370/310-350.ccls. and pilot channels same (estimat$5 or measur$5) adj2 (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| L10 | 27 | pilot channels same (estimat$5 or measur$5) adj2 (amplitud$5) and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:23 |
| L11 | 1 | ("20070087756").PN. | US-PGPUB; USPAT; USOCR | OR | OFF | 2012/09/05 19:35 |

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**CONFIRMATION NO. 7845**

| SERIAL NUMBER | FILING or 371(c) DATE<br>RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | 370 | 2473 | 234/16 UTIL |

**APPLICANTS**

Joshua D Niedzwiecki, Manchester, NH;
Brandon P Hombs, Merrimack, NH;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/US09/58409 09/25/2009
which claims benefit of 61/100,461 09/26/2008

**** FOREIGN APPLICATIONS ***************************

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| Foreign Priority claimed | ☐ Yes ☑ No | ☐ Met after Allowance | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
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| 35 USC 119(a-d) conditions met | ☐ Yes ☑ No | | NH | 8 | 20 | 3 |
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**ADDRESS**

OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511
UNITED STATES

**TITLE**

MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

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**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 12742686 |
| Filing Date | 2010-05-13 |
| First Named Inventor | Joshua D. Niedzwiecki |
| Art Unit | 2473 |
| Examiner Name | Kwang Bin Yao |
| Attorney Docket Number | 234/16 UTIL |

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| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 7245673 | B2 | 2007-07-17 | MacLeod | |

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|---|---|---|---|---|---|---|
| | 1 | 20020070845 | A1 | 2002-06-13 | Reisinger et al. | |

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| | 1 | 2000-252918 | JP | A | 2000-09-14 | OKI Electric Ind. Co. Ltd.; Iochi Hitoshi | | ☒ |
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|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2473 |
| | Examiner Name | Kwang Bin Yao |
| | Attorney Docket Number | 234/16 UTIL |

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|---|---|---|---|
| | 1 | JP Office Action dated November 29, 2011 against JP Patent Application No. 2009-098246; translation by Meisei International Patent Firm | ☒ |
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|---|---|---|
| | Application Number | 12742686 |
| | Filing Date | 2010-05-13 |
| | First Named Inventor | Joshua D. Niedzwiecki |
| | Art Unit | 2473 |
| | Examiner Name | Kwang Bin Yao |
| | Attorney Docket Number | 234/16 UTIL |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☒ A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Bentley J. Olive/ | Date (YYYY-MM-DD) | 2012-05-30 |
|---|---|---|---|
| Name/Print | Bentley J. Olive | Registration Number | 44,985 |

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| In re Patent Application of: | Mail Stop: Amendment |
| Joshua D. Niedzwiecki | Group Art Unit: 2479 |
| Application No.: 12/742,686 | Examiner: Kenan Cehic |
| Filed: May 13, 2010 | Confirmation No.: 7845 |

Title: Media Access Control Protocol for Multiuser Detection Enabled Ad-Hoc Wireless Communications

* * * * * * * * * * * * * * * * * * * * * * * * * * * * *

AMENDMENT UNDER 37 C.F.R. § 1.111

Mail Stop: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This paper is responsive to the Office Action mailed May 29, 2013, for which a shortened statutory period for reply is set to expire on August 29, 2013. Entry and favorable consideration of the following Amendments and/or Remarks is respectfully requested.

Amendments to the Claims are reflected in the Listing of Claims that begins on page 2 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:

providing a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

2. (Original) The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.

3. (Original) The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.

4. (Original) The method of claim 1, wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.



INTEL-1002

5. (Original) The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.

6. (Original) The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.

7. (Original) The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.

8. (Original) The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.

9. (Original) The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.

10. (Original) The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

11. (Original) The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.

12. (Original) The method of claim 1, further comprising requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.



INTEL-1002

13. (Original) The method of claim 1, wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies.

14. (Original) The method of claim 13, wherein the parameter channels are shifted according to a random hopping pattern.

15. (Original) The method of claim 14, wherein the random hopping pattern is based on a GPS clock timebase.

16. (Original) The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.

17. (Original) A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising:

using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes; and

detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

18. (Original) The method of claim 17, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.



INTEL-1002

19. (Original) A method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising:

using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel;

requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel;

detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes; and

detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

20. (Original) The method of claim 19, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

21. (New) A method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:

receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node;



INTEL-1002

estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals; and

distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter.

## REMARKS

### Status Summary

Claims 1-20 are pending in the present application, of which claims 1, 17, and 19 are presented in independent form. No claims have been allowed and claims 1-20 stand rejected. New claim 21 is added by this amendment.

### Claim Rejection(s) - 35 U.S.C. § 102

Claims 1-11, 13, 14, and 16-20 stand rejected as being anticipated by U.S. Patent Publication No. 2006/0114826 to Brommer (hereinafter "Brommer").

Claim 1 defines a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network. A plurality of parameter channels is provided on the network in addition to the shared communication channel. Each transmitting node is required to transmit a parameter-estimating signal on an unshared said parameter channel. The parameter-estimating signals on the unshared parameter channels are detected and at least one unique signal parameter for each of the transmitting nodes is estimated therefrom. The information simultaneously received from each of the transmitting nodes is detected and distinguished according to their respective said unique estimated signal parameters.

Brommer does not disclose (or suggest) "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel," as recited in claim 1. The Office reasons, on page 3 of the Office Action, "a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]." Brommer, paragraph 0011, is reproduced below:

> [0011] One embodiment of the present invention provides a method for polling and scheduling in a multiuser network that includes a plurality of bandwidth efficient modems configured in accordance with the principles of the present invention, with at least one modem designated as a polling point coordinator access point (AP) element. The method includes indicating the beginning of a contention-free period, and **simultaneously transmitting on a single channel a first set of polling signals**. Each polling signal corresponds to a particular terminal included in a first set of terminals included in the network. The method proceeds with receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element. The method may further include transmitting clear-to-send messages to any terminals requesting to send data, as indicated by received responses. Note that when the receiving modems contain multiuser receivers (MUD enabled), the AP element schedules multiple interfering data transmissions in the same channel, exploiting the ability of the multiuser receivers to demodulate signals in the presence of interference from other transmitters sharing the channel.

It appears the Office is trying to equate Brommer's polling signal to the parameter-estimating signal defined by claim 1. First, parameter-estimating signals and polling signals are very different. As described in Applicants' specification, parameter-estimating signals carry parameter-estimating symbol patterns. A polling signal simply polls communication nodes to initiate a response. Second, Brommer does not disclose transmitting on an unshared channel. Brommer discloses "simultaneously transmitting on a single channel a first set of polling signals." The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously."

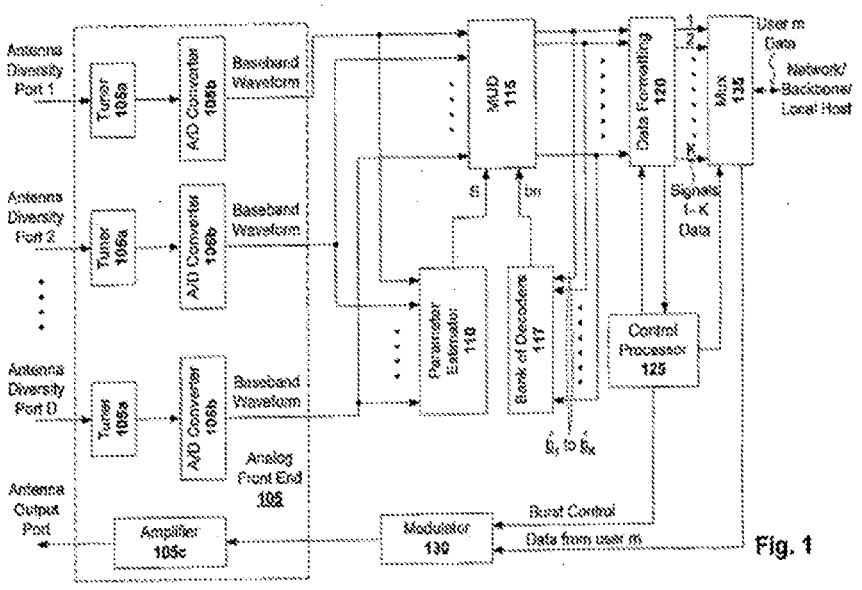
Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes," as recited in claim 1. Brommer paragraphs 0083 and 0084 are reproduced below:

> [0083] The antenna inputs may be from multiple polarizations or multiple locations or both in order to enhance the ability of the co-channel receiver to demodulate many interfering signals simultaneously. Note that D is the number of diversity ports, while K is the number of estimated co-channel interfering signals. The antenna inputs feed corresponding front end tuners 105a, each of which downconverts higher frequency signals into

baseband signals or other relatively lower frequency signals prior to processing**. At baseband, A/D converters 105b digitize each received signal into sampled data streams**. Filtering, amplification, and other conventional processing, may also be implemented in the analog front end 105.

[0084] **The sampled data streams are provided as inputs to the parameter estimation module 110, which is a synchronization device for interfering digital signals**. The parameter estimation module 110 estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal. The result of such parameter estimation is a matrix (S) of estimated composite signature waveforms for each of the K users, which is used by the MUD module 115 to help separate the channel signals.

The parameter estimation module 110 in Brommer samples the same data stream that is provided to the MUD 115, as is apparent from the cited passages above and Figure 1 of Brommer reproduced below:



Since the parameter estimation in Brommer is done on the same data stream as the data provided to the MUD 115, Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the **unshared** parameter channels," as recited in claim 1. The parameter estimation is done on the same channel as the multi-user detection in Brommer, which makes it a **shared** channel.

Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no mention of using the polling signals. In Brommer, the polling signals have nothing to do with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper.

Accordingly, since Brommer fails to disclose each and every feature of the claimed invention for at least the above reasons, claim 1 is not anticipated by Brommer. Independent claims 17 and 19 include analogous similar distinguishing features and therefore claims 2-11, 13, 14, and 16-20 are not anticipated by Brommer. Furthermore, rejected claims 1-11, 13, 14, and 16-20 are novel and inventive for at least the same reasons.

Claim Rejection(s) - 35 U.S.C. § 103

Claim 12 stands rejected as being unpatentable over Brommer in view of U.S. Patent Publication No. 2006/0140259 to Dunyak, et al. (hereinafter "Dunyak"). Claim 15 stands rejected as being unpatentable over Brommer in view of U.S. Patent Publication No. 2007/0087756 to Hoffberg, et al. (hereinafter "Hoffberg").

Neither Dunyak nor Hoffberg cure the deficiencies of Brommer discussed above. Accordingly, since the cited document(s) fails to disclose or suggest all of the claim limitations for at least the above reasons, the obviousness rejections of claims 12 and 15 should be withdrawn. Furthermore, rejected claims 12 and 15 are novel and inventive for at least the same reasons.

## New Claims

New claim 21 has been added by this amendment as indicated above.

It is respectfully submitted that new claim 21 is allowable over the prior art. No new matter is considered to have been added.

## CONCLUSION

In view of the above, it is respectfully submitted that the present application is now in proper condition for allowance, and an early notice to such effect is earnestly solicited. The absence of additional patentability arguments should not be construed as either a disclaimer of such arguments or that such arguments are not believed to be meritorious. The Examiner is respectfully requested to telephone the undersigned patent attorney at the below-listed number if, after reviewing the above Remarks, the Examiner believes outstanding matters remain that may be resolved without the issuance of a subsequent Official Action.

## DEPOSIT ACCOUNT

The Commissioner is hereby authorized to charge any additional fees, or credit any overpayment, associated with the filing of this paper to Deposit Account No. 50 5561.

Respectfully submitted,

Date: August 27, 2013

/Theodosios Thomas R45159/

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919 233 9907 (fax)



INTEL-1002

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 12742686 |
| **Filing Date:** | 13-May-2010 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Attorney Docket Number:** | C116/US |

Filed as Large Entity

## U.S. National Stage under 35 USC 371 Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| Claims in excess of 20 | 1615 | 1 | 80 | 80 |
| Independent claims in excess of 3 | 1614 | 1 | 420 | 420 |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **500** |



INTEL-1002

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 16696851 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 114420 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | C116/US |
| **Receipt Date:** | 27-AUG-2013 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 14:20:27 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

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| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $500 |
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| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|



INTEL-1002

| | | | | | |
|---|---|---|---|---|---|
| 1 | | C116US_Amendment.pdf | 399709<br>2da636a44d14717c353b6755be2c2faed72bff45 | yes | 11 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Amendment/Req. Reconsideration-After Non-Final Reject | 1 | 1 |
| | Claims | 2 | 6 |
| | Applicant Arguments/Remarks Made in an Amendment | 7 | 11 |

**Warnings:**

**Information:**

| | | | | | |
|---|---|---|---|---|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 32028<br>8452499746e805e52c90d089f06ec0cafdf8b194 | no | 2 |

**Warnings:**

**Information:**

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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>12/742,686 | Filing Date<br>05/13/2010 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| | (Column 1) | (Column 2) | | |
|---|---|---|---|---|
| FOR | NUMBER FILED | NUMBER EXTRA | RATE ($) | FEE ($) |
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 08/27/2013 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 21 | Minus | ** 20 | = 1 | X $80 = | 80 |
| | Independent (37 CFR 1.16(h)) | * 4 | Minus | ***3 | = 1 | X $420 = | 420 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | **500** |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/YOLANDA A. MIDDLETON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 12/16/2013

Collision Communications, Inc.
5400 Trinity Road
Suite 303
Raleigh, NC 27607

| EXAMINER | |
|---|---|
| CEHIC, KENAN | |
| ART UNIT | PAPER NUMBER |
| 2479 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 12/16/2013 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. 12/742,686 | Applicant(s) NIEDZWIECKI ET AL. | |
|---|---|---|---|
| | Examiner KENAN CEHIC | Art Unit 2479 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *08/27/2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-21* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-21* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1-11,13,14, 16-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Brommer (US 2006/0114826 A1).

For claim 1, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel, para [0011], [0015]), the method compdsing: providing a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring



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each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel (a polling signal corresponds to a particular terminal out of a first set'of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 2, Brommer teaches wherein said providing a plurality of parameter channels comprises using channel-spreading technology (access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0092]).

For claim 3, Brommer teaches wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA (CDMA, para [0092]).

For claim 4, Brommer teaches wherein requiting each transmitting node to transmit a parameter-estimating signal includes requiting each transmitting node to transmit the



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parameter-estimating signal while simultaneously transmitting information on the shared communication channel (two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]).

For claim 5, Brommer teaches wherein the parameter-estimating signal is a parameter-estimating symbol pattern (a bank of decoders receives a recovered symbol stream for each of the multiple users output by the MUD module, para [0086]).

For claim 6, Brommer teaches wherein the at least one unique signal parameter comprises signal amplitude (parameter estimation module estimates amplitudes, para [0084]).

For claim 7, Brommer teaches wherein the at least one unique signal parameter includes a signal phase (parameter estimation module estimates phases, para [0084]).

For claim 8, Brommer teaches wherein the at least one unique signal parameter includes a signal carrier frequency offset (FSK offset frequency, para [0054]).

For claim 9, Brommer teaches wherein the at least one unique signal parameter includes a signal relative time delay (parameter estimation module estimates the relative received timing offsets, para [0084]).

For claim 10, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, pare [0084]).

For claim 11, Brommer teaches requiting each transmitting node to transmit spreading code type information on the unshared parameter channel (spread spectrum techniques are used, para [0052]).



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For claim 13, Brommer teaches wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies (frequency hopping communication technique, para [0041], [0052], [0054]).

For claim 14, Brommer teaches wherein the parameter channels are shifted according to a random hopping pattern (frequency hopping communication technique, para [0041], [0052], [0054]).

For claim 16, Brommer teaches wherein the parameter channels are low in communication rate compared to the shared communication channel (the transmitted informational data stream is impressed upon a much higher rate data stream, para [0007], 10055]).

For claim 17, Brommer teaches a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wirelessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared



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said parameter channel while simultaneously transmitting information on the shared communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled tenminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 18, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

For claim 19, Brommer teaches method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes



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on a shared communication channel of a wireless ad-hoc digital network (modem with a multiuser detection module that can simultaneously demodulate and recover multiple wiralessly transmitted signals using co-channel demodulation, where signals are simultaneously transmitted on a single channel on a network, such as an ad-hoc network, para [0011], [0015], [0046]), the method comprising: using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel (the modem uses a any one of a number of access schemes, including FDMA which provides multiple channels for communication where the multiple channels are divided by frequency, hence frequency division multiple access (FDMA), para [0007], [0092]); requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel (a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, and where two or more terminals simultaneously transmit messages to a first set of destination modems, para [0011], [0015], [0140]); detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carder offset frequency for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering



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signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]); and detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084]).

For claim 20, Brommer teaches requiring each transmitting node to transmit node identifying information on the unshared parameter channel (sampled data streams are provided as inputs to the parameter estimation module, para [0084]).

For claim 21, Brommer teaches A method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising: receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node (the modem uses a any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, where each transmitting node (there are multiple) transmits logical / data channels / streams for communication and responses to polling as described in para [0007], [0011], [0083], [0089], [0092] );

estimating at least one unique signal parameter for each of the received plurality of



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parameter-estimating signals (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted, para [0011], [0015], [0079], [0084], [0089]);; and distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter (the result of such parameter estimation is a matrix of estimated composite signature waveforms for each of the K users, which is used by the multiuser detection module to help separate the channel signals, para [0084] and / or para. 0089; transmission / format mode also distinguishes the received information signals from different terminals).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.



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The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brommer (US 2006/0114826 A1) in view of Dunyak et al. (US 200610140259 A1).

Brommer does not explicitly discuss the following:

For claim 12, requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

Dunyak from the same or similar field of endeavor discloses the following features:

For claim 12, Dunyak discloses requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel for each channel, if the power is determined to exceed a threshold, its amplitude is estimated as the ratio of its power to the pilot power, para [0087]), the parameter-estimating signal



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amplitude and the information transmitting amplitude having a predetermined ratio for each channel, if the power is determined to exceed a threshold, its amplitude is estimated as the ratio of its power to the pilot power, para [0087]).

It would have been obvious to one of the ordinary skill in the art at the time of the invention to modify / combine the features of Brommer by using the above recited features, as taught by Dunyak, in order to provide techniques for canceling MAI that can be practically implemented while still providing effective and adequate cancellation (see Dunyak sections 0010-12). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the method of Brommer to include requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio, as taught by Dunyak, for the advantage of a more precisely monitor the channels.

3. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brommer (US 2006/0114826 A1) in view of Hoffberg et al. (US 2007/0087756 A1).

Brommer does not explicitly discuss the following:

For claim 15, wherein the random hopping pattern is based on a GPS clock timebase.



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Hoffberg from the same or similar field of endeavor discloses the following features:

For claim 15, Hoffberg discloses wherein the random hopping pattern is based on a GPS clock timebase (frequency hopping, where a demodulator tracks the hop frequency sequence and time synchronization may be effected by using the timing functions of a GPS receiver, para [0535]).

It would have been obvious to one of the ordinary skill in the art at the time of the invention to modify / combine the features of Brommer by using the above recited features, as taught by Hoffberg, in order to provide a system, utilizing game theory, which is controlled by providing incentives and disincentives for various behaviors and actions seeking to promote an efficient outcome for the system as a whole, given the external constraints, wherein each agent then maximizes its own state based on its own value function, in light of the incentives and disincentives, resulting in an optimal network (see Hoffberg sections 0073-74). It would have been obvious to a person of ordinary skill in the art at the time of the applicant's invention to modify the method of Brommer to include wherein the random hopping pattern is based on a GPS clock timebase, as taught by Hoffberg, in order to to provide a central time reference for the hopping pattern.



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***Response to Arguments***

Applicant's arguments filed 08/27/2013 have been fully considered but they are not persuasive.

For claim 1, the applicant argues the following:

"

Brommer does not disclose (or suggest) "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel," as recited in claim 1. The Office reasons, on page 3 of the Office Action, "a polling signal corresponds to a particular terminal out of a first set of terminal included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011].

.....

It appears the Office is trying to equate Brommer's polling signal to the parameter-estimating signal defined by claim 1. First, parameter-estimating signals and polling signals are very different. As described in Applicants' specification, parameter-estimating signals carry parameter-estimating symbol patterns. A polling signal simply polls communication nodes to initiate a response. Second, Brommer does not disclose transmitting on an unshared channel. Brommer discloses "simultaneously transmitting on a single channel a first set of polling signals." The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously."



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The examiner respectfully disagrees. Brommer discloses a single shared physical channel that is used by multiple devices as explained in paragraph 0011 and 0015. However, "channel" has merely the following definitions "a course into which something can be directed or moved:" (channel." Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers.) or "a course into which something may be directed:" ("channel." Dictionary.com Unabridged. Random House, Inc.). As pointed out in para. 0007, 0011, 0079, 0083, 0089, it is clear that each terminal / modem sends its informational data streams / channels (including responses to polling by the AP) which are not shared with other transmitting devices. Here "channel" is interpreted based on the above broadest reasonable interpretation (i.e. a logical channel versus a physical channel which the applicant seems to argue about). Brommer's teachings of polling, over which the applicant mainly argues about, are not directly utilized in the rejection and further even support the Examiner's stance regarding Brommer's teachings; they indicate that we have multiple terminals / modems that get to transmit their logical / informational streams / channels and the responses to polling on them as explained above.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "As described in Applicants' specification, parameter- estimating signals carry parameter-estimating symbol patterns.") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the



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specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The applicant further argues on pages 8-10 of the Response the following regarding claim 1:

"

Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes," as recited in claim 1. Brommer paragraphs 0083 and 0084 are reproduced below:....

....

Since the parameter estimation in Brommer is done on the same data stream as the data provided to the MUD 115, Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels," as recited in claim 1. The parameter estimation is done on the same channel as the multi-user detection in Brommer, which makes it a shared channel.

Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no mention of using the polling signals. In Brommer, the polling signals have nothing to do



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with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper."

The examiner respectfully disagrees. As explained above, multiple terminals / modems transmit unshared informational / logical channels or streams and responses to polling. As clearly stated in para. 0084 we estimate a multiplicity of parameters (offsets, phase) for the specific signals (such as responses to polling) / data stream of a particular terminal / modem and further in para 0089 where the terminal / modem specific signals / data streams are used to determine the formatting / transmission mode; both of these disclosure teach "estimating" parameters that are associated / unique to a transmitting terminal. It is pointed out to the applicant, that the parameter channels were mapped to the logical / informational streams / channels as described in para. 0007, while para. 0011 was pointed out to show that in Brommer each / multiple terminals get to transmit (as taught by the polling / responses) where such transmission is are the logical / informational streams as explained above on which estimation is performed as described in para. 0084 and 0089, **and** further in para. 0011, where it is taught that terminals polled transmit responses to the polling on which co-channel demodulation is performed ("receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element" ; para. 0011), which as described in para. 0084 and 0089 performs the estimation as described above.



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Arguments for dependent claims are based on the above addressed arguments.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENAN CEHIC whose telephone number is (571)270-3120. The examiner can normally be reached on Monday through Friday 8:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Chriss can be reached on (571) 272-1774. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kenan Cehic/

Examiner, Art Unit 2479

/ANDREW CHRISS/

Supervisory Patent Examiner, Art Unit 2479



INTEL-1002

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 09/05/2012 | 12/10/2013 | | | | | | | |
| | 1 | ✓ | ✓ | | | | | | | |
| | 2 | ✓ | ✓ | | | | | | | |
| | 3 | ✓ | ✓ | | | | | | | |
| | 4 | ✓ | ✓ | | | | | | | |
| | 5 | ✓ | ✓ | | | | | | | |
| | 6 | ✓ | ✓ | | | | | | | |
| | 7 | ✓ | ✓ | | | | | | | |
| | 8 | ✓ | ✓ | | | | | | | |
| | 9 | ✓ | ✓ | | | | | | | |
| | 10 | ✓ | ✓ | | | | | | | |
| | 11 | ✓ | ✓ | | | | | | | |
| | 12 | ✓ | ✓ | | | | | | | |
| | 13 | ✓ | ✓ | | | | | | | |
| | 14 | ✓ | ✓ | | | | | | | |
| | 15 | ✓ | ✓ | | | | | | | |
| | 16 | ✓ | ✓ | | | | | | | |
| | 17 | ✓ | ✓ | | | | | | | |
| | 18 | ✓ | ✓ | | | | | | | |
| | 19 | ✓ | ✓ | | | | | | | |
| | 20 | ✓ | ✓ | | | | | | | |
| | 21 | | ✓ | | | | | | | |

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | Examiner | Art Unit |
| | KENAN CEHIC | 2479 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 370 | 310-350 | 9/5/2012 | kc |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Inventorship and east text search | 09/05/2012 | kc |
| update search | 12/02/2013 | kc |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

| | |
|---|---|
| | |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 1 | (US-20060114826-$).did. | US-PGPUB | ADJ | OFF | 2013/12/10 15:15 |
| L2 | 1 | L1 and (control$4 or $4rier or pilot$3 or estimat$5) | US-PGPUB; USPAT | ADJ | OFF | 2013/12/10 15:15 |
| L3 | 1 | L1 and (poll$4) | US-PGPUB; USPAT | ADJ | OFF | 2013/12/10 15:36 |
| S1 | 4 | ((BRANDON) near2 (HOMBS)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:43 |
| S2 | 20 | ((JOSHUA) near2 (NIEDZWIECKI)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:43 |
| S3 | 52153 | 370/310-350.ccls. and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 18:45 |
| S4 | 0 | (("20060114826") or ("20060140259") or ("20070067756")).PN. | USPAT; USOCR | OR | OFF | 2012/09/05 18:46 |
| S5 | 3 | (("20060114826") or ("20060140259") or ("20070067756")).PN. | US-PGPUB; USPAT; USOCR | OR | OFF | 2012/09/05 18:46 |
| S6 | 21 | 370/310-350.ccls. and pilot channels same fdma | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:21 |
| S7 | 2 | 370/310-350.ccls. and pilot channels with (estimat$5 or measur$5) (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| S8 | 3 | 370/310-350.ccls. and pilot channels with (estimat$5 or measur$5) adj2 (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| S9 | 3 | 370/310-350.ccls. and pilot channels same (estimat$5 or measur$5) adj2 (amplitud$5) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:22 |
| S10 | 27 | pilot channels same (estimat$5 or measur$5) adj2 (amplitud$5) and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/05 19:23 |
| S11 | 1 | ("20070087756").PN. | US-PGPUB; USPAT; | OR | OFF | 2012/09/05 19:35 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | USOCR | | | |
| S12 | 1032 | multiuser detection and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/21 06:38 |
| S13 | 220 | multiuser detection and (estimat$5 near3(( phase$2 or timing) offsets, phase$2, amplitude$2 or delay or phase))) and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") | US-PGPUB; USPAT | ADJ | OFF | 2012/09/21 06:42 |
| S14 | 2 | "US 20110051674" | US-PGPUB; USPAT; USOCR; DERWENT | ADJ | OFF | 2012/09/21 06:46 |
| S15 | 52 | multiuser detection and (estimat$5 near3(( phase$2 or timing) offsets, phase$2, amplitude$2 or delay or phase))) and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") and (fdma or ofdma) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/21 06:51 |
| S16 | 31 | multiuser detection and channel$2 with (estimat$5 near3( (( phase$2 or timing) offsets, phase$2, amplitude$2 or delay or phase))) and (@ad<="20080926" or @pd<="20080926" or @rlan<="20080926" or @rlad<="20080926" or @rlpn<="20080926") and (fdma or ofdma) | US-PGPUB; USPAT | ADJ | OFF | 2012/09/21 06:55 |
| S17 | 1 | ("20060114826").PN. | US-PGPUB; USPAT; USOCR | OR | OFF | 2013/12/04 12:35 |
| S18 | 1 | (US-20060114826-$).did. | US-PGPUB | ADJ | OFF | 2013/12/10 11:41 |
| S19 | 1 | S18 and (channel$2 or stream$2 or co-channel$2) | US-PGPUB; USPAT | ADJ | OFF | 2013/12/10 11:42 |
| S20 | 1 | S18 and (control$4 or $5cch or pilot$3) | US-PGPUB; USPAT | ADJ | OFF | 2013/12/10 11:43 |
| S21 | 1 | S18 and (control$4 or $4rier or pilot$3) | US-PGPUB; USPAT | ADJ | OFF | 2013/12/10 11:45 |

**12/10/2013 4:04:48 PM**
**C:\Users\kcehic\Desktop\apps\12742686\12742686.wsp**

Doc Code: AP.PRE.REQ

PTO/SB/33 (07-05)
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| PRE-APPEAL BRIEF REQUEST FOR REVIEW | Docket Number (Optional) C116/US |
|---|---|

| I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)]<br><br>On _____<br><br>Signature _____<br><br>Typed or printed name _____ | Application Number<br>12/742,686 | Filed<br>September 25, 2009 |
|---|---|---|
| | First Named Inventor<br>Joshua D. Niedzwiecki | |
| | Art Unit<br>2479 | Examiner<br>Kenan Cehic |

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

☒ attorney or agent of record.
Registration number 45,159

☐ attorney or agent acting under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34

/Theodosios Thomas R45159/
Signature

Theodosios Thomas
Typed or printed name

919-233-1942 x203
Telephone number

March 17, 2014
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

This collection of information is required by 35 U.S.C. 132. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450. If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PRE-APPEAL BRIEF REQUEST FOR REVIEW

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants request review of the final rejection of claims 1-21 in the subject application. No amendments are being filed with this Request.

This Request is being filed with a Notice of Appeal.

Background

Claims 1-21 are pending in the present application, of which claims 1, 17, 19, and 21 are presented in independent form. Claims 1-21 stand rejected.

Reasons for Request

The record fails to address the recitations in the claims of "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel."

1. The references cited fail to disclose or render obvious the above-cited features in the Office's rejections of independent claims 1, 17, 19, and 21.

Brommer does not disclose (or suggest) "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel," as recited in claim 1. The Office reasons, on page 3 of the Final Office Action, "a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]."

It appears the Office is trying to equate Brommer's polling signal to the parameter-estimating signal defined by claim 1. First, parameter-estimating signals and polling signals are very different. As described in Applicants' specification, parameter-estimating signals carry parameter-estimating symbol patterns. A polling signal simply polls communication nodes to initiate a response. On page 14 of the Final Office Action, the office contends "the features upon which applicant relies (i.e., "As described in Applicants' specification, parameter-

estimating signals carry parameter-estimating symbol patterns.") are not recited in the rejected claim(s)" and "limitations from the specification are not read into the claims."

Appellant respectfully submits that the Office's interpretation of the claim terms as described above is similar to the situation as described in In Re Suitco Surface, Inc. (U.S. Court of Appeals for the Federal Circuit, 2009-1418, April 14, 2010), in which the Court held that the USPTO based its rejection on unreasonable construction. There, the Court reiterated the rule that the USPTO must give claims their broadest reasonable construction that is consistent with the specification, and determined whether the USPTO's interpretation of the disputed claim language is "reasonable." First, the Court found that the USPTO's proffered construction ignores a certain reality. Then, the Court found that this construction does not reasonably reflect the plain language and disclosure of the underlying patent. Despite the USPTO's emphasis that it was required to give all "claims their broadest reasonable construction," the Court instructed that any such construction be consistent with the specification and that claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art. Appellant respectfully submits that the Office's interpretation of the claim terms as described above for claim 1, which is further discussed below) is also unreasonably broad since it is not read consistent with the specification as it would be interpreted by one of ordinary skill in the art.

The present specification (at paragraph 0019 of the publication) recites "Each transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel." One of ordinary skill in this art would, reading the specification, interpret a parameter-estimating signal to include parameter-estimating symbol patterns, since that interpretation is consistent with the specification. At a minimum, a parameter-estimating signal must be usable to estimate parameters, which a polling signal clearly is not. Accordingly, the Office's overbroad interpretation of parameter-estimating signal to include the polling signals of Brommer cannot stand.

Second, Brommer does not disclose transmitting on an unshared channel. The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously," (see paragraph 0011). This much is admitted in by the Office on page 14 of the Final Office Action. The Office contends, however, that the term channel could be defined so broad as to be limited only to "a course into which something can be directed or moved." Once again, the Office is applying overbroad definitions for terms such that they are inconsistent with the specification. Here, the Office is using general definitions of the term "channel" without regard to how the term is used in the specification or even in the communications art. One cannot interpret the term "unshared said parameter channel" to include definitions for channel that include shared channels. The Office reasons that "it is clear that each terminal I modem sends its informational data streams I channels (including responses to polling by the AP) which are not shared with other transmitting devices." In fact, it is clear that the opposite is taking place. Brommer discloses, at paragraph 0011, "simultaneously transmitting on a single channel a first set of polling signals" and "receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using

co-channel demodulation capabilities of the AP element." Brommer itself recognizes that "a single channel" is used and the entire point of Brommer is to share the single channel to receive and recover "recovering each of those two or more simultaneous responses."

Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes," as recited in claim 1. Brommer paragraphs 0083 and 0084 are reproduced below:

> [0083] The antenna inputs may be from multiple polarizations or multiple locations or both in order to enhance the ability of the co-channel receiver to demodulate many interfering signals simultaneously. Note that D is the number of diversity ports, while K is the number of estimated co-channel interfering signals. The antenna inputs feed corresponding front end tuners 105a, each of which downconverts higher frequency signals into baseband signals or other relatively lower frequency signals prior to processing**. At baseband, A/D converters 105b digitize each received signal into sampled data streams**. Filtering, amplification, and other conventional processing, may also be implemented in the analog front end 105.
>
> [0084] **The sampled data streams are provided as inputs to the parameter estimation module 110, which is a synchronization device for interfering digital signals**. The parameter estimation module 110 estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal. The result of such parameter estimation is a matrix (S) of estimated composite signature waveforms for each of the K users, which is used by the MUD module 115 to help separate the channel signals.

The parameter estimation module 110 in Brommer samples the same data stream that is provided to the MUD 115, as is apparent from the cited passages above and Figure 1 of Brommer reproduced below:

Since the parameter estimation in Brommer is done on the same data stream as the data provided to the MUD 115, Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the **unshared** parameter channels," as recited in claim 1. **T**he parameter estimation is done on the same channel as the multi-user detection in Brommer, which makes it a **shared** channel.

Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no mention of using the polling signals. In Brommer, the polling signals have nothing to do with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper.

Accordingly, since Brommer fails to disclose each and every feature of the claimed invention for at least the above reasons, claim 1 is not anticipated by Brommer. Independent

claims 17 and 19 include analogous similar distinguishing features and therefore claims 2-11, 13, 14, and 16-20 are not anticipated by Brommer. Furthermore, rejected claims 1-11, 13, 14, and 16-20 are novel and inventive for at least the same reasons.

Neither Dunyak nor Hoffberg cure the deficiencies of Brommer discussed above. Accordingly, since the cited document(s) fails to disclose or suggest all of the claim limitations for at least the above reasons, the obviousness rejections of claims 12 and 15 should be withdrawn. Furthermore, rejected claims 12 and 15 are novel and inventive for at least the same reasons.

Summary

As stated above, the record fails to address the above recitations in the claims. Moreover, Applicants respectfully assert that these features are absent from the cited documents. Accordingly, the rejection of independent claims 1, 17, 19, and 21 should be withdrawn and the application should be passed to issue.

Respectfully submitted,

Date: March 17, 2014
/Theodosios Thomas R45159/
Theodosios Thomas, Reg. No. 45,159
Attorney for Applicant

Customer No: 114420
5400 Trinity Road, Ste 303
Raleigh, North Carolina 27607
919 233 1942 x203 (voice)
919 233 9907 (fax)

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 12742686 |
| **Filing Date:** | 13-May-2010 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Attorney Docket Number:** | C116/US |

Filed as Large Entity

## U.S. National Stage under 35 USC 371 Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| Notice of Appeal | 1401 | 1 | 800 | 800 |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
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| | | | **Total in USD ($)** | **800** |



INTEL-1002

# Electronic Acknowledgement Receipt

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| **Application Number:** | 12742686 |
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| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
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| 1 | Notice of Appeal Filed | C116US_Notice_Of_Appeal.pdf | 25232<br>0fca584234673c8b576cb4e3eeb3af11836c2968 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Pre-Brief Conference request | C116US_PreAppeal_Brief_Request.pdf | 37425<br>0e324e53f05977419bebdb2c802c62c705744728 | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30551<br>67c9ee324c6ae4e46f46f1121d5bc984e5cb89c1 | no | 2 |
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**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

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**NOTICE OF APPEAL** FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Docket Number (Optional): C116/US

In re Application of: Joshua D. Niedzwiecki

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)]

On _____
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| Application Number | Filed |
|---|---|
| 12/742,686 | 2009-09-25 |

For: Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications

| Art Unit | Examiner |
|---|---|
| 2479 | Kenan Cehic |

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner:

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) — A 800.00

- ☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: A _____
- ☐ A check in the amount of the fee is enclosed.
- ☒ Payment by credit card via EFS-Web submitted concurrently with filing.
- ☐ The Director has already been authorized to charge fees in this application to a Deposit Account. I have enclosed a duplicate copy of this sheet.
- ☒ The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-3512.
- ☐ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☒ attorney or agent of record. Registration number 45,159.
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34

/Theodosios Thomas R45159/
Signature

Theodosios Thomas
Typed or printed name

919-233-1942 x-203
Telephone number

March 17, 2014
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

This collection of information is required by 35 U.S.C. 132. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 05/15/2014

Collision Communications, Inc.
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| EXAMINER | |
|---|---|
| CEHIC, KENAN | |
| ART UNIT | PAPER NUMBER |
| 2479 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 05/15/2014 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Notice of Panel Decision from Pre-Appeal Brief Review | Application No. 12/742,686 | Applicant(s) NIEDZWIECKI ET AL. |
|---|---|---|
| | Examiner KENAN CEHIC | Art Unit 2479 |

This is in response to the Pre-Appeal Brief Request for Review filed 17 March, 2014.

1. ☐ **Improper Request** – The Request is improper and a conference will not be held for the following reason(s):

☐ The Notice of Appeal has not been filed concurrent with the Pre-Appeal Brief Request.
☐ The request does not include reasons why a review is appropriate.
☐ A proposed amendment is included with the Pre-Appeal Brief request.
☐ Other: .

The time period for filing a response continues to run from the receipt date of the Notice of Appeal or from the mail date of the last Office communication, if no Notice of Appeal has been received.

2. ☒ **Proceed to Board of Patent Appeals and Interferences** – A Pre-Appeal Brief conference has been held. The application remains under appeal because there is at least one actual issue for appeal. Applicant is required to submit an appeal brief in accordance with 37 CFR 41.37. The time period for filing an appeal brief will be reset to be one month from mailing this decision, or the balance of the two-month time period running from the receipt of the notice of appeal, whichever is greater. Further, the time period for filing of the appeal brief is extendible under 37 CFR 1.136 based upon the mail date of this decision or the receipt date of the notice of appeal, as applicable.

☒ The panel has determined the status of the claim(s) is as follows:
Claim(s) allowed: _____.
Claim(s) objected to: _____.
Claim(s) rejected: *1-21*.
Claim(s) withdrawn from consideration: _____.

3. ☐ **Allowable application** – A conference has been held. The rejection is withdrawn and a Notice of Allowance will be mailed. Prosecution on the merits remains closed. No further action is required by applicant at this time.

4. ☐ **Reopen Prosecution** – A conference has been held. The rejection is withdrawn and a new Office action will be mailed. No further action is required by applicant at this time.

All participants:

| | |
|---|---|
| (1) *KENAN CEHIC*. | (3) *DANG TON*. |
| (2) *ANDREW CHRISS*. | (4)_____. |

| | | |
|---|---|---|
| /KENAN CEHIC/<br>Examiner, Art Unit 2479 | /ANDREW CHRISS/<br>Supervisory Patent Examiner, Art Unit 2479 | /DANG TON/<br>Supervisory Patent Examiner, Art Unit 2475 |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

In re Patent Application of:
Joshua D. Niedzwiecki, et al.

Application No.: 12/742,686

Filed: September 25, 2009

For: Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications

Mail Stop: Appeal Brief - Patents

Group Art Unit: 2479

Examiner: Kenan Cehic

Confirmation No.: 7845

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APPEAL BRIEF

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## I. REAL PARTY IN INTEREST

Appellant respectfully submits that Collision Communications, Inc. is the real party in interest, as evidenced by the assignment set forth at Reel 028490, Frame 0285.



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## II. RELATED APPEALS AND INTERFERENCES

Appellant states that no such proceedings exist.

## III. SUMMARY OF CLAIMED SUBJECT MATTER

In the following summary, Appellants have noted where in the Specification certain subject matter exists. Appellants wish to point out that these citations are for demonstrative purposes only and that the Specification may include additional discussion of the various elements, citations to which are not pointed out below. Thus, the noted citations are in no way intended to limit the scope of the pending claims.

Claim 1 is directed to a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network. A plurality of parameter channels are provided on the network in addition to the shared communication channel [0036]. Each transmitting node is required to transmit a parameter-estimating signal on an unshared said parameter channel [0036]. The parameter-estimating signals on the unshared parameter channels are detected and at least one unique signal parameter for each of the transmitting nodes is estimated therefrom [0043]. The information simultaneously received from each of the transmitting nodes is detected and distinguished according to their respective said unique estimated signal parameters [0043].

Claim 17 is directed to a method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network. Channel-spreading technology is used to provide a plurality of parameter channels on the network in addition to the shared communication channel; requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel [0036]. The parameter-estimating signals are detected on the unshared parameter channels and at least a signal amplitude and a signal phase is estimated therefrom for each of the transmitting nodes [0043]. The information simultaneously received from each of the transmitting nodes is detected and distinguished according to their respective said estimated signal amplitudes and signal phases [0043].



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Claim 19 is directed to a method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network. FDMA channel-spreading technology is used to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel [0041]. Each transmitting node is required to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel [0042]. The parameter-estimating signals is detected on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes [0043]. The plurality of data packets simultaneously received from each of the transmitting nodes are detected and distinguished according to their respective said estimated signal amplitudes and signal phases [0043].

Claim 21 is directed to a method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network. A plurality of parameter-estimating signals are received each on an unshared parameter channel from a corresponding transmitting node [0036]. At least one unique signal parameter is estimated for each of the received plurality of parameter-estimating signals [0036]. Information concurrently received from the transmitting nodes is distinguished according to their corresponding estimated unique signal parameter [0043].

## IV. STATUS OF CLAIMS

Claims 1-21 are pending in the present application, of which claims 1, 17, 19, and 21 are presented in independent form. Claims 1-21 stand rejected in the Final Office Action mailed on December 16, 2013. The rejection of claims 1-21 is appealed and all applied rejections concerning those claims are herein being appealed.

## V. ARGUMENTS

A. Summary of the Applied Rejections

In the Final Office Action mailed December 16, 2013:

Claims 1-11, 13, 14, and 16-21 stand rejected as being anticipated by US Publication No. 2006/0114826 to Brommer (hereinafter "Brommer"). Claim 12 stands rejected as being unpatentable over Brommer in view of US Publication No. 2006/0140259 to Dunyak, et al. (hereinafter "Dunyak"). Claim 15 stands rejected as being unpatentable over Brommer in view of US Publication No. 2007/0087756 to Hoffberg, et al. (hereinafter "Hoffberg").

B. The Cited Prior Art

Brommer relates to a modem that provides efficient use of wireless network bandwidth in the presence of multi-user interference and noise comprising a multi-user detection module, a data formatting module, a control processor and a demultiplexer. (Abstract).

Dunyak relates to reduction of multiple access interference, such as for asynchronous CDMA systems using long codes. In one aspect, parallel interference cancellation (PIC) implements a decoupled estimate, preferably non-linear and applied at chip intervals. According to another aspect, interference is cancelled using a technique that estimates bits for a symbol by interpolating signature waveforms for users to a common sampling lattice of the received data. According to another aspect, multi-stage, hybrid multi-stage, and reconfigurable recursive multi-stage multi-user detection architectures and corresponding processes are provided. (Abstract).

Hoffberg relates to providing unequal allocation of rights among agents while operating according to fair principles, comprising assigning a hierarchal rank to each agent. A Synthetic economic value is provided to a first set of agents at the high level of the hierarchy. Portions of the synthetic economic value is allocated by the first set of agents to a second set of agents at respectively different hierarchal rank than the first set of agents; and conducting an auction amongst agents using the synthetic economic value as the currency. (Abstract).



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C. Independent Claims 1, 17, 19, and 21 are Allowable Over Brommer

Brommer does not disclose (or suggest) "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel," as recited in claim 1. The Office reasons, on page 3 of the Final Office Action, "a polling signal corresponds to a particular terminal out of a first set of terminals included in the network, where the modem receives two or more simultaneous responses from a first set of polled terminals, para [0011]."

It appears the Office is trying to equate Brommer's polling signal to the parameter-estimating signal defined by claim 1. First, parameter-estimating signals and polling signals are very different. As described in Applicants' specification, parameter-estimating signals carry parameter-estimating symbol patterns. A polling signal simply polls communication nodes to initiate a response. On page 14 of the Final Office Action, the office contends "the features upon which applicant relies (i.e., "As described in Applicants' specification, parameter- estimating signals carry parameter-estimating symbol patterns.") are not recited in the rejected claim(s)" and "limitations from the specification are not read into the claims."

Appellant respectfully submits that the Office's interpretation of the claim terms as described above is similar to the situation as described in In Re Suitco Surface, Inc. (U.S. Court of Appeals for the Federal Circuit, 2009-1418, April 14, 2010), in which the Court held that the USPTO based its rejection on unreasonable construction. There, the Court reiterated the rule that the USPTO must give claims their broadest reasonable construction that is consistent with the specification, and determined whether the USPTO's interpretation of the disputed claim language is "reasonable." First, the Court found that the USPTO's proffered construction ignores a certain reality. Then, the Court found that this construction does not reasonably reflect the plain language and disclosure of the underlying patent. Despite the USPTO's emphasis that it was required to give all "claims their broadest reasonable construction," the Court instructed that any such construction be consistent with the specification and that claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art.

Appellant respectfully submits that the Office's interpretation of the claim terms as described above for claim 1, which is further discussed below, is also unreasonably broad since it is not read consistent with the specification as it would be interpreted by one of ordinary skill in the art.

The present specification (at paragraph 0019 of the publication) recites "Each transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel." One of ordinary skill in this art would, reading the specification, interpret a parameter-estimating signal to include a set of parameter-estimating symbol patterns, since that interpretation is consistent with the specification. At a minimum, a parameter-estimating signal by definition must be usable to estimate parameters, which a polling signal clearly is not. Accordingly, the Office's overbroad interpretation of parameter-estimating signal to include the polling signals of Brommer cannot stand.

Second, Brommer does not disclose transmitting on an unshared channel. The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously," (see paragraph 0011). This much is admitted by the Office on page 14 of the Final Office Action. The Office contends, however, that the term channel could be defined so broad as to be limited only to "a course into which something can be directed or moved." Once again, the Office is applying overbroad definitions for terms such that they are inconsistent with the specification. Here, the Office is using general definitions of the term "channel" without regard to how the term is used in the specification or even in the communications art. One cannot interpret the term "unshared said parameter channel" to include definitions for channel that include shared channels. The Office reasons on page 14 of the Final Office Action that "it is clear that each terminal/modem sends its informational data streams/channels (including responses to polling by the AP) which are not shared with other transmitting devices." In fact, it is clear that the opposite is taking place. Brommer discloses, at paragraph 0011, "simultaneously transmitting on a single channel a first set of polling signals" and "receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities

of the AP element." Brommer itself recognizes that "a single channel" is used and the entire point of Brommer is to share the single channel to receive and recover "each of those two or more simultaneous responses." The Office is trying to use a definition of "channel" that is directly opposed to the use of the term in the very reference the Office proffers as proof.

Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes," as recited in claim 1. Brommer paragraphs 0083 and 0084 are reproduced below:

> [0083] The antenna inputs may be from multiple polarizations or multiple locations or both in order to enhance the ability of the co-channel receiver to demodulate many interfering signals simultaneously. Note that D is the number of diversity ports, while K is the number of estimated co-channel interfering signals. The antenna inputs feed corresponding front end tuners 105a, each of which downconverts higher frequency signals into baseband signals or other relatively lower frequency signals prior to processing. At baseband, A/D converters 105b digitize each received signal into sampled data streams. Filtering, amplification, and other conventional processing, may also be implemented in the analog front end 105.
>
> [0084] The sampled data streams are provided as inputs to the parameter estimation module 110, which is a synchronization device for interfering digital signals. The parameter estimation module 110 estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal. The result of such parameter estimation is a matrix (S) of estimated composite signature waveforms for each of the K users, which is used by the MUD module 115 to help separate the channel signals.

The parameter estimation module 110 in Brommer samples the same data stream that is provided to the MUD 115, as is apparent from the cited passages above and Figure 1 of Brommer reproduced below:

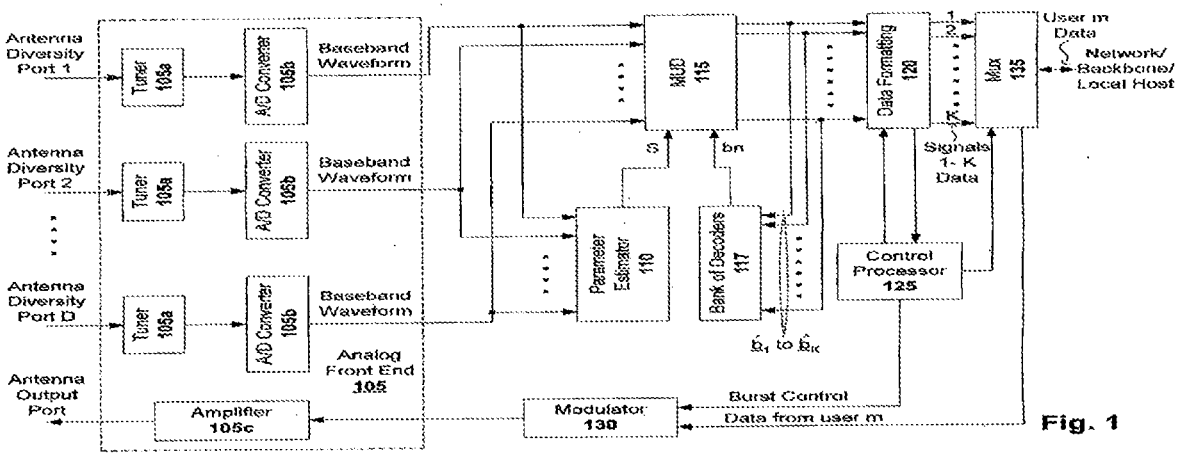



Fig. 1

Since the parameter estimation in Brommer is done on the same data stream as the data provided to the MUD 115, Brommer does not disclose (or suggest) "detecting the parameter-estimating signals on the unshared parameter channels," as recited in claim 1. The parameter estimation is done on the same channel as the multi-user detection in Brommer, which makes it a shared channel.

Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no mention of using the polling signals. In Brommer, the polling signals have nothing to do with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper.

Accordingly, since Brommer fails to disclose each and every feature of the claimed invention for at least the above reasons, claim 1 is not anticipated by Brommer. Independent claim 17 recites, inter alia, "using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel," "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel," and "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a

signal phase for each of the transmitting nodes." Accordingly, for at least the same reasons provided above, independent claim 17 is not anticipated by Brommer.

Independent claim 19 recites, inter alia, "using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel," "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel," and "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes." Accordingly, for at least the same reasons provided above, independent claim 19 is not anticipated by Brommer.

Independent claim 21 recites, inter alia, "receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node," "estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals," and "distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter." Accordingly, for at least the same reasons provided above, independent claim 21 is not anticipated by Brommer.

Dependent claims 2-11, 13, 14, 16, 18, and 20 depend from one of claims 1, 17, 19, or 21 and therefore are not anticipated by Brommer for at least the same reasons.

D. Dependent Claims 12 and 15 Are Allowable Over the Cited Art

Neither Dunyak nor Hoffberg cure the deficiencies of Brommer discussed above. Accordingly, since the cited document(s) fails to disclose or suggest all of the claim limitations for at least the above reasons, rejected claims 12 and 15 are novel and inventive.

E. Summary of Arguments

For at least the reasons set forth above, Appellant respectfully submits that claims 1-21 are allowable over the cited references. Appellant respectfully requests that the final rejection of claims 1-21 be reversed.

**Note: For convenience of detachment without disturbing the integrity of the remainder of pages of this Appeal Brief, Appellant's APPENDICES A-B are attached on separate sheets following the signatory portion of this Appeal Brief.**

The Commissioner is hereby authorized to charge any additional fees, or credit any overpayment, associated with the filing of this paper to Deposit Account No. 50 5561.

Respectfully submitted,

Date: June 12, 2014
By: /Theodosios Thomas R45159/

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## APPENDIX A

CLAIMS

1. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising: providing a plurality of parameter channels on the network in addition to the shared communication channel; requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel; detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

2. The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.

3. The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.

4. The method of claim 1, wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.

5. The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.

6. The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.



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7. The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.

8. The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.

9. The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.

10. The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

11. The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.

12. The method of claim 1, further comprising requiring each transmitting node to transmit its parameter-estimating signal at an amplitude that is greater than the amplitude at which the transmitting node transmits information on the shared communication channel, the parameter-estimating signal amplitude and the information transmitting amplitude having a predetermined ratio.

13. The method of claim 1, wherein the parameter channels are randomly shifted over time between a plurality of wireless frequencies.

14. The method of claim 13, wherein the parameter channels are shifted according to a random hopping pattern.

15. The method of claim 14, wherein the random hopping pattern is based on a GPS clock timebase.



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16. The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.

17. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising: using channel-spreading technology to provide a plurality of parameter channels on the network in addition to the shared communication channel; requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel; detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes; and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

18. The method of claim 17, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

19. A method for enabling a receiving node to distinguish a plurality of data packets simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless ad-hoc digital network, the method comprising: using FDMA channel-spreading technology to divide the shared communication channel into a primary data communication channel and a plurality of parameter channels, the parameter channels being offset in carrier frequency from each other and from the primary data communication channel; requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting data packets on the shared communication channel; detecting the parameter-estimating signals on the unshared parameter channels and



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estimating therefrom at least a signal amplitude, a signal phase, and a signal carrier offset frequency for each of the transmitting nodes; and detecting and distinguishing the plurality of data packets simultaneously received from each of the transmitting nodes according to their respective said estimated signal amplitudes and signal phases.

20. The method of claim 19, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.

21. A method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:
receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node;
estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals; and
distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter.



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**APPENDIX B**

EVIDENCE

(NONE)

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 19285436 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 114420 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | C116/US |
| **Receipt Date:** | 12-JUN-2014 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 13:24:17 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Appeal Brief Filed | C116US_Appeal_Brief.pdf | 234387<br>f02c9aeda6ff201a2b3b0b42ca8663faf318957c | no | 19 |
| **Warnings:** | | | | | |
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 10/09/2014

Collision Communications, Inc.
5400 Trinity Road
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| EXAMINER | |
|---|---|
| CEHIC, KENAN | |
| ART UNIT | PAPER NUMBER |
| 2479 | |

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

Application Number: 12742686
Filing Date: 05/13/2010
Appellant(s): Niedzwiecki, Joshua; Hombs, Brandon

Theodosios Thomas
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 06/12/2014.

**(2) Response to Argument**

For the above reasons, it is believed that the rejections should be sustained.

In regards to argument brought in Section C. of the Appeal Brief

On page 9 3rd paragraph through page 11, the applicant argues Brommer does not disclose transmission of a parameter estimating signal as following:

"
It appears the Office is trying to equate Brommer's polling signal to the parameter-estimating signal defined by claim 1. First, parameter-estimating signals and polling signals are very different. As described in Applicants' specification, parameter-estimating signals carry parameter-estimating symbol patterns. A polling signal simply polls communication nodes to initiate a response. On page 14 of the Final Office Action, the office contends "the features upon which applicant relies (i.e., "As described in Applicants' specification, parameter- estimating signals carry parameter-estimating symbol patterns." are not recited in the rejected claim(s)" and "limitations from the specification are not read into the claims."
Appellant respectfully submits that the Office's interpretation of the claim terms as described above is similar to the situation as described in In Re Suitco Surface, Inc. (U.S. Court of Appeals for the Federal Circuit, 2009-1418, April 14, 2010), in which the Court held that the USPTO based its rejection on unreasonable construction. There, the Court reiterated the rule that the USPTO must give claims their broadest reasonable construction that is consistent with the specification, and determined whether the USPTO's interpretation of the disputed claim language is "reasonable." First, the Court found that the USPTO's proffered construction ignores a certain reality. Then, the Court found that this construction does not reasonably reflect the plain language and disclosure of the underlying patent. Despite the USPTO's emphasis that it was required to give all "claims their broadest reasonable construction," the Court instructed that any such construction be consistent with the specification and that claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art.

Appellant respectfully submits that the Office's interpretation of the claim terms as described above for claim 1, which is further discussed below, is also unreasonably broad since it is not read consistent with the specification as it would be interpreted by one of ordinary skill in the art.
The present specification (at paragraph 0019 of the publication) recites "Each



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transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel." One of ordinary skill in this art would, reading the specification, interpret a parameter-estimating signal to include a set of parameter-estimating symbol patterns, since that interpretation is consistent with the specification. At a minimum, a parameter-estimating signal by definition must be usable to estimate parameters, which a polling signal clearly is not. Accordingly, the Office's overbroad interpretation of parameter-estimating signal to include the polling signals of Brommer cannot stand.

The examiner respectfully disagrees. Multiple terminals / modems transmit unshared informational / logical channels or streams and responses to polling. As clearly stated in para. 0084 we estimate a multiplicity of parameters (offsets, phase) for the specific signals (such as responses to polling) / data stream of a particular terminal / modem and further in para 0089 where the terminal / modem specific signals / data streams are used to determine the formatting / transmission mode; both of these disclosure teach "estimating" parameters that are associated / unique to a transmitting terminal. It is pointed out to the applicant, that the parameter channels were mapped to the logical / informational streams / channels as described in para. 0007, while para. 0011 was pointed out to show that in Brommer each / multiple terminals get to transmit (as taught by the polling / responses) where such transmission is are the logical / informational streams as explained above on which estimation is performed as described in para. 0084 and 0089, **and** further in para. 0011, where it is taught that terminals polled transmit responses to the polling on which co-channel demodulation is performed ("receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element" ; para. 0011), which as described in para.



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0084 and 0089 performs the estimation as described above. The examiner believes such disclosure covers the broadest reasonable interpretation of "parameter estimating signal" as Brommer clearly discloses performing parameter estimation (para. 0084, 0089) based on received signals.

On page 10 2nd -3rd paragraph, the applicant argues that Brommer does not disclose transmitting on an unshared channel as claimed as following:"

Second, Brommer does not disclose transmitting on an unshared channel. The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously," (see paragraph 0011). This much is admitted by the Office on page 14 of the Final Office Action. The Office contends, however, that the term channel could be defined so broad as to be limited only to "a course into which something can be directed or moved." Once again, the Office is applying overbroad definitions for terms such that they are inconsistent with the specification. Here, the Office is using general definitions of the term "channel" without regard to how the term is used in the specification or even in the communications art. One cannot interpret the term "unshared said parameter channel" to include definitions for channel that include shared channels. The Office reasons on page 14 of the Final Office Action that "it is clear that each terminal/modem sends its informational data streams/channels (including responses to polling by the AP) which are not shared with other transmitting devices." In fact, it is clear that the opposite is taking place. Brommer discloses, at paragraph 0011, "simultaneously transmitting on a single channel a first set of polling signals" and "receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities
of the AP element." Brommer itself recognizes that "a single channel" is used and the entire point of Brommer is to share the single channel to receive and recover "each of those two or more simultaneous responses." The Office is trying to use a definition of "channel" that is directly opposed to the use of the term in the very reference the Office proffers as proof…..

Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no



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mention of using the polling signals. In Brommer, the polling signals have nothing to do with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper."

The examiner respectfully disagrees. Brommer discloses a single shared physical channel that is used by multiple devices as explained in paragraph 0011 and 0015. However, "channel" has merely the following definitions "a course into which something can be directed or moved:" (channel." Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers.) or "a course into which something may be directed:" ("channel." Dictionary.com Unabridged. Random House, Inc.). As pointed out in para. 0007, 0011, 0079, 0083-84, 0089, it is clear that each terminal / modem sends its informational data streams / channels (including responses to polling by the AP) which are not shared with other transmitting devices. Here "channel" is interpreted based on the above broadest reasonable interpretation (i.e. a logical channel (e.g. a logical stream associated with a user as stated in para. 0084) versus a physical channel which the applicant seems to argue about). Brommer's teachings of polling, over which the applicant mainly argues about, are not directly utilized in the rejection and further even support the Examiner's stance regarding Brommer's teachings; they indicate that we have multiple terminals / modems that get to transmit their logical / informational streams / channels and the responses to polling on them as explained above.



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Arguments brought in regards to dependent claims in sections D depend on the same arguments discussed above.

Respectfully submitted,

/KENAN CEHIC/

Examiner, Art Unit 2479

Conferees:

/DERRICK FERRIS/

Supervisory Patent Examiner, Art Unit 2478

/DANG TON/

Supervisory Patent Examiner, Art Unit 2475/D. T./

Supervisory Patent Examiner, Art Unit 2475

**Requirement to pay appeal forwarding fee.** In order to avoid dismissal of the instant appeal in any application or ex parte reexamination proceeding, 37 CFR 41.45 requires payment of an appeal forwarding fee within the time permitted by 37 CFR 41.45(a), unless appellant had timely paid the fee for filing a brief required by 37 CFR 41.20(b) in effect on March 18, 2013.

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Application Number: 12742686
Filing Date: 05/13/2010
Appellant(s): Niedzwiecki, Joshua; Hombs, Brandon

Theodosios Thomas
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 06/12/2014 appealing from the Office action mailed 12/16/2013.



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**(1) Grounds of Rejection to be Reviewed on Appeal**

Every ground of rejection set forth in the Office action dated 12/16/2013 from which the appeal is taken is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(2) Response to Argument**

For the above reasons, it is believed that the rejections should be sustained.

In regards to argument brought in Section C. of the Appeal Brief

On page 9 3rd paragraph through page 11, the applicant argues Brommer does not disclose transmission of a parameter estimating signal as following:

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Appellant respectfully submits that the Office's interpretation of the claim terms as described above is similar to the situation as described in In Re Suitco Surface, Inc.



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(U.S. Court of Appeals for the Federal Circuit, 2009-1418, April 14, 2010), in which the Court held that the USPTO based its rejection on unreasonable construction. There, the Court reiterated the rule that the USPTO must give claims their broadest reasonable construction that is consistent with the specification, and determined whether the USPTO's interpretation of the disputed claim language is "reasonable." First, the Court found that the USPTO's proffered construction ignores a certain reality. Then, the Court found that this construction does not reasonably reflect the plain language and disclosure of the underlying patent. Despite the USPTO's emphasis that it was required to give all "claims their broadest reasonable construction," the Court instructed that any such construction be consistent with the specification and that claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art.

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The present specification (at paragraph 0019 of the publication) recites "Each transmitting node simultaneously transmits a set of parameter-estimating symbol patterns to the receiving nodes using an unshared, dedicated, low-collision or collision-free parameter channel." One of ordinary skill in this art would, reading the specification, interpret a parameter-estimating signal to include a set of parameter-estimating symbol patterns, since that interpretation is consistent with the specification. At a minimum, a parameter-estimating signal by definition must be usable to estimate parameters, which a polling signal clearly is not. Accordingly, the Office's overbroad interpretation of parameter-estimating signal to include the polling signals of Brommer cannot stand.

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On page 10 2nd -3rd paragraph, the applicant argues that Brommer does not disclose transmitting on an unshared channel as claimed as following:"

Second, Brommer does not disclose transmitting on an unshared channel. The channel Brommer uses is clearly a single shared channel since the polling signals are transmitted "simultaneously," (see paragraph 0011). This much is admitted by the Office on page 14 of the Final Office Action. The Office contends, however, that the term channel could be defined so broad as to be limited only to "a course into which something can be directed or moved." Once again, the Office is applying overbroad definitions for terms such that they are inconsistent with the specification. Here, the Office is using general definitions of the term "channel" without regard to how the term is used in the specification or even in the communications art. One cannot interpret the term "unshared said parameter channel" to include definitions for channel that include shared channels. The Office reasons on page 14 of the Final Office Action that "it is



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Moreover, the Office is attempting to use two different features in Brommer to disclose the parameter-estimating signal of claim 1. First, the Office purports the polling signal of Brommer is the parameter-estimating signal of claim 1. Then, the Office relies on paragraph 0084 (among others) that describes parameter estimation but makes no mention of using the polling signals. In Brommer, the polling signals have nothing to do with parameter estimation. It appears the Office is simply treating each element of claim 1 independently instead of considering the claim as a whole. This is improper."

The examiner respectfully disagrees. Brommer discloses a single shared physical channel that is used by multiple devices as explained in paragraph 0011 and 0015. However, “channel” has merely the following definitions “a course into which something can be directed or moved:” (channel." Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers.) or "a course into which something may be directed:” ("channel." Dictionary.com Unabridged. Random House, Inc.). As pointed out in para. 0007, 0011, 0079, 0083-84, 0089, it is clear that each terminal / modem sends its informational data streams / channels (including responses to polling by the AP) which are not shared with other transmitting devices. Here "channel" is interpreted based on the above broadest reasonable interpretation (i.e. a logical



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channel (e.g. a logical stream associated with a user as stated in para. 0084) versus a physical channel which the applicant seems to argue about). Brommer's teachings of polling, over which the applicant mainly argues about, are not directly utilized in the rejection and further even support the Examiner's stance regarding Brommer's teachings; they indicate that we have multiple terminals / modems that get to transmit their logical / informational streams / channels and the responses to polling on them as explained above.

Arguments brought in regards to dependent claims in sections D depend on the same arguments discussed above.

Respectfully submitted,

/KENAN CEHIC/

Examiner, Art Unit 2479

Conferees:

/ANDREW CHRISS/

Supervisory Patent Examiner, Art Unit 2479

/DANG TON/

Supervisory Patent Examiner, Art Unit 2475/D. T./

Supervisory Patent Examiner, Art Unit 2475

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| | |
|---|---|
| In re Patent Application of:<br>Joshua D. Niedzwiecki, et al. | Mail Stop: Appeal Brief - Patents |
| | Group Art Unit: 2479 |
| Application No.: 12/742,686 | Examiner: Kenan Cehic |
| Filed: September 25, 2009 | Confirmation No.: 7845 |
| For: Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications | |

* * * * * * * * * * * * * * * * * * * * * * * * * * * * *

# REPLY BRIEF

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## STATUS OF CLAIMS

Claims 1-21 are pending in the present application, of which claims 1, 17, 19, and 21 are presented in independent form. Claims 1-21 stand rejected in the Final Office Action mailed on December 16, 2013. The rejection of claims 1-21 is appealed and all applied rejections concerning those claims are herein being appealed.



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## ARGUMENTS

### Response to Examiner's Answer

In response to the Examiner's Answer mailed October 9, 2014 ("Answer"), Appellants incorporate by reference herein to thereby reiterate all of Appellants' arguments raised in the Appeal Brief filed June 12, 2014 ("Appeal Brief").

Moreover, Appellants address specifically hereinbelow, where appropriate, points raised by the Examiner in the Answer.

It appears the Examiner is trying to combine a conventional CDMA system described as prior art in Brommer with the improvements to the CDMA system Brommer describes separately, such that for certain claim limitations, aspects of the conventional CDMA system are considered unmodified and for other claim limitations, those same aspects are considered as modified by Brommer. More particularly, the Examiner refers to the conventional unmodified CDMA system for teaching unshared parameter channels and then to the Brommer-modified system as teaching shared communication channels, when the very improvement Brommer describes over conventional CDMA systems is to provide for shared channels. "[A] prior art reference -- in order to anticipate under 35 U.S.C. § 102 -- must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim'...more accurately understood to mean 'arranged or combined in the same way as in the claim,'" NetMoneyIn, Inc. v. Verisign, Inc., 545 F.3d 1359, 1370 (Fed. Cir. 2008).

The Examiner refers to paragraph 0007 of Brommer, which Brommer describes as a prior art CDMA system, to disclose the unshared parameter channel of claim 1. Brommer discusses the advantages available over this system through the use of "[a] multiuser receiver [that] would further improve signal density by permitting multiple communicators to **share the same FDMA, TDMA, CDMA or other channel**" (paragraph 0009) (emphasis added). The Examiner then refers to paragraph 0011 of Brommer, which describes Brommer's improvement over prior art systems (such as the CDMA system described in paragraph 0007) wherein in "multiuser receivers (MUD enabled), the



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AP element schedules multiple interfering data transmissions in the same channel, exploiting the ability of the multiuser receivers to demodulate signals in the presence of interference from other transmitters **sharing the channel**" (emphasis added). The Examiner also references, paragraphs 0084 and for parameter estimation 0089, which are clearly referring to simultaneously received interfering signals (signals received on the same shared channel).

Brommer's system therefore employs the use of shared channels with simultaneous signals. Nowhere does Brommer disclose (or suggest) "providing a plurality of parameter channels on the network in addition to the shared communication channel," "requiring each transmitting node to transmit a parameter-estimating signal on an **unshared** said parameter channel," or "detecting the parameter-estimating signals on the **unshared** parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes," as recited in claim 1.

Regardless of the Examiner's chosen overbroad definition of channel, surely the Examiner cannot define both a "shared communication channel" and an "unshared parameter channel" as one in the same and cannot refer to the same channel in Brommer as teaching both limitations. To allow this is to remove words from the claim.

Appellant respectfully submits that the Office's interpretation of the claim terms as described above is similar to the situation as described in In Re Suitco Surface, Inc. (U.S. Court of Appeals for the Federal Circuit, 2009-1418, April 14, 2010), in which the Court held that the USPTO based its rejection on unreasonable construction, in a Reexamination Proceeding. In that case, the USPTO construed that the claim term "material for finishing the top surface of the floor" could be any layer above the floor regardless of whether it was the top or final layer. The USPTO also construed the claim term "uniform flexible film" to mean "including, for example, a flexible film having the same thickness throughout, as well as a flexible film having the same textured surface throughout." There, the Court reiterated the rule that the USPTO must give claims their broadest reasonable construction that is consistent with the specification, and determined whether the USPTO's interpretation of the disputed claim language is "reasonable." First,

the Court found that the USPTO's proferred construction ignores a certain reality. Then, the Court found that this construction does not reasonably reflect the plain language and disclosure of the underlying patent. Despite the USPTO's emphasis that it was required to give all "claims their broadest reasonable construction," the Court instructed that any such construction be consistent with the specification and that claim language must be read in light of the specification as it would be interpreted by one of ordinary skill in the art. As such, the Court found that the USPTO's construction there was unreasonably broad. Appellant respectfully submits that the Office's interpretation of the claim terms as described above is also unreasonably broad since it is not read in light of the specification as it would be interpreted by one of ordinary skill in the art.

Independent claims 17 and 19 each recite "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel while simultaneously transmitting information on the shared communication channel" and "detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least a signal amplitude and a signal phase for each of the transmitting nodes," and are not anticipated by Brommer for at least the same reasons.

Independent claims 21 recites "[a] method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising: receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node; estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals; and distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter' and is not anticipated by Brommer for at least the same reasons.

**Summary of Arguments**

For at least the reasons set forth above, Appellant respectfully submits that claims 1-21 are allowable over the cited references. Appellant respectfully requests that the final rejection of claims 1-21 be reversed.

The Commissioner is hereby authorized to charge any additional fees, or credit any overpayment, associated with the filing of this paper to Deposit Account No. 50 5561.

Respectfully submitted,

Date: December 9, 2014
By: /Theodosios Thomas R45159/
Theodosios Thomas, Reg. No. 45,159

Customer No: 114420
5400 Trinity Road, Ste 303
Raleigh, North Carolina 27607
919 233 1942 x203 (voice)
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# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 12742686 |
| **Filing Date:** | 13-May-2010 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Attorney Docket Number:** | C116/US |

Filed as Large Entity

**Filing Fees for U.S. National Stage under 35 USC 371**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| Appeal Forwarding Fee | 1413 | 1 | 2000 | 2000 |
| **Post-Allowance-and-Post-Issuance:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **2000** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 20904411 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 114420 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | C116/US |
| **Receipt Date:** | 09-DEC-2014 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 13:48:13 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

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| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $2000 |
| RAM confirmation Number | 85 |
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INTEL-1002

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Reply Brief Filed | C116US_Reply_Brief.pdf | 55128<br>bca960b77b8da3d4878d6406d9b2f320bed50c13 | no | 7 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30675<br>e0213121a9c5c7bf06ce40f4203c7225cd978d1f | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 85803 | | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 01/29/2015

Collision Communications, Inc.
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| EXAMINER | |
|---|---|
| CEHIC, KENAN | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2479 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 01/29/2015 | PAPER |

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COLLISION COMMUNICATIONS, INC.
5400 TRINITY ROAD
SUITE 303
RALEIGH, NC 27607

Appeal No: 2015-002401
Application: 12/742,686
Appellant: Joshua D Niedzwiecki et al.

# Patent Trial and Appeal Board Docketing Notice

Application 12/742,686 was received from the Technology Center at the Board on December 18, 2014 and has been assigned Appeal No: 2015-002401.

In all future communications regarding this appeal, please include both the application number and the appeal number.

The mailing address for the Board is:

**PATENT TRIAL and APPEAL BOARD**
**UNITED STATES PATENT AND TRADEMARK OFFICE**
**P.O. BOX 1450**
**ALEXANDRIA, VIRGINIA 22313-1450**

Telephone inquiries can be made by calling 571-272-9797 and referencing the appeal number listed above.

By order of the Patent Trial and Appeal Board.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

114420 7590 04/21/2017

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| EXAMINER |
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| CEHIC, KENAN |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2479 | |

| NOTIFICATION DATE | DELIVERY MODE |
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| 04/21/2017 | ELECTRONIC |

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JOSHUA D. NIEDZWIECKI and BRANDON P. HOMBS

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Appeal 2015-002401
Application 12/742,686[1]
Technology Center 2400

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Before THU A. DANG, TERRENCE W. McMILLIN, and MELISSA A. HAAPALA, *Administrative Patent Judges*.

McMILLIN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) of the Final Rejection of claims 1–21. Final Act. 1. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[1] According to Appellants, the real party in interest is Collision Communication, Inc. (App. Br. 3).



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REJECTIONS ON APPEAL

Claims 1–11, 13, 14, and 16–21 stand rejected under pre-AIA 35 U.S.C. § 102(b) as being anticipated by Brommer (US 2006/0114826 A1, published June 1, 2006).

Claim 12 stands rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Brommer and Dunyak et al. (US 2006/01040259 A1, published June 29, 2006).

Claim 15 stands rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Brommer and Hoffberg (US 2007/0087756 A1, published Apr. 19, 2007).

THE CLAIMED INVENTION

According to the Specification, "the invention relates to digital communication systems, and more particularly to ad hoc wireless multiuser digital communication systems." Spec. ¶ 3. Independent claims 1, 17, 19, and 21 are directed to methods. App. Br. 15, 17–18.

Claim 1 recites (formatting added):

> 1. A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:
>
> providing a plurality of parameter channels on the network in addition to the shared communication channel;
>
> requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;
>
> detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and
>
> detecting and distinguishing the information simultaneously received from each of the transmitting nodes



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> according to their respective said unique estimated signal parameters.

ANALYSIS

Appellants argue claim 1 is allowable. App. Br. 9–12. Appellants also argue that independent claims 17, 19, and 21 recite commensurate limitations and are allowable for the same reasons as claim 1. *Id.* at 12–13. And, Appellants argue the dependent claims are allowable for the same reasons. *Id.* at 13. We shall treat claims 1, 17, 19, 21, and claims 2–11, 13, 14, 18, and 20 depending therefrom as a single group and make our decision based on our determination as to representative claim 1. 37 C.F.R. § 41.37(c)(iv).

Appellants argue that Brommer does not disclose, "providing a plurality of parameter channels on the network in addition to the shared communication channel" or "requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel" as recited in claim 1. App. Br. 9–12. Specifically, Appellants argue, "Brommer does not disclose transmitting on an unshared channel." App. Br. 10. *See also* Reply Br. 4–5.

In response, the Examiner relies on paragraphs 7, 11, 79, 83, 84, and 89 of Brommer as disclosing transmission of signals on unshared channels. Ans. 5–6. *See also* Final Act. 14.

We have reviewed the cited paragraphs of Brommer and do not agree with the Examiner that they disclose transmitting on an *unshared* channel, as required by claim 1. Paragraph 11 of Brommer under the heading "Brief Summary of the Invention" states (emphasis added):

> One embodiment of the present invention provides a method for polling and scheduling in a multiuser network that



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> includes a plurality of bandwidth efficient modems configured in accordance with the principles of the present invention, with at least one modem designated as a polling point coordinator access point (AP) element. The method includes indicating the beginning of a contention-free period, and simultaneously transmitting ***on a single channel*** a first set of polling signals. Each polling signal corresponds to a particular terminal included in a first set of terminals included in the network. The method proceeds with receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of these two or more simultaneous responses using ***co-channel*** demodulation capabilities of the AP element. The method may further include transmitting clear-to-send messages to any terminals requesting to send data, as indicated by received responses. Note that when the receiving modems contain multiuser receivers (MUD enabled), the AP element schedules multiple interfering data transmissions in the ***same channel***, exploiting the ability of multiuser receivers to demodulate signals in the presence of interference from other transmitters using the ***same channel***.

Brommer, ¶ 11.

The other cited paragraphs in Brommer are in accordance with the disclosure in paragraph 11 of a single, *shared* channel for transmission of signals. Brommer, ¶¶ 7, 79, 83, 84, and 89.

Based on this record, we are constrained to reverse the Examiner's 35 U.S.C. § 102 rejection of claim 1 and claims 2–11, 13, 14, and 16–21 as anticipated by Brommer.

The Examiner does not identify how Dunyak and Hoffberg cure the deficiencies of Brommer. Accordingly, we are also constrained to reverse the Examiner's 35 U.S.C. § 103 rejections of claim 12 over Brommer in further view of Dunyak ; and of claim 15 over Brommer in further view of Hoffberg.

DECISION

The rejection of claims 1–21 is reversed.

REVERSED



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# NOTICE OF ALLOWANCE AND FEE(S) DUE

114420 7590 07/06/2017

Collision Communications, Inc.
20 Depot Street
Suite 2A
Peterborough, NH 03458

| EXAMINER |
|---|
| CEHIC, KENAN |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2479 | |

DATE MAILED: 07/06/2017

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

TITLE OF INVENTION: MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 10/06/2017 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

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III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 12/742,686 | 05/13/2010 | Joshua D Niedzwiecki | C116/US | 7845 |

TITLE OF INVENTION: MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
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|---|---|---|
| CEHIC, KENAN | 2479 | 370-329000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
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- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE



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| 2479 | |

114420 7590 07/06/2017
Collision Communications, Inc.
20 Depot Street
Suite 2A
Peterborough, NH 03458

DATE MAILED: 07/06/2017

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



INTEL-1002

| Notice of Allowability | Application No. 12/742,686 | Applicant(s) NIEDZWIECKI ET AL. | |
|---|---|---|---|
| | Examiner KENAN CEHIC | Art Unit 2479 | AIA (First Inventor to File) Status No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *PTAB decision mailed 04/21/2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-21*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABL**E.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

| /KENAN CEHIC/ Examiner, Art Unit 2479 | /ANDREW CHRISS/ Supervisory Patent Examiner, Art Unit 2479 |
|---|---|

1. The present application is being examined under the pre-AIA first to invent provisions.

**Reason for Allowance**

The following is an examiner's statement of reasons for allowance:

The rejections of claims 1-21 based on Brommer (US 2006/0114826 A1) have been reversed in the Patent Board Decision dated 04/21/2017.

For claim 1 and similarly 17, 19, and 21, the closest prior art Brommer (US 2006/0114826 A1) discloses providing a plurality of parameter channels on the network in addition to the shared communication channel (the modem uses any one of a number of access schemes, e.g., FDMA, TDMA, CDMA, which provides multiple channels for communication, para [0007], [0092]) and detecting the parameter-estimating signals on the shared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes (a parameter estimation module estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, and further where a control processor detects which protocol mode the at least one of the multiple recovered signals was transmitted on a channel, para [0011], [0015], [0079], [0084], [0089]);. The second closest prior art Dunyak et al. (US 200610140259 A1) discloses transmitting parameter estimating signals on a shared communication channel (see para. 0087 estimating power on pilot signals on a shared channel).

However the prior art does not, either by anticipation or reasonable combination, disclose the following for claim 1 and similarly 17, 19, and 21:



INTEL-1002

"requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel; detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENAN CEHIC whose telephone number is (571)270-3120. The examiner can normally be reached on Monday through Friday 9:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Chriss can be reached on 571-272-1774. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KENAN CEHIC/
Examiner, Art Unit 2479

/ANDREW CHRISS/
Supervisory Patent Examiner, Art Unit 2479



INTEL-1002

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 42 | ((BRANDON) near2 (HOMBS)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:28 |
| L2 | 23 | ((JOSHUA) near2 (NIEDZWIECKI)).INV. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:29 |
| L3 | 10 | 1 and (parameter or shared or unshared).clm. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:29 |
| L4 | 10 | 1 and (parameter or shared or unshared or parameter$estimat$3).clm. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:29 |
| L5 | 12 | 1 and (parameter or shared or unshared or parameter$estimat$3 or concurrent$3).clm. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:30 |
| L6 | 8 | 2 and (parameter or shared or unshared or parameter$estimat$3 or concurrent$3).clm. not 5 | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:33 |

**6/22/2017 11:44:24 AM**
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**EAST Search History**

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L7 | 1 | (unique signal parameter and shared communication channel).clm. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:47 |
| L8 | 1 | (unique signal parameter and parameter$estimating signal).clm. | US-PGPUB; USPAT | ADJ | OFF | 2017/06/22 09:47 |

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| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 09/05/2012 | 12/10/2013 | 06/22/2017 | | | | | | |
| | 1 | ✓ | ✓ | = | | | | | | |
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| | 3 | ✓ | ✓ | = | | | | | | |
| | 4 | ✓ | ✓ | = | | | | | | |
| | 5 | ✓ | ✓ | = | | | | | | |
| | 6 | ✓ | ✓ | = | | | | | | |
| | 7 | ✓ | ✓ | = | | | | | | |
| | 8 | ✓ | ✓ | = | | | | | | |
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| | 17 | ✓ | ✓ | = | | | | | | |
| | 18 | ✓ | ✓ | = | | | | | | |
| | 19 | ✓ | ✓ | = | | | | | | |
| | 20 | ✓ | ✓ | = | | | | | | |
| | 21 | | ✓ | = | | | | | | |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H04W | | 74 | / | 0833 | F | 2013-01-01 |
| H04B | | 1 | / | 7105 | I | 2013-01-01 |
| H04L | | 27 | / | 0006 | A | 2013-01-01 |
| H04W | | 74 | / | 002 | A | 2013-01-01 |
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| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | **Type** | **Set** | **Ranking** | **Version** |
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|---|---|---|---|
| /KENAN CEHIC/<br>Examiner.Art Unit 2479<br><br>(Assistant Examiner) | 06/22/2017<br><br>(Date) | **Total Claims Allowed:**<br>21 | |
| /ANDREW CHRISS/<br>Supervisory Patent Examiner.Art Unit 2479<br><br>(Primary Examiner) | 06/22/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | | | | | NON-CLAIMED | | | | | |
| | | H | 0 | 4 | J | 1 / 00 (2006.01.01) | | | | | | |

| CROSS REFERENCE(S) | | | | | | |
|---|---|---|---|---|---|---|
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | | |
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| /KENAN CEHIC/<br>Examiner.Art Unit 2479<br><br>(Assistant Examiner) | 06/22/2017<br><br>(Date) | **Total Claims Allowed:**<br>21 | |
| /ANDREW CHRISS/<br>Supervisory Patent Examiner.Art Unit 2479<br><br>(Primary Examiner) | 06/22/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

U.S. Patent and Trademark Office

Part of Paper No. 20170622

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | **Examiner** | **Art Unit** |
| | KENAN CEHIC | 2479 |

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 17 | | | | | | | | | | | | |
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| /KENAN CEHIC/<br>Examiner.Art Unit 2479<br><br>(Assistant Examiner) | 06/22/2017<br><br>(Date) | **Total Claims Allowed:**<br>21 | |
| /ANDREW CHRISS/<br>Supervisory Patent Examiner.Art Unit 2479<br><br>(Primary Examiner) | 06/22/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 12742686 | NIEDZWIECKI ET AL. |
| | Examiner | Art Unit |
| | KENAN CEHIC | 2479 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 370 | 310-350 | 9/5/2012 | kc |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Inventorship and east text search | 09/05/2012 | kc |
| update search | 12/02/2013 | kc |
| Update inventorship search and consulted with SPE Andrew Chriss | 6/22/2017 | KC |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | See Interference search printout | 6/22/2017 | KC |

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ALEXANDRIA VA 22313-1451

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Collision Communications, Inc.
20 Depot Street
Suite 2A
Peterborough, NH 03458

**Courtesy Reminder for**
**Application Serial No: 12/742,686**

Attorney Docket No: C116/US
Customer Number: 114420
Date of Electronic Notification: 07/08/2017

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
uspto.correspondence@sceneralabs.com

To view your correspondence online or update your email addresses, please visit us anytime at **https://sportal.uspto.gov/secure/myportal/privatepair.** If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| In re Patent Application of: | Mail Stop: ISSUE FEE |
| Joshua D Niedzwiecki | Group Art Unit: 2479 |
| Application No.: 12/742,686 | Examiner: Kenan Cehic |
| Filed: 2009-09-25 | Confirmation No.: 7845 |
| For: Media Access Control Protocol For Multiuser Detection Enabled Ad-Hoc Wireless Communications | |

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**COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE**

Mail Stop: ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notice of Allowability mailed July 6, 2017, the Applicants traverse the Examiner's statement to the extent it differs from a mere restatement of the claim language. Applicants further traverse the Examiner's statement and reasoning insofar as they would lead to or suggest, if at all, an interpretation of the claimed invention different from the full extent of claim scope afforded thereto by the established law in the absence of the statement of the reasons for allowance.

Respectfully submitted,

Date: October 6, 2017

/Theodosios Thomas R45159/

Customer Number: 71739

Theodosios Thomas, Reg. No. 45,159
Attorney for Applicant(s)

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 30593777 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 114420 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | C116/US |
| **Receipt Date:** | 06-OCT-2017 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 18:54:43 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Post Allowance Communication - Incoming | C116US_Comments_on_Reasons_for_Allowance.pdf | 11657<br>2e071c660e94ef4f4852d66ee4faeeea10e3d725 | no | 1 |

**Warnings:**



INTEL-1002

| Information: | |
|---|---|
| Total Files Size (in bytes): | 11657 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

Document Description: Issue Fee Payment (PTO-85B)

# Issue Fee Transmittal Form

| Application Number | Filing Date | First Named Inventor | Atty. Docket No. | Confirmation No. |
|---|---|---|---|---|
| 12742686 | 13-May-2010 | Joshua Niedzwiecki | C116/US | 7845 |

**TITLE OF INVENTION :**

MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS

| Entity Status | Application Type | Art Unit | Class - Subclass | EXAMINER |
|---|---|---|---|---|
| Regular Undiscounted | U.S. National Stage under 35 USC 371 | 2479 | 329000 | KENAN CEHIC |

| Issue Fee Due | Publication Due | Total Fee(s) Due | Date Due | Prev. Paid Fee |
|---|---|---|---|---|
| $960 | $0 | $960 | 06-Oct-2017 | $0 |

## 1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

| Current Correspondence Address: | Current Indicated Fee Address : |
|---|---|
| 114420<br>Collision Communications, Inc.<br><br>20 Depot Street<br>Suite 2A<br>Peterborough NH 03458<br>UNITED STATES<br>603-924-3214<br>uspto.correspondence@sceneralabs.com | |
| ☐ Change of correspondence address requested, system generated AIA/122-EFS form attached | ☐ Fee Address indication requested, system generated SB/47-EFS form attached |

## 2.Entity Status

**Change in Entity Status**

○ Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.
Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.

○ Applicant asserting small entity status. See 37 CFR 1.27.
Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

◉ Applicant changing to regular undiscounted fee status.
Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

Document Description: Issue Fee Payment (PTO-85B)

**3.The Following Fee(s) Are Submitted:**

| | |
|---|---|
| ☒ Issue Fee | ☐ I authorize USPTO to apply my previously paid issue fee to the current fees due |
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| ☐ Advance Order - # of copies _____ | ☐ If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number _____ . The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.** |

**4.Firm and/or Attorney Names To Be Printed**

**NOTE: If no name is listed, no name will be printed**
For printing on the patent front page, list to be displayed as entered

1.

2.

3.

**5.Assignee Name(s) and Residence Data To Be Printed**

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

| Name | City | State | Country | Category |
|---|---|---|---|---|
| COLLISION COMMUNICATIONS, INC. | Peterborough | NEW HAMPSHIRE | united states | corporation |

**6.Signature**

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

| | | | |
|---|---|---|---|
| **Signature** | /Theodosios Thomas R45159/ | **Date** | 10-06-2017 |
| **Name** | Theodosios Thomas | **Registration Number** | 45159 |

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 12742686 |
| **Filing Date:** | 13-May-2010 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Attorney Docket Number:** | C116/US |

Filed as Large Entity

**Filing Fees for U.S. National Stage under 35 USC 371**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| UTILITY APPL ISSUE FEE | 1501 | 1 | 960 | 960 |
| PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL | 1504 | 1 | 0 | 0 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **960** |



INTEL-1002

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 30593828 |
| **Application Number:** | 12742686 |
| **International Application Number:** | |
| **Confirmation Number:** | 7845 |
| **Title of Invention:** | MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS |
| **First Named Inventor/Applicant Name:** | Joshua D Niedzwiecki |
| **Customer Number:** | 114420 |
| **Filer:** | Theodosios Thomas/Cheryl Ramey |
| **Filer Authorized By:** | Theodosios Thomas |
| **Attorney Docket Number:** | C116/US |
| **Receipt Date:** | 06-OCT-2017 |
| **Filing Date:** | 13-MAY-2010 |
| **Time Stamp:** | 19:08:50 |
| **Application Type:** | U.S. National Stage under 35 USC 371 |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $960 |
| RAM confirmation Number | 101017INTEFSW19084900 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Issue Fee Payment (PTO-85B) | Web85b.pdf | 45748<br>c3077e3cb0b0d74c8d445878baa0f4adf09cb3bf | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 32606<br>fd6228bf49ce531c1ac23c8583646938c5e7f4e7 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 78354 | | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
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| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 12/742,686 | 11/07/2017 | 9814071 | C116/US | 7845 |

114420 7590 10/18/2017

Collision Communications, Inc.
20 Depot Street
Suite 2A
Peterborough, NH 03458

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 2309 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Joshua D Niedzwiecki, Manchester, NH;
Brandon P Hombs, Merrimack, NH;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

AO 120 (Rev. 08/10)

| TO: | REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK |
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas on the following

☐ Trademarks or ☑ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

| DOCKET NO. | DATE FILED | U.S. DISTRICT COURT |
|---|---|---|
| 2:21-cv-308 | 8/10/2021 | Eastern District of Texas |

| PLAINTIFF | DEFENDANT |
|---|---|
| Collision Communications, Inc. | Nokia Corporation, Nokia Solutions and Networks Oy, and Nokia of America Corporation |

| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
|---|---|---|---|
| 1 | 7,233,620 | 6/19/2007 | Collision Communications, Inc. |
| 2 | 7,593,492 | 9/22/2009 | Collision Communications, Inc. |
| 3 | 7,724,851 | 5/25/2010 | Collision Communications, Inc. |
| 4 | 9,814,071 | 11/7/2017 | Collision Communications, Inc. |
| 5 | 9,888,479 | 2/6/2018 | Collision Communications, Inc. |

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

| DATE INCLUDED | INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading | | |
|---|---|---|---|
| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

In the above—entitled case, the following decision has been rendered or judgement issued:

| DECISION/JUDGEMENT |
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| CLERK | (BY) DEPUTY CLERK | DATE |
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☐ Trademarks or ☑ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

| DOCKET NO. | DATE FILED | U.S. DISTRICT COURT |
|---|---|---|
| 2:21-cv-308 | 8/10/2021 | Eastern District of Texas |

| PLAINTIFF | DEFENDANT |
|---|---|
| Collision Communications, Inc. | Nokia Corporation, Nokia Solutions and Networks Oy, and Nokia of America Corporation |

| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
|---|---|---|---|
| 1 | 10,477,561 | 11/12/2019 | Collision Communications, Inc. |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

| DATE INCLUDED | INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading | | |
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| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
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| DOCKET NO. | DATE FILED | U.S. DISTRICT COURT |
|---|---|---|
| 2:21-cv-00327 | 8/27/2021 | Eastern District of Texas |

| PLAINTIFF | DEFENDANT |
|---|---|
| Collision Communications, Inc. | Telefonaktiebolaget LM Ericsson and Ericsson Inc. |

| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
|---|---|---|---|
| 1 | 7,233,620 | 6/19/2007 | Collision Communications, Inc. |
| 2 | 7,593,492 | 9/22/2009 | Collision Communications, Inc. |
| 3 | 7,724,851 | 5/25/2010 | Collision Communications, Inc. |
| 4 | 9,814,071 | 11/7/2017 | Collision Communications, Inc. |
| 5 | | | |

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

| DATE INCLUDED | INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading | | |
|---|---|---|---|
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| 3 | | | |
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In the above—entitled case, the following decision has been rendered or judgement issued:

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Trials@uspto.gov
Tel: 571-272-7822

Paper 12
Entered: January 19, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

ERICSSON INC. AND NOKIA OF AMERICA CORPORATION,
Petitioner,

v.

COLLISION COMMUNICATIONS, INC.,
Patent Owner.

---

IPR2022-01233
Patent 9,814,071 B2

---

Before THU A. DANG, NEIL T. POWELL, and
KEVIN C. TROCK, *Administrative Patent Judges*.

POWELL, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
*35 U.S.C. § 314*



INTEL-1002

# I. INTRODUCTION

## A. BACKGROUND

Ericsson Inc. and Nokia of America Corporation (collectively, "Petitioner") filed a Petition for *inter partes* review of claims 1–10, 13, 14, 16, and 21 of U.S. Patent No. 9,814,071 B2 (Ex. 1001, "the '071 patent"). Paper 3 ("Pet."). Collision Communications, Inc. ("Patent Owner") filed a Preliminary Response. Paper 7 ("Prelim. Resp."). With our authorization, Petitioner filed a Reply to Patent Owner Preliminary Response (Paper 8 ("Reply")), and Patent Owner filed a Preliminary Sur-reply (Paper 10 ("Sur-reply")).

We have authority, acting by designation of the Director, to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4(a). We may institute an *inter partes* review if the information presented in the petition filed under 35 U.S.C. § 311, and any preliminary response filed under § 313, shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least one of the claims challenged in the petition. 35 U.S.C. § 314(a).

However, we have discretion to deny a petition even if a petitioner satisfies the "reasonable likelihood" threshold standard for instituting trial. *See, e.g.*, *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) ("[T]he agency's decision to deny a petition is a matter committed to the Patent Office's discretion."). Based on the current record and for the reasons explained below, we exercise our discretion under 35 U.S.C. § 314(a) to deny institution of an *inter partes* review of the '071 patent.

B. RELATED MATTERS

The parties identify the following cases as related matters: *Collision Communications, Inc. v. Nokia Corp. et al.*, 2-21-cv-00308 (E.D.Tex.) (the "Nokia district court proceeding") and *Collision Communications, Inc. v. Telefonaktiebolaget LM Ericsson et al.*, 2-21-cv-00327 (E.D.Tex.) (the "Ericsson district court proceeding"). Pet. 82; Paper 6, 2.

C. THE '071 PATENT

The '071 patent relates to "ad hoc wireless multiuser digital communication systems." Ex. 1001, 1:22–24. The '071 patent explains that multiple users, or "nodes," use one communication medium in shared, multiuser networks. *Id.* at 1:37–40. This provides certain advantages, but cannot accommodate more than one node sending information on the shared medium at any particular time. *Id.* at 1:37–45. The '071 patent discusses this in connection with Figure 1A, which is reproduced below.

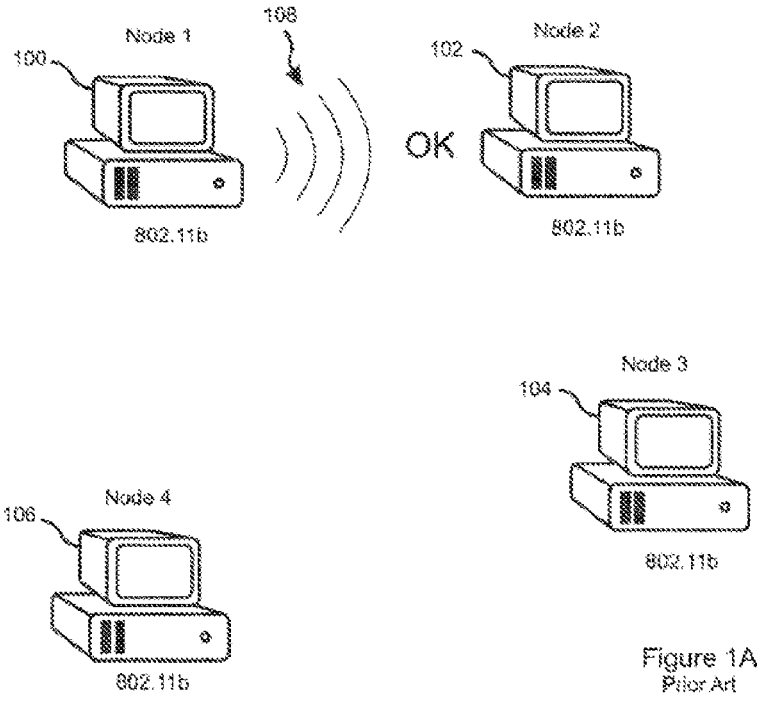



Figure 1A
Prior Art



INTEL-1002

Figure 1A "is a functional diagram illustrating a single packet transmission on a shared, ad hoc, wireless, multiuser digital communication network." *Id.* at 6:7–9.

The communication network of Figure 1A has nodes 100, 102, 104, and 106 "in communication through a wireless 802.11b network." *Id.* at 6:34–37. Figure 1A shows node 100 sending packet 108 to node 102. *Id.* at 6:41–42. At that time, "no other communication is attempted on the network," which facilitates successful transmission, but requires nodes 104 and 106 to abstain from communicating, slowing communication. *Id.* at 6:42–49.

The '071 patent discloses that "[a] method is claimed that employs multiuser detection (MUD) technology so as to allow a plurality of nodes to transmit simultaneously over a shared communication channel in a wireless ad hoc digital network." *Id.* at 3:17–20. The '071 patent explains that

> MUD technology distinguishes, or "demodulates," overlapping digital signals by capitalizing on differences in certain signal parameters that are applicable to the digital signals, such as, but not limited to, analog signal parameters that may include signal amplitude, signal phase, and relative time delay. In a wireless network, all of these parameters will be affected by the relative distances between nodes, as well as by the presence of any intervening buildings or other structures, or any environmental anomalies that affect, attenuate and/or reflect the signals. Multiple signals can be distinguished using MUD technology, so long as the signal parameters for each of the overlapping signals are known, or can be accurately estimated.

*Id.* at 7:13–25.

The '071 patent shows "an embodiment of the present invention" in Figure 1C. *Id.* at 7:26–27. Figure 1C is reproduced below.

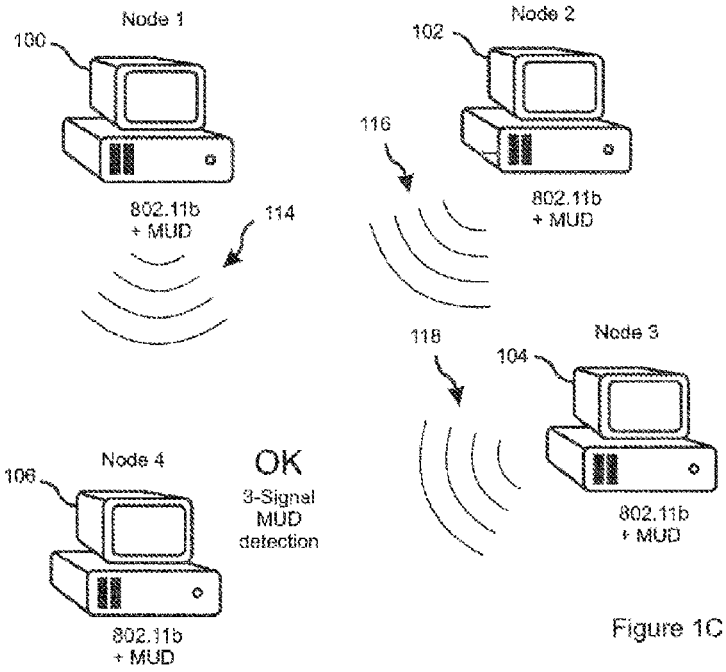



Figure 1C

Figure 1C shows "successful simultaneous transmission of a plurality of packets on a shared, ad hoc, wireless, multiuser digital communication network." *Id.* at 6:13–16.

The network in Figure 1C resembles the network of Figure 1A, but in the network of Figure 1C, each of nodes 100, 102, 104, 106 implements MUD detection. *Id.* at 7:27–30. The '071 patent explains that

> a spread-spectrum technology (not illustrated) is used to provide at least three separate, low-rate parameter channels. Three of the nodes 100, 102, 104 have each acquired one of these parameter channels, and are transmitting parameter-estimating symbol patterns on the parameter channels while simultaneously transmitting data packets 114, 116, 118 to a fourth node 106.

*Id.* at 7:30–36. Fourth node 106's MUD detector can use the parameter-estimating symbol patterns to accurately estimate the signal parameters for the transmitting nodes. *Id.* at 7:56–59. Fourth node 106 can

use the estimated parameters "to demodulate the three packets 114, 116, 118 and receive all of them." *Id.* 7:56–61.

The '071 patent discusses communication channels in more detail in connection with Figure 3, which is reproduced below.

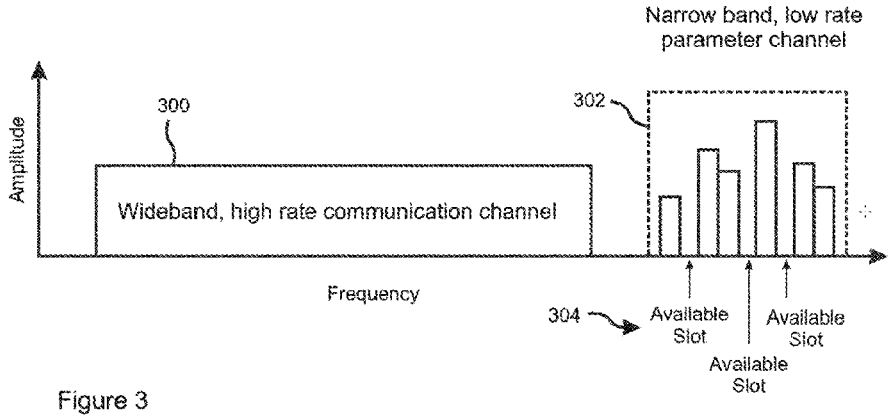



Figure 3

Figure 3 shows "FDMA spreading is used to spread a shared communication medium into a main communication channel 300 and a plurality of parameter channels 302." *Id.* at 8:27–30. "The main communication channel 300 is a high rate channel and so requires a wide frequency bandwidth. The plurality of parameter channels 302 or 'slots' are clustered together in a narrow range of frequencies 302." *Id.* at 8:30–34.

The '071 patent discusses methods of transmitting information in connection with Figure 4. Figure 4 is reproduced below.

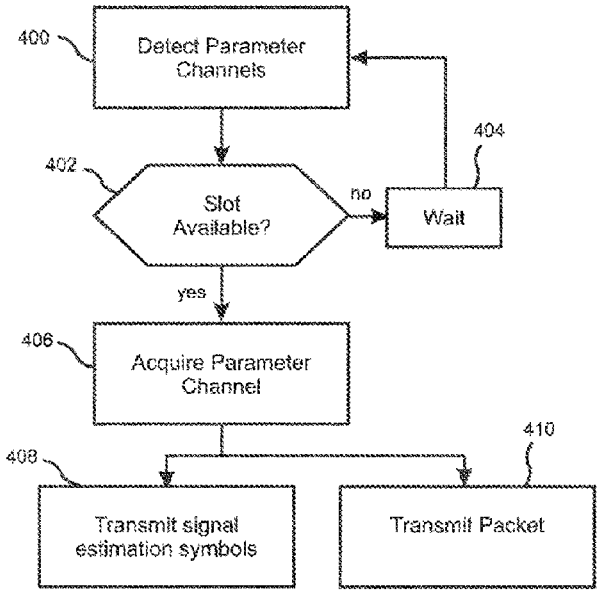



Figure 4

Figure 4 "is a flow diagram that illustrates the steps followed by a node that is seeking to transmit a packet on the network of [Figure] 3." *Id.* at 8:43–45.

At 400 and 402, the node detects parameter channels and determines if any slot is available. *Id.* at 8:46–47. If no parameter channels are available, at 404, the node waits and keeps monitoring the parameter channels. *Id.* at 8:47–49. If a parameter channel is open, at 406, the node obtains one of the parameter channels. *Id.* at 8:49–50. At 408, the node sends a parameter-estimating symbol pattern. *Id.* at 8:49–51. Simultaneously, at 410, the node transmits the packet on the main communication channel. *Id.* at 8:49–53.

The '071 patent discusses a method of receiving information in connection with Figure 5, which is reproduced below.

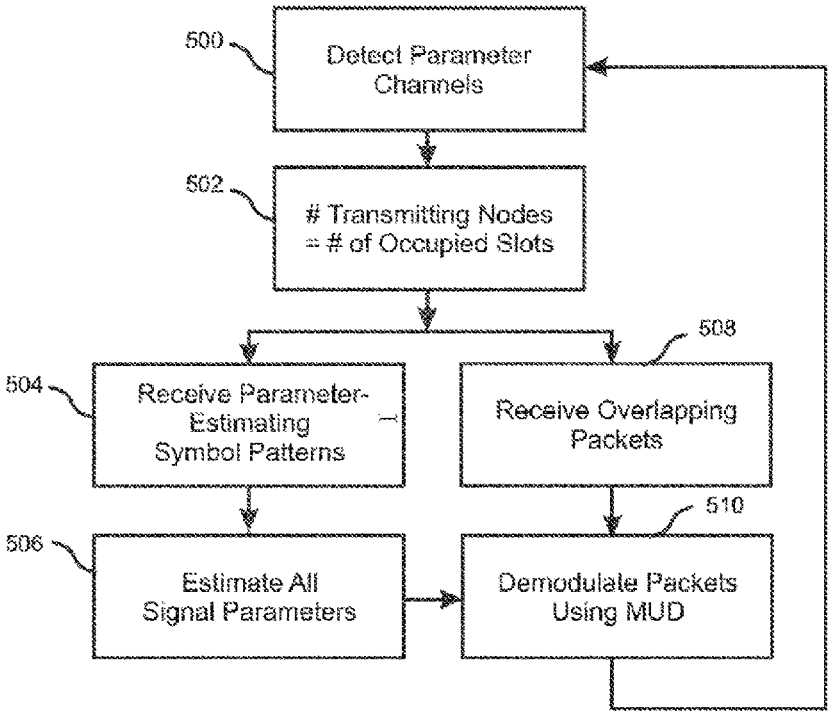



Figure 5

Figure 5 "is a flow diagram that illustrates the steps followed by a node that is seeking to receive a packet on the network of [Figure] 3." *Id.* at 8:54–56.

At 500, the receiving node detects and obtains all of the parameter channels' traffic. *Id.* at 8:56–57. As shown at 502, the transmitting node can ascertain how many nodes are transmitting from the number of occupied slots. *Id.* at 8:57–59. At 504, the receiving node can use the parameter-estimating symbol patterns to estimate each transmitting node's signal parameters, "including amplitude, phase, and relative time delay." *Id.* at 8:59–63. At 506, "[t]he estimated parameters are then provided to the MUD detector." *Id.* at 8:65–67. This allows the MUD detector to demodulate and individually receive the overlapping, simultaneously received information packets at 508 and 510. *Id.* at 8:65–9:2.

D. ILLUSTRATIVE CLAIM

Of the challenged claims, claims 1 and 21 are independent. Each of claims 2–10, 13, 14, and 16 depends, directly or indirectly, from claim 1. Claim 1 is illustrative and is reproduced below with labels added:[1]

> 1. [1.0] A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:
>
> [1.1] providing a plurality of parameter channels on the network in addition to the shared communication channel;
>
> [1.2] requiring each transmitting node to transmit a parameter estimating signal on an unshared said parameter channel;
>
> [1.3] detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and
>
> [1.4] detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.

Ex. 1001, 9:12–28.

[1] We have added the same labels that Petitioner applies to the different portions of claim 1. *See* Ex. 1020.



INTEL-1002

E. ASSERTED GROUNDS OF UNPATENTABILITY

Petitioner challenges the patentability of claims 1–10, 13, 14, 16, and 21 of the '071 patent on the following grounds (Pet. 8):

| Claims Challenged | 35 U.S.C. § | References |
|---|---|---|
| 1–3, 5–7, 13, 14, 16, 21 | 103 | Kim[2] |
| 1–5, 10, 16, 21 | 103 | Tong[3], Jia[4] |
| 6, 7 | 103 | Tong, Jia, Zhu[5] |
| 13, 14 | 103 | Tong, Jia, Zhu, Dubac[6] |
| 1, 4, 8–10 | 103 | Baum[7] |

Petitioner supports its challenge with a Declaration of Sumit Roy, Ph.D. Ex. 1003.

## II. ANALYSIS

### A. 35 U.S.C. § 314(a)

Institution of *inter partes* review is discretionary. *See Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."); 35 U.S.C. § 314(a). The Board has held that the advanced state of a parallel district court action is a factor that may weigh in favor of denying a petition under

[2] U.S. Patent Application Publication No. US 2008/0032630 A1, published Feb. 7, 2008 ("Kim") (Ex. 1010).

[3] U.S. Patent Application Publication No. US 2004/0114618 A1, published June 17, 2004 ("Tong") (Ex. 1011).

[4] U.S. Patent Application Publication No. US 2004/0066866 A1, published Apr. 8, 2004 ("Jia") (Ex. 1020).

[5] U.S. Patent No. 7,778,337 B2, issued Aug. 17, 2010 ("Zhu") (Ex. 1012).

[6] U.S. Patent No. 7,486,735 B2, issued Feb. 3, 2009 ("Dubuc") (Ex. 1006).

[7] U.S. Patent No. 5,867,478, issued Feb. 2, 1999 ("Baum") (Ex. 1005).

§ 314(a). *See NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 20 (PTAB Sept. 12, 2018) (precedential); Patent Trial and Appeal Board, Consolidated Trial Practice Guide, 58 & n.2 (Nov. 2019) ("Trial Practice Guide")[8]. We consider the following factors to assess "whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding":

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

*Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) ("*Fintiv*"). In evaluating these factors, we "take[] a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review." *Id.* at 6.

The Director has issued additional guidance on the application of *Fintiv*. *See* Katherine K. Vidal, *Interim Procedure for Discretionary*

[8] Available at https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf.



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*Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* (June 21, 2022)[9] ("Fintiv Memo").

Petitioner argues that we should not exercise our discretion to deny institution under *Fintiv*. Pet. 83–86; Reply 1–5. Patent Owner argues that we should. Prelim. Resp. 43–50; Sur-reply 1–5.

1. *Whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted*

Neither party asserts that a motion to stay has been or will be filed. *See* Pet. 84; Prelim. Resp. 44–45; Reply 1; Sur-reply 1. Based on that, Petitioner argues that Factor 1 is neutral, whereas Patent Owner argues it weighs in favor of denial. Pet. 84; Prelim. Resp. 44–45; Reply 1; Sur-reply 1. We will not speculate regarding the possibility of a stay, and we find Factor 1 neutral. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (PTAB May 13, 2020) (informative); *HP Inc. v. Slingshot Printing LLC*, IPR2020-01084, Paper 13 at 9 (PTAB Jan. 14, 2021).

2. *Proximity of the court's trial date to the Board's projected statutory deadline for a final written decision*

Petitioner asserts that this factor is neutral. Pet. 84–85; Reply 1. Petitioner argues that the trial date is uncertain. Pet. 84–85; Reply 1. In the Petition and the Reply, Petitioner acknowledged that trial was scheduled for early January 2023, but noted that other trials were scheduled at the same time. *Id.* Additionally, Petitioner asserted that "the median time to trial in the Eastern District of Texas is 24.2 months . . . , yielding a trial date of approximately August 2023." Pet. 84.

[9] Available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf



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Patent Owner argues that "this factor strongly favors denial," given the scheduled trial date of January 2023. Sur-reply 1–2. At the time of its Sur-reply, Patent Owner noted that the Nokia district court proceeding was "fifth on the court's trial docket." Sur-reply 1 (citing Ex. 2013). Patent Owner also argues that "even using Petitioners' August 2023 date, trial would take place more than four months before any final written decision." *Id.* at 2.

We do not agree with Petitioner that this factor is neutral. Even if we assume trial would not occur until August 2023, that weighs in favor of denying institution, given that we would not expect to issue a final written until at least four months later. Moreover, in the Nokia district court proceeding, the final pretrial conference occurred on December 19, 2022, and trial is scheduled for January 23, 2023. Ex. 3001, 44, 46; Paper 11, 2. Additionally, a PACER search reveals that each of the district court cases that was listed ahead of the Nokia district court proceeding in Exhibit 2013 has been stayed, referred to mediation, dismissed, or already tried (jury verdict entered). Thus, trial in the Nokia district court proceeding appears imminent, which weighs heavily in favor of denying institution, given that we would not issue a final written decision until approximately a year later.

3. *Investment in the parallel proceeding by the court and the parties*

In the Petition, Petitioner argued that this factor "favors institution." Pet. 85. Petitioner explained that it "promptly filed this Petition." *Id.* Petitioner added that "it is premature to argue regarding the timing of respective milestones in the proceeding versus the litigation, as the schedule may shift in the coming several months." *Id.*



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Patent Owner countered that this factor "strongly favors denial." Prelim. Resp. 46. Patent Owner explained that, before the due date for our decision whether to institute *inter partes* review, the

> trial date will have passed; all substantive motions (including dispositive motions, *Daubert* motions, and motions *in limine*) have been filed (October 14 or 17, 2022 for dispositive motions and *Daubert*) or will have been filed (November 9, 2022 for motions *in limine*); pre-trial disclosures were served on October 19, 2022; and expert discovery has already concluded (October 13, 2022). *See* Ex. 2002, 1-4. The magistrate judge issued a *Markman* Order on August 31, 2022. Ex. 2001. Thus, the present cases are significantly advanced.

*Id.* Patent Owner also argues that Petitioner did not file its Petition promptly after Patent Owner's assertion of infringement. Prelim. Resp. 50.

In its Reply, Petitioner states that this factor "weighs against institution, but only marginally." Reply 1–2. Petitioner explains that "[a]lthough the district court lawsuits are at an advanced stage," the parties did not dispute claim terms for the '071 patent and Petitioner has stopped relying on Baum for invalidity in the district court. *Id.* at 2.

In its Sur-reply, Patent Owner reiterates that *Fintiv* factor 3 "strongly favors denial." Sur-reply 2. Patent Owner maintains that there have been "significant investments by the parties and the court, including fact and expert discovery in addition to substantive motions and pre-trial disclosure." *Id.*

We agree with the parties that this factor weighs in favor of discretionary denial. Petitioner has not rebutted Patent Owner's arguments that the parties and the court have invested great time, effort, and expense in discovery, briefing, and substantive orders. *See* Pet. 85; Prelim. Resp. 46–47; Reply 1–2; Sur-reply 2. This substantially outweighs

Petitioner's arguments that the parties and the court have not done certain things. Reply 1–2; Sur-reply 2. Additionally, we agree with Patent Owner that, contrary to Petitioner's argument, the Petition was not filed "promptly." Pet. 85; Prelim. Resp. 50; Sur-reply 2. In particular, we do not agree with Petitioner's view that filing the Petition "less than nine months after receiving infringement contentions" constitutes filing the Petition "promptly." Pet. 85. Moreover, as Patent Owner notes, Petitioner waited almost a year from inception of the Nokia district court proceeding on August 10, 2021 until the filing of the Petition on July 20, 2022. Prelim. Resp. 50. Accordingly, we find this factor weighs decidedly in favor of discretionary denial.

4. *Overlap between issues raised in the Petition and in the parallel proceeding*

In its Petition, Petitioner argued that the "overlap is minimal." Pet. 85. Petitioner explained that its invalidity positions in the district court did not rely in any way on four of the six references cited in the Petition. *Id.* Petitioner also noted that its Petition "addresses all claims asserted in district court." *Id.*

In its Preliminary Response, Patent Owner asserted that this factor favors denial. Prelim. Resp. 47–48. Patent Owner argued that Petitioner had "not offered to withdraw ***all*** grounds that it reasonably could have raised—i.e., the full scope of estoppel if this IPR proceeds to final written decision." *Id.* (citing 35 U.S.C. § 315(e)(2); *Sand Revolution II, LLC v. Continental Intermodal Group-Trucking LLC*, IPR2019-01393, Paper 24, 12 n.5 (PTAB June 16, 2020) (informative).

In its Reply, Petitioner states that it "hereby stipulates not to pursue invalidity challenges to [the '071] patent in the [Nokia district court proceeding] and the [Ericsson district court proceeding] that rely on any prior art reference used in the grounds of the Petition (specifically, Baum, Kim, Tong, Jia, Dubuc, or Zhu)." Reply 2. Petitioner adds that its "[s]tipulation is not conditioned on institution of [*inter partes* review]." *Id.* Petitioner asserts that its "stipulation 'occupies an intermediate ground between the stipulations in *Sotera* and *Sand Revolution.*'" *Id.* Accordingly, Petitioner argues that its stipulation favors institution. *Id.* (citing *Ericsson Inc. v. Koninklijke KPN N. V.*, IPR2022-00069, Paper 9 at 13–14 (PTAB May 25, 2022)).

Patent Owner responds that Petitioner's "stipulation (PPR, 2) is narrower than a *Sotera* stipulation." Sur-reply 2. Patent Owner also contends that Petitioner is "pursuing invalidity arguments in district court regarding the '071 patent that could have been brought before the Board." *Id.*

In view of Petitioner's stipulation, we find this factor weighs against discretionary denial.[10]

5. *Whether the petitioner and the defendant in the parallel proceeding are the same party*

Petitioner and the defendant in the district court proceeding are the same party. Pet. 85–86; Prelim. Resp. 49; Reply 2; Sur-reply 2. Accordingly, this factor weighs in favor of denial.

[10] As both parties note, however, Petitioner's stipulation falls short of a *Sotera* stipulation, which would have obviated a full analysis of the *Fintiv* factors. Reply 2; Sur-reply 2; Fintiv Memo 7.



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6. *Other circumstances that impact the Board's exercise of discretion, including the merits.*

Petitioner argues that this factor weighs against discretionary denial. Pet. 86; Reply 2–5. Petitioner contends that based solely on its allegedly "compelling unpatentability challenge," we should not exercise discretion to deny. *Id.*

Patent Owner argues this factor weighs in favor of discretionary denial. Prelim. Resp. 49–50; Sur-reply 2–5. Patent Owner contends that Petitioner does not demonstrate a reasonable likelihood of prevailing on the merits, much less a "compelling unpatentability challenged." *Id.*

We do not agree with Petitioner's assertion that it presents a "compelling unpatentability challenge." Pet. 86; Reply 2–5. Weighing the arguments and evidence presently of record, we do not find Petitioner's evidence sufficient to "plainly" result in a conclusion of unpatentability. Fintiv Memo 5 n.6; Pet. 9–81; Prelim. Resp. 16–43. For example, in the challenge based on Kim, we do not find Petitioner's evidence regarding claim elements [1.4] and [21.3] sufficient to plainly lead to a conclusion of unpatentability. *See* Pet. 12–18, 28; Prelim. Resp. 21–25. We find significant merit in Patent Owner's position that Petitioner fails to address persuasively limitation [1.4]'s recitation of "distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters" and similar language in element [21.3]. Prelim. Resp. 21–25. Patent Owner presents viable arguments that Petitioner addresses this claim language with evidence that is unavailing, for instance, because it relates to Kim's request channel, whereas Petitioner's evidence for earlier, related limitations relates to traffic data. *Id.*

As another example, we find significant merit in Patent Owner's position that Petitioner's Baum-based challenge relies on different embodiments of Baum without providing sufficiently persuasive evidence that the different embodiments would apply to one another. *See* Pet. 75–76 (relying on "joint detection"); Prelim. Resp. 41 ("First, the Petition combines multiple embodiments from Baum, but without any explanation of why the teachings relating to the ***non-joint detection*** embodiment would apply to the ***joint detection*** embodiment so as to teach distinguishing the individual signal components of the 'joint desired signal.'"); *see* also Reply 5; Sur-reply 5. Petitioner apparently views the disclosures in Baum's columns 18–21 as all discussing the same embodiment, but Petitioner does not provide sufficiently persuasive support for this position. *See* Pet. 75–76; Reply 5.

Because the Petition does not represent a "compelling unpatentability challenge," we do not agree with Petitioner's contention that we should decline to discretionarily deny based solely on this factor. Fintiv Memo 4–5; *OpenSky Indus., LLC v. VLSI Tech. LLC*, IPR2021-01064, Paper 102 at 49 (PTAB Oct. 4, 2022) (precedential, decision upon Director review). Considering the above, we find *Fintiv* factor 6 weighs slightly in favor of discretionary denial.

7. *Balancing the Fintiv Factors*

A holistic balancing of the *Fintiv* factors weighs decidedly in favor of a discretionary denial. As discussed above, only factor 4 weighs against discretionary denial, factor 1 is neutral, and factors 2, 3, 5, and 6 weigh in favor of discretionary denial. Given the lack of strong countervailing considerations, the timing of the Petition, the great investment of the parties

in the district court, and the imminence of trial overwhelmingly favor exercising our discretion to deny institution in this proceeding.

## III. CONCLUSION

For the foregoing reasons, we exercise our discretion pursuant to 35 U.S.C. § 314(a) to deny institution of *inter partes* review.

## IV. ORDER

In consideration of the foregoing, it is:

ORDERED that the Petition (Paper 3) is denied as to the challenged claims of the '071 patent; and

FURTHER ORDERED that no *inter partes* review is instituted.

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