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EXPRESS MAIL RECEIPT NO. EL 749593586 US

Re: U.S. Patent Application for "APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM"
Our File: WEST14-00014

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Enclosed please find the following documents for filing:

Express Mail Certificate of Mailing;
Patent Application (43 pages including cover sheet);
Informal Drawings (4 sheets);
Declaration and Power of Attorney;
Assignment and Recordation Form Cover Sheet;
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INDEP. CLAIMS	2 - 3=	-0-	$ 40	$ -0-
MULTIPLE DEPENDENT CLAIM PRESENTED				$ -0-

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Very truly yours,

Novakov Davis & Munck, P.C.

William A. Munck

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Enclosures

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ATTY. DOCKET NO. WEST14-00014 PATENT

APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

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APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

The present invention is related to those disclosed in the following United States Provisional and Non-Provisional Patent Applications:

1. Serial No. 09/713,684, filed on November 15, 2000, entitled "SUBSCRIBER INTEGRATED ACCESS DEVICE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS";
2. [Docket No. WEST14-00005] filed concurrently herewith, entitled "WIRELESS COMMUNICATION SYSTEM USING BLOCK FILTERING AND FAST EQUALIZATION-DEMODULATION AND METHOD OF OPERATION";
3. [Docket No. WEST14-00015], filed concurrently herewith, entitled "APPARATUS AND METHOD FOR OPERATING A SUBSCRIBER INTERFACE IN A FIXED WIRELESS SYSTEM";
4. [Docket No. WEST14-00016], filed concurrently herewith, entitled "APPARATUS AND METHOD FOR CREATING SIGNAL AND PROFILES AT A RECEIVING STATION";
5. [Docket No. WEST14-00017], filed concurrently herewith, entitled "SYSTEM AND METHOD FOR INTERFACE BETWEEN A SUBSCRIBER

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MODEM AND SUBSCRIBER PREMISES INTERFACES";

6. [Docket No. WEST14-00018], filed concurrently herewith, entitled "BACKPLANE ARCHITECTURE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS";

7. [Docket No. WEST14-00019], filed concurrently herewith, entitled "SYSTEM AND METHOD FOR ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS" ;

8. [Docket No. WEST14-00020], filed concurrently herewith, entitled "SYSTEM FOR COORDINATION OF TDD TRANSMISSION BURSTS WITHIN AND BETWEEN CELLS IN A WIRELESS ACCESS SYSTEM AND METHOD OF OPERATION";

9. [Docket No. WEST14-00021], filed concurrently herewith, entitled "REDUNDANT TELECOMMUNICATION SYSTEM USING MEMORY EQUALIZATION APPARATUS AND METHOD OF OPERATION";

10. [Docket No. WEST14-00022], filed concurrently herewith, entitled "WIRELESS ACCESS SYSTEM FOR ALLOCATING AND SYNCHRONIZING UPLINK AND DOWNLINK OF TDD FRAMES AND METHOD OF OPERATION";

11. [Docket No. WEST14-00023], filed concurrently herewith, entitled "TDD FDD AIR INTERFACE";

12. [Docket No. WEST14-00024], filed concurrently herewith, entitled "APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING

WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM";

13. [Docket No. WEST14-00026], filed concurrently herewith, entitled "WIRELESS ACCESS SYSTEM USING MULTIPLE MODULATION"];

14. [Docket No. WEST14-00027], filed concurrently herewith, entitled "WIRELESS ACCESS SYSTEM AND ASSOCIATED METHOD USING MULTIPLE MODULATION FORMATS IN TDD FRAMES ACCORDING TO SUBSCRIBER SERVICE TYPE";

15. [Docket No. WEST14-00028], filed concurrently herewith, entitled "APPARATUS FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM";

16. [Docket No. WEST14-00029], filed concurrently herewith, entitled "APPARATUS FOR REALLOCATING COMMUNICATION RESOURCES TO ESTABLISH A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM";

17. [Docket No. WEST14-00030], filed concurrently herewith, entitled "METHOD FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM";

18. [Docket No. WEST14-00033], filed concurrently herewith, entitled "SYSTEM AND METHOD FOR PROVIDING AN IMPROVED COMMON CONTROL BUS FOR USE IN ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS";

19. Serial No. 60/262,712, filed on January 19, 2001, entitled

"WIRELESS COMMUNICATION SYSTEM USING BLOCK FILTERING AND FAST EQUALIZATION-DEMODULATION AND METHOD OF OPERATION" [Docket No. WEST14-00005];

20. Serial No. 60/262,698, filed on January 19, 2001, entitled "APPARATUS AND METHOD FOR OPERATING A SUBSCRIBER INTERFACE IN A FIXED WIRELESS SYSTEM" [Docket No. WEST14-00015];

21. Serial No. 60/262,827, filed on January 19, 2001, entitled "APPARATUS AND METHOD FOR CREATING SIGNAL AND PROFILES AT A RECEIVING STATION" [Docket No. WEST14-00016];

22. Serial No. 60/262,826, filed on January 19, 2001, entitled "SYSTEM AND METHOD FOR INTERFACE BETWEEN A SUBSCRIBER MODEM AND SUBSCRIBER PREMISES INTERFACES" [Docket No. WEST14-00017];

23. Serial No. 60/262,951, filed on January 19, 2001, entitled "BACKPLANE ARCHITECTURE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS" [Docket No. WEST14-00018];

24. Serial No. 60/262,824, filed on January 19, 2001, entitled "SYSTEM AND METHOD FOR ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS" [Docket No. WEST14-00019];

25. Serial No. 60/263,101, filed on January 19, 2001, entitled "SYSTEM FOR COORDINATION OF TDD TRANSMISSION BURSTS WITHIN AND BETWEEN CELLS IN A WIRELESS ACCESS SYSTEM AND METHOD OF

OPERATION" [Docket No. WEST14-00020];

26. Serial No. 60/263,097, filed on January 19, 2001, entitled "REDUNDANT TELECOMMUNICATION SYSTEM USING MEMORY EQUALIZATION APPARATUS AND METHOD OF OPERATION" [Docket No. WEST14-00021];

27. Serial No. 60/273,579, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM FOR ALLOCATING AND SYNCHRONIZING UPLINK AND DOWNLINK OF TDD FRAMES AND METHOD OF OPERATION" [Docket No. WEST14-00022];

28. Serial No. 60/262,955, filed January 19, 2001, entitled "TDD FDD AIR INTERFACE" [Docket No. WEST14-00023];

29. Serial No. 60/262,708, filed on January 19, 2001, entitled "APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" [Docket No. WEST14-00024];

30. Serial No. 60/273,689, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM USING MULTIPLE MODULATION" [Docket No. WEST14-00026];

31. Serial No. 60/273,757, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM AND ASSOCIATED METHOD USING MULTIPLE MODULATION FORMATS IN TDD FRAMES ACCORDING TO SUBSCRIBER SERVICE TYPE" [Docket No. WEST14-00027];

32. Serial No. 60/270,378, filed February 21, 2001, entitled

"APPARATUS FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" [Docket No. WEST14-00028];

33. Serial No. 60/270,385, filed February 21, 2001, entitled "APPARATUS FOR REALLOCATING COMMUNICATION RESOURCES TO ESTABLISH A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" [Docket No. WEST14-00029]; and

34. Serial No. 60/270,430, filed February 21, 2001, entitled "METHOD FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" [Docket No. WEST14-00030].

The above applications are commonly assigned to the assignee of the present invention. The disclosures of these related patent applications are hereby incorporated by reference for all purposes as if fully set forth herein.

TECHNICAL FIELD OF THE INVENTION

The present invention is directed, in general, to communication network access systems and, more specifically, to an apparatus for processing data signals received from wireless

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subscriber stations.

BACKGROUND OF THE INVENTION

Telecommunications access systems provide for voice, data, and multimedia transport and control between the central office (CO) of the telecommunications service provider and the subscriber (customer) premises. Prior to the mid-1970s, the subscriber was provided phone lines (e.g., voice frequency (VF) pairs) directly from the Class 5 switching equipment located in the central office of the telephone company. In the late 1970s, digital loop carrier (DLC) equipment was added to the telecommunications access architecture. The DLC equipment provided an analog phone interface, voice CODEC, digital data multiplexing, transmission interface, and control and alarm remotely from the central office to cabinets located within business and residential locations for approximately 100 to 2000 phone line interfaces. This distributed access architecture greatly reduced line lengths to the subscriber and resulted in significant savings in both wire installation and maintenance. The reduced line lengths also improved communication performance on the line provided to the subscriber.

By the late 1980s, the limitations of data modem connections over voice frequency (VF) pairs were becoming obvious to both

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subscribers and telecommunications service providers. ISDN (Integrated Services Digital Network) was introduced to provide universal 128 kbps service in the access network. The subscriber interface is based on 64 kbps digitization of the VF pair for digital multiplexing into high speed digital transmission streams (e.g., T1/T3 lines in North America, E1/E3 lines in Europe). ISDN was a logical extension of the digital network that had evolved throughout the 1980s. The rollout of ISDN in Europe was highly successful. However, the rollout in the United States was not successful, due in part to artificially high tariff costs which greatly inhibited the acceptance of ISDN.

More recently, the explosion of the Internet and deregulation of the telecommunications industry have brought about a broadband revolution characterized by greatly increased demands for both voice and data services and greatly reduced costs due to technological innovation and intense competition in the telecommunications marketplace. To meet these demands, high speed DSL (digital subscriber line) modems and cable modems have been developed and introduced. The DLC architecture was extended to provide remote distributed deployment at the neighborhood cabinet level using DSL access multiplexer (DSLAM) equipment. The increased data rates provided to the subscriber resulted in upgrade

DLC/DSLAM transmission interfaces from T1/E1 interfaces (1.5/2.0 Mbps) to high speed DS3 and OC3 interfaces. In a similar fashion, the entire telecommunications network backbone has undergone and is undergoing continuous upgrade to wideband optical transmission and switching equipment.

Similarly, wireless access systems have been developed and deployed to provide broadband access to both commercial and residential subscriber premises. Initially, the market for wireless access systems was driven by rural radiotelephony deployed solely to meet the universal service requirements imposed by government (i.e., the local telephone company is required to serve all subscribers regardless of the cost to install service). The cost of providing a wired connection to a small percentage of rural subscribers was high enough to justify the development and expense of small-capacity wireless local loop (WLL) systems.

Deregulation of the local telephone market in the United States (e.g., Telecommunications Act of 1996) and in other countries shifted the focus of fixed wireless access (FWA) systems deployment from rural access to competitive local access in more urbanized areas. In addition, the age and inaccessibility of much of the older wired telephone infrastructure makes FWA systems a cost-effective alternative to installing new, wired infrastructure.

Also, it is more economically feasible to install FWA systems in developing countries where the market penetration is limited (i.e., the number and density of users who can afford to pay for services is limited to small percent of the population) and the rollout of wired infrastructure cannot be performed profitably. In either case, broad acceptance of FWA systems requires that the voice and data quality of FWA systems must meet or exceed the performance of wired infrastructure.

Wireless access systems must address a number of unique operational and technical issues including:

1) Relatively high bit error rates (BER) compared to wire line or optical systems; and

2) Transparent operation with network protocols and protocol time constraints for the following protocols:

a) ATM;

b) Class 5 switch interfaces (domestic GR-303 and international V5.2);

c) TCP/IP with quality-of-service QoS for voice over IP (VoIP) (i.e., RTP) and other H.323 media services;

d) Distribution of synchronization of network time out to the subscribers;

3) Increased use of voice, video and/or media compression and concentration of active traffic over the air interface to conserve bandwidth;

4) Switching and routing within the access system to distribute signals from the central office to multiple remote cell sites containing multiple cell sectors and one or more frequencies of operation per sector; and

5) Remote support and debugging of the subscriber equipment, including remote software upgrade and provisioning.

Unlike physical optical or wire systems that operate at bit error rates (BER) of 10^{-11}, wireless access systems have time varying channels that typically provide bit error rates of 10^{-3} to 10^{-6}. The wireless physical (PHY) layer interface and the media access control (MAC) layer interface must provide modulation, error correction and ARQ protocol that can detect and, where required, correct or retransmit corrupted data so that the interfaces at the network and at the subscriber site operate at wire line bit error rates.

The wide range of equipment and technology capable of providing either wireline (i.e., cable, DSL, optical) broadband access or wireless broadband access has allowed service providers to match the needs of a subscriber with a suitable broadband access

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solution. However, in many areas, the cost of cable modem or DSL service is high. Additionally, data rates may be slow or coverage incomplete due to line lengths. In these areas and in areas where the high cost of replacing old telephone equipment or the low density of subscribers makes it economically unfeasible to introduce either DSL or cable modem broadband access, fixed wireless broadband systems offer a viable alternative. Fixed wireless broadband systems use a group of transceiver base stations to cover a region in the same manner as the base stations of a cellular phone system. The base stations of a fixed wireless broadband system transmit forward channel (i.e., downstream) signals in directed beams to fixed location antennas attached to the residences or offices of subscribers. The base stations also receive reverse channel (i.e., upstream) signals transmitted by the broadband access equipment of the subscriber.

Unfortunately, the diversity of broadband access technology has resulted in a lack of standardization in the broadband access equipment. Cable modems and DSL routers are incompatible with each other and with fiber optic equipment. Different service providers locate broadband access equipment in different locations on the subscriber premises. Often this equipment is located inside the office or residence of the subscriber, which makes it inaccessible

to maintenance workers unless the subscriber is present to admit the workers to the premises. The lack of standardization of broadband access equipment and the frequent inaccessibility of such equipment adds to the cost and complexity of broadband access.

Therefore, there is a need in the art for broadband access equipment that can be readily and inexpensively deployed in the large domestic and international markets that are not currently served by wired or wireless broadband access technology. Further, there is a need for an apparatus to increase the communication capacity of the communication system.

The broadband access equipment includes base stations which have RF (radio frequency) modems capable of modulating and demodulating data signals communicated between the base stations and subscriber stations. A large number of subscriber stations are generally capable of communicating with a single base station.

The RF modems must be capable of communicating with the subscriber stations in manners which permit quick, and accurate, receive operations to be performed upon signals transmitted thereto by the subscriber stations.

Any manner by which to provide increased speed and accuracy of receive operations to be performed upon the signals transmitted to a base station of an FWA system would be advantageous.

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SUMMARY OF THE INVENTION

The present invention, accordingly, advantageously provides apparatus, and an associated method, by which to operate upon data signals received at a receiving station, such as a base station of a fixed wireless access communication system.

During operation of an embodiment of the present invention, data signals are processed at a receiving station, such as a base station of fixed wireless access communication system. The data signals are transmitted to the receiving stations by any of a plurality of subscriber stations. Improved uplink capacity of data signals sent by the subscriber stations to the base station is possible as a result of operation of an embodiment of the present invention. Additionally, better compensation is made to counteract the effects of distortion of the data signals communicated during operation of a communication system in which an embodiment of the present invention is implemented.

In one aspect of the present invention, at least two demodulators (typically the demodulators are contained in radio frequency (RF) modems and demodulators and modems will be referred to interchangeably hereinafter) are provided at the receive portion of a base station of a fixed wireless access communication system, or

other receiving station. The data signals communicated to the base station by subscriber stations, or other sending stations, are applied to the separate demodulators according to a selected pattern. When two demodulators are provided, successive bursts of data are applied, for instance to alternating ones of the demodulators. The demodulators form, for instance, the demodulator portions of modems.

In another aspect of the present invention, separate profiles are created and stored at the base station, are accessible thereto. The profiles profile the channels upon which bursts of data are transmitted by separate subscriber stations and also characteristics of the data transmitted by the separate subscriber stations. The profiles are updated, as appropriate, and include the information required of the demodulators to permit their operation to demodulate bursts of data applied thereto.

In another aspect of the present invention, cyclo-stationary filtering is performed upon the bursts of data provided to the demodulator portions of the modems. Each of the bursts of data transmitted to the base station by a subscriber station is considered to be a separate and distinct station channel environment. Each of the channels is processed by configuring the receive portion of the base station with a matched filter. The

matched filter forms an equalizer, operable to equalize any of the separate and distinct stationary channels upon which the bursts of data are transmitted. The filter weights of the equalizer formed of the matched filter associated with each of the channels forms portions of the profiles which are stored and accessed during system operation.

The profiles further selectably include other parameters, such as the modulation index of the data signals communicated by the subscriber stations to the base station, the modulation orthogonalizations of the bursts of data signals of the bursts of data signals, parameters associated with FEC (forward error correction) of the data bursts sent to the base station by the subscriber stations, antenna combining parameters when antenna diversity is utilized, timing adjustment parameters, time and frequency changes of the signals, as well as other values.

When a burst of data is provided to a demodulator, a profile associated with the channel upon which the burst is communicated to the base station is retrieved and utilized in the demodulation of the burst of data. As the burst of data is demodulated, the values of the profile associated with the channel upon which the data burst is communicated are updated as appropriate. The updated profile is stored to be retrieved thereafter, when subsequent data

bursts are received at the base station and demodulated at a demodulator thereof.

Thereby, through operation of an embodiment of the present invention improved uplink communication capacity as well as improved compensation for distortion of the data communicated to the base station is provided.

Elements of the profile created and stored during operation of an embodiment of the present invention are selected to be values pertinent to the implementation of the communication system. Upgrades, or other changes in the operation of the communication system, are readily implemented, as necessary, thereby to adapt operation of an embodiment of the present invention corresponding to the changes in operation of the communication system.

In one implementation, an embodiment of the present invention is implemented at the base station of a fixed wireless access communication system. Data bursts of data signals are communicated to the base station. The data bursts are generated by a plurality of subscriber stations positioned within the coverage area defined by the base station. Alternating ones of the bursts are provided to a pair of modems forming part of the receive portion of the base station. The modems are controlled by a controller, such as a base station central processing unit, to control demodulation operations

thereat. The controller maintains profiles associated with the channels separate ones of the data bursts are communicated. The profiles are retrieved and values of the elements of such profiles are utilized in the demodulation of the respective data bursts.

In these and other aspects, therefore, apparatus and an associated method, is provided for a communication station operable in a wireless communication system, at least to receive first data signals transmitted thereto by a first subscriber station and at least second data signals transmitted thereto by at least a second subscriber station. A first demodulator is selectably coupled to receive at least one of the first and second data signals transmitted to the communication station by the first and second subscriber stations. A controller is coupled to the first demodulator and to the at least second demodulator in a feedback arrangement. The controller selects which of the first and second data signals, respectively, are applied to the first demodulator. And, the controller selects which of the first and second data signals, respectively, are applied to the second demodulator.

The present invention will be better understood when read in light of the accompanying drawings which are described in the detailed description hereinbelow and in light of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, wherein like numbers designate like objects, and in which:

FIGURE 1 illustrates an exemplary fixed wireless access network according to an embodiment of the present invention;

FIGURE 2 illustrates an exemplary data frame, as defined by the fixed wireless access network in FIGURE 1, according to an embodiment of the present invention;

FIGURE 3 illustrates a functional block diagram of a portion of the present invention comprising two modems and a controller in an embodiment of the present invention; and

FIGURE 4 illustrates a high-level block diagram of the controller and one modem in the base station of FIGURE 2 in an embodiment of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

FIGURES 1 through 4, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that the principles of the present invention may be implemented in any suitably arranged subscriber integrated access device.

FIGURE 1 illustrates exemplary fixed wireless access network 100 according to one embodiment of the present invention. Fixed wireless network 100 comprises a plurality of transceiver base stations, including exemplary transceiver base station 110, that transmit forward channel (i.e., downlink or downstream) broadband signals to a plurality of subscriber premises, including exemplary subscriber premises 121, 122 and 123, and receive reverse channel (i.e., uplink or upstream) broadband signals from the plurality of subscriber premises. Subscriber premises 121-123 transmit and receive via fixed, externally-mounted antennas 131-133, respectively. Subscriber premises 121-123 may comprise many different types of residential and commercial buildings, including single family homes, multi-tenant offices, small business

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enterprises (SBE), medium business enterprises (MBE), and so-called "SOHO" (small office/home office) premises.

The transceiver base stations, including transceiver base station 110, receive the forward channel (i.e., downlink) signals from external network 150 and transmit the reverse channel (i.e., uplink) signals to external network 150. External network 150 may be, for example, the public switched telephone network (PSTN) or one or more data networks, including the Internet or proprietary Internet protocol (IP) wide area networks (WANs) and local area networks (LANs). Exemplary transceiver base station 110 is coupled to RF modem shelf 140, which, among other things, up-converts baseband data traffic received from external network 150 to RF signals transmitted in the forward channel to subscriber premises 121-123. RF modem shelf 140 also down-converts RF signals received in the reverse channel from subscriber premises 121-123 to baseband data traffic that is transmitted to external network 150.

RF modem shelf 140 comprises a plurality of RF modems capable of modulating (i.e., up-converting) the baseband data traffic and demodulating (i.e., down-converting) the reverse channel RF signals. In an exemplary embodiment of the present invention, each of the transceiver base stations covers a cell site area that is divided into a plurality of sectors. In an advantageous embodiment

of the present invention, each of the RF modems in RF modem shelf 140 may be assigned to modulate and demodulate signals in a particular sector of each cell site. By way of example, the cell site associated with transceiver base station 110 may be partitioned into six sectors and RF modem shelf 140 may comprise six primary RF modems (and, optionally, a seventh spare RF modem), each of which is assigned to one of the six sectors in the cell site of transceiver base station 110. In another advantageous embodiment of the present invention, each RF modem in RF modem shelf 140 comprises two or more RF modem transceivers which may be assigned to at least one of the sectors in the cell site. For example, the cell site associated with transceiver base station 110 may be partitioned into six sectors and RF modem shelf 140 may comprise twelve RF transceivers that are assigned in pairs to each one of the six sectors. The RF modems in each RF modem pair may alternate modulating and demodulating the downlink and uplink signals in each sector.

RF modem shelf 140 is located proximate transceiver base station 110 in order to minimize RF losses in communication line 169. RF modem shelf 140 may receive the baseband data traffic from external network 150 and transmit the baseband data traffic to external network 150 via a number of different paths. In one

embodiment of the present invention, RF modem shelf 140 may transmit baseband data traffic to, and receive baseband data traffic from, external network 150 through central office facility 160 via communication lines 166 and 167. In such an embodiment, communication line 167 may be a link in a publicly owned or privately owned backhaul network. In another embodiment of the present invention, RF modem shelf 140 may transmit baseband data traffic to, and receive baseband data traffic from, external network 150 directly via communication line 168 thereby bypassing central office facility 160.

Central office facility 160 comprises access processor shelf 165. Access processor shelf 165 provides a termination of data traffic for one or more RF modem shelves, such as RF modem shelf 140. Access processor shelf 165 also provides termination to the network switched circuit interfaces and/or data packet interfaces of external network 150. One of the principal functions of access processor shelf 165 is to concentrate data traffic as the data traffic is received from external network 150 and is transferred to RF modem shelf 140. Access processor shelf 165 provides data and traffic processing of the physical layer interfaces, protocol conversion, protocol management, and programmable voice and data compression.

It should be noted that network 100 was chosen as a fixed wireless network only for the purposes of simplicity and clarity in explaining a subscriber integrated access device according to the principles of the present invention. The choice of a fixed wireless network should not be construed in any manner that limits the scope of the present invention in any way. As will be explained below in greater detail, in alternate embodiments of the present invention, a subscriber integrated access device according to the principles of the present invention may be implemented in other types of broadband access systems, including wireline systems (i.e, digital subscriber line (DSL), cable modem, fiber optic, and the like) in which a wireline connected to the subscriber integrated access device carries forward and reverse channel signals.

FIGURE 2 illustrates an exemplary data frame as defined by fixed wireless access network 100 according to an embodiment of the present invention. The time division duplex (TDD) data frame 200 is comprised of downlink portion 202 and uplink portion 204 and is propagated along an independent propagation channel, as illustrated in FIGURE 1. Downlink portion 202 is comprised of at least frame header 206, modulation segment 208 which signals low complexity modulation, modulation segment 210 which dictates the next highest

modulation and contention segment 214. These parameters are managed between both the up link and the down link under control of the basestation RF modem. Boundary 212 is a variable boundary between the uplink and downlink and system monitors and optimize these parameters adaptively and continuously by monitoring the received signal quality optimizing the operating parameters to increase the data throughput. Though only two levels of modulation are indicated in FIGURE 2 for ease of explanation, the number of modulations of increasing complexity is arbitrary and may be dictated by the conditions imposed by the system and/or operator.

Unlike the downlink, where each subscriber receives only the base station signal, the base station receives a burst of data on a demand basis from the subscribers on the uplink and the base station has to process each channel. As shown in FIGURE 1, the system includes multiple modems connected to access processor 165 for covering the subscribers associated with each base station. Uplink portion 204 of data frame 200 is received by a base station modem and comprises multiple segments: contention period 214 at which access is given to the subscriber stations to communicate the data bursts of uplink data, modulation level, forward Error Correction (FEC) and power level designation from antenna (1) 216,

modulation level, forward Error Correction (FEC) and power level designation from antenna (2) 218, and modulation level, forward Error Correction (FEC) and power level designation from antenna (n) 220, where n is the number of antennas transmitting from a subscriber premises.

FIGURE 3 illustrates a functional block diagram of a portion of the present invention comprising two modems and a controller in an embodiment of the present invention. Modem 302 and modem 304 are selectively coupled to receive uplink signals sent by different ones of subscriber stations to the base station (not shown). Here, IF/RF (intermediate frequency/radio frequency) receive circuitry 306 of the base station is shown to pass the uplink signals to the modems. Circuitry 306 is operable to down-convert in frequency uplink signals received from receive circuitry 304. Thereafter, the down-converted signals, bursts sub3...sub1 and bursts subN...sub2 are operated upon by modems 304 and 302 respectively. The modems are shown to be functionally coupled to controller 308 via lines 310, for receiving contention results, and 312 for passing parameters, frame times and weight values for the modems to apply to the received signals. Controller 314 includes control CPU 316 and memory device 318.

Control CPU 316 is operable, amongst other things, to perform

queue management, scheduling operations, as well as to exert control over operation of modems 302 and 304. Profiles (not shown) are created and maintained by controller 314 in a memory such as memory device 318. The profiles include values which represent channel characteristics upon which uplink signals are transmitted as well as characteristics of the uplink signals. The profiles are stored at memory device 318 and are updated as conditions warrant.

Modem 302 includes equalizer 303 which performs equalization functions, and modem 304 includes equalizer 305, also operable to perform equalization functions. The profiles associated with the various communication channels stored at memory device 318 include weighting values 320 by which to weight equalizers 303 and 305. Values 320 are utilizes to weight equalizers 303 or 305, as appropriate, when data signals sent to the base station on the corresponding channel are to be operated upon by the selected modem. As channel conditions change, changes to values 318 are calculated and stored. Other values of the profiles, while not separately shown, are analogously stored at memory device 318.

Because changes in the channel condition typically vary at a rate much slower than the rate of data transmission of the uplink data signals, the update rates at which the values of the profiles need to be applied to the modems are a mere fraction of the data

transmission rates. For instance, fading rates are typically of a level of approximately 1 to 2 Hz while frame updates of the frames are on the order of approximately 500 Hz. Updates are typically needed at approximately five to ten times the channel rate, i.e. of about 5 to 20 Hz. The updates are common in one implementation are made in conjunction with a status polling mechanism. Additionally, a demand access mechanism permits scheduling of traffic bursts, i.e., bursts of uplink signals that may be anticipated to arrive from a particular subscriber station. A demand access burst within contention period portion 214 of uplink portion 204 of a frame is of a relatively brief duration and utilizes relatively robust FEC and modulation short orthogonalization codes when utilizing a spread spectrum arrangement. The modem at which the burst of the uplink data signal is to be operated cyclically adapts equalization functions performed by the equalizer.

FIGURE 4 illustrates a high-level block diagram of the controller and one modem in the base station of FIGURE 2 in an embodiment of the present invention. Uplink data signal bursts transmitted to the base station by various subscriber stations are represented by the blocks 204-1 through 204-N-1. As a burst of data transmitted by selected subscriber station is applied to modem 302 and 304, a corresponding profile is retrieved from the memory

device of the controller and applied to modem 302 or 304. The profiles are represented in the figure by the blocks 402-1 through 402-N-1.

The demodulator portion of modem 302 or 304 operates upon the burst of data received and a resultant packet of data, here represented by the block 404, is generated in which, amongst other things, the values of the data packet have been compensated for the effects of distortion generate thereon.

Updates are made to the profile as appropriate (indicated by block 406) and the updated profile is stored at the memory device of the controller. When subsequent bursts generated by the same subscriber station are received at the base station and applied to the modem, the updated profile is retrieved and utilized when the subsequent burst of data is to be operated upon by the modem. Compensation for distortion introduced on the uplink data signal is improved because the profile was updated as the data signal's channel conditions changed.

Cyclo-stationary adaptive filtering (CSAF) is performed upon the uplink data burst signal. CSAF is a signal processing technique to allow adaptive filters to operate in environments that exhibit cyclic/deterministic channel environments. Each burst of the data signal transmitted by a subscriber station forms a

separate and distinct stationary channel environment. Each of the channels is processed by configuring the receive portion of the base station with a matched filter forming the equalizer, such as equalizers 303 and 305 (shown in FIGURE 3) for the specific channel. The values forming the profiles stored at the memory device of the controller are used to weight the equalizer, as appropriate.

In an exemplary implementation, two separate modems are utilized to demodulate separate bursts of uplink data signals. By utilizing at least two separate modems, alternating ones of the modems are utilized to demodulate successive bursts of data. During a time period in which a demodulator is not being utilized to operate upon a data burst, values associated with another channel upon which a subsequent data burst is expected to be transmitted is applied to the unused modem. Thereby, when the subsequent burst of data is received at the base station the modem is primed to operate upon the burst of the uplink data signal.

In another implementation, different types of modems operable upon different types of signals form the separate modems. When a signal generated by a subscriber station is received at the base station, the signal burst is applied to the modem which is capable of operating upon the particular signal. Modem-types are

upgradeable while maintaining the backward compatibility of the base station. Additional modems are added, as needed, thereby to permit continued operation of the base station as new types of technology are made available.

Profile values, for example, include: weighting values for the equalizers in the time domain or transformed weights in the frequency domain; the modulation index of the uplink data signal, the modulation orthogonalization; parameters associated with forward error correction of the uplink data signal, antenna combining parameters when antenna diversity and/or beam-forming is utilized, and residual carrier or baud timing adjustments.

Thereby, through operation of an embodiment of the present invention, a manner is provided by which to operate upon data signals received at a receiving station, such as a base station of a fixed wireless access communication system. The distortion introduced upon the data signals during their communication upon non-ideal communication channels is better compensated for, thereby permitting improved quality of communications as well as increased throughput rates to increase the capacity of the communication system.

The previous descriptions are of preferred examples for implementing the invention, and the scope of the invention should

not necessarily be limited by this description. The scope of the present invention is defined by the following claims.

Express Mail Label No. EV326526620

WHAT IS CLAIMED IS:

1. Apparatus for a communication station operable in a wireless communication system at least to receive first data signals transmitted thereto by a first subscriber station and at least second data signals transmitted thereto by at least a second subscriber station, said apparatus comprising:

a first demodulator selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively;

at least a second demodulator also selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; and

a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller at least for selecting which of the first and second data signals, respectively, are applied to said first demodulator and for selecting which of the first and second data signals, respectively, are applied to said second demodulator.

2. The apparatus of Claim 1 wherein the wireless communication system comprises a fixed wireless access system, wherein the communication station comprises a base station of the fixed wireless access system in which the data signals transmitted thereto by the first subscriber station comprise first uplink burst data signals and the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem.

3. The apparatus of Claim 2 wherein said second demodulator is embodied at a second modem.

4. The apparatus of Claim 1 wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern.

5. The apparatus of Claim 4 wherein the selected pattern according to which said first demodulator and said second demodulator receive the first and at least second data signals comprise alternately coupling said first demodulator and said second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

6. The apparatus of Claim 1 wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals.

Ex.1002.00038

7. The apparatus of Claim 1 wherein said controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller.

8. The apparatus of claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively.

9. The apparatus of claim 8 wherein said first demodulator and said second demodulator each include equalizer portions for equalizing the at least one of the first and second data signals selectably applied to said first demodulator and said second demodulator, respectively.

10. The apparatus of claim 9 wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof.

11. The apparatus in claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively.

12. The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

13. The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

Ex.1002.00040

14. The apparatus of claim 11 wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

15. The apparatus of claim 7 wherein the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

16. The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals.

17. The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals.

Page 39 of 39

18. A method for acting upon data signals transmitted to a communication station operable in a wireless communication system by a first subscriber station and at least a second subscriber station, said method comprising:

selecting at which of a first demodulator and at least a second demodulator to apply at least one of the first data signals and the at least the second data signals;

demodulating the at least one of the first and at least second data signals at the first demodulator when the first demodulator is selected during said operation of selecting; and

demodulating the at least one of the first and at least second data signals at the second demodulator when the second demodulator is selected during said operation of selecting.

19. The method of claim 18 wherein selections made during said operation of selecting are made according to a selected pattern.

20. The method of claim 18 further comprising the operation of maintaining profiles associated with each of the first and at least second data signals transmitted upon the first and at least second channels, respectively, and wherein said operations of demodulating further comprise accessing the profiles.

Petitioner's Exhibit 1002, Page 41

APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATIO OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

ABSTRACT

Apparatus, and an associated method, for acting upon data signals received at a base station of a fixed wireless access communication system. A plurality of modems are positioned at the base station, and a controller controls to which modem that a data signal, transmitted by a particular subscriber station, is applied to a particular modem. Profiles relating to channel and signal characteristics are also maintained and used by the modem during demodulation operations.

Ex.1002.00045

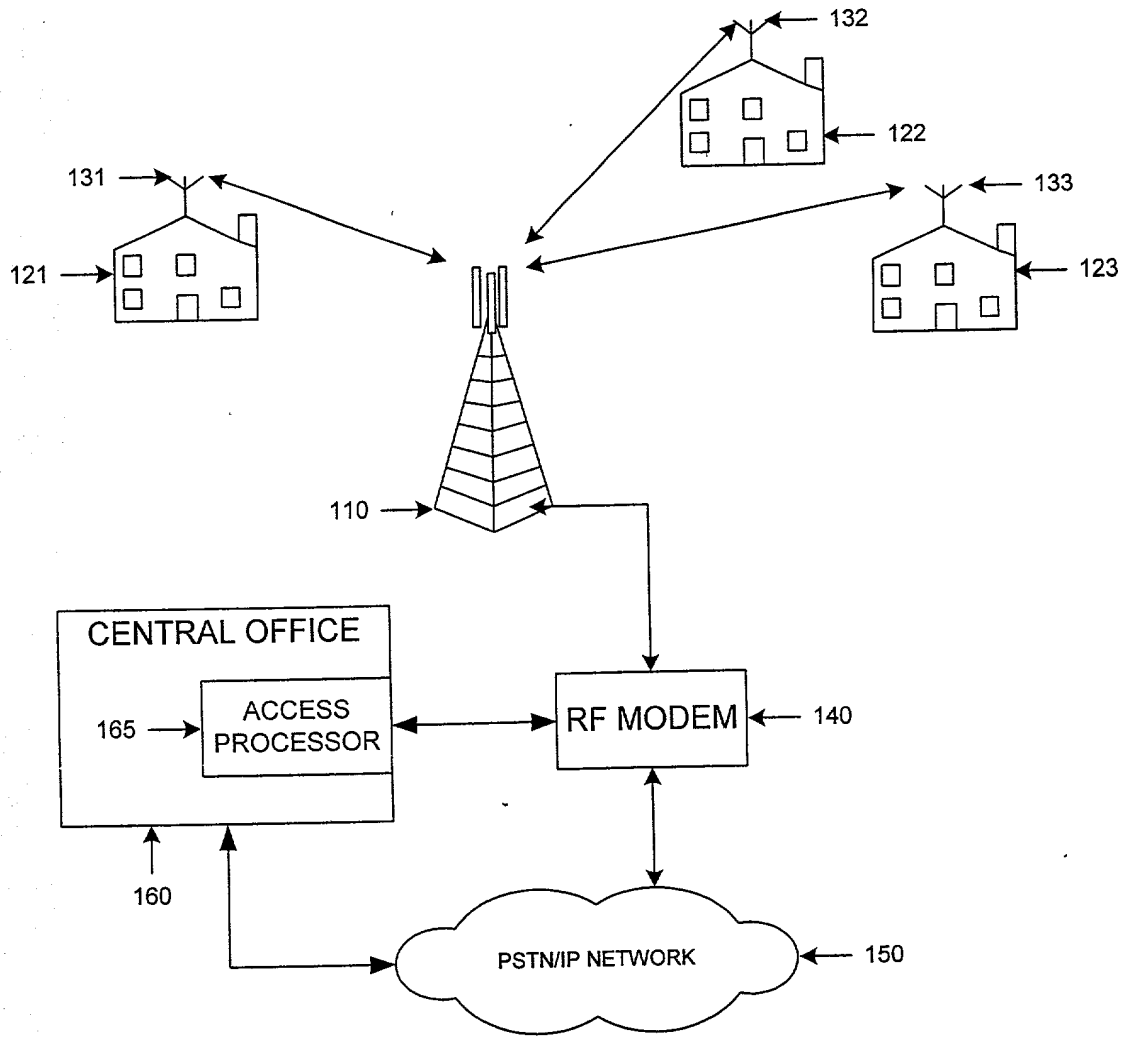


FIGURE 1

Ex.1002.00046

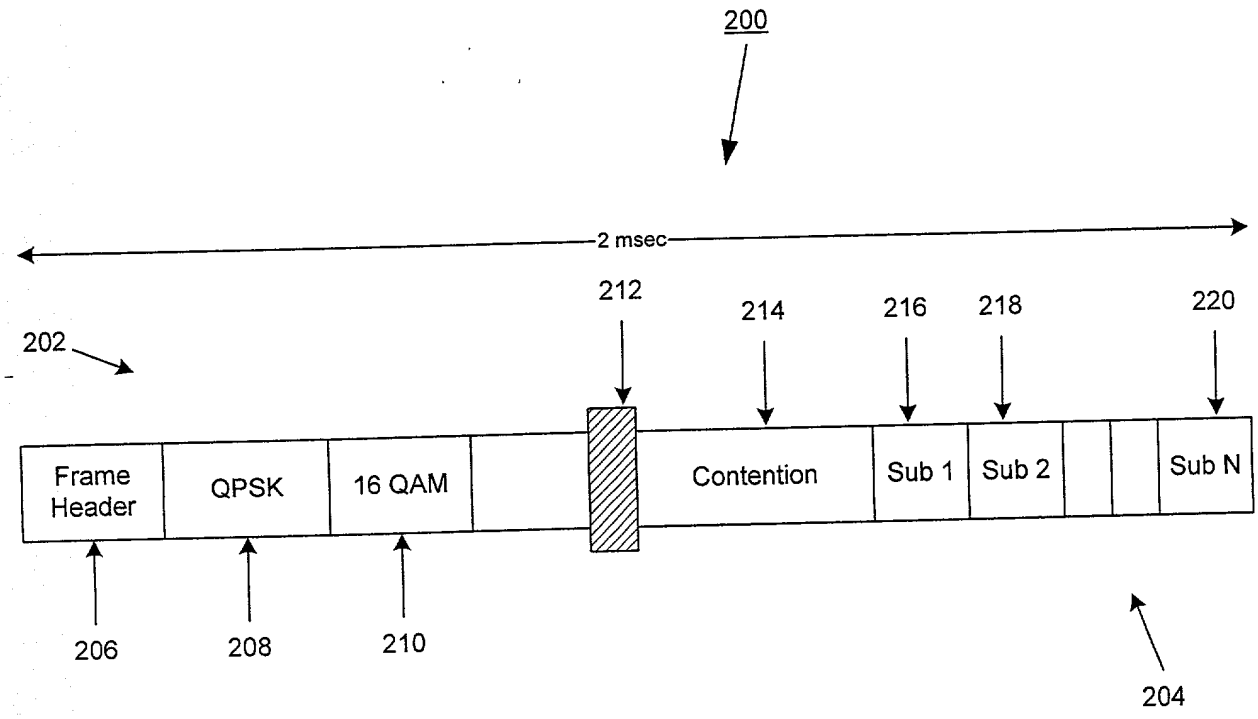


FIGURE 2

Ex.1002.00047

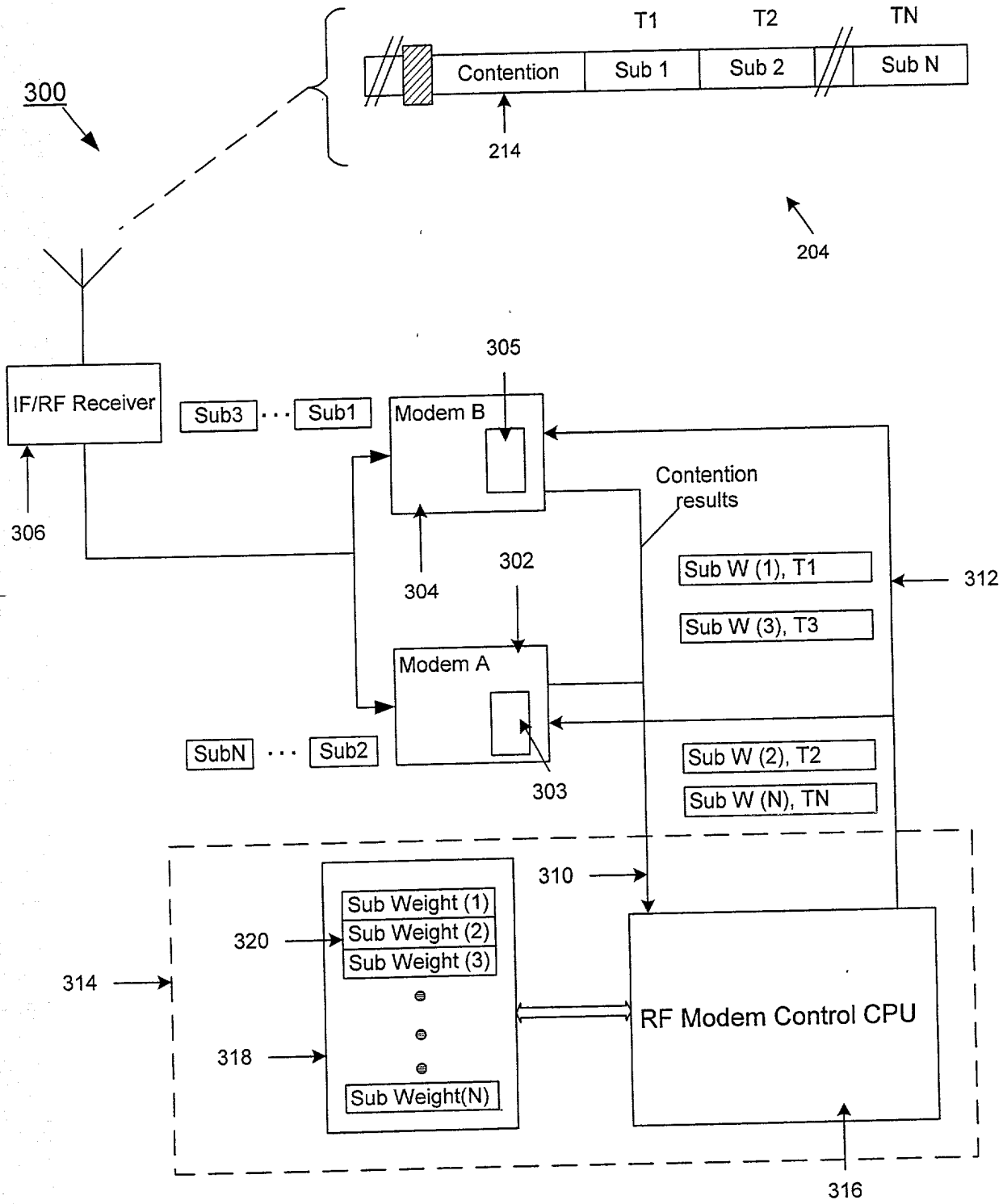

300
T1
T2
TN
Contention
Sub 1
Sub 2
Sub N
214
204
305
IF/RF Receiver
Sub3
Sub1
Modem B
Contention results
306
304
302
Sub W (1), T1
312
Sub W (3), T3
Modem A
SubN
Sub2
303
Sub W (2), T2
Sub W (N), TN
310
Sub Weight (1)
320
Sub Weight (2)
Sub Weight (3)
314
RF Modem Control CPU
318
Sub Weight(N)
316

FIGURE 3

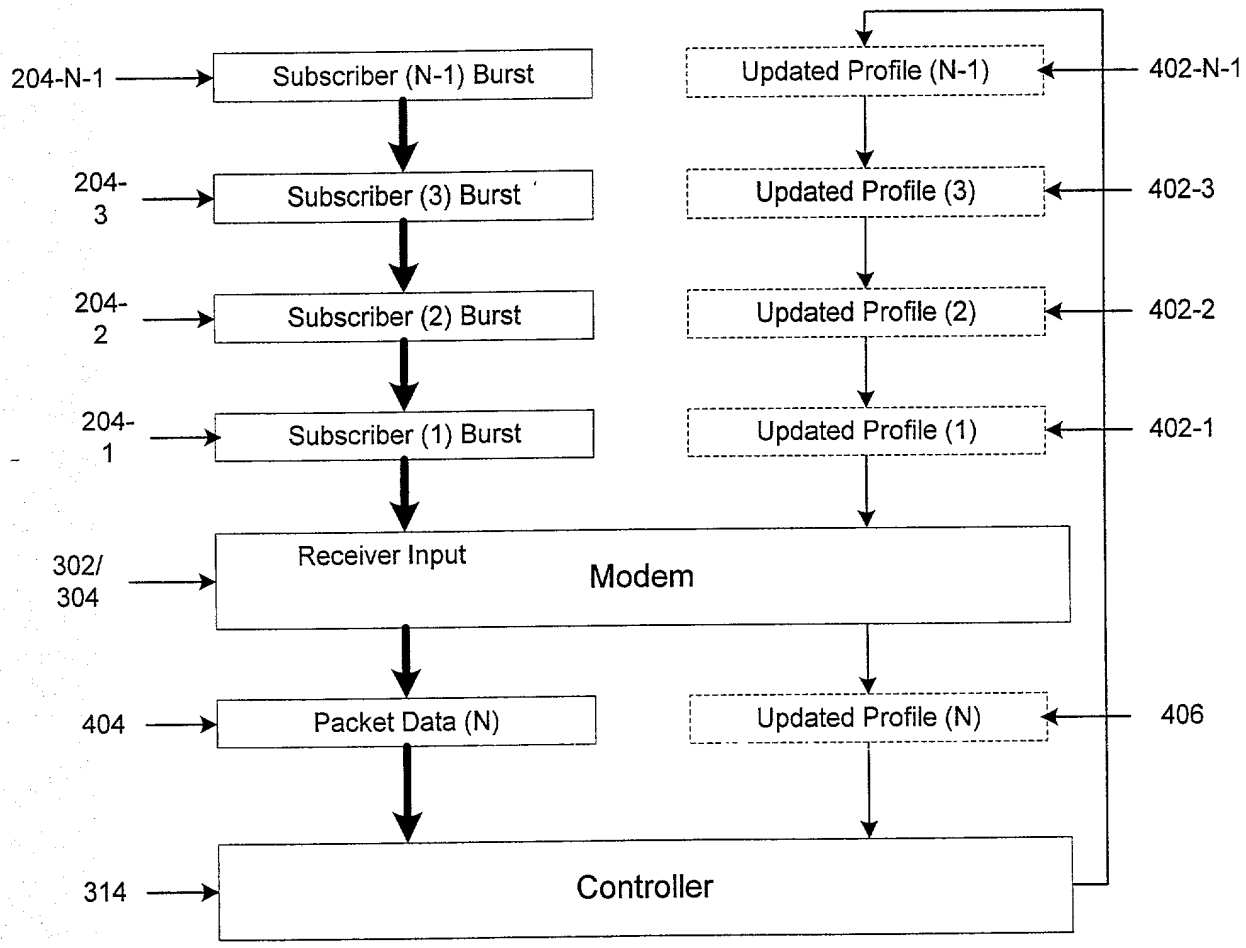

204-N-1
Subscriber (N-1) Burst
204-3
Subscriber (3) Burst
204-2
Subscriber (2) Burst
204-1
Subscriber (1) Burst
302/304
Receiver Input
Modem
404
Packet Data (N)
314
Controller
Updated Profile (N-1)
402-N-1
Updated Profile (3)
402-3
Updated Profile (2)
402-2
Updated Profile (1)
402-1
Updated Profile (N)
406

FIGURE 4

DOCKET NO. WEST14-00014 **PATENT**

DECLARATION AND POWER OF ATTORNEY

As a below named joint inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention, design or discovery entitled:

"APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM"

the specification of which is attached hereto.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability of this application as defined by Title 37, Code of Federal Regulations, § 1.56.

I hereby claim no foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate on which priority is claimed.

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	DATE FILED	STATUS
60/262,825	January 19, 2001	Pending

additional United States applications listed on the attached Appendix A.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	DATE FILED	STATUS
09/713,684	November 15, 2000	Pending

I hereby appoint:

William A. Munck, Registration No. 39,308
John T. Mockler, Registration No. 39,775

all of the firm of NOVAKOV DAVIS & MUNCK, P.C. my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon before any international authorities under the Patent Cooperation Treaty.

Send correspondence to:	William A. Munck, Esq. NOVAKOV DAVIS & MUNCK, P.C. 900 Three Galleria Tower 13155 Noel Road Dallas, Texas 75240
Direct telephone calls to:	William A. Munck, Esq. (214) 922-9221
Atty. Docket No.:	WEST14-00014

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 § 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 issuing thereon.

Full name of first inventor:	Paul F. Struhsaker
Inventor's signature:	
Date:	19 April 2001
Residence (City, County, State):	Plano, Collin County, Texas
Citizenship:	United States of America
Post Office Address:	5304 Brouette Court Plano, Texas 75023

Ex.1002.00051

Full name of second inventor: Russell C. McKown

Inventor's signature: Russell C. McKown

Date: 4/19/01

Residence (City, County, State): Richardson, Collin County, Texas

Citizenship: United States of America

Post Office Address: 1104 Pittsburg Landing
Richardson, Texas 75080

Attorney Docket No.: 5050-00100

APPENDIX A

Application Serial No.	Dated Filed	Status
60/262,712	January 19, 2001	Pending
60/262,698	January 19, 2001	Pending
60/262,827	January 19, 2001	Pending
60/262,826	January 19, 2001	Pending
60/262,951	January 19, 2001	Pending
60/262,824	January 19, 2001	Pending
60/263,101	January 19, 2001	Pending
60/263,097	January 19, 2001	Pending
60/273,579	March 5, 2001	Pending
60/262,955	January 19, 2001	Pending
60/262,708	January 19, 2001	Pending
60/273,689	March 5, 2001	Pending
60/273,757	March 5, 2001	Pending
60/270,378	February 21, 2001	Pending
60/270,385	February 21, 2001	Pending
60/270,430	April 17, 2001	Pending

Ex.1002.00053

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

04/25/2001 HMOHAMM1 00000034 09839726
01 FC:201 355.00 OP

PTO-1556
(5/87)

*U.S. GPO: 2000-468-987/39595

Application or Docket Number

WEST 14-00014

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	20	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL	355.00	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
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.

CLAIMS ONLY

SERIAL NO.	FILING DATE
09/839,726	04-20-01

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.	2	⇩		⇩		⇩
TOTAL DEP.	16					
TOTAL CLAIMS	20					

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	IND.	DEP.	IND.	DEP.	IND.	DEP.
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TOTAL IND.		⇩		⇩		⇩
TOTAL DEP.						
TOTAL CLAIMS						

* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

FORM PTO-2022 (1-98)

U.S.DEPARTMENT OF COMMERCE
Patent and Trademark Office

*U.S. Government Printing Office: 1998 - 433-217/00003

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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

FILE COPY

Bib Data Sheet

CONFIRMATION NO. 1219

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/839,726	04/20/2001 RULE	455	2682	WEST14-00014

APPLICANTS

Paul F. Struhsaker, Plano, TX;
Russell C. McKown, Richardson, TX;

**** CONTINUING DATA ***************************

THIS APPLN CLAIMS BENEFIT OF 60/262,825 01/19/2001
AND CLAIMS BENEFIT OF 60/262,712 01/19/2001
AND CLAIMS BENEFIT OF 60/262,698 01/19/2001
AND CLAIMS BENEFIT OF 60/262,826 01/19/2001
AND CLAIMS BENEFIT OF 60/262,951 01/19/2001
AND CLAIMS BENEFIT OF 60/262,824 01/19/2001
AND CLAIMS BENEFIT OF 60/263,101 01/19/2001
AND CLAIMS BENEFIT OF 60/263,097 01/19/2001
AND CLAIMS BENEFIT OF 60/273,579 03/05/2001
AND CLAIMS BENEFIT OF 60/262,955 01/19/2001
AND CLAIMS BENEFIT OF 60/262,708 01/19/2001
AND CLAIMS BENEFIT OF 60/273,689 03/05/2001
AND CLAIMS BENEFIT OF 60/273,757 03/05/2001
AND CLAIMS BENEFIT OF 60/270,378 02/21/2001
AND CLAIMS BENEFIT OF 60/270,385 02/21/2001
AND CLAIMS BENEFIT OF 60/270,430 02/21/2001

**** FOREIGN APPLICATIONS *********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 06/14/2001

		STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed	☐ yes ☐ no	TX	4	20	2
35 USC 119 (a-d) conditions met	☐ yes ☐ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature Initials				

ADDRESS

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NOVAKOV DAVIS & MUNCK, P.C.
900 Three Galleria Tower
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Dallas ,TX 75240

TITLE

Apparatus and associated method for operating upon data signals received at a receiving station of a fixed wireless access communication system

☐ All Fees

FILING FEE RECEIVED 355	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Receipt
2.

DOCKET NO. WEST14-00014 PATENT

OIPE JC154 JUN 2 5 2001 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED SEP 1 7 2001 Technology Center 2600

In re application of	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	(Not Yet Assigned)

Assistant Commissioner for Patents
Washington, D. C. 20231

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on 6/22/01 (Date)

KATHY LONGENECKER
(Printed or typed name of person signing the certificate)

Kathy Longenecker
(Signature of the person signing the certificate)

Sir:

REQUEST FOR CORRECTED OFFICIAL FILING RECEIPT

In reviewing the file, it has been noted that the Official Filing Receipt contains an error in **Domestic Priority data as claimed by applicant**. The priority information should be corrected to read as follows:

-- THIS APPLN CLAIMS BENEFIT OF 60/262,825 01/19/2001
09/713,684 11/15/2000
60/262,712 01/19/2001
60/262,698 01/19/2001
60/262,827 01/19/2001
60/262,826 01/19/2001
60/262,951 01/19/2001
60/262,824 01/19/2001
60/263,101 01/19/2001

60/263,097 01/19/2001
60/273,579 03/05/2001
60/262,955 01/19/2001
60/262,708 01/19/2001
60/273,689 03/05/2001
60/273,757 03/05/2001
60/270,378 02/21/2001
60/270,385 02/21/2001
60/270,430 04/17/2001

as indicated on the Declaration and Power of Attorney as filed in this patent application (copy enclosed).

A copy of the Official Filing Receipt is also attached. Once the correction is made, please forward a new filing receipt to the undersigned attorney at the below identified address.

Further, as this correction is not due to any error by Applicant, no fee is due.

Respectfully submitted,

NOVAKOV DAVIS & MUNCK, P.C.

Date: June 21, 2001

William A. Munck
Registration No. 39,308

P.O. Drawer 800889
Dallas, Texas 75380
Tel.: (214) 922-9221
Fax: (214) 969-7557
E-mail: *wmunck@novakov.com*

OIPE JC154 JUN 25 2001 PATENT & TRADEMARK OFFICE

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/839,726	04/20/2001	2682	355	WEST14-00014	4	20	2

CONFIRMATION NO. 1219

FILING RECEIPT

William A. Munck, Esq.
NOVAKOV DAVIS & MUNCK, P.C.
900 Three Galleria Tower
13155 Noel Road
Dallas, TX 75240

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SEP 17 2001
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Date Mailed: 06/15/2001

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. 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 write to the Office of Initial Patent Examination's Customer Service Center. 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 (if appropriate).**

Applicant(s)

Paul F. Struhsaker, Plano, TX;
Russell C. McKown, Richardson, TX;

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JUN 18 2001
NOVAKOV DAVIS & MUNCK

Domestic Priority data as claimed by applicant

THIS APPLN CLAIMS BENEFIT OF 60/262,825 01/19/2001

Foreign Applications

If Required, Foreign Filing License Granted 06/14/2001

Projected Publication Date: 07/25/2002

Non-Publication Request: No

Early Publication Request: No

DOCKETED
JUN 19 2001

**** SMALL ENTITY ****

Title

COPY

Apparatus and associated method for operating upon data signals received at a receiving station of a fixed wireless access communication system

Preliminary Class

455

Data entry by : TRUONG, T **Team :** OIPE **Date:** 06/15/2001

[redacted]

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 Office of Export Administration, Department of Commerce (15 CFR 370.10 (j)); the Office of Foreign Assets Control, 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).

PLEASE NOTE the following information about the Filing Receipt:

- The articles such as "**a**," "**an**" and "**the**" are not included as the first words in the title of an application. They are considered to be unnecessary to the understanding of the title.
- The words "**new**," "**improved**," "**improvements in**" or "**relating to**" are not included as first words in the title of an application because a patent application, by nature, is a new idea or improvement.
- The title may be truncated if it consists of more than 500 characters (letters and spaces combined).
- The docket number allows a maximum of 25 characters.
- If your application was submitted under 37 CFR 1.10, your filing date should be the "date in" found on the Express Mail label. If there is a discrepancy, you should submit a request for a corrected Filing Receipt along with a copy of the Express Mail label showing the "date in."
- The title is recorded in sentence case.

Any corrections that may need to be done to your Filing Receipt should be directed to:

Assistant Commissioner for Patents
Office of Initial Patent Examination
Customer Service Center
Washington, DC 20231

OIPE JC154 JUN 2 5 2001 PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**

DECLARATION AND POWER OF ATTORNEY

As a below named joint inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention, design or discovery entitled:

"APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM"

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the specification of which is attached hereto.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability of this application as defined by Title 37, Code of Federal Regulations, § 1.56.

I hereby claim no foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate on which priority is claimed.

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	DATE FILED	STATUS
60/262,825	January 19, 2001	Pending

additional United States applications listed on the attached Appendix A.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	DATE FILED	STATUS
09/713,684	November 15, 2000	Pending

I hereby appoint:

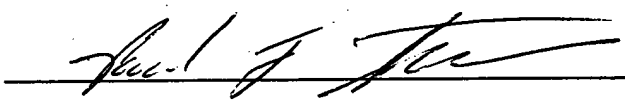
William A. Munck, Registration No. 39,308
John T. Mockler, Registration No. 39,775

COPY

all of the firm of NOVAKOV DAVIS & MUNCK, P.C. my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon before any international authorities under the Patent Cooperation Treaty.

Send correspondence to:	William A. Munck, Esq. NOVAKOV DAVIS & MUNCK, P.C. 900 Three Galleria Tower 13155 Noel Road Dallas, Texas 75240
Direct telephone calls to:	William A. Munck, Esq. (214) 922-9221
Atty. Docket No.:	WEST14-00014

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 § 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 issuing thereon.

Full name of first inventor:	Paul F. Struhsaker
Inventor's signature:	
Date:	19 April 2001
Residence (City, County, State):	Plano, Collin County, Texas
Citizenship:	United States of America
Post Office Address:	5304 Brouette Court Plano, Texas 75023

Full name of second inventor: Russell C. McKown

Inventor's signature: Russell C. McKown

Date: 4/19/01

Residence (City, County, State): Richardson, Collin County, Texas

Citizenship: United States of America

Post Office Address: 1104 Pittsburg Landing
Richardson, Texas 75080

APPENDIX A

Application Serial No.	Dated Filed	Status
60/262,712	January 19, 2001	Pending
60/262,698	January 19, 2001	Pending
60/262,827	January 19, 2001	Pending
60/262,826	January 19, 2001	Pending
60/262,951	January 19, 2001	Pending
60/262,824	January 19, 2001	Pending
60/263,101	January 19, 2001	Pending
60/263,097	January 19, 2001	Pending
60/273,579	March 5, 2001	Pending
60/262,955	January 19, 2001	Pending
60/262,708	January 19, 2001	Pending
60/273,689	March 5, 2001	Pending
60/273,757	March 5, 2001	Pending
60/270,378	February 21, 2001	Pending
60/270,385	February 21, 2001	Pending
60/270,430	April 17, 2001	Pending

Ex.1002.00068

OIPE JUN 25 2001 JC154 PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	(Not Yet Assigned)

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

CERTIFICATE OF MAILING

I hereby certify that this correspondence, including the attachments listed, is being deposited with the United States Postal Service, via First Class Mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231 on 6/22/01 (Date)

KATHY LONGENECKER
Printed Name of Person Mailing

Kathy Longenecker
Signature of Person Mailing

CHANGE OF CORRESPONDENCE ADDRESS

Please direct future correspondence and telephone calls relating to this patent application to the following:

Docket Clerk
P.O. Drawer 800889
Dallas, Texas 75380

Phone: (214) 922-9221
Fax: (214) 969-7557

Respectfully submitted,

NOVAKOV DAVIS & MUNCK, P.C.

Date: Jun 21, 2004

William A. Munck
Registration No. 39,308

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (214) 922-9221
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E-mail: *wmunck@novakov.com*

AO 2682

OIPE JUL 23 2001 PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Paul F. Struhsaker, et al.
U.S. Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	(Not Yet Assigned)

Commissioner for Patents
Washington, D. C. 20231

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on 7/19/01.

KATHY LONGENECKER
(Printed or typed name of person signing the certificate)

Kathy Longenecker
(Signature of the person signing the certificate)

Dear Sir:

INFORMATION DISCLOSURE STATEMENT

Pursuant to the duty of disclosure under 37 C.F.R. § 1.56, Applicant submits this statement. This submittal is made in accordance with 37 C.F.R. §§ 1.97 and 1.98 and § 609 of the Manual of Patent Examining Procedure. The patents, publications and other information herein are listed below and on the attached Form PTO-1449. Copies of the listed references are submitted herewith.

RECEIVED
JUL 26 2001
Group 2600

U.S. Patent No.	Inventor	Date
5,638,371	Raychaudhuri, et al.	June 10, 1997
5,684,791	Raychaudhuri, et al.	Nov. 4, 1997
5,694,424	Ariyavisitakul	Dec. 2, 1997
5,809,086	Ariyavisitakul	Sept. 15, 1998
5,991,292	Focsaneanu, et al.	Nov. 23, 1999
6,188,873	Wickman, et al.	Feb. 13, 2001

Applicant hereby expressly reserves the right to swear behind the effective dates of any of the above Patents and to question the relevance and materiality of the Patents and Publications listed herein, in whole, in part, or in combination, subsequent to filing this Information Disclosure Statement.

Respectfully submitted,

NOVAKOV DAVIS & MUNCK, P.C.

Date: July 18, 2001

William A. Munck
Registration No. 39,308

P.O. Drawer 800889
Dallas, Texas 75380
Telephone: (214) 922-9221
Facsimile: (214) 969-7557
email: wmunck@novakov.com

FORM PTO-1449 (REV. 7.80)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. WEST14-00014	SERIAL NO. 09/839,726
LIST OF REFERENCES CITED BY APPLICANT (Use several sheets if necessary)		APPLICANT Paul F. Struhsaker, et al.	
		FILING DATE April 20, 2001	GROUP 2682

OIPE JC157 JUL 23 2001 PATENT & TRADEMARK OFFICE

RECEIVED JUL 26 2001 Group 2600

U. S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (if appropriate)
	AA	5,638,371	06/10/1997	Raychaudhuri, et al.	370	347	June 27, 1995
	AB	5,684,791	11/04/1997	Raychaudhuri, et al.	370	278	Nov. 7, 1995
	AC	5,694,424	12/02/1997	Ariyavisitakul	375	233	Mar. 15, 1996
	AD	5,809,086	09/15/1998	Ariyavisitakul	375	332	Mar. 20, 1996
	AE	5,991,292	11/23/1999	Focsaneanu, et al.	370	352	Mar. 6, 1997
	AF	6,188,873	02/13/2001	Wickman, et al.	455	11.1	June 9, 1999

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Dra if not in conformance and not considered. Include copy of this form with next communication to applican

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

OIPE JC87 FEB 12 2002 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#4/A
L. McLaughlin
3.4.02

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	(Not Yet Assigned)

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Technology Center 2600

BOX NON-FEE AMENDMENT
Commissioner for Patents
Washington, D. C. 20231

Sir:

PRELIMINARY AMENDMENT

Before examination of the above-identified application, please amend it as follows:

IN THE SPECIFICATION

Page 1, prior to "Cross-Reference to Related Application" please insert the following:

A1

-- The present invention claims priority to United States Provisional Application Serial No. 60/262,825 filed January 19, 2001. --

Please delete Page 1, line 4 through Page 6, line 10, in its entirety, and insert the following:

-- CROSS-REFERENCE TO RELATED APPLICATIONS

The present invention is related to those disclosed in the following United States Provisional and Non-Provisional Patent Applications:

1) Serial No. 09/713,684, filed on November 15, 2000, entitled "SUBSCRIBER INTEGRATED ACCESS DEVICE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00004);

2) Serial No. 09/838,810, filed April 20, 2001, entitled "WIRELESS COMMUNICATION SYSTEM USING BLOCK FILTERING AND FAST EQUALIZATION-DEMODULATION AND METHOD OF OPERATION" (Docket No. WEST14-00005);

A2 Cont.

3) Serial No. 09/839,729, filed April 20, 2001, entitled "APPARATUS AND METHOD FOR OPERATING A SUBSCRIBER INTERFACE IN A FIXED WIRELESS SYSTEM" (Docket No. WEST14-00015);

4) Serial No. 09/839,719, filed April 20, 2001, entitled "APPARATUS AND METHOD FOR CREATING SIGNAL AND PROFILES AT A RECEIVING STATION" (Docket No. WEST14-00016);

5) Serial No. 09/838,910, filed April 20, 2001, entitled "SYSTEM AND METHOD FOR INTERFACE BETWEEN A SUBSCRIBER MODEM AND SUBSCRIBER PREMISES INTERFACES" (Docket No. WEST14-00017);

6) Serial No. 09/839,509, filed April 20, 2001, entitled "BACKPLANE ARCHITECTURE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00018);

7) Serial No. 09/839,514, filed April 20, 2001, entitled "SYSTEM AND METHOD FOR ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00019);

A2 Cont.

8) Serial No. 09/839,512, filed April 20, 2001, entitled "SYSTEM FOR COORDINATION OF TDD TRANSMISSION BURSTS WITHIN AND BETWEEN CELLS IN A WIRELESS ACCESS SYSTEM AND METHOD OF OPERATION" (Docket No. WEST14-00020);

9) Serial No. 09/839,259, filed April 20, 2001, entitled "REDUNDANT TELECOMMUNICATION SYSTEM USING MEMORY EQUALIZATION APPARATUS AND METHOD OF OPERATION" (Docket No. WEST14-00021);

10) Serial No. 09/839,457, filed April 20, 2001, entitled "WIRELESS ACCESS SYSTEM FOR ALLOCATING AND SYNCHRONIZING UPLINK AND DOWNLINK OF TDD FRAMES AND METHOD OF OPERATION" (Docket No. WEST14-00022);

11) Serial No. 09/839,075, filed April 20, 2001, entitled "TDD FDD AIR INTERFACE" (Docket No. WEST14-00023);

12) Serial No. 09/839,499, filed April 20, 2001, entitled "APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00024);

13) Serial No. 09/839,458, filed April 20, 2001, entitled "WIRELESS ACCESS SYSTEM USING MULTIPLE MODULATION" (Docket No. WEST14-00026);

A2 Cont.

14) Serial No. 09/839,456, filed April 20, 2001, entitled "WIRELESS ACCESS SYSTEM AND ASSOCIATED METHOD USING MULTIPLE MODULATION FORMATS IN TDD FRAMES ACCORDING TO SUBSCRIBER SERVICE TYPE" (Docket No. WEST14-00027);

15) Serial No. 09/838,924, filed April 20, 2001, entitled "APPARATUS FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00028);

16) Serial No. 09/839,727, filed April 20, 2001, entitled "APPARATUS FOR REALLOCATING COMMUNICATION RESOURCES TO ESTABLISH A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00029);

17) Serial No. 09/839,734, filed April 20, 2001, entitled "METHOD FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00030);

18) Serial No. 09/839,513, filed April 20, 2001, entitled "SYSTEM AND METHOD FOR PROVIDING AN IMPROVED COMMON CONTROL BUS FOR USE IN ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00033);

19) Serial No. 60/262,712, filed on January 19, 2001, entitled "WIRELESS COMMUNICATION SYSTEM USING BLOCK FILTERING AND FAST EQUALIZATION-DEMODULATION AND METHOD OF OPERATION" (Docket No. WEST14-00005);

20) Serial No. 60/262,698, filed on January 19, 2001, entitled "APPARATUS AND METHOD FOR OPERATING A SUBSCRIBER INTERFACE IN A FIXED WIRELESS SYSTEM" (Docket No. WEST14-00015);

21) Serial No. 60/262,827, filed on January 19, 2001, entitled "APPARATUS AND METHOD FOR CREATING SIGNAL AND PROFILES AT A RECEIVING STATION" (Docket No. WEST14-00016);

22) Serial No. 60/262,826, filed on January 19, 2001, entitled "SYSTEM AND METHOD FOR INTERFACE BETWEEN A SUBSCRIBER MODEM AND SUBSCRIBER PREMISES INTERFACES" (Docket No. WEST14-00017);

23) Serial No. 60/262,951, filed on January 19, 2001, entitled "BACKPLANE ARCHITECTURE FOR USE IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00018);

24) Serial No. 60/262,824, filed on January 19, 2001, entitled "SYSTEM AND METHOD FOR ON-LINE INSERTION OF LINE REPLACEABLE UNITS IN WIRELESS AND WIRELINE ACCESS SYSTEMS" (Docket No. WEST14-00019);

A2 Cont.

25) Serial No. 60/263,101, filed on January 19, 2001, entitled "SYSTEM FOR COORDINATION OF TDD TRANSMISSION BURSTS WITHIN AND BETWEEN CELLS IN A WIRELESS ACCESS SYSTEM AND METHOD OF OPERATION" (Docket No. WEST14-00020);

26) Serial No. 60/263,097, filed on January 19, 2001, entitled "REDUNDANT TELECOMMUNICATION SYSTEM USING MEMORY EQUALIZATION APPARATUS AND METHOD OF OPERATION" (Docket No. WEST14-00021);

27) Serial No. 60/273,579, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM FOR ALLOCATING AND SYNCHRONIZING UPLINK AND DOWNLINK OF TDD FRAMES AND METHOD OF OPERATION" (Docket No. WEST14-00022);

28) Serial No. 60/262,955, filed January 19, 2001, entitled "TDD FDD AIR INTERFACE" (Docket No. WEST14-00023);

29) Serial No. 60/262,708, filed on January 19, 2001, entitled "APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00024);

30) Serial No. 60/273,689, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM USING MULTIPLE MODULATION" (Docket No. WEST14-00026);

31) Serial No. 60/273,757, filed March 5, 2001, entitled "WIRELESS ACCESS SYSTEM AND ASSOCIATED METHOD USING MULTIPLE MODULATION FORMATS IN TDD FRAMES ACCORDING TO SUBSCRIBER SERVICE TYPE" (Docket No. WEST14-00027);

32) Serial No. 60/270,378, filed February 21, 2001, entitled "APPARATUS FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00028);

33) Serial No. 60/270,385, filed February 21, 2001, entitled "APPARATUS FOR REALLOCATING COMMUNICATION RESOURCES TO ESTABLISH A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00029); and

A2 Cont.

34) Serial No. 60/270,430, filed February 21, 2001, entitled "METHOD FOR ESTABLISHING A PRIORITY CALL IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM" (Docket No. WEST14-00030). --

REMARKS

This Preliminary Amendment is being submitted herein to amend the priority claim to the provisional patent applications, and also to indicate the serial numbers and filing dates of related applications. The serial numbers were not yet available when the present application was filed. A Supplemental Declaration and Power of Attorney is attached herewith to include the serial number and filing date to the provisional patent application in which Applicant claims priority.

Should it facilitate allowance of the application, the Examiner is invited to telephone the undersigned attorney. The Commissioner is hereby authorized to charge any additional payment that may be due or credit any overpayment to Novakov Davis Deposit Account No. 50-0208.

Respectfully submitted,

NOVAKOV DAVIS & MUNCK, P.C.

Date: Jan. 18, 2002

William A. Munck
Registration No. 39,308

P.O. Drawer 800889
Dallas, Texas 75380
Tel.: (214) 922-9221
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2682

DOCKET NO. WEST14-00014 PATENT
Customer No. 23990

OIPE JC67
FEB 12 2002
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	(Not Yet Assigned)

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Washington, D.C. 20231

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Sir:

The undersigned hereby certifies that the following documents:

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2. Supplemental Declaration and Power of Attorney; and
3. A postcard receipt;

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to Box NON-FEE AMENDMENT, Commissioner for Patents, Washington, D.C. 20231, on 1/18/02.

Date: 1/18/02 Kathy Jengnechen
Mailer

Date: Jan. 18, 2002 William A. Munck
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DOCKET NO. WEST14-00014 PATENT

SUPPLEMENTAL DECLARATION AND POWER OF ATTORNEY

I, a below named joint inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention, design or discovery entitled:

"APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM"

the specification of which was filed in the United States Patent and Trademark Office on April 20, 2001, and assigned U.S. Serial No. 09/839,726.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability of this application as defined by Title 37, Code of Federal Regulations, § 1.56.

I hereby claim no foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate on which priority is claimed.

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	DATE FILED	STATUS
60/262,825	January 19, 2001	Pending

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in § 1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

APPLICATION SERIAL NO. DATE FILED STATUS

N/A

I hereby appoint:

William A. Munck, Registration No. 39,308
John T. Mockler, Registration No. 39,775

all of the firm of NOVAKOV DAVIS & MUNCK, P.C. my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon before any international authorities under the Patent Cooperation Treaty.

Send correspondence to: Docket Clerk
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Dallas, Texas 75240

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Atty. Docket No.: WEST14-00014

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 § 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 issuing thereon.

Full name of first inventor: Paul F. Struhsaker

Inventor's signature: _____

Date: 9 Nov 2001

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Full name of second inventor:	Russell C. McKown
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DOCKET NO. WEST14-00014
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12-19-02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
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Group No.	:	2682
Examiner	:	(Not Yet Assigned)

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Commissioner for Patents
Washington, D.C. 20231

Sir:

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The undersigned hereby certifies that the following documents:

1. Postcard receipt;
2. Supplemental Information Disclosure Statement;
3. Form PTO-1449;
4. Copy of International Search Report issued in Int'l Application No. PCT/IB02/00138;
5. Six (6) references

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to Commissioner for Patents, Washington, D.C. 20231, on December 12, 2002.

Date: 12/12/02

Mailer

Date: Dec. 12, 2002

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PATENT

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Dear Sir:

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Pursuant to the duty of disclosure under 37 C.F.R. § 1.56, Applicant submits this statement. This submittal is made in accordance with 37 C.F.R. §§ 1.97 and 1.98 and § 609 of the Manual of Patent Examining Procedure. The patents, publications and other information herein are listed below and on the attached Form PTO-1449. These references were located in a International Search Report issued in the related PCT Patent Application No. PCT/IB02/00138, a copy of which is attached hereto. Copies of the listed references are submitted herewith.

United States Patents

U.S. PATENT NO.	INVENTOR	DATE
5,440,589	Kaku et al.	August 8, 1995

U.S. PATENT NO.	INVENTOR	DATE
6,011,785	Carney et al.	January 4, 2000

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Foreign Patents

PATENT NO.	COUNTRY	DATE
WO95/12296	PCT	May 4, 1995
WO00/28753	PCT	May 18, 2000
GB 2320991	UNITED KINGDOM	July 8, 1998
EP 0890271	EUROPE	January 13, 1999

Applicant hereby expressly reserves the right to swear behind the effective dates of any of the above Patents and to question the relevance and materiality of the Patents and Publications listed herein, in whole, in part, or in combination, subsequent to filing this Information Disclosure Statement.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: Dec. 12, 2002

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FORM PTO-1449 (REV. 7.80)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. WEST14-00014	SERIAL NO. 09/839,726
LIST OF REFERENCES CITED BY APPLICANT (Use several sheets if necessary)		APPLICANT Paul F. Struhsaker	
		FILING DATE April 20, 2001	GROUP 2682

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U. S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (if appropriate)
	AA	5,440,589	08/08/1995	Kaku, et al.	375	344	08/13/1993
	AB	6,011,785	01/04/2000	Carney, et al.	370	330	10/30/1996

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FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AC	WO 95/12296	05/04/1995	PCT				
	AD	WO 00/28753	05/18/2000	PCT				
	AE	GB 2320991	07/08/1998	United Kingdom				
	AF	EP 0890271	01/13/1999	Europe			Yes (Abstract	

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line if not in conformance and not considered. Include copy of this form with next communication to applicant.

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144,903 28 October 1993 (28.10.93) US

(71) Applicant: QUALCOMM INCORPORATED [US/US]; 6455 Lusk Boulevard, San Diego, CA 92121 (US).

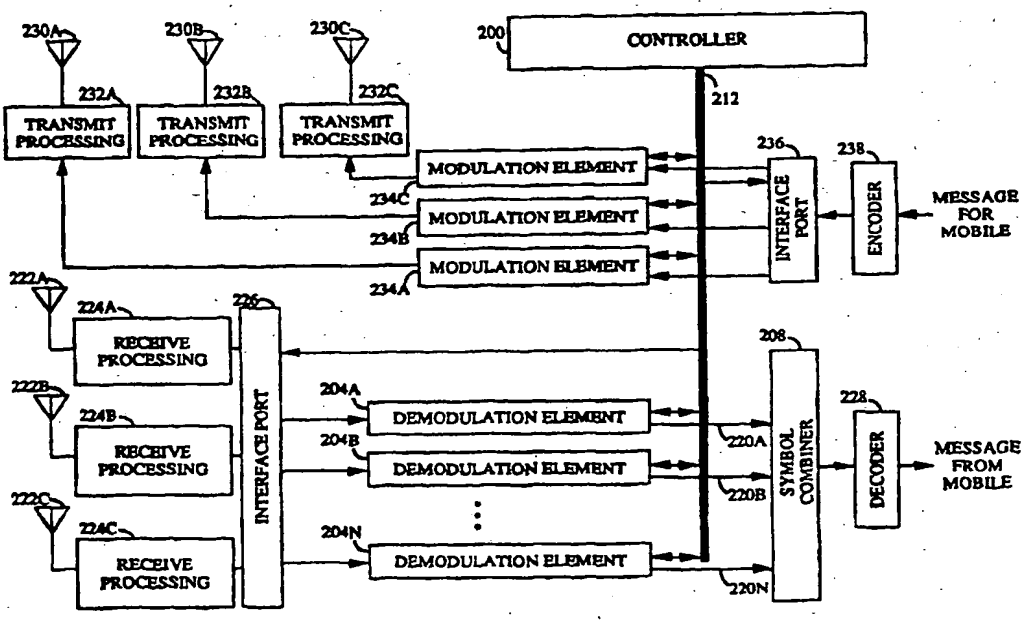
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(74) Agents: OGROD, Gregory, D. et al.; Qualcomm Incorporated, 6455 Lusk Boulevard, San Diego, CA 92121 (US).

(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ).

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(54) Title: METHOD AND APPARATUS FOR PERFORMING HANDOFF BETWEEN SECTORS OF A COMMON BASE STATION



(57) Abstract

A method and apparatus providing softer handoff of a mobile unit (90) between sectors (50, 70 and 80) of a common base station (60). A sectorized base station (60) comprises a set of demodulation elements (240A-204N). Each demodulation element (240A-204N) may be assigned to a signal from one of a plurality of sectors. The output of the demodulators (240A-204N) are combined before the decoding process independent of the sector from which the data originated. This configuration provides improved output data reliability, more stable power control, and more efficient use of resources at the base station.

BNSDOCID: <WO 9512296A1 I >

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METHOD AND APPARATUS FOR PERFORMING HANDOFF BETWEEN SECTORS OF A COMMON BASE STATION

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to communication systems, particularly to a method and apparatus for performing handoff between two sectors of a common base station.

II. Description of the Related Art

In a code division multiple access (CDMA) cellular telephone system or personal communications system, a common frequency band is used for communication with all base stations in a system. The common frequency band allows simultaneously communication between a mobile unit and more than one base station. Signals occupying the common frequency band are discriminated at the receiving station through the spread spectrum CDMA waveform properties based on the use of a high speed pseudonoise (PN) code. The high speed PN code is used to modulate signals transmitted from the base stations and the mobile units. Transmitter stations using different PN codes or PN codes that are offset in time produce signals that can be separately received at the receiving station. The high speed PN modulation also allows the receiving station to receive a signal from a single transmitting station where the signal has traveled over several distinct propagation paths.

A signal having traveled several distinct propagation paths generates the multipath characteristics of the radio channel. One characteristic of a multipath channel is the time spread introduced in a signal that is transmitted through the channel. For example, if an ideal impulse is transmitted over a multipath channel, the received signal appears as a stream of pulses. Another characteristic of the multipath channel is that each path through the channel may cause a different attenuation factor. For example, if an ideal impulse is transmitted over a multipath channel, each pulse of the received stream of pulses generally has a different signal strength than other received pulses. Yet another characteristic of the multipath channel is that each path through the channel may cause a

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different phase on the signal. For example, if an ideal impulse is transmitted over a multipath channel, each pulse of the received stream of pulses generally has a different phase than other received pulses.

In the radio channel, the multipath is created by reflection of the signal from obstacles in the environment, such as buildings, trees, cars, and people. In general the radio channel is a time varying multipath channel due to the relative motion of the structures that create the multipath. For example, if an ideal impulse is transmitted over the time varying multipath channel, the received stream of pulses would change in time location, attenuation, and phase as a function of the time that the ideal impulse was transmit.

The multipath characteristic of a channel can result in signal fading. Fading is the result of the phasing characteristics of the multipath channel. A fade occurs when multipath vectors added destructively, yielding a received signal that is smaller than either individual vector. For example if a sine wave is transmitted through a multipath channel having two paths where the first path has an attenuation factor of X dB, a time delay of δ with a phase shift of Θ radians, and the second path has an attenuation factor of X dB, a time delay of δ with a phase shift of $\Theta + \pi$ radians, no signal would be received at the output of the channel.

In narrow band modulation systems such as the analog FM modulation employed by conventional radio telephone systems, the existence of multiple path in the radio channel results in severe multipath fading. As noted above with a wideband CDMA, however, the different paths may be discriminated in the demodulation process. This discrimination not only greatly reduces the severity of multipath fading but provides an advantage to the CDMA system.

In an exemplary CDMA system, each base station transmits a pilot signal having a common PN spreading code that is offset in code phase from the pilot signal of other base stations. During system operation, the mobile unit is provided with a list of code phase offsets corresponding to neighboring base stations surrounding the base station through which communication is established. The mobile unit is equipped with a searching element that allows the mobile unit to track the signal strength of the pilot signal from a group of base stations including the neighboring base stations.

A method and system for providing a communication with the mobile unit through more than one base station during the handoff process

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are disclosed in U.S. Patent Application Serial No. 07/847,148, filed March 5, 1992, entitled "MOBILE ASSISTED SOFT HANDOFF IN A CDMA CELLULAR TELEPHONE SYSTEM," assigned to the assignee of the present invention. Using this system, communication between the mobile unit and the end user is uninterrupted by the eventual handoff from an original base station to a subsequent base station. This type of handoff may be considered as a "soft" handoff in that communication with the subsequent base station is established before communication with the original base station is terminated. When the mobile unit is in communication with two base stations, a single signal for the end user is created from the signals from each base station by a cellular or personal communication system controller.

Mobile unit assisted soft handoff operates based on the pilot signal strength of several sets of base stations as measured by the mobile unit. The Active Set is the set of base stations through which active communication is established. The Neighbor Set is a set of base stations surrounding an active base station comprising base stations that have a high probability of having a pilot signal strength of sufficient level to establish communication. The Candidate Set is a set of base stations having a pilot signal strength of sufficient level to establish communication.

When communications are initially established, a mobile unit communicates through a first base station and the Active Set contains only the first base station. The mobile unit monitors the pilot signal strength of the base stations of the Active Set, the Candidate Set, and the Neighbor Set. When a pilot signal of a base station in the Neighbor Set exceeds a predetermined threshold level, the base station is added to the Candidate Set and removed from the Neighbor Set at the mobile unit. The mobile unit communicates a message to the first base station identifying the new base station. A cellular or personal communication system controller decides whether to establish communication between the new base station and the mobile unit. Should the cellular or personal communication system controller decide to do so, the cellular or personal communication system controller sends a message to the new base station with identifying information about the mobile unit and a command to establish communications therewith. A message is also transmitted to the mobile unit through the first base station. The message identifies a new Active Set that includes the first and the new base stations. The mobile unit searches for the new base station transmitted information signal and communication is established with the new base station without

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termination of communication through the first base station. This process can continue with additional base stations.

When the mobile unit is communicating through multiple base stations, it continues to monitor the signal strength of the base stations of the Active Set, the Candidate Set, and the Neighbor Set. Should the signal strength corresponding to a base station of the Active Set drop below a predetermined threshold for a predetermined period of time, the mobile unit generates and transmits a message to report the event. The cellular or personal communication system controller receives this message through at least one of the base stations with which the mobile unit is communicating. The cellular or personal communication system controller may decide to terminate communications through the base station having a weak pilot signal strength.

The cellular or personal communication system controller upon deciding to terminate communications through a base station generates a message identifying a new Active Set of base stations. The new Active Set does not contain the base station through which communication is to be terminated. The base stations through which communication is established send a message to the mobile unit. The cellular or personal communication system controller also communicates information to the base station to terminate communications with the mobile unit. The mobile unit communications are thus routed only through base stations identified in the new Active Set.

Because the mobile unit is communicating with the end user though at least one base station at all times throughout the soft handoff processes, no interruption in communications occurs between the mobile unit and the end user. A soft handoff provides significant benefits in its inherent "make before break" communication over conventional "break before make" techniques employed in other cellular communication systems.

In a cellular or personal communication telephone system, maximizing the capacity of the system in terms of the number of simultaneous telephone calls that can be handled is extremely important. System capacity in a spread spectrum system can be maximized if the transmitter power of each mobile unit is controlled such that each transmitted signal arrives at the base station receiver at the same level. In an actual system, each mobile unit may transmit the minimum signal level that produces a signal-to-noise ratio that allows acceptable data recovery. If a signal transmitted by a mobile unit arrives at the base station receiver at a

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power level that is too low, the bit-error-rate may be too high to permit high quality communications due to interference from the other mobile units. On the other hand, if the mobile unit transmitted signal is at a power level that is too high when received at the base station, communication with this particular mobile unit is acceptable but this high power signal acts as interference to other mobile units. This interference may adversely affect communications with other mobile units.

Therefore to maximize capacity in an exemplary CDMA spread spectrum system, the transmit power of each mobile unit within the coverage area of a base station is controlled by the base station to produce the same nominal received signal power at the base station. In the ideal case, the total signal power received at the base station is equal to the nominal power received from each mobile unit multiplied by the number of mobile units transmitting within the coverage area of the base station plus the power received at the base station from mobile units in the coverage area of neighboring base stations.

The path loss in the radio channel can be characterized by two separate phenomena: average path loss and fading. The forward link, from the base station to the mobile unit, operates on a different frequency than the reverse link, from the mobile unit to the base station. However because the forward link and reverse link frequencies are within the same frequency band, a significant correlation between the average path loss of the two links exists. On the other hand, fading is an independent phenomenon for the forward link and reverse link and varies as a function of time.

In an exemplary CDMA system, each mobile unit estimates the path loss of the forward link based on the total power at the input to the mobile unit. The total power is the sum of the power from all base stations operating on the same frequency assignment as perceived by the mobile unit. From the estimate of the average forward link path loss, the mobile unit sets the transmit level of the reverse link signal. Should the reverse link channel for one mobile unit suddenly improve compared to the forward link channel for the same mobile unit due to independent fading of the two channels, the signal as received at the base station from this mobile unit would increase in power. This increase in power causes additional interference to all signals sharing the same frequency assignment. Thus a rapid response of the mobile unit transmit power to the sudden improvement in the channel would improve system performance.

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Mobile unit transmit power is also controlled by one or more base stations. Each base station with which the mobile unit is in communication measures the received signal strength from the mobile unit. The measured signal strength is compared to a desired signal strength level for that particular mobile unit. A power adjustment command is generated by each base station and sent to the mobile unit on the forward link. In response to the base station power adjustment command, the mobile unit increases or decreases the mobile unit transmit power by a predetermined amount. By this method, a rapid response to a change in the channel is effected and the average system performance is improved.

When a mobile unit is in communication with more than one base station, power adjustment commands are provided from each base station. The mobile unit acts upon these multiple base station power adjustment commands to avoid transmit power levels that may adversely interfere with other mobile unit communications and yet provide sufficient power to support communication from the mobile unit to at least one of the base stations. This power control mechanism is accomplished by having the mobile unit increase its transmit signal level only if every base station with which the mobile unit is in communication requests an increase in power level. The mobile unit decreases its transmit signal level if any base station with which the mobile unit is in communication requests that the power be decreased. A system for base station and mobile unit power control is disclosed in U.S. Patent No. 5,056,109 entitled "METHOD AND APPARATUS FOR CONTROLLING TRANSMISSION POWER IN A CDMA CELLULAR MOBILE TELEPHONE SYSTEM," issued October 8, 1991, assigned to the Assignee of the present invention.

Base station diversity at the mobile unit is an important consideration in the soft handoff process. The power control method described above operates optimally when the mobile unit communicates with each base station through which communication is possible. In doing so, the mobile unit avoids inadvertently interfering with communications through a base station receiving the mobile unit's signal at an excessive level but unable to communicate a power adjustment command to the mobile unit because communication is not established therewith.

A typical cellular or personal communication system contains some base stations having multiple sectors. A multi-sectored base station comprises multiple independent transmit and receive antennas. The

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present invention is a method and apparatus of handoff between sectors of a common base station. The present invention is called softer handoff.

It is therefore the object of the present invention to provide method and apparatus for performing handoff between two sectors of a common base station.

It is another object of the present invention to provide method and apparatus for performing softer handoff between two sectors of a common base station such that improved power control performance is provided.

It is yet another object of the present invention to provide method and apparatus for performing softer handoff between two sectors of a common base station such that base station resources are used efficiently.

SUMMARY OF THE INVENTION

The present invention defines a method and apparatus for performing softer handoff between sectors of a common base station. The method and apparatus provide a set of demodulation elements in the base station. The demodulation elements, instead of being assigned to a single sector, may be assigned to a signal from any one of a set of sectors in the base station. Thus, the base station may use it resources with high efficiency by assigning demodulation elements to the strongest signals available.

The combination process in softer handoff allows demodulated data from different sectors to be combined before decoding and thus produce a single soft decision output value. The combination process can be performed based on the relative signal level of each signal thus providing the most reliable combination process.

Combining signals from sectors of a common base station also allows a sectorized base station to make a single power adjustment command for mobile unit power control. Thus the power adjustment command from each sector of a common base station is the same. This uniformity in power control allows flexible handoff operation in that sector diversity at the mobile unit is not critical to the power control process.

BRIEF DESCRIPTION OF THE DRAWINGS

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

Figure 1 is a diagram illustrating an exemplary base station coverage area structure;

Figure 2 is a block diagram illustrating an exemplary sectorized base station comprising multiple independent sectors;

Figure 3 is a block diagram illustrating an exemplary sectorized base station according to the present invention; and

Figure 4 is an exemplary representation of the coverage area of three sectors of a sectorized base station.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 illustrates an exemplary base station coverage area structure. In such an exemplary structure, hexagonal base station coverage areas abut one another in a symmetrically tiled arrangement. Each mobile unit is located within the coverage area of one of the base stations. For example, mobile unit 10 is located within the coverage area of base station 20. In a code division multiple access (CDMA) cellular or personal communication telephone system, a common frequency band is used for communication with all base stations in a system allowing simultaneously communication between a mobile unit and more than one base station. Mobile unit 10 is located very close to base station 20 and therefore receives a large signal from base station 20 and relatively small signals from surrounding base stations. However mobile unit 30 is located in the coverage area of base station 40 but is close to the coverage area of base stations 100 and 110. Mobile unit 30 receives a relatively weak signal from base station 40 and similarly sized signals from base stations 100 and 110. Mobile unit 30 might be in soft handoff with base stations 40, 100, and 110.

The exemplary base station coverage area structure illustrated in Figure 1 is highly idealized. In the actual cellular or personal communication environment, base station coverage areas may vary in size and in shape. Base station coverage areas may tend to overlap with coverage area boundaries defining coverage area shapes different from the ideal hexagon shape. Furthermore, base stations may also be sectored such as into three sectors, as is well known in the art. Furthermore, base stations may also be sectored such as into three sectors, as is well known in the art. Base station 60 is shown as a three sectored base station. However base stations with lesser or greater numbers of sectors are envisioned.

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Base station 60 of Figure 1 represents an idealized three sectored base station. Base station 60 has three sectors, each of which covers more than 120 degrees of the base station coverage area. Sector 50, having a coverage area indicated by the unbroken lines 55, overlaps the coverage area of sector 70, having a coverage area indicated by the coarse dashed lines 75. Sector 50 also overlaps the sector 80, having a coverage area as indicated by the fine dashed lines 85. For example, location 90 as indicated by the X is located in both the coverage area of sector 50 and sector 70.

In general a base station is sectorized to reduce the total interference power to mobile units located within the coverage area of the base station while increasing the number of mobile units that can communicate through the base station. For example, sector 80 would not transmit a signal intended for a mobile unit at location 90 and thus no mobile unit located in sector 80 is significantly interfered with by the communication of a mobile unit at location 90 with base station 60.

For a mobile unit positioned at location 90, the total interference has contributions from sectors 50 and 70 and from base stations 20 and 120. A mobile unit a location 90 might be in softer handoff, as described below, with sectors 50 and 70. A mobile unit at location 90 may simultaneously be in soft handoff with base stations 20 and 120.

A method and system for providing communication with a mobile unit through more than one base station during the handoff process are disclosed in U.S. Patent Application Serial No. 07/847,148 as described above. This type of handoff may be considered a "soft" handoff in that communication with the subsequent base station is established before communication with the original base station is terminated.

At a unsectorized base station, a set of multipath signals from a single mobile unit are separately demodulated and then combined before the decoding process. Therefore the decoded data output from each base station is based on all of the advantageous signal paths available from the mobile unit. The decoded data is sent to the cellular or personal communication system controller from each base station in the system.

For each mobile unit operating in soft handoff in the system, the cellular or personal communication system controller receives decoded data from at least two base stations. For example, in Figure 1 the cellular or personal communications system controller would receive decoded data from mobile unit 30 from base stations 40, 100 , and 110. Combining the decoded data does not yield the great advantage of combining the data prior

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to decoding. A typical cellular or personal communication system controller may choose not to combine the decoded data from each base station and instead select the decoded data from the base station having the highest signal quality index and discard the data from any other base station.

The method of soft handoff could be directly applied to a sectorized base station by treating each sector of a common base station as a separate, independent base station. Each sector of the base station could combine and decode multipath signals from a common mobile unit. The decoded data could be sent directly to the cellular or personal communication system controller by each sector of the base station or it could be compared and selected at the base station and the result sent to the cellular or personal communication system controller.

Figure 2 illustrates an exemplary embodiment of a three sectored base station that does not employ the present invention. In Figure 2, each of antennas 310, 326, and 344 is the receive antenna for one sector of a common base station. Figure 2 represents a typical sectorized base station in that antennas 310, 326, and 344 have overlapping coverage areas such that a single mobile unit signal may be present at more than one antenna at a time.

Antennas 310, 326, and 344 supply a receive signal to receive processings 312, 328, and 346 respectively. Receive processings 312, 328, and 346 process the RF signal and convert the signal to digital bits. Receive processings 312, 328, and 346 may also filter the digital bits. Receive processing 312 provides the filtered digital bits to demodulation elements 316A - 316N. Receive processing 328 provides the filtered digital bits to demodulation elements 332A - 332N. Likewise, receive processing 346 provides the filtered digital bits to demodulation elements 350A - 350N.

Demodulation elements 316A - 316N are controlled by controller 318 through interconnection 320. Controller 318 assigns demodulation elements 316A - 316N to one of the plurality of information signals from a single mobile unit. Demodulation elements 316A - 316N produce data bits 322A - 322N that are combined in symbol combiner 324. The output of symbol combiner 324 may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 314 and output Message 1 from the mobile unit is passed to the cellular or personal communications system controller.

A power adjustment command for the mobile unit is created by the controller from the estimated signal strengths of each signal demodulated

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by demodulation elements 316A - 316N. The controller can pass the power control information to the transmit circuitry of this sector of the base station (not shown) to be relayed to the mobile unit.

Demodulation elements 332A - 332N are controlled by controller 334 through interconnection 336. Controller 334 assigns demodulation elements 332A - 332N to one of the plurality of information signals from a single mobile unit. Demodulation elements 332A - 332N produce data bits 338A - 338N that are combined in symbol combiner 340. The output of symbol combiner 340 may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 342 and output Message 2 from the mobile unit is passed to the cellular or personal communications system controller.

A power adjustment command for the mobile unit is created by the controller from the estimated signal strengths of each signal demodulated by demodulation elements 332A - 332N. The controller can pass the power control information to the transmit circuitry of this sector of the base station (not shown) to be relayed to the mobile unit.

Demodulation elements 350A - 350N are controlled by controller 352 through interconnection 354. Controller 352 assigns demodulation elements 350A - 350N to one of the plurality of information signals from a single mobile unit from the corresponding sector. Demodulation elements 350A - 350N produce data bits 356A - 356N that are combined in symbol combiner 352. The output of symbol combiner may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 360 and the output Message 3 from the mobile unit is passed to the cellular or personal communications system controller.

A power adjustment command for the mobile unit is created by the controller from the estimated signal strengths of each signal demodulated by demodulation elements 350A - 350N. The controller can pass this information to the transmit circuitry of this sector of the base station (not shown) to be relayed to the mobile unit.

The present invention provides a much improved version of handoff between sectors of a common base station. In the present invention, signals from sectors of a common base station are combined within the base station in the same manner as multipath signals from an unsectorized base station. Signals from sectors of a common base station are combined before decoding occurs thus providing an improved system performance.

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In the present invention, the process of soft handoff and the process of softer handoff are the same from the mobile unit's perspective. However the base station operation in softer handoff is different from soft handoff. The handoff process as described in U.S. Patent Application Serial No. 07/847,148 referred to above, is summarized in the following steps as applied to handoff between two sectors of a common base station.

Normal operation of softer handoff:

1: Mobile unit is communicating with base station X through sector alpha antenna meaning base station X, sector alpha is identified as a member of the Active Set.

2: Mobile unit monitors that the pilot signal from base station X, sector beta antenna that is identified as a member of the Neighbor Set. The pilot signal strength from base station X, sector beta antenna exceeds a predetermined threshold.

3: Mobile unit identifies base station X, sector beta as a member of the Candidate Set and informs base station X through sector alpha antenna.

4: Base station X establishes the availability of resources in sector beta.

5: Sector beta antenna begins to receive a reverse link signal from mobile unit.

6: Sector beta antenna begins to transmit a forward link signal to mobile unit.

7: Base station X through sector alpha antenna updates the mobile unit Active Set to identify sector beta as a member.

8: Mobile unit establishes communication with base station X, sector beta antenna. Mobile unit combines the signals from sector alpha antenna and sector beta antenna based on the signal strength of the pilot signal from the corresponding sector antenna.

9: Base station X combines the signals from mobile unit received through sector alpha antenna and sector beta antenna (softer handoff).

Figure 3 illustrates an exemplary embodiment of a three sectored base station. Figure 3 is a representation of a preferred embodiment of the present invention in a three sectored base station however the ideas present invention are equally applicable to base stations with fewer or more sectors. Although only one receive antenna is show for each sector, typically two antennas are used for diversity with the receive signal combined for processing.

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In Figure 3, each of antennas 222A - 222C is the receive antenna for one sector and each of antennas 230A - 230C is the transmit antenna for one sector. Antenna 222A and antenna 230A correspond to a common coverage area and can ideally have the same antenna pattern. Likewise antennas 222B and 230B, and antennas 222C and 230C correspond to common coverage areas respectfully. Figure 3 represents a typical base station in that antennas 222A - 222C have overlapping coverage areas such that a single mobile unit signal may be present at more than one antenna at a time.

Figure 4 is a more realistic representation of the coverage areas of three sectors of a sectorized base station than base station 60 of Figure 1. Coverage area 300A, as represented by the finest line, corresponds to the coverage area of both antennas 222A and 230A. Coverage area 300B, as represented by the medium width line, corresponds to the coverage area of both antennas 222B and 230B. Coverage area 300C, as represented by the heaviest line, corresponds to the coverage area of both antennas 222C and 230C. The shape of the three coverage areas is the shape produced by standard directional dipole antenna. The edges of the coverage areas can be thought of as the location at which a mobile unit receives the minimum signal level to support communication through that sector. As a mobile unit moves into the sector, the signal strength increases. As a mobile unit moves past the edge of the sector, communication through that sector may degrade. A mobile unit operating in softer handoff mode is likely to be located in the overlapped region of two coverage areas.

Referring again to Figure 3, antennas 222A, 222B, and 222C supply the received signal to receive processings 224A, 224B, and 224C respectively. Receive processings 224A, 224B, and 224C process the RF signal and convert the signal to digital bits. Receive processings 224A, 224B, and 224C may filter the digital bits and provide the resulting digital bits to interface port 226. Interface port 226 may connect any of the three incoming signal paths to any of the demodulation elements 204A - 204N under the control of controller 200 through interconnection 212.

The preferred embodiment of Figure 3 gives an implementation where receive processings 224A, 224B, and 224C produce digital bits and interface port 226 is a digital device. This portion of the architecture could be implemented in a variety of methods. In one alternative method, receive processing 224A, 224B, and 224C pass analog signals to

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demodulation elements 204A - 204N and interface port 226 incorporates the appropriate analog circuitry.

Continuing in with the preferred embodiment, demodulation elements 204A - 204N are controlled by controller 200 through interconnection 212. Controller 200 assigns demodulation elements 204A - 204N to one of the plurality of information signals from a single mobile unit from any one of the sectors. Demodulation elements 204A - 204N produce data bits 220A - 220N each representing an estimate of the data from the single mobile unit. Data bits 220A - 220N are combined in symbol combiner 208 to produce a single estimate of the data from the mobile unit. The output of symbol combiner 208 may be aggregate soft decision data suitable for Viterbi decoding. The combined symbols are passed to decoder 228.

Demodulation elements 204A - 204N also provide several output control signals to controller 200 through interconnection 212. The information passed to controller 200 includes an estimate of the signal strength of the signal assigned to a particular demodulator. Each one of demodulation elements 204A - 204N measures a signal strength estimation of the signal that it is demodulating and provides the estimation to controller 200.

In many applications, an actual base station also comprises at least one searcher element. The searcher element is also capable of demodulating a signal and is used to continually scan the time domain in search of available signals. The searcher element identifies a set of available signals and passes the information to the controller. The controller may use the set of available signals to assign or re-assign the demodulation elements to the most advantageous signals available. The placement of the searcher element is the same as the placement of the demodulating elements in Figure 2. As such the searcher elements may also be assigned to a signal from a plurality of sectors of a common base station. In the most general case, demodulation elements 204A - 204N can be assumed to comprise some elements that are capable of performing the searching function.

Notice that symbol combiner 208 can combine signals from just one sector to produce an output or it can combine symbols from multiple sectors as selected by the interface port 226. A single power control command is created by the controller from the estimated signal strengths independent of the sector through which the signal is received. The controller can pass this information to the transmit circuitry of each sector of the base station. Thus

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each sector in the base station transmits the same power control information to a single mobile unit.

When symbol combiner 208 is combining signals from a mobile unit that is communicating through more than one sector, the mobile unit is in softer handoff. The base station may send the output of decoder 228 to a cellular or personal communication system controller. At the cellular or personal communication system controller, signals from this base station and from other base stations are used produce a single output (soft handoff.)

The transmit process shown in Figure 3 receives a message for a mobile unit from the end user through the cellular or personal communication system controller. The message can be sent on one or more of antennas 230A - 230C. Interface port 236 connects the message for the mobile unit to one of more of modulation elements 234A - 234C as set by controller 200. Modulation elements modulate the message for the mobile unit with the appropriate PN code. The modulated data from modulation elements 234A - 234C is passed to transmit processing 232A - 232C respectively. Transmits processings 232A - 232C convert the message to an RF frequency and transmit the signal at an appropriate signal level through antennas 230A - 230C respectively. Notice that interface port 236 and interface port 226 operate independently in that receiving a signal from a particular mobile unit through one of antennas 222A - 222C does not necessarily mean that the corresponding transmit antenna 230A - 230C is transmitting a signal to the particular mobile unit. Also note that the power control commands sent through each antenna is the same, thus sector diversity from a common base station is not critical for the optimal power control performance.

Another feature of the present invention is the increased flexibility of the base station resources. Comparing Figure 2 to Figure 3, the flexibility is apparent. In the three sectors represented in Figure 2, suppose that the sector corresponding to antenna 310 is heavily loaded with signals such that the number of incoming signals is greater than the number of demodulation elements. The fact that the sector corresponding to antenna 326 is lightly loaded and has unused demodulation elements does not aid the sector corresponding to antenna 310. In Figure 3, however, each demodulation element may be assigned to a plurality of sectors thus allowing allocation of resources to the most heavily loaded sector.

There are many obvious variations to the present invention as presented including simple architectural changes. The previous description

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of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. The various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without the use of the inventive faculty. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

WE CLAIM:

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CLAIMS

1. An apparatus for receiving a plurality of signals through a set of antenna system comprising:

a plurality of demodulation elements, each of said plurality of demodulation elements having an input and an output;

a controllable switch deposed between said set of antenna systems and said input of at least one of said plurality of demodulation elements such that said at least one of said plurality of demodulation elements may be switchablely connected to any one of at least two antenna systems of said set of antenna systems; and

means for controlling said controllable switch.

2. The apparatus of Claim 1 comprising means for combining having a set of inputs, each input of said set of inputs coupled to said output of one of said plurality of demodulation elements.

3. A method of providing communication between a mobile unit and a base station, said base station having a plurality of antennas, comprising the steps of:

receiving through a first antenna at said base station a first signal from said mobile unit;

coupling through said first signal to a first receiver to provide an output signal from said first receiver;

receiving from a second antenna at said base station a second signal from said mobile unit;

coupling through said second signal to a second receiver to provide an output signal from said second receiver; and

combining said output signal from said first receiver and said output signal from said second receiver to produce an aggregate output signal.

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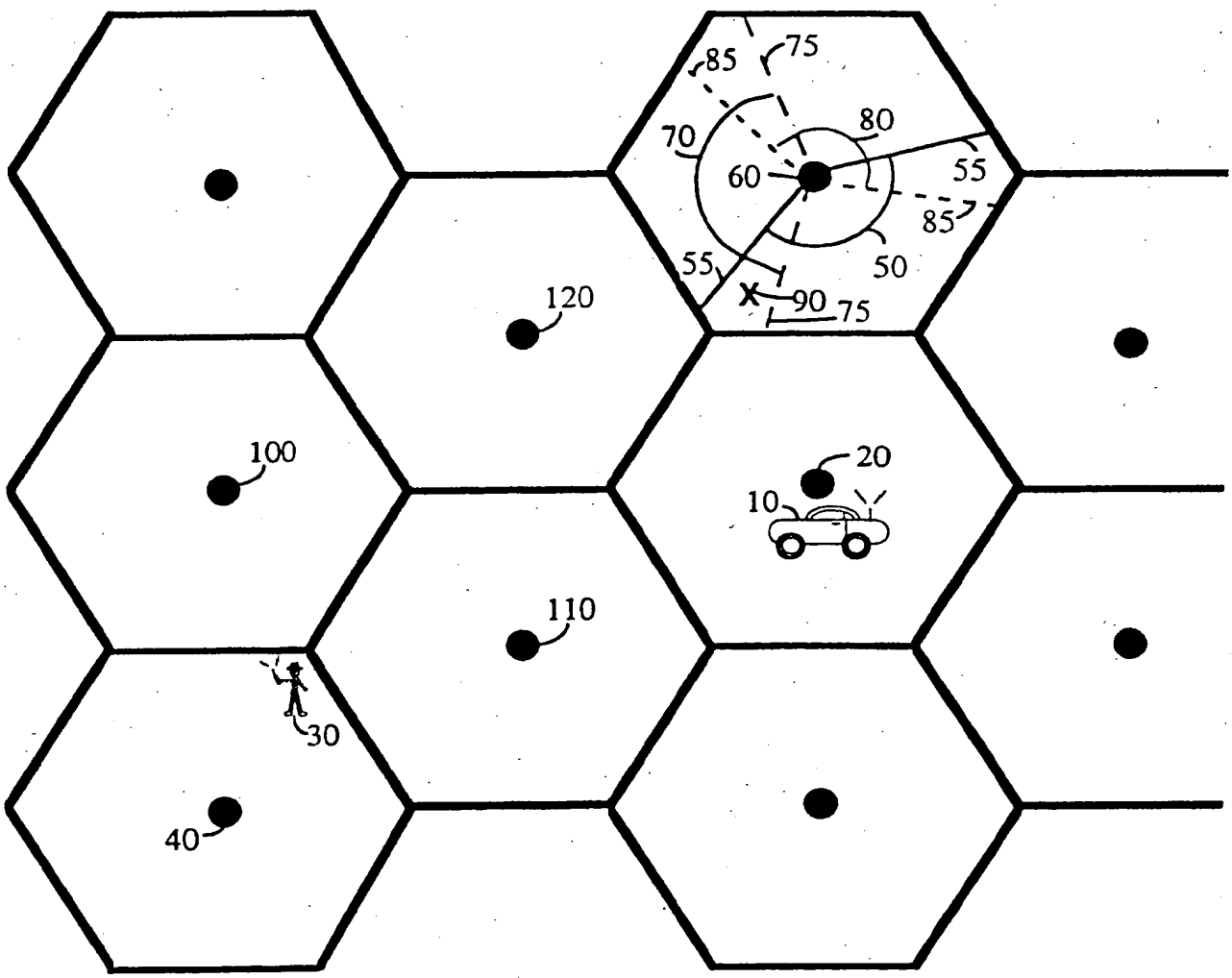


FIG. 1

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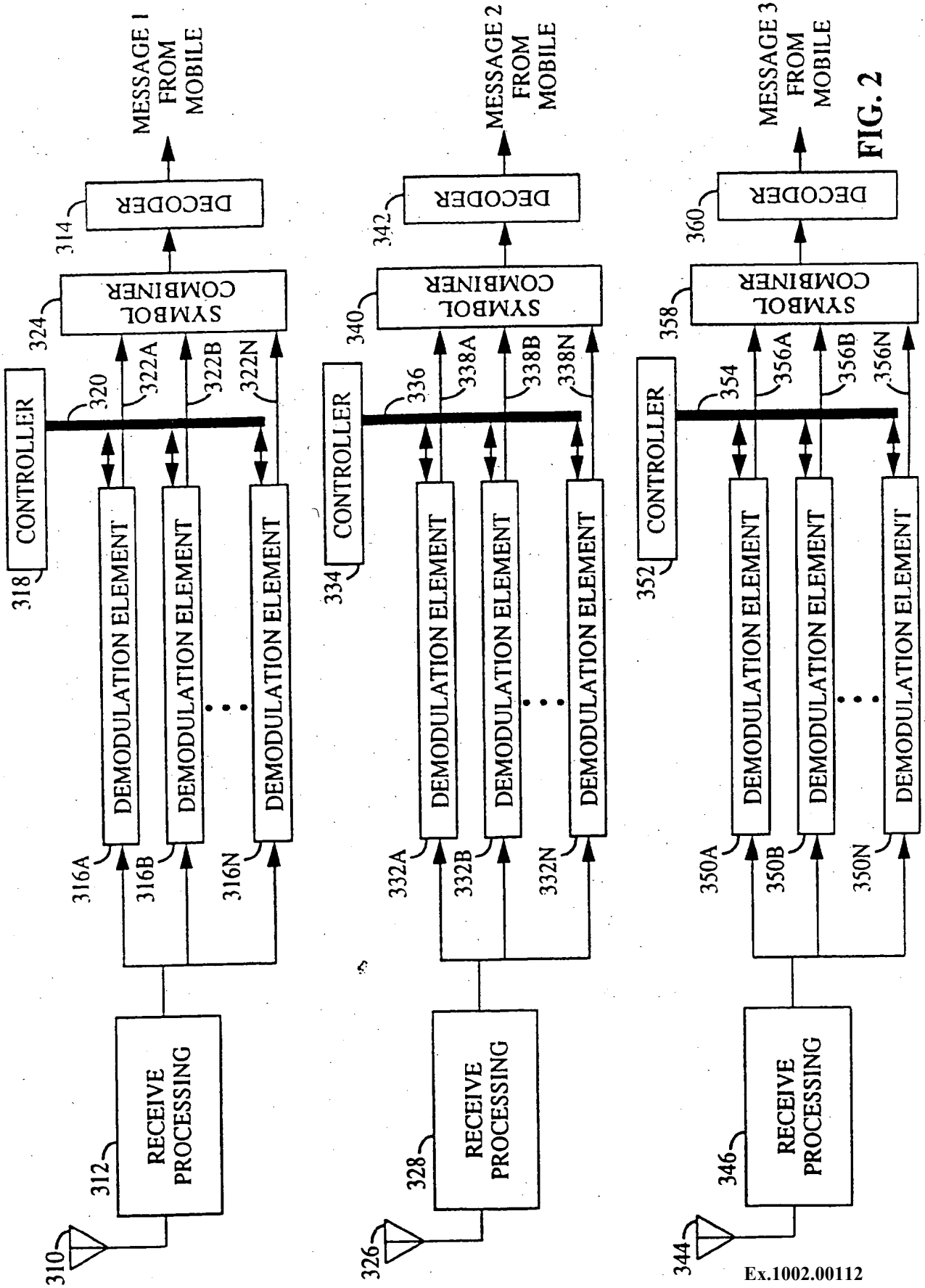


FIG. 2

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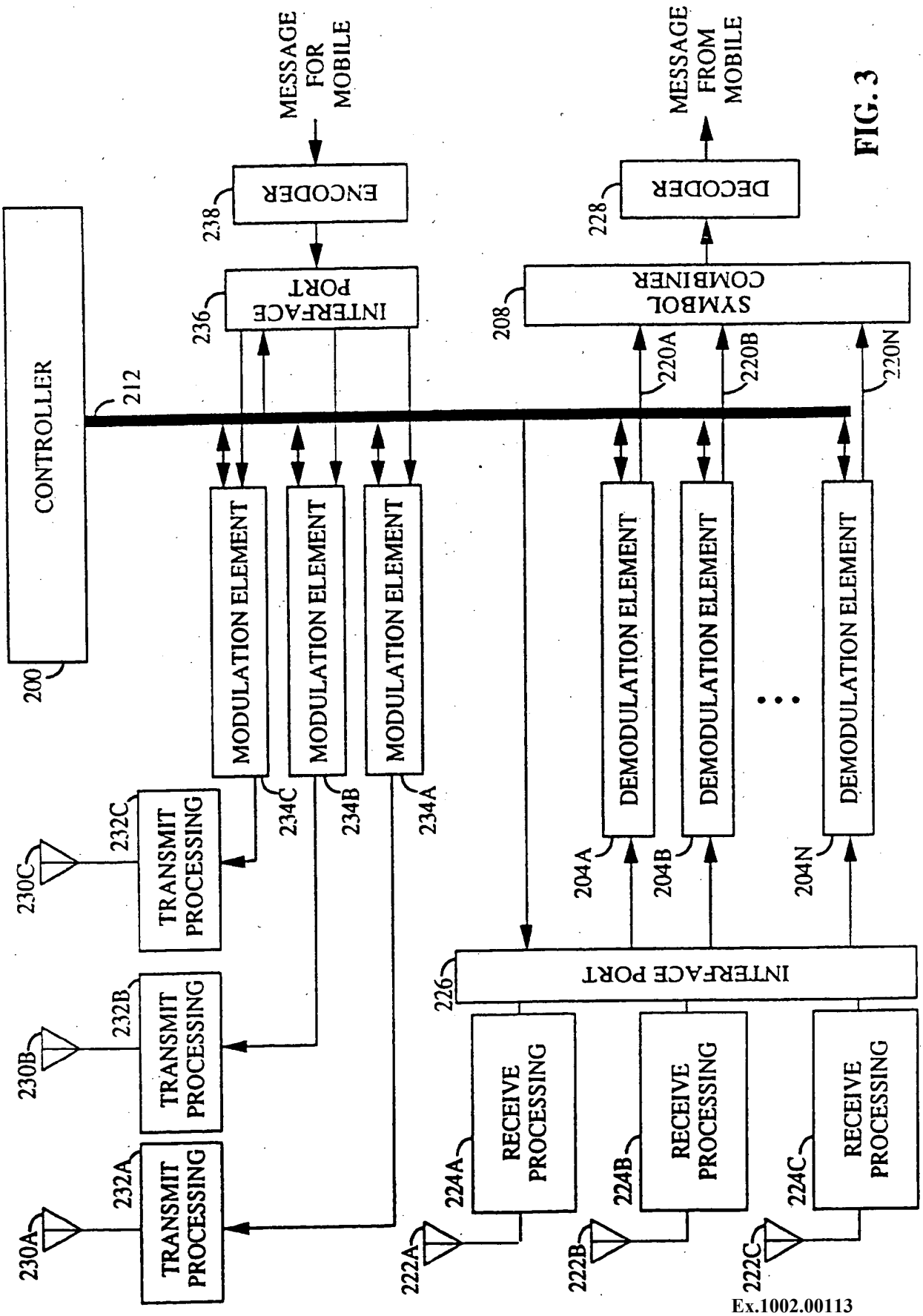


FIG. 3

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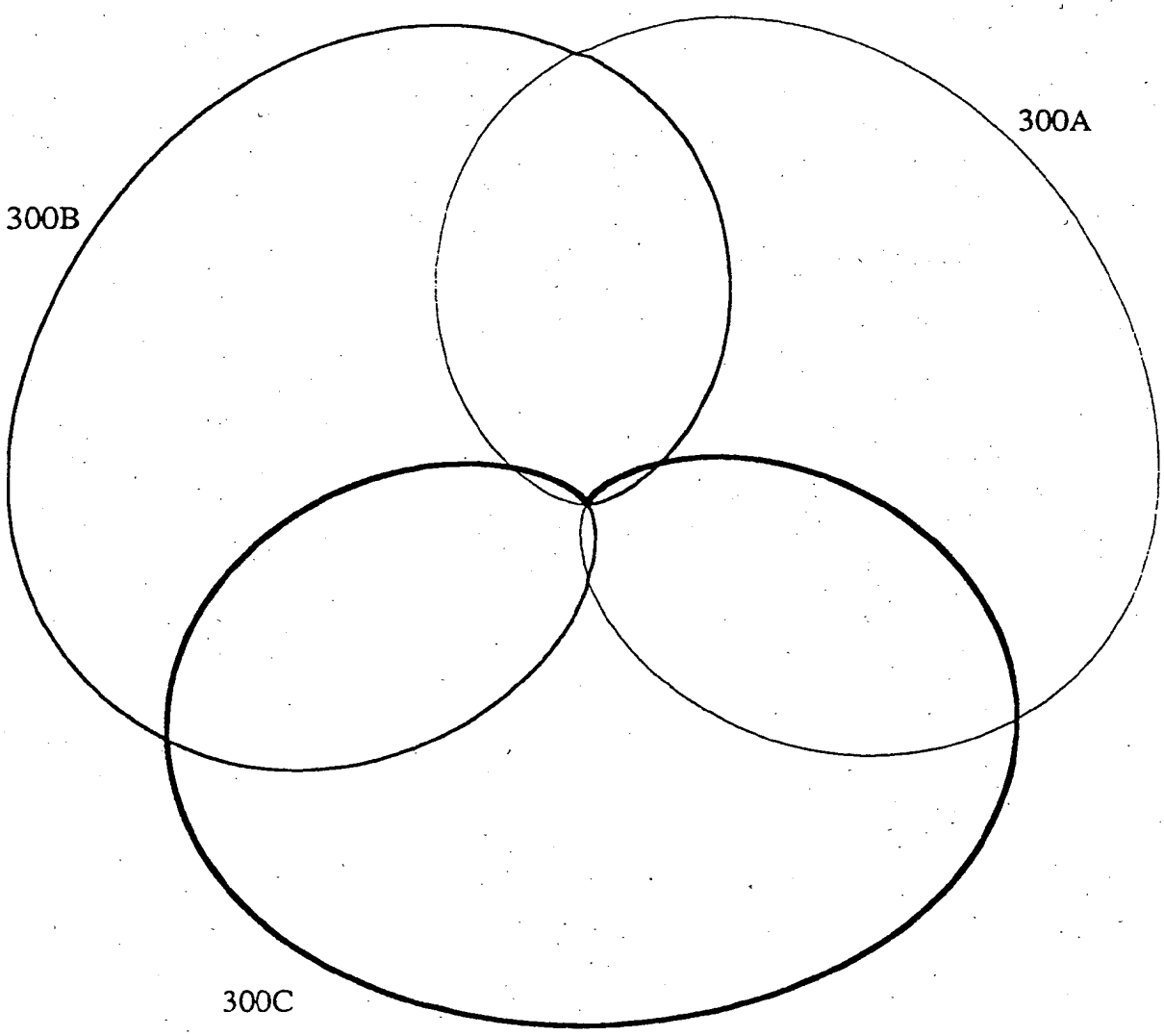


FIG. 4

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INTERNATIONAL SEARCH REPORT

Interr ial Application No
PCT/US 94/12453

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

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)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,92 17954 (PACTEL) 15 October 1992 see page 6, line 35 - page 7, line 25 see page 9, line 16 - page 10, line 18 see page 12, line 34 - page 16, line 10 see page 17, line 4 - page 18, line 8 see page 28, line 11 - page 29, line 18; figures	1-3
A	WO,A,91 07036 (QUALCOMM) 16 May 1991 see page 11, line 6 - page 12, line 26	1-3

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

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Date of the actual completion of the international search	Date of mailing of the international search report
9 February 1995	08.03.95

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

information on patent family members

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(54) Title: LOCAL MULTIPOINT DISTRIBUTION SERVICE BASE STATION APPARATUS

(57) Abstract

A local multipoint distribution service base station apparatus for sending and receiving communication signals to and from subscribers includes a base unit having at least one rack which is adapted to receive at least one subrack. At least one communication signal generating unit is also arranged and configured to be received by the subrack. In addition, a transmitting/receiving unit is operationally connected to the base unit for transmitting and/or receiving the communication signals to and from the subscribers.

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LOCAL MULTIPOINT DISTRIBUTION SERVICE BASE STATION APPARATUS

TECHNICAL FIELD OF THE INVENTION

The present invention generally relates to a local multipoint distribution service (LMDS) system or local multipoint communication system (LMCS), and more particularly to the base station architecture of the LMDS system.

BACKGROUND OF THE INVENTION

The LMDS system provides a "wireless local loop" or the "last mile" link to subscribers for fixed communication services such as video and telephony including data information such as facsimile and computer signals. The LMDS system includes a base station or node for sending and receiving selected communication signals to and from a customer premises equipment (CPE) which is remotely located with the subscribers. In addition to the CPE, the base station is also connected to a video serving office or other distribution centers for video content and to a central office switched telephony network for telephony services. A typical LMDS system consists of several base stations per central office and video serving office, and several thousand CPE sites per base station. In this manner, the LMDS system is a "point-to-multipoint" cellular communication system, the base station being the point, and the CPE sites, the multipoint. The connection between the

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base station and the subscribers is generally through broadband radio frequency (RF). The bandwidth depends on the spectrum allocation but is generally about 1 GHz. The subscriber equipment or CPE tunes to one or more RF frequency channels within the 1 GHz band to connect to the base station.

It is cost effective to have the capacity of the base station correspond to the demand of the subscribers linked to the base station at a given time. However, it is difficult to predict the number of subscribers who will be linked to the base station, especially when the LMDS system is initially being implemented. Consequently, if the number of subscribers grows unexpectedly from the initially projected number, a conventional base station would not be capable of servicing all the subscribers without an extensive and time consuming reconfiguration of the base station, which is an expensive operation. On the other hand, if the number of subscribers predicted is too high or if a significant number of the subscriptions is canceled, the base station would operate at undercapacity.

Also, the conventional base stations generally include a base unit and a remote unit which are physically partitioned from each other. The remote unit includes an antenna which is located, for example, on a tower or on top of a building, and is connected to the other parts of the remote unit via a long wave-guide. A disadvantage of using a long waveguide is that it is expensive and prone to excessive loss (approximately 15 dB/100ft). Routing the wave-guide to the top of a building, for example, is also a difficult task.

SUMMARY OF THE INVENTION

In accordance with the present invention, an approved base station for cost effectively implementing an LMDS system is provided.

In one embodiment of the present invention, a local multipoint distribution service base station apparatus is disclosed for sending and receiving communication signals to and from a plurality of remotely located subscriber equipment. The apparatus includes a base station having at least one rack, the rack configured and adapted to receive at least one sub-rack. The apparatus also includes at least one communication signal generating means arranged and configured to be received by at least one sub-rack. Also, a transmitting/receiving unit is operationally connected to the base unit for transmitting and receiving the communication signals to and from the subscriber equipment.

Technical advantages of the present invention include an improved base station having a base unit which has a modular configuration to allow operation of both small and large systems. The base station may also adopt a modular configuration for grouping similar functions in approximately located shelves to minimize cabling and RS signal impairments. The base unit may also include a remote unit which minimizes the length of the waveguide between an antenna and the other remote unit electronics. In a particular embodiment, this remove unit integrates an antenna in the associated transmitter and receiver into a single assembly.

Other technical advantages are readily apparent to one skilled in the art from the following figures, descriptions, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and for further features and advantages, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a block diagram of a local multipoint distribution service system of this invention;

FIG. 2 is a block diagram of a base station embodying the present invention;

FIG. 3 is a front view of the base unit of FIG. 2;

FIG. 4 is a front view one of the racks of FIG. 3;

FIG. 5 is a perspective view of one of the racks of FIG. 3;

FIG. 6 is a front view of one of the racks of FIG. 3;

FIG. 7 is a side view of the rack of FIG. 6;

FIG. 8 is a perspective view of a rack enclosed in a housing;

FIG. 9 is a perspective view of a remote unit embodying the present invention; and

FIG. 10 is a side view of the remote unit of FIG. 9, with the cover removed.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to the architecture of a base station of a local multipoint distribution cellular communication system that can provide telephony/data and video services to residential, business and educational facilities. One of the novel features of the present base station is that the components of the base station are provided in modules according to their functions, so that these modules can be added or removed correspondingly with an increase or a decrease in demand on the base station. Another novel feature of the present invention is that the antenna is integrated into an assembly with the electronics of the transmitting/receiving unit of the base station.

Broadly stated, a local multipoint distribution service base station apparatus for sending and receiving communication signals to and from a plurality of remotely located subscriber equipment includes a base unit having, at least one rack which is configured and adapted to receive at least one subrack. Also, at least one communication signal generating unit is arranged and configured to be received in the subrack. A transmitting/receiving unit is operationally connected to the base unit for transmitting and receiving the communication signals to and from the subscriber equipment.

In another embodiment, a local multipoint distribution service base station apparatus for sending and receiving communication signals to and from subscriber equipment includes a communication signal generating unit for generating the communication signals. A transmitting/receiving unit is operationally connected to the communication signal generating unit and is adapted to transmit/receive the communication signals to and from the

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subscriber equipment. Also, an antenna unit is operatively connected to the transmitting/receiving unit for directing and receiving the communication signals to and from the subscriber equipment. The antenna unit and the transmitting/receiving unit are arranged and configured into an integrated assembly.

Turning now to the drawings, and particularly FIG. 1, a block diagram of a local multipoint distribution service (LMDS) system, indicated generally at 20, is shown and generally includes a base station or node 22 having a base unit 24 and a remote unit 26. The remote unit 26 is linked to a customer premises equipment (CPE) 28 which receives video, and/or telephony services from the base station 22. The base unit 24 is connected to a video serving office (VO) 30 or other distribution centers that provide the video content to the base station 22. Also connected to the base unit 24 is a central office (CO) switch 32 which provides the telephony services.

Turning now to FIG. 2, the base unit 24 includes a multiplexer 34 which connects the base station 22 to the VO 30 and the CO 32 via a known "backhaul" network 35 such as a NOC-x synchronous optical network (SONET) ring or a DS3 network, which are broad bandwidth networks. If the connection is made to a DS3 network, the multiplexer 34 provides the multiplexing from DS3 (44 Mbps) rates to DS1 (1.544 Mbps) rates and if connected to a SONET network, the multiplexer 34 translates from OC-48 (2.488Mbps) rates to OC-3 (155 Mbps) rates.

The video signals from the multiplexer 34 are supplied to the video unit 36 which allows the mapping between RF channels, in which the video signals are sent to the subscribers, and the backhaul channels. The RF carriers containing the video channels can be analog or digitally

modulated. The telephony signals from the multiplexer 34 are supplied to a telephony unit 38 which performs multiplexing and demultiplexing functions to convert downstream signals (base station to CPE) and upstream signals (CPE to base station) into asymmetric data streams. For downstream transmission, the telephony unit bundles as much traffic as possible into a downstream RF carrier. For example, the industry standard transmission format such as OC-3, DS1 or E1 (2.048 Mbps) is bundled into a high-speed time-division-multiplexed signal (e.g., DS3). In the preferred embodiment, the bundled signal contains 28 T1s, (44.7 Mbps) or 16 E1s for international applications. Additional control bytes are added for forward error correction, radio control, and potentially for encryption.

Thus described feature in which data is sent at an asymmetric rate during the upstream and downstream transmissions is an important aspect of the present invention. High-speed telephony downstream transmission is ideally suited for a point-to-multipoint communication in that the signals are broadcast to all receivers. Each receiver tunes to a designated frequency and time slot; however, each receiver has access to any downstream signals. The receiver demultiplexes the downstream signals to recover only the bit stream of interest. By increasing the downstream data rate, the number of downstream transmitters (or number of RF carriers per transmitter) can be reduced. In addition, every RF channel requires some amount of guard-band to prevent adjacent channel interference. Fewer channels take fewer guard-bands and therefore, more payload can be sent per a given band. As a result the spectral efficiency is increased.

Upstream transmission is performed at a lower rate of about 3.3 Mbps which accommodates both DS1 and E1 payloads

and can be either in continuous format or burst format. The telephony unit 38 is used to reformat the data to a symmetric format for transmission by the multiplexer 34 to the backhaul network 35. Continuous format supports fixed services such as T1 or E1. In burst mode, multiple CPEs 28 can share an RF channel using a time-division multiple access (TDMA) scheme. With the TDMA scheme, the time of transmission of a burst must be timed such that the bursts arrive at the receiving base station 22 at a precise time. Preferably, the burst format consists of a 28 byte pocket in a 2 milli-second frame to support the DS1 telephony frame rate. In this manner, twenty-four subscribers can be accommodated on a single RF channel which provides full rate 64 kbps service to each CPE 28.

Modulators 40 (one shown), which are digital video broadcast (DVB) compliant, for example, connect to the output of the video unit 36 and the telephony unit 38, and modulate the received signals onto a L-band, intermediate frequency signals (950 to 1950 MHZ), and send the modulated signals to the remote unit 26. The digital video and the telephony signals are preferably quadrature phase shift key (QPSK) modulated, which requires less signal-to-noise ratio than most other modulation formats, and therefore provides the longest range. For analog video signals, the invention can be implemented such that the modulators 40 perform frequency modulation (FM). Upstream signals received from the CPE 28 via the remote unit 26 are supplied to demodulators 42 (one shown) which perform a QPSK demodulation and send the signals onto the telephony unit 38.

Another important aspect of the present invention is that a master oscillator 44 provides a single frequency reference which is tracked by all the frequency setting

components in the LMDS system 20. Throughout the base unit 24, oscillator signals are frequency division multiplexed onto combiner and distributed networks (not shown) along 6 with payload signals to minimize the need for a separate network to distribute the oscillator signals. In the preferred embodiment an optional pilot tone generator 46 which is a special oscillator that is frequency locked to the master oscillator 44 is used to lock the oscillators on the remote unit 26 and the CPE 28. It can be located either in the base unit 24 as in the preferred embodiment, or in the remote unit 26 and operates at about 960 MHZ for example. Alternatively, two optional pilot tone generators 46 and two master oscillators 44 can be employed in the base station 22 for redundant implementation.

A node controller 48 contains a database of all the provisional items (objects) at the base station 22 and the CPE 28, and provides overall control, provisioning and alarm processing functions. A power system 50 is also provided for converting in-country prime power to -48VDC which is distributed through the base and the remote units 24,26.

The base unit 24 is connected to the remote unit 26 via a fiber optic link 52 which carries the signals transmitted between the two units 24, 26. The fiber optic link 52 is preferable because it provides better immunity to lighting than copper wires, and allows the remote unit 26 to be located from the base unit 24 by as long as several miles. For example, the remote unit 26 may be placed on a tower or a tall structure such as a building, and the base unit 24 may be located in an equipment room or remotely from the remote unit 26 in an equipment building such as the central office 32. It should be noted that a coaxial cable(s) may also be employed to connect the base

unit 24 and the remote unit 26 instead of the fiber optic link 52.

An intermediate frequency (IF) protocol is used to interface the base unit 24 with the remote unit 26 to allow the base unit to be independent of the operating frequency of the remote unit. In this manner, different tower equipment assemblies can be "plugged" into a common base unit 24 to solve the problem of supporting different RF bands. L-band IF is preferred because it is high enough so that frequency conversion to 28 GHz can be accomplished in one translation stage and is low enough such that RF components are readily available and reasonably inexpensive. It is contemplated that wireless point-to-point radio can also be used as the connection between the base unit 24 and the remote unit 26.

The remote unit 26 includes a transmitter/up-converter 54 which is connected to the modulator 40 via the fiber optic link 52 for converting the IF signals from the modulator to RF carrier signals, and sending the converted RF signals to the CPE 28. A receiver/down-converter 56 receives the RF signals from the CPE 28 and converts the RF signals to the IF signals, which is then sent to the demodulator 42 in the base unit 22 via the fiber optic link 52.

Distributed oscillators 58 are included to act as separate milli-meter local oscillators for providing reference signals to each of the transmitter/up-converter 54 and the receiver/down-converter 56 for up and down frequency conversions. The oscillators 58 are connected via the fiber optic link 52 to the optional pilot tone generator 46 which provides the preferred common reference frequency of 960 MHZ. By having a separate oscillator 58 for each of the transmitter/up-converter 54 and the

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receiver/down-converter 56, a problem of having to have a milli-meter wave distribution network is avoided. The distribution network reduces flexibility because it requires knowing the number of ports and mechanical arrangement of the transmitter/up-converter and the receiver/downer-converter 54, 56.

In the preferred embodiment, a remote unit controller 60 is operatively connected to the node controller 48 of the base unit 24 via the fiber optic link 52 and acts as a central control computer that collects alarm information and provides a collection point of the control and communications away from the remote site. It should be noted that the utilization of the remote unit controller 60 in the present invention is optional, and that the functions of the remote unit controller can be performed by the node controller 48. The remote power supply 62 is connected to the power system 50 of the base unit 24 and provides the preferred -48VDC power needed for transmitting and receiving signals to and from the CPE 28.

It is important to note that the base unit 24 may include multiple numbers of each of the components described above depending on the number of subscribers the base unit is designed to service. Thus, one important feature of the present invention is that the components of the base unit 24 performing the same function are physically grouped together into individual modules. Such modular configuration is shown in FIG. 3 in which the base unit 24 is arranged into a number of subracks or shelves 64 within five racks 66. While the base unit 24 shown in FIG. 3 includes one video unit 36 and three telephony units 38, this is only intended to be an example. The actual number of each of the base unit 24 components is dictated by the subscriber capacity, i.e., subracks 64 and racks 66 can be

added to increase capacity and removed to decrease capacity. Increasing and decreasing capacity would only require connecting or disconnecting one or more racks 66 to and from the base station 22. In this manner, the modular configuration of the present invention allows the LMDS system 20 to easily adapt to the needs of the subscribers.

In the preferred embodiment, each of the racks 66 includes one subrack 64 for housing the node controller 48. The network of these node controllers 48 in the base unit 24 provides control of equipment settings such as transmission levels, power up sequencing, fault detection and switching, performing monitoring and remote control from a central network management facility. Communication between the racks 66 is preferably through ethernet, and communication between subracks 64 is preferably through an RS-485 bus for low data rate subracks and a VME bus for high data rate subracks. It is important to note that in the preferred embodiment, the subracks 64 having similar functions are arranged so that they are in close proximity to each other. For example, the node controllers 48 are adjacent each other, the telephony units 38 are also adjacent each other and so are the demodulators 42. This is to minimize cabling and RF signal impairments.

Turning now to FIG. 4, each of the components in the base unit 24 are integrated onto at least one circuit card assembly (CCA) 68, which are adapted to be received by the subracks 64. The CCAs 68 plug into the subracks 64 and are designated as "line replaceable items" which allow for "live insertion" or "hot swap". Preferably, the connection or "make" of the CCA 68 to the subrack 64 at a connector terminal (not shown) is made in tile order of ground power and signal and the disconnection or "break" is made in the order of signal, power and ground. The dimensions of the

subracks 64 specifically the height and the depth, vary accordingly to accommodate the size of the CCAs 68. However, the width should be such that the CCAs 68 is able to fit horizontally between a pair vertical sections 70 (best seen in FIG. 5) of the racks 66. The modularity of the CCA 68 allows components of the base unit 24 to be added or removed with capacity, and repairs to be made by merely replacing the faulty CCA.

Turning now to FIGS. 6 and 7, one of the racks 66 in FIG. 3 is shown independently, and preferably has a width, as indicated by an arrow 72, of approximately 20 inches, a height, as indicated by an arrow 74, of approximately 84 inches and a depth, as indicated by an arrow 76, of approximately 6 inches. It should be noted that the size of the racks 66 may be varied as necessary to desired dimensions.

Turning to FIG. 8, the racks 66 and their subracks 64 are preferably fully encased in a housing 78 having an access door 80 in order to meet the conducted and radiated emissions requirement. An open frame racks 66 may also be utilized, provided that the individual CCAs 68 within the subracks 64 are adequately shielded.

Turning now to FIGS. 9 and 10, the remote unit 26 is shown to include a radome/polarizer 82, an antenna 84 and an electronic housing 86. An important feature of the present invention is that these components are integrated into a single assembly, with a wave-guide 88 (best shown in FIG. 10, which is a side view the remote unit with cover of the housing 86 removed) connecting the antenna 84 with the components within the electronic housing 86. This arrangement significantly reduces the length of the wave-guide 88, so that the signal loss inherently associated with the wave-guide is minimized.

From the foregoing detailed description, it should be understood that a LMDS base station apparatus for sending and receiving telephony and video signals to and from multitude of subscribers has been shown which has many advantages and desirable attributes. Of particular advantage is the ability to add capacity in a modular fashion by organizing the various functions of the base station into subracks or shelves. Another advantage is that the antenna and the associated electronics are integrated into a single housing thereby reducing the length of the connection between the antenna and the other components.

While various embodiments of the present invention have been shown and described, it should be understood that other modifications, substitutions and alternatives are apparent to one of ordinary skill in the art. Such modifications, substitutions and alternatives can be made without departing from the spirit and scope of the invention, which should be determined from the appended claims.

Various features of the invention are set forth in the appended claims.

WHAT IS CLAIMED IS:

1. Local multipoint distribution service base station apparatus for sending and receiving communication signals to and from a plurality of remotely located subscriber equipment, comprising:

a base unit including at least one rack, said rack configured and adapted to receive at least one subrack;

at least one communication signal generating means arranged and configured to be received by said at least one subrack;

a transmitting/receiving unit operationally connected to said base unit for transmitting and receiving the communication signals to and from the subscriber equipment.

2. A base station apparatus as defined in claim 1 wherein said base unit includes a plurality of said communication signal generating means and a plurality of said subracks, and wherein said plurality of said communication signal generating means are received in said plurality of said subracks.

3. A base station apparatus as defined in claim 2 wherein said plurality of said subracks which have received said plurality of said communication signal generating means are arranged adjacent to each other in said at least one rack.

4. A base station apparatus as defined in claim 1 wherein said communication signal generating means is provided on at least one circuit card, and said subrack is configured and adapted to receive said at least one circuit card.

5. A base station as defined in claim 1 wherein said base unit is connected to a communication signal source for supplying the communication signals to said base unit.

6. A base station apparatus as defined in claim 5 wherein said base unit is adapted to send the communication signals from said communication signal source to the subscriber equipment at a higher data rate than a data rate of the communication signals received from the subscriber equipment.

7. A base station apparatus as defined in claim 6 wherein said base unit converts a data rate of the communication signals received from said communication signal source to a lower data rate, and performs a multiplexing function on the communication signals to send the communication signals at said higher data rate than said data rate of the communication signals received from the subscriber equipment.

8. A base station apparatus as defined in claim 7 wherein said base unit includes a multiplexer for converting said data rate of the communication signals received from said communication signal source to said lower data rate.

9. A base station apparatus as defined in claim 7 wherein said multiplexing function is performed by said communication signal generating means.

10. A base station apparatus as defined in claim 5 wherein said base unit is connected to said communication signal source via a broad bandwidth connection network.

11. A base station apparatus as defined in claim 1 wherein said communication signal generating means includes video signal generating means and telephony signal generating means, and the communication signals include video signals and telephone signals.

12. A base station apparatus as defined in claim 11 wherein said base unit includes a plurality of said video signal generating means, a plurality of said telephony signal generating means and a plurality of said subracks, and said plurality of said video signal means and said telephony signal generating means are received in said plurality of said subracks.

13. A base station apparatus as defined in claim 12 wherein said subracks in which said plurality of said video signal generating means have been received are arranged adjacent to each other in said at least one rack, and said subracks in which said plurality of said telephony signal generating means have been received are arranged adjacent to each other in said at least one rack.

14. A base station apparatus as defined in claim 12 wherein each of said plurality of said video signal means and said telephony signal means is provided on at least one circuit card, and said circuit card is configured and adapted to be received in said plurality of subracks.

15. A base station apparatus as defined in claim 11 wherein said telephony signal generating mean generates data signals.

16. A base station apparatus as defined in claim 11 wherein said base unit is connected to a video signal source and a telephony signal source for supplying said video signals and said telephony signals, respectively, to said base unit.

17. A base station apparatus as defined in claim 16 wherein said base unit is adapted to send said video and said telephony signals from said video and said telephony signal sources to the subscriber equipment at a higher data rate than a data rate of said video and said telephony signals received from the subscriber equipment.

18. A base station apparatus as defined in claim 17 wherein said base unit converts a data rate of said video and said telephony signals received from said video and said telephony signal sources to a lower data rate, and performs a multiplexing function on said video and said telephony signals to send said video and said telephony signals at said higher data rate than said data rate of said video and said telephony signals received from the subscriber equipment.

19. A base station apparatus as defined in claim 18 wherein said base unit includes a multiplexer for converting said data rate of said video and said telephony signals received from said video and said telephony signal sources to said lower data rate.

20. A base station apparatus as defined in claim 19 wherein said multiplexing function is performed by said video signal generating means and said telephony signal generating means.

21. A base station apparatus as defined in claim 16 wherein said base unit is connected to said video and said telephony signal sources via a broad bandwidth connection network.

22. A base station apparatus as defined in claim 1 wherein said communication signal generating means is telephony signal generating means and the communication signals are telephony signals.

23. A base station apparatus as defined in claim 22 wherein said base unit includes a plurality of said telephony signal generating means and a plurality of said subracks and said plurality of said telephony signal generating means are received in said plurality of subracks

24. A base station apparatus as defined in claim 23 wherein said subracks in which said plurality of said telephony signal generating means have been received are arranged adjacent to each other in said at least one rack.

25. A base station apparatus as defined in claim 23 wherein each of said plurality of said telephony signal generating means is provided on at least one circuit card, and said circuit card is configured and adapted to be received in said plurality of subracks.

26. A base station apparatus as defined in claim 22 wherein said telephony signal generating means generates data signals.

27. A base station apparatus as defined in claim 22 wherein said base unit is connected to a telephony signal source for supplying said telephone signals to said base unit.

28. A base station apparatus as defined in claim 27 wherein said base unit is adapted to send said telephony signals from said telephony signal source to the subscriber equipment at a higher data rate than a data rate of said telephony signals received from the subscriber equipment.

29. A base station apparatus as defined in claim 28 wherein said base unit converts a data rate of said telephony signals received from said telephony signal source to a lower data rate and performs a multiplexing function on said telephony signals to send said telephony signals at said higher data rate than said data rate of said telephony signals received from the subscriber equipment.

30. A base station apparatus as defined in claim 29 wherein said base unit includes a multiplexer for converting said data rate of said telephony signals received from said telephony signal source to said lower data rate.

31. A base station apparatus as defined in claim 30 wherein said multiplexing function is performed by said telephony signal generating means.

32. A base station apparatus as defined in claim 1 wherein said communication signal generating means is a

video signal generating means, and the communication signals are video signals.

33. A base station apparatus as defined in claim 32 wherein said base unit includes a plurality of said video signal generating means and a plurality of said subracks, and said plurality of said video signal generating means are received in said plurality of subracks.

34. A base station apparatus as defined in claim 33 wherein said subracks in which said plurality of said video signal generating means have been received are arranged adjacent to each other in said at least one rack.

35. A base station apparatus as defined in claim 33 wherein each of said plurality of said video signal generating means is provided on at least one circuit card and said circuit card is configured and adapted to be received in said plurality of subracks.

36. A base station apparatus as defined in claim 32 wherein said base unit is connected to a video signal source for supplying said video signals to said base unit.

37. A base station apparatus as defined in claim 36 wherein said base unit is adapted to send said video signals from said video signal source to the subscriber equipment at a higher data rate than a data rate of said video signals received from the subscriber equipment.

38. A base station apparatus as defined in claim 37 wherein said base unit converts a data rate of said video signals received from said video signal source to a lower

data rate, and performs a multiplexing function on said video signals to send said video signals at said higher data rate than said data rate of said video signals received from the subscriber equipment.

39. A base station apparatus as defined in claim 38 wherein said base unit includes a multiplexer for converting said data rate of said video signals received from said video signal source to said lower data rate.

40. A base station apparatus as defined in claim 39 wherein said multiplexing function is performed by said video signal generating means.

41. A base station apparatus as defined in claim 1 wherein said base unit further comprises:

at least one modulator connected between said communication signal generating means and said transmitting/receiving unit for modulating the communication signals; and

at least one demodulator connected between said communication signal generating means and said transmitting/receiving unit for demodulating the communication signals received from the subscriber equipment.

42. A base station apparatus as defined in claim 1 wherein said base unit further comprises a master oscillator for providing a single frequency reference for all frequency setting components of said base station apparatus.

43. A base station apparatus as defined in claim 42 wherein said base unit further comprises a pilot tone generator operationally connected to said master oscillator for providing said frequency reference to said transmitting/receiving unit and the subscriber equipment.

44. A base station apparatus as defined in claim 1 wherein said base unit is connected to said transmitting/receiving unit via one of at least one fiber optic link and at least one coaxial cable.

45. A base station apparatus as defined in claim 44 wherein a frequency of the communication signals transmitted between said base unit and said transmitting/receiving unit is different than a frequency of the communication signals transmitted between said transmitting/receiving unit and the subscriber equipment.

46. A base station apparatus as defined in claim 45 wherein said frequency of the communication signals transmitted between said base unit and said transmitting receiving unit is in intermediate frequency and said frequency of the communication signals transmitted between said transmitting/receiving unit and the subscriber equipment is in radio frequency.

47. A base station apparatus as defined in claim 1 wherein said base station is adapted to receive the communication signals from the subscriber equipment in one of a continuous format and a burst format.

48. A base station apparatus as defined in claim 47 wherein the communication signals in said burst format is

received by said base station in a time-division multiple access (TDMA) scheme.

49. A local multipoint distribution service base station apparatus for sending and receiving communication signals to and from subscriber equipment, comprising:

communication signal generating means for generating the communication signals;

a transmitting/receiving unit operationally connected to said communication signal generating means and adapted to transmit/receive the communication signals to and from the subscriber equipment; and

antenna means operatively connected to said transmitting/receiving unit for directing and receiving the communication signals to and from the subscriber equipment;

wherein said antenna means and said transmitting/receiving unit are arranged and configured into an integrated assembly.

50. A base station apparatus as defined in claim 49 wherein said antenna means includes a radome/polarizer and an antenna.

51. Local multipoint distribution service base station apparatus for sending and receiving communication signals to and from remotely located subscriber equipment, comprising:

a base unit including at least one rack, said rack configured and adapted to receive at least one subrack:

at least one communication signal generating means arranged and configured to be received in said at least one subrack:

a transmitting/receiving unit operationally connected to said base unit for transmitting and receiving the communication signals to and from the subscriber equipment; and

antenna means operatively connected to said transmitting/receiving unit for directing and receiving the communication signals to and from the subscriber equipment;

wherein said antenna means and said transmitting/receiving unit are arranged and configured into an integrated assembly.

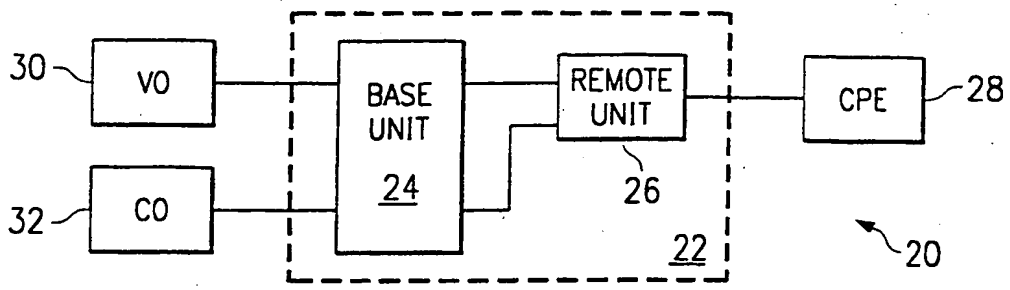


FIG. 1

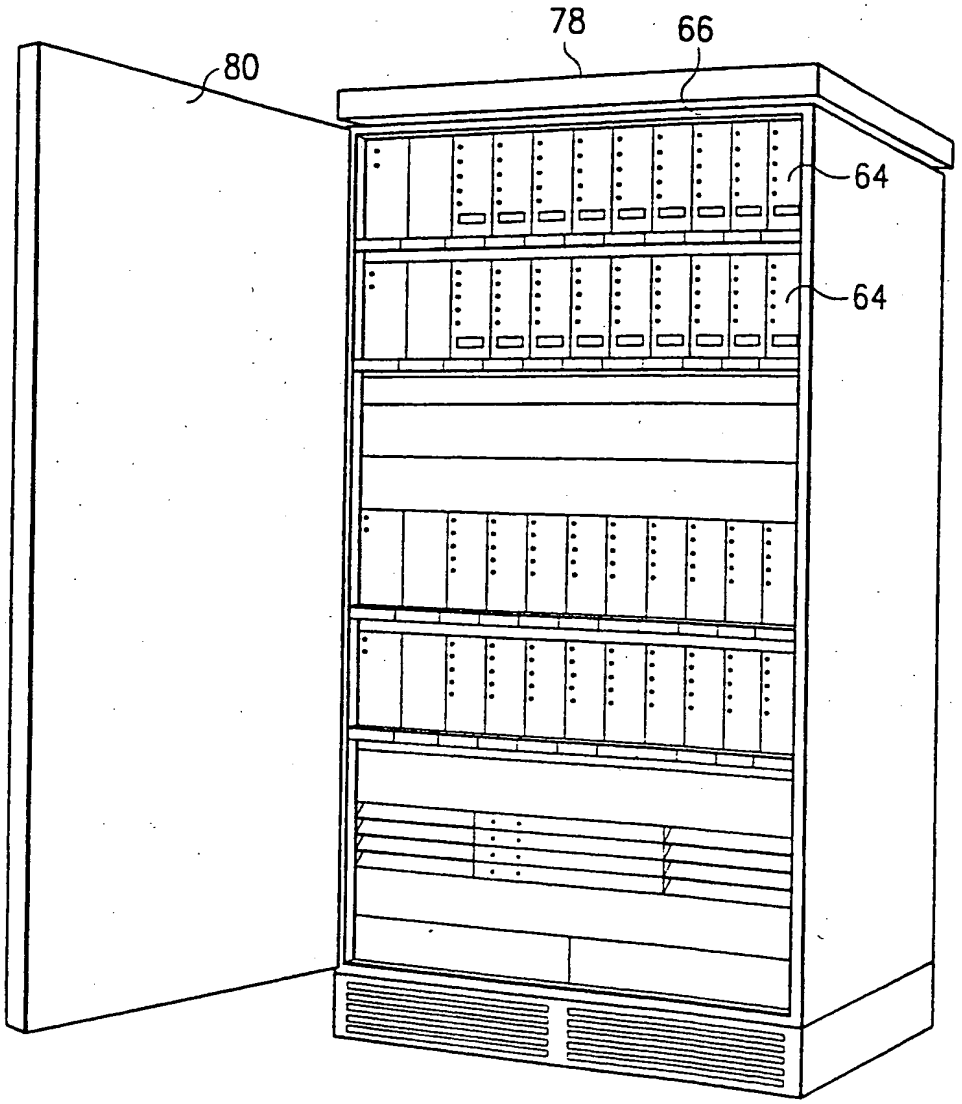


FIG. 8

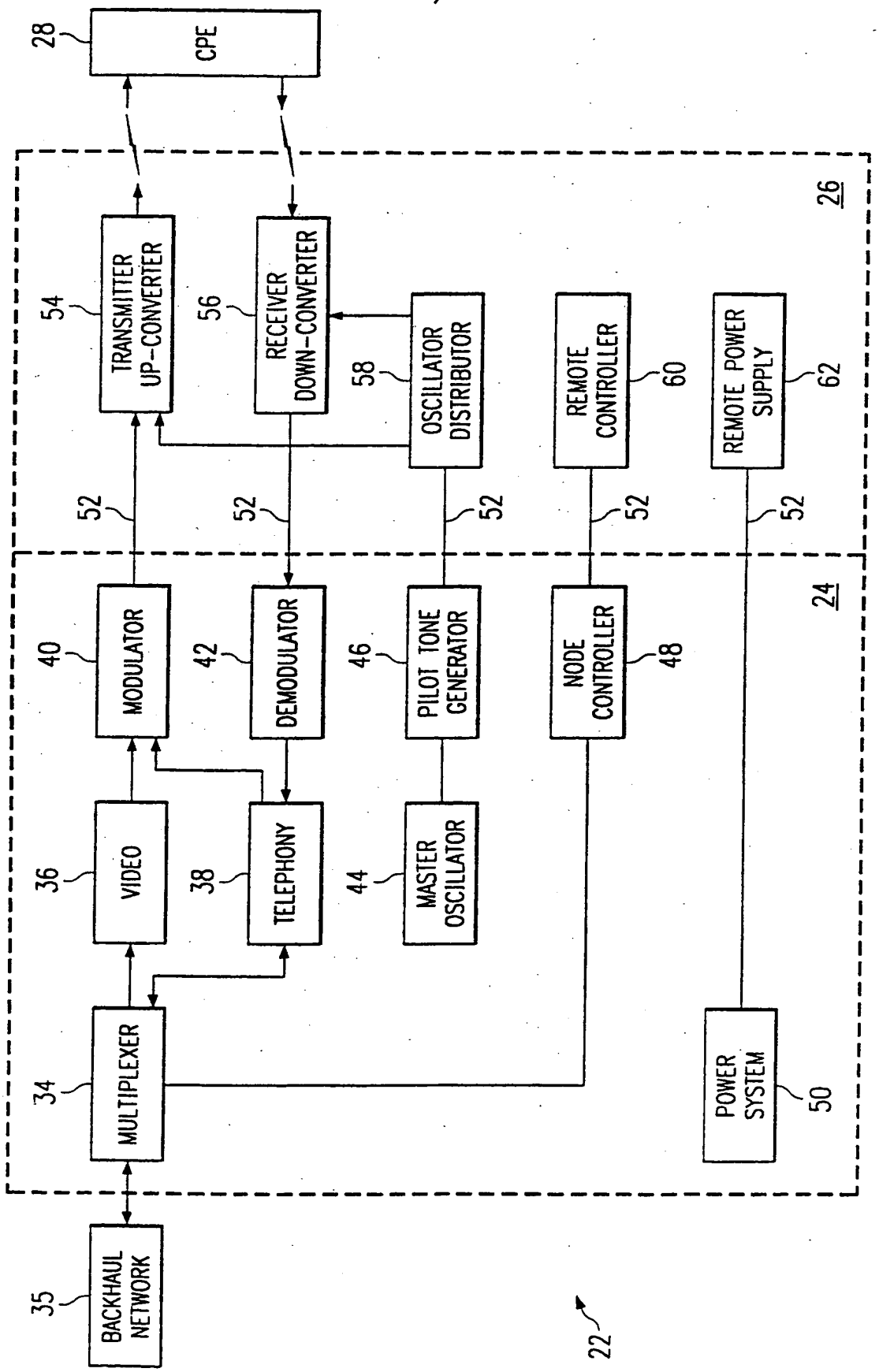


FIG. 2

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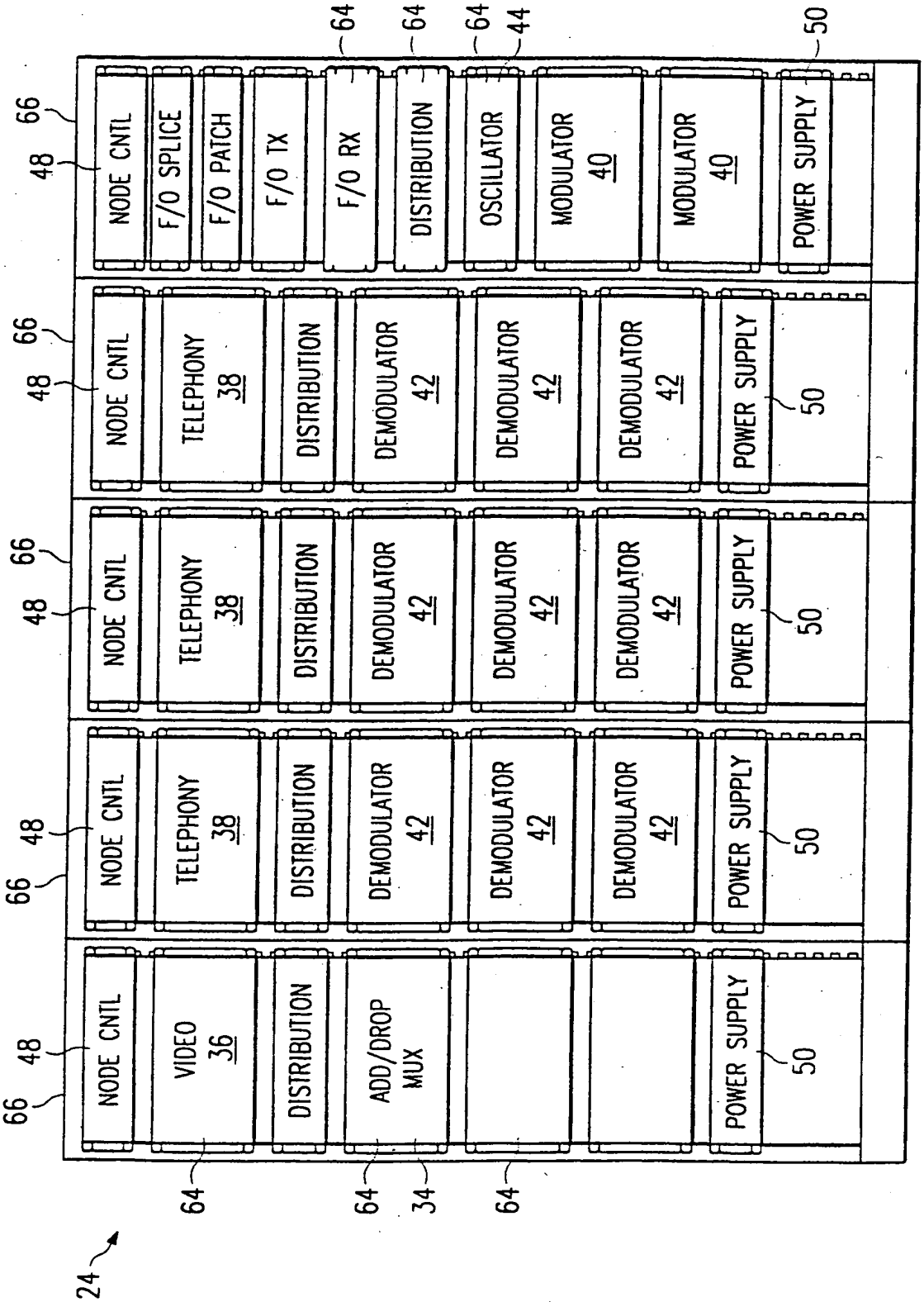
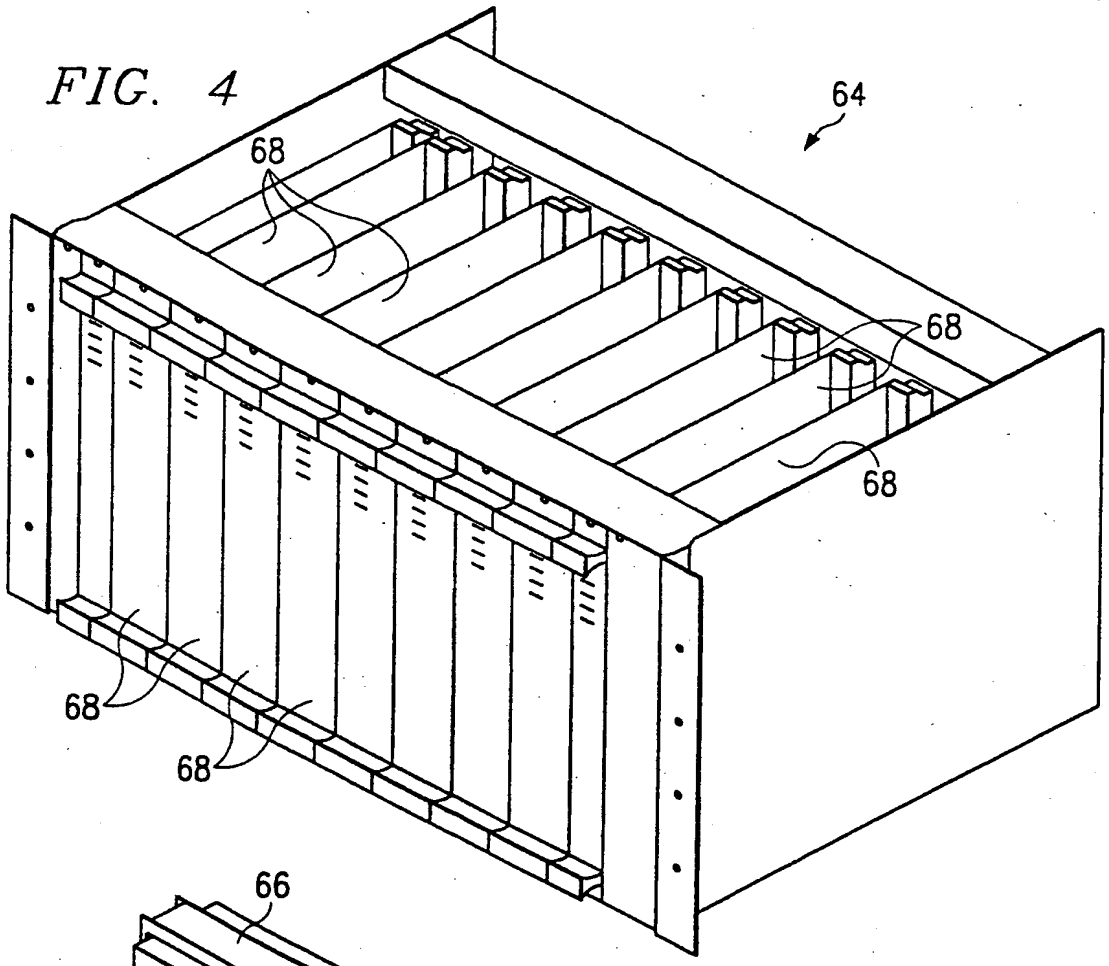

24
64
64
64
44
50
66
48
NODE CNTL
F/O SPLICE
F/O PATCH
F/O TX
F/O RX
DISTRIBUTION
OSCILLATOR
MODULATOR 40
MODULATOR 40
POWER SUPPLY
TELEPHONY 38
DEMODULATOR 42
VIDEO 36
ADD/DROP MUX
34

FIG. 3

FIG. 4



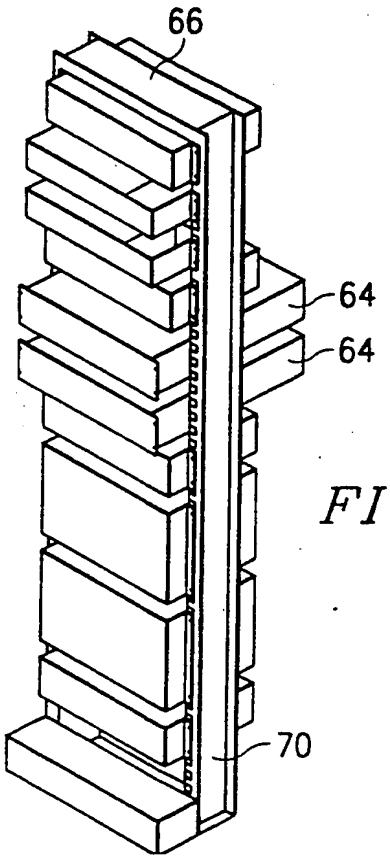


FIG. 5

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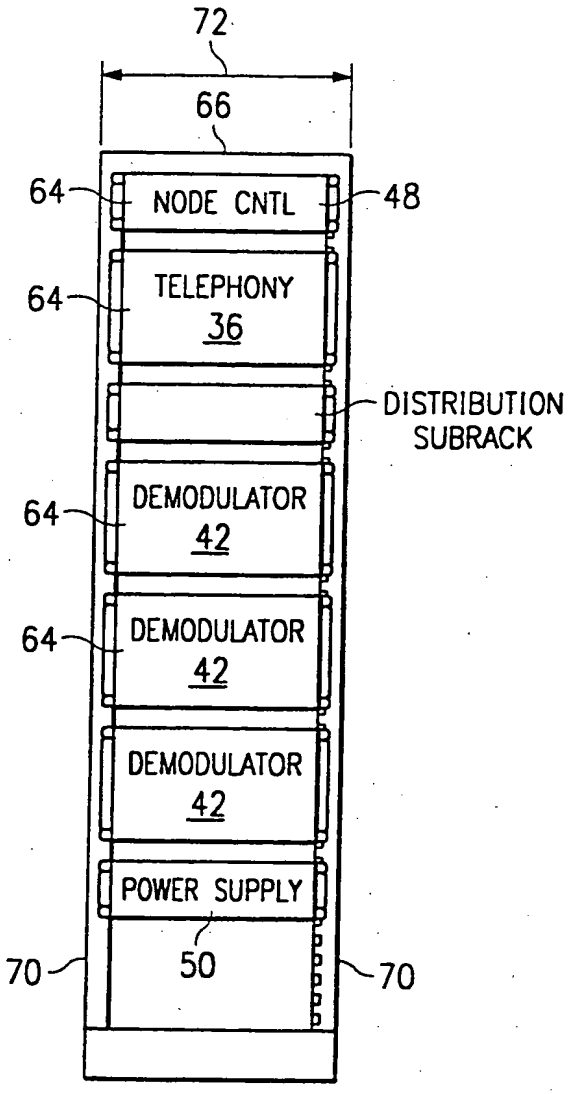

72
66
64
NODE CNTL
48
64
TELEPHONY
36
DISTRIBUTION
SUBRACK
64
DEMODULATOR
42
64
DEMODULATOR
42
DEMODULATOR
42
POWER SUPPLY
70
50
70

FIG. 6

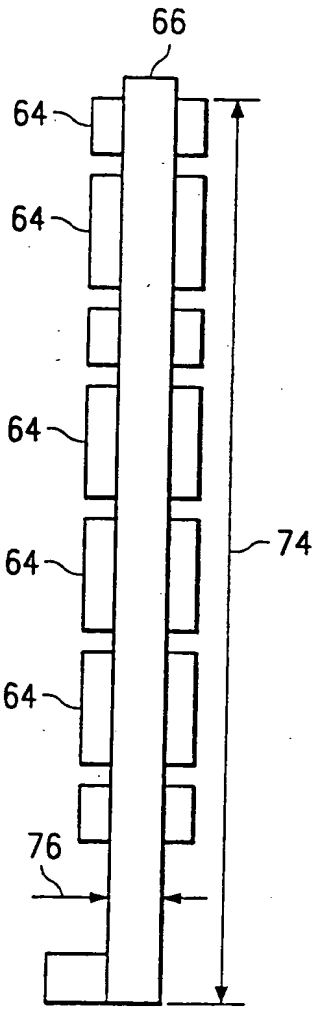

66
64
64
64
64
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74
76

FIG. 7

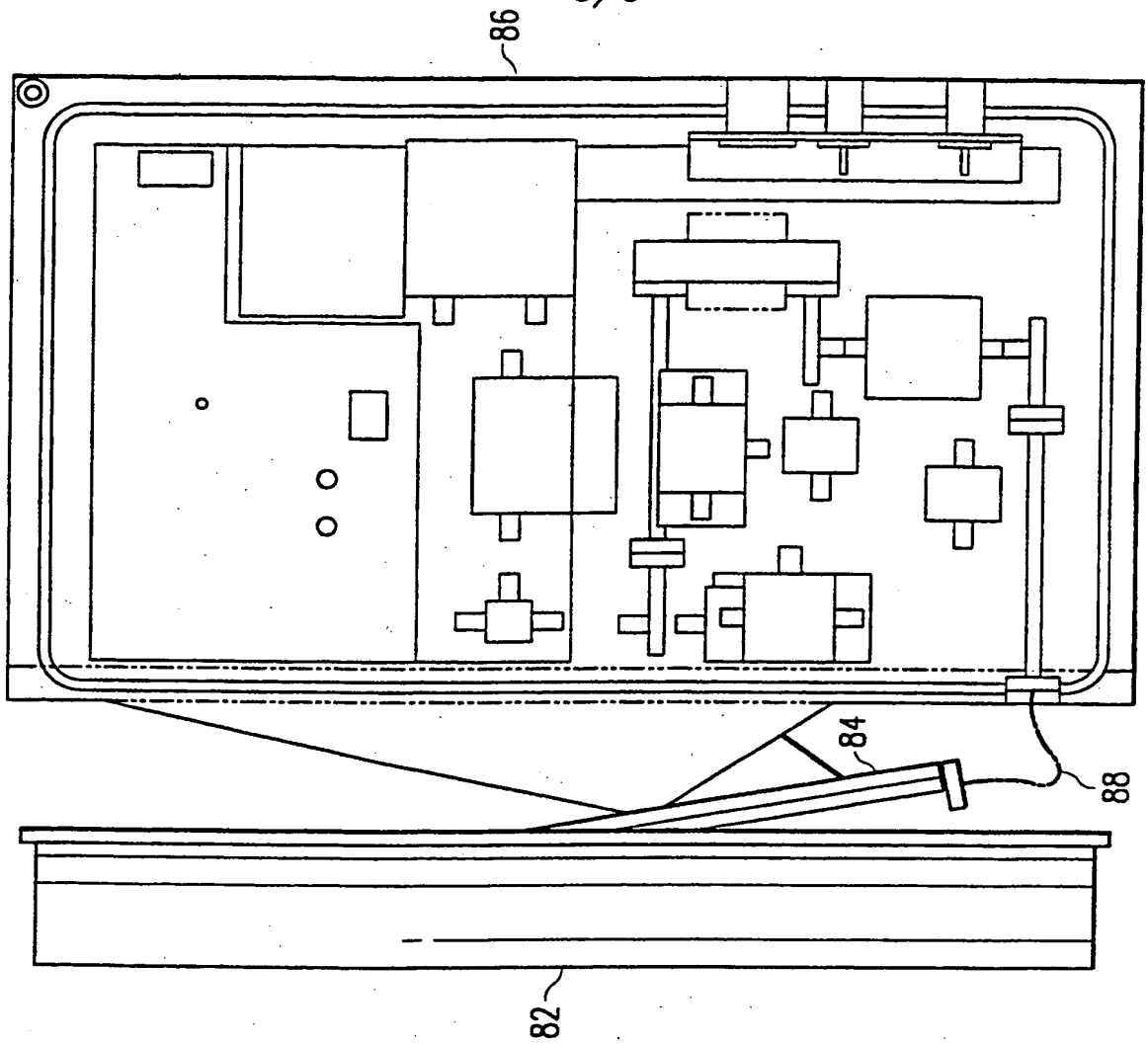


FIG. 10

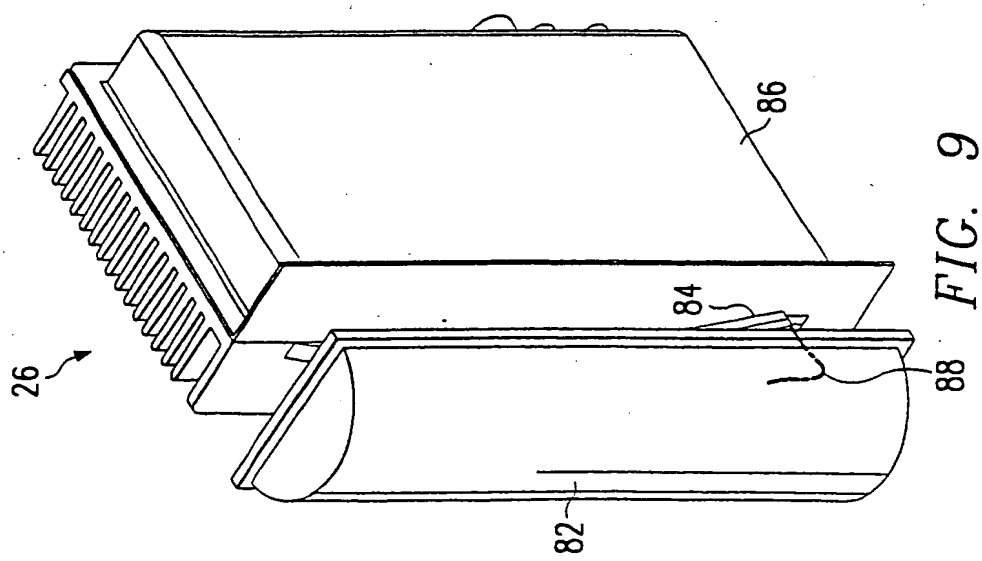


FIG. 9

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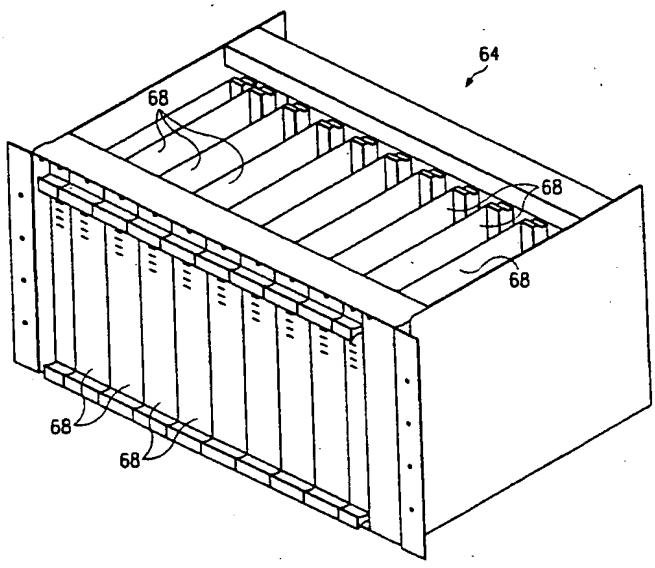
(74) Agent: SHOWALTER, Barton, E.; Baker & Botts, L.L.P., 2001 Ross Avenue, Dallas, TX 75201-2980 (US).

(81) Designated States: AT, AT (Utility model), AU, CA, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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9 November 2000 (09.11.00)

(54) Title: LOCAL MULTIPOINT DISTRIBUTION SERVICE BASE STATION APPARATUS



(57) Abstract

A local multipoint distribution service base station apparatus for sending and receiving communication signals to and from subscribers includes a base unit having at least one rack which is adapted to receive at least one subrack. At least one communication signal generating unit is also arranged and configured to be received by the subrack. In addition, a transmitting/receiving unit is operationally connected to the base unit for transmitting and/or receiving the communication signals to and from the subscribers.

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INTERNATIONAL SEARCH REPORT

Int‹ ional Application No
PCT/US 99/25657

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H05K7/18 H04Q7/30 H04Q7/20

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)
IPC 7 H05K H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 38786 A (DSC COMMUNICATIONS) 5 December 1996 (1996-12-05) page 5, line 25 -page 6, line 6; figure 1	1-48,51
X	WO 97 29608 A (QUALCOMM INC) 14 August 1997 (1997-08-14)	49,50
A	page 14, line 22 - line 25; figures 1,3	51
A	US 5 754 961 A (NAKAJIMA NOBUYASU ET AL) 19 May 1998 (1998-05-19) column 9, line 46 -column 11, line 31; figures 3-6	1,6-21, 28-40

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Date of the actual completion of the international search	Date of mailing of the international search report
2 June 2000	13/06/2000

Name and mailing address of the ISA	Authorized officer
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Information on patent family members

Inte ional Application No
PCT/US 99/25657

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(12) UK Patent Application (19) GB (11) 2 320 991 (13) A

(43) Date of A Publication 08.07.1998

(21) Application No 9626588.9

(22) Date of Filing 20.12.1996

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United Kingdom

(51) INT CL[6]
H04Q 7/38 , H04B 7/26 , H04Q 7/32 // H04B 1/69 ,
H04J 13/02 , H04Q 7/20

(52) UK CL (Edition P)
H4L LDFC LDSU L1H10

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(58) Field of Search
UK CL (Edition O) H4L LDFC LDSJ LDSM
INT CL[6] H04B 1/74 7/26 , H04Q 7/20 7/30 7/32 7/38
ONLINE DATABASE:WPI

(54) Abstract Title
Channel selection control in a cellular radio communications system

(57) A channel selection controller selects a preferred frequency from a list of frequencies in a storage and attempts to establish a communication link between a subscriber terminal 20 and a base station 10 on that frequency. If the attempt fails, an alternative frequency of the same or a different base station is selected. The controller may be contained in the subscriber unit which may have a fixed position. In a CDMA system an alternative frequency is selected if there is no available orthogonal traffic channel within the preferred frequency. An alternative frequency may be selected when there is a base station equipment fault, the call is blocked, for traffic load balancing or for frequency diversity. Base stations broadcast a list of base stations and their frequencies in a service domain which the subscriber terminal stores for use when establishing a link. A CDMA system is described in detail, employing overlay codes in addition to pseudo-random noise codes and Rademacher-Walsh codes to expand the number of user signals per frequency for uplink channels and downlink control channels. For downlink traffic channels a hybrid CDMA/TDM system is used. Also described is channel acquisition for incoming, outgoing and priority calls, and interference limiting by reducing the number of traffic channels if the C/I ratio or bit error rate is low.

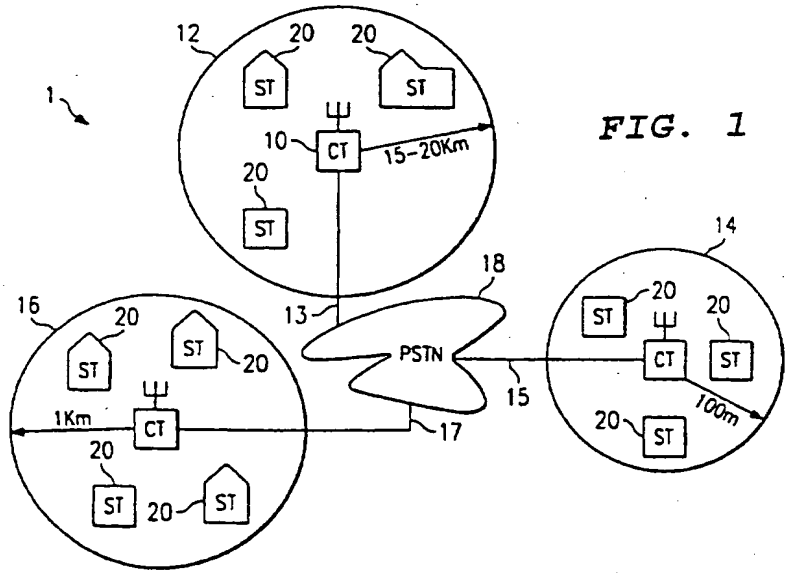


FIG. 1

GB 2 320 991 A

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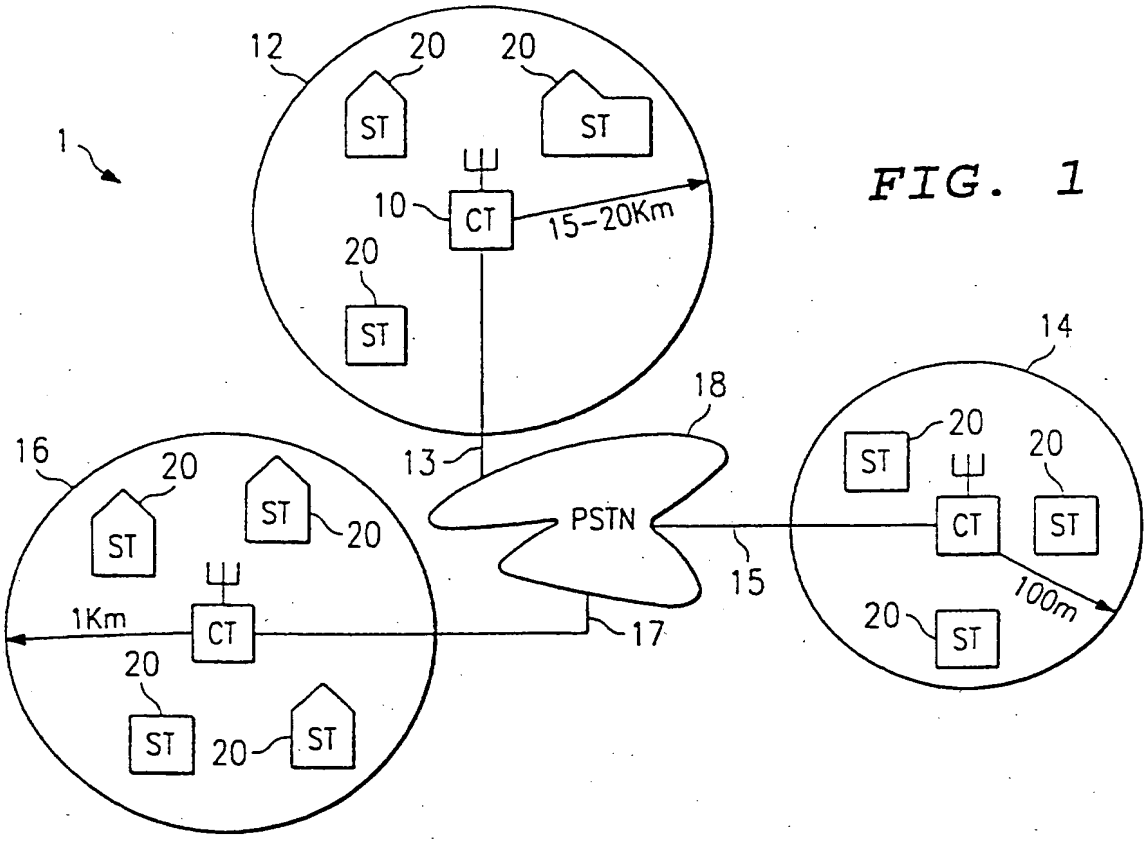


FIG. 1

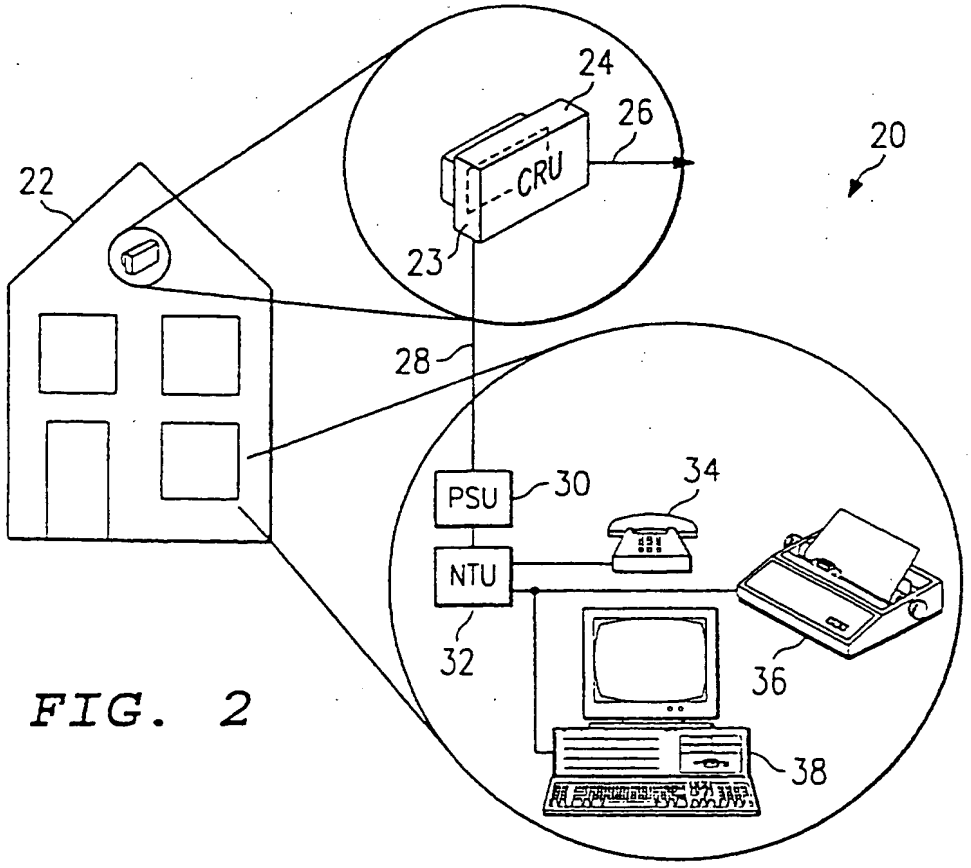


FIG. 2

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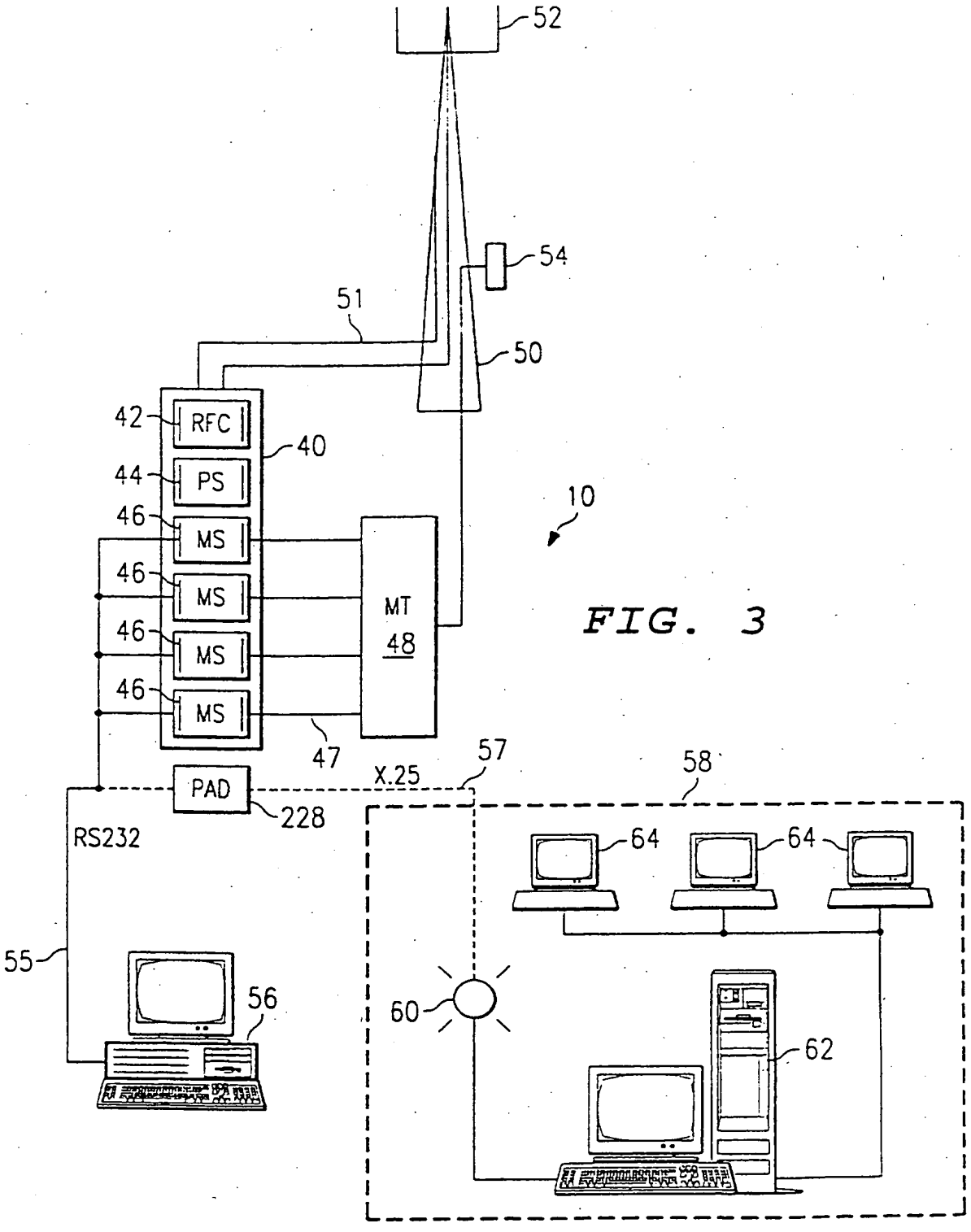


FIG. 3

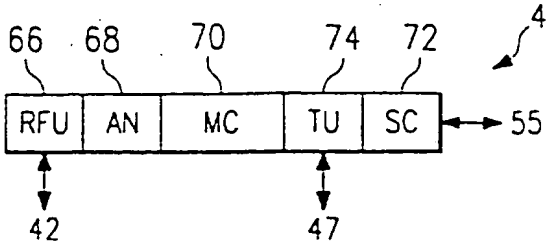


FIG. 3A

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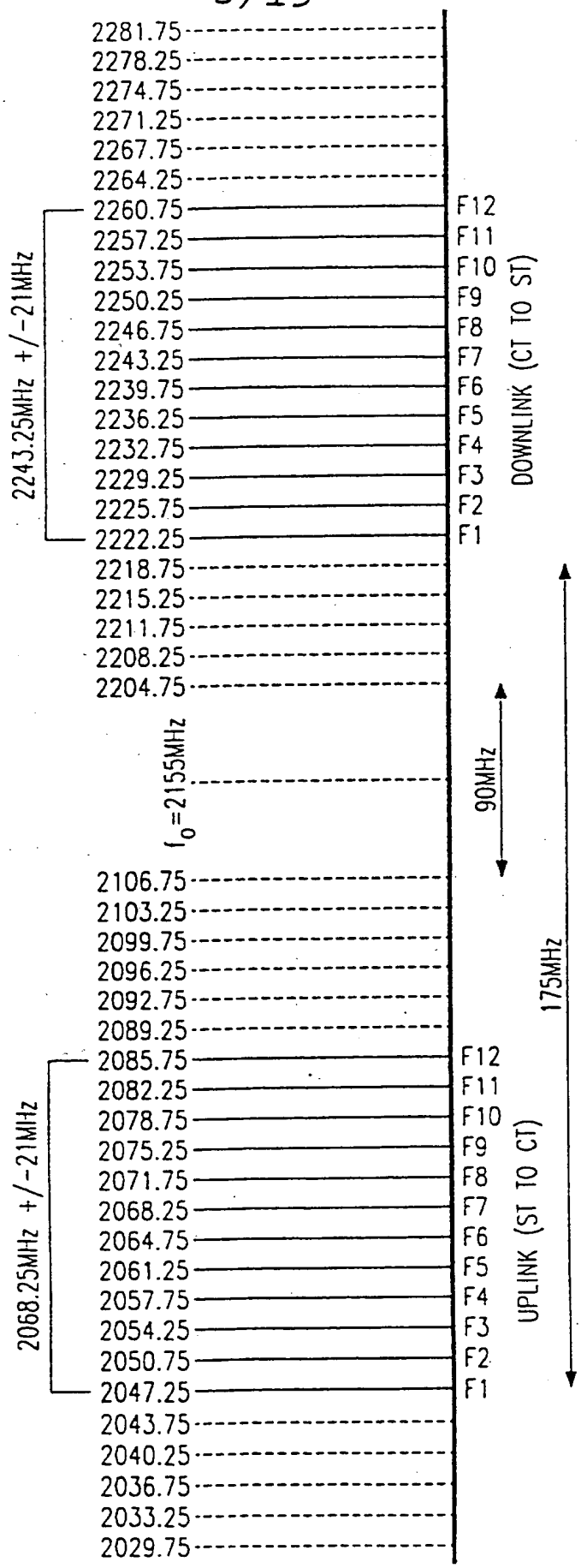
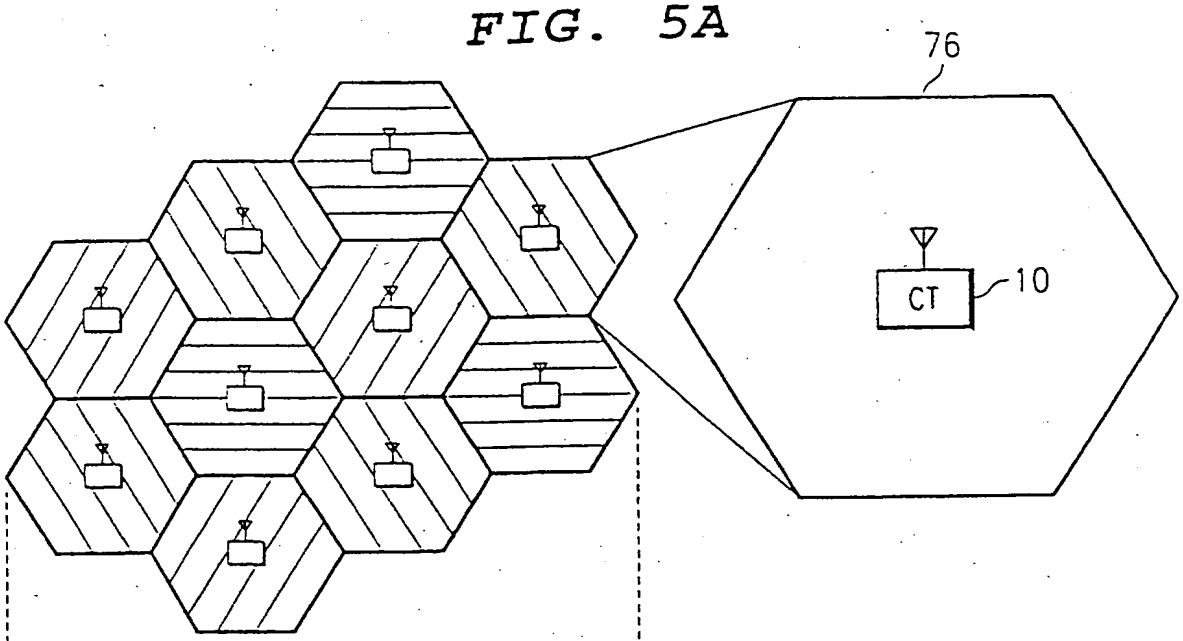


FIG. 4

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FIG. 5A



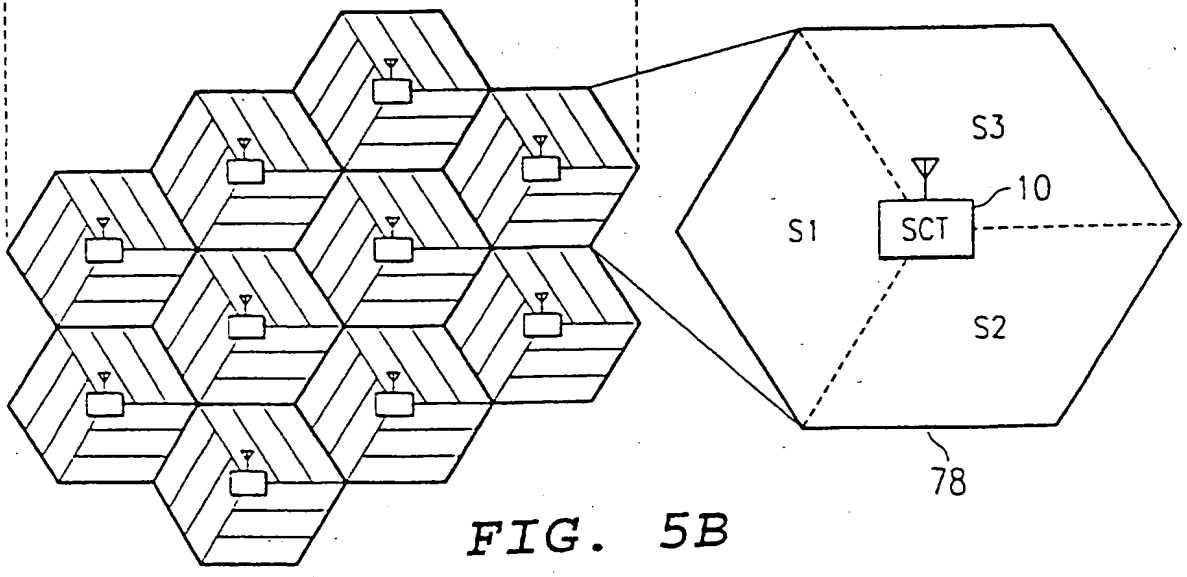


FIG. 5B

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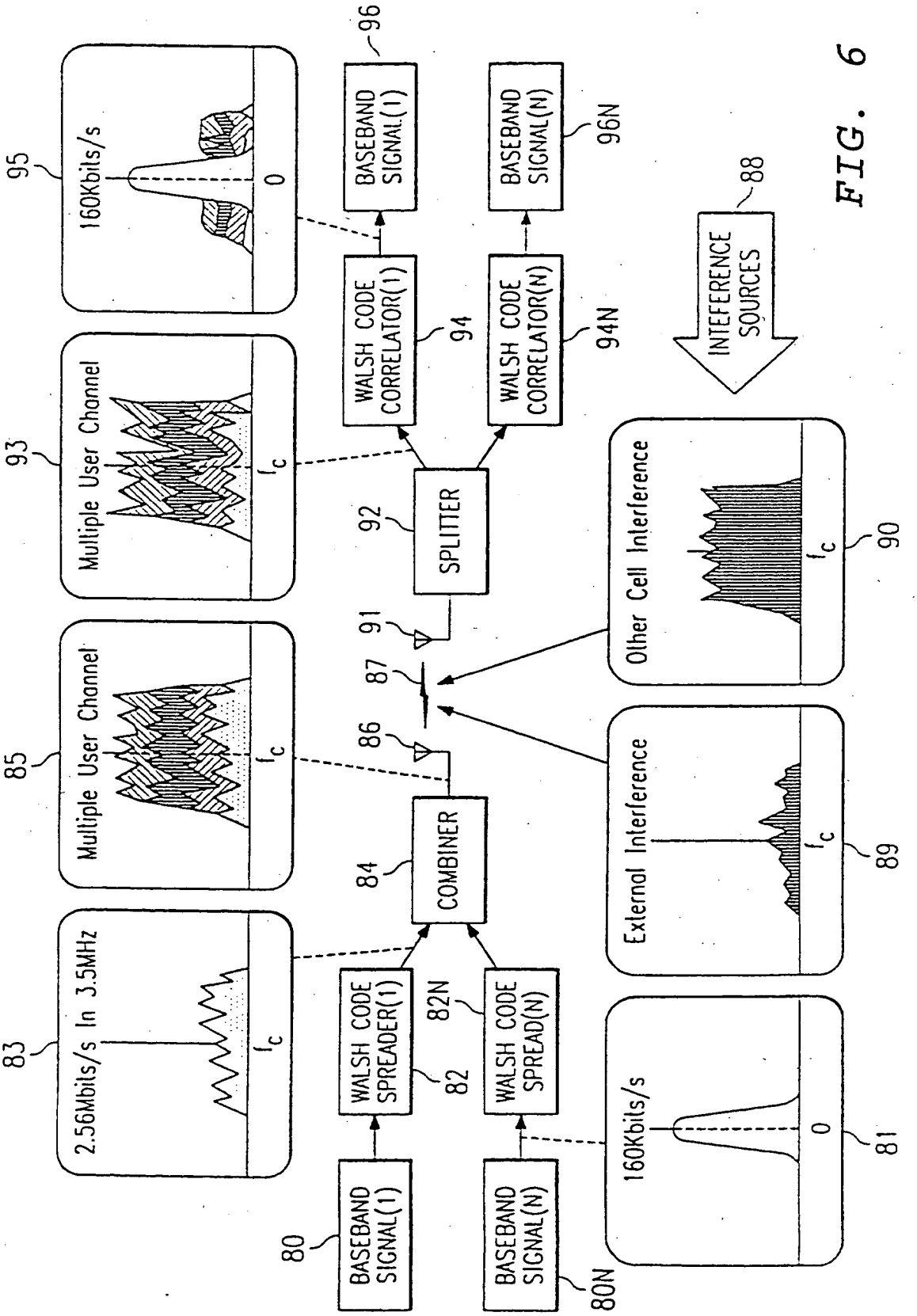


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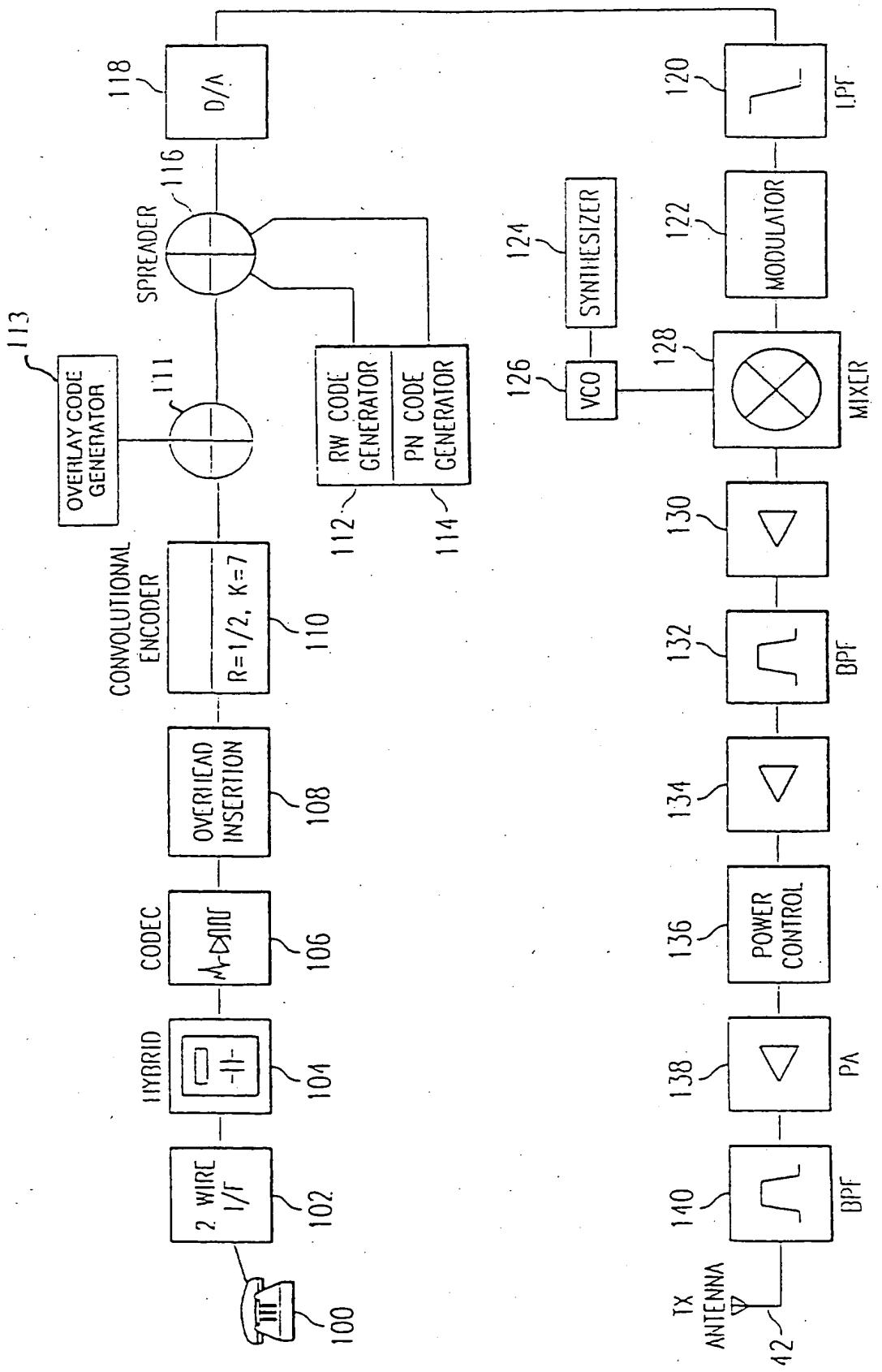


FIG. 7A

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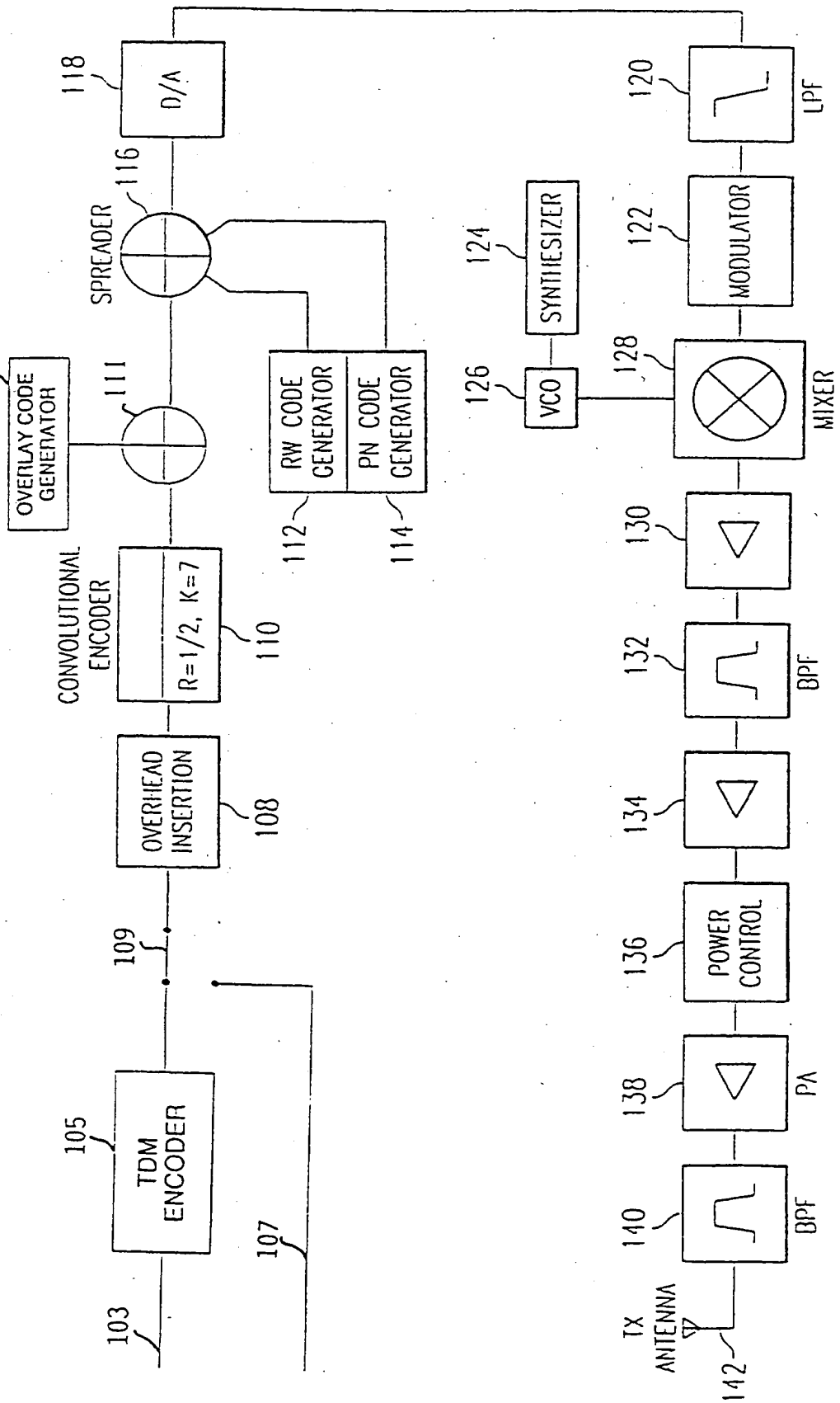


FIG. 7B

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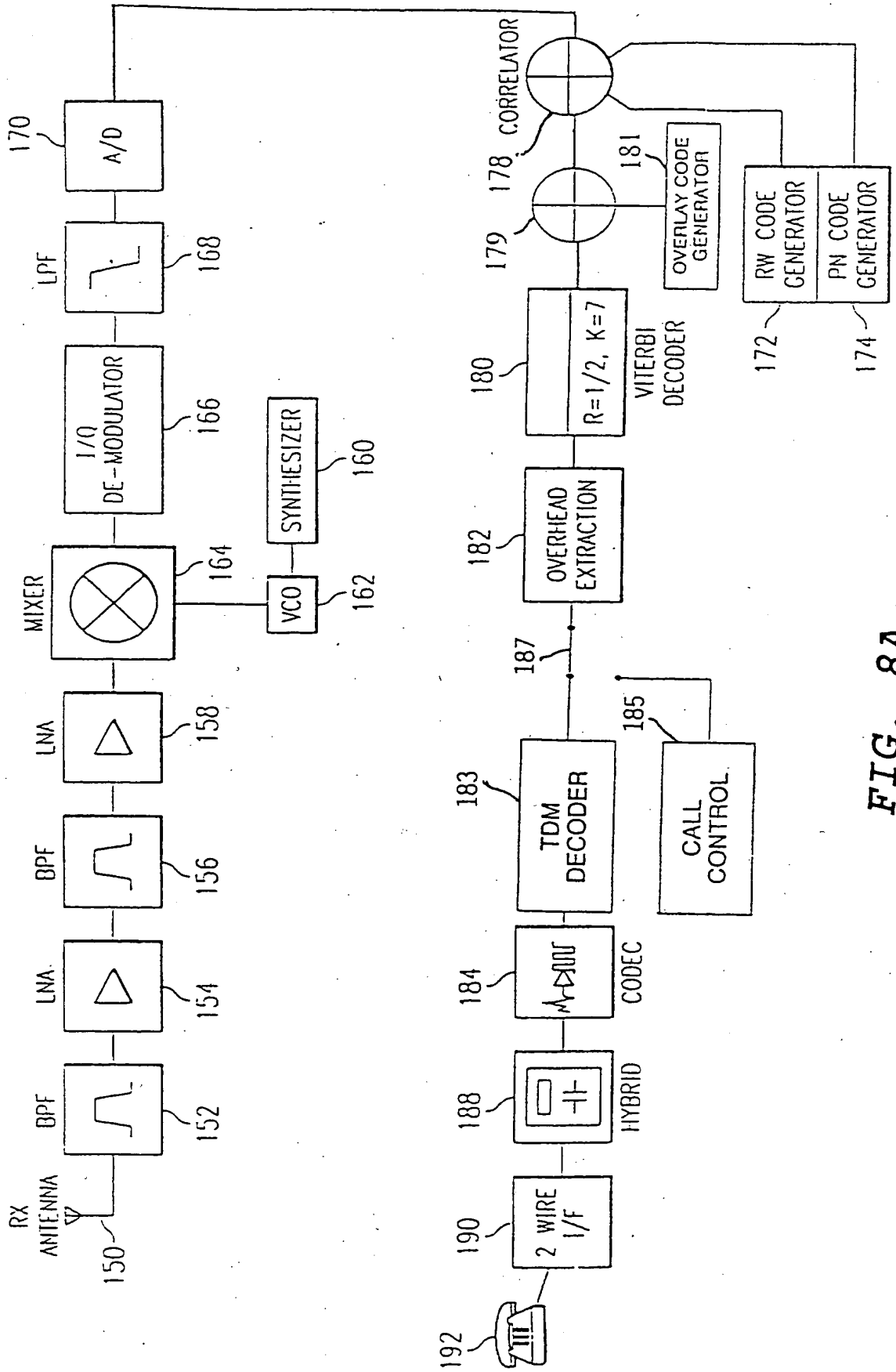


FIG. 8A

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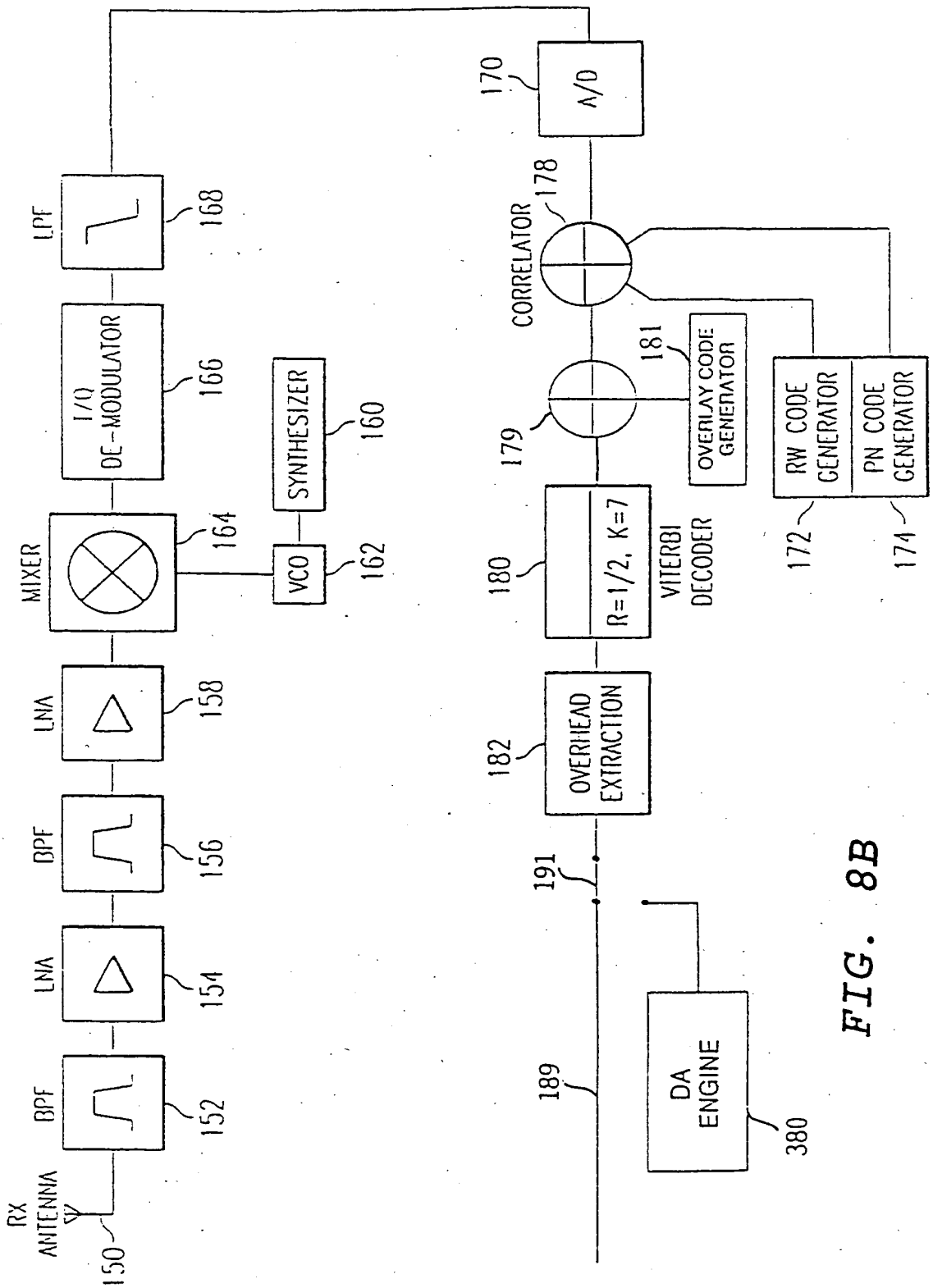


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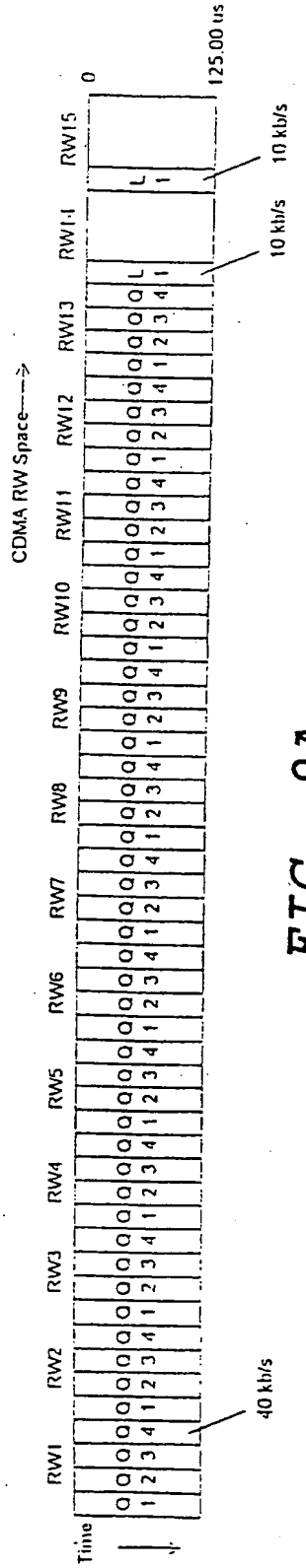


FIG. 9A

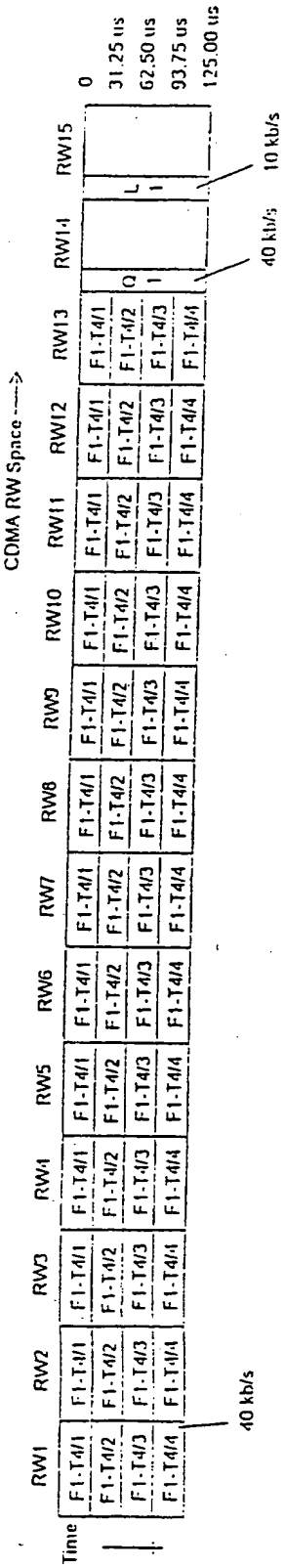


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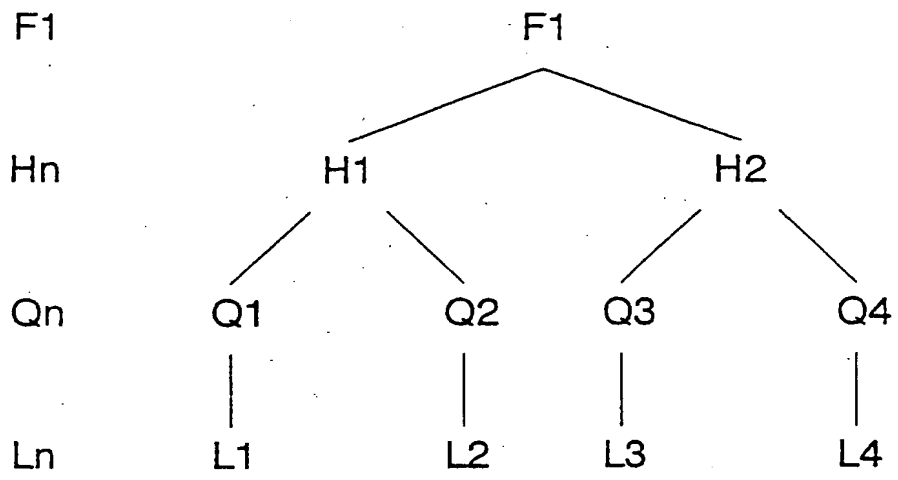


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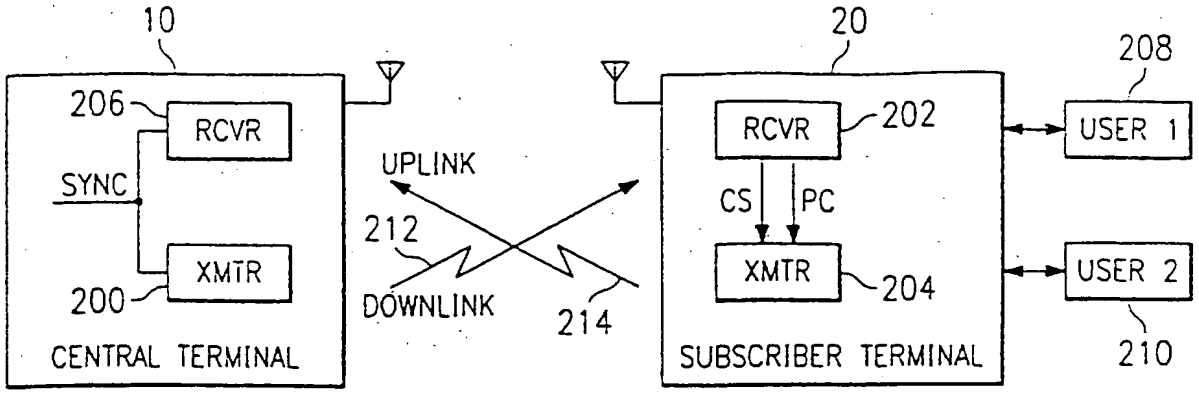


FIG. 11

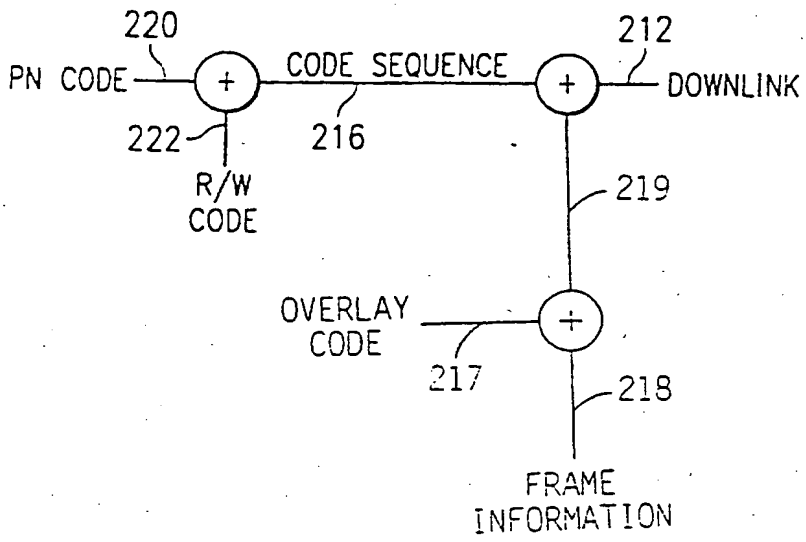


FIG. 12

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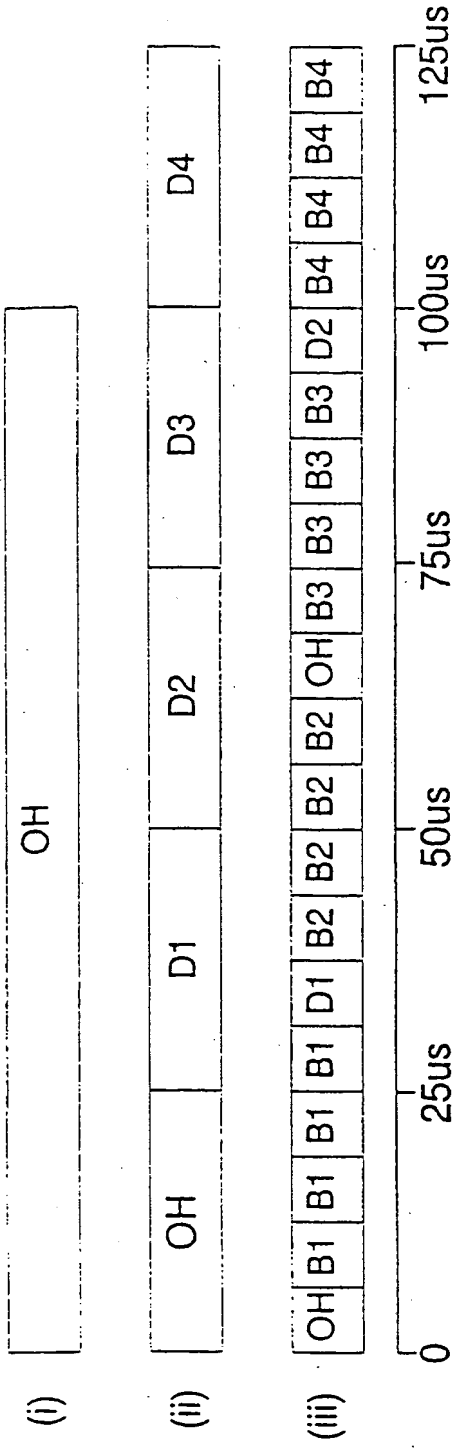


FIG. 13A

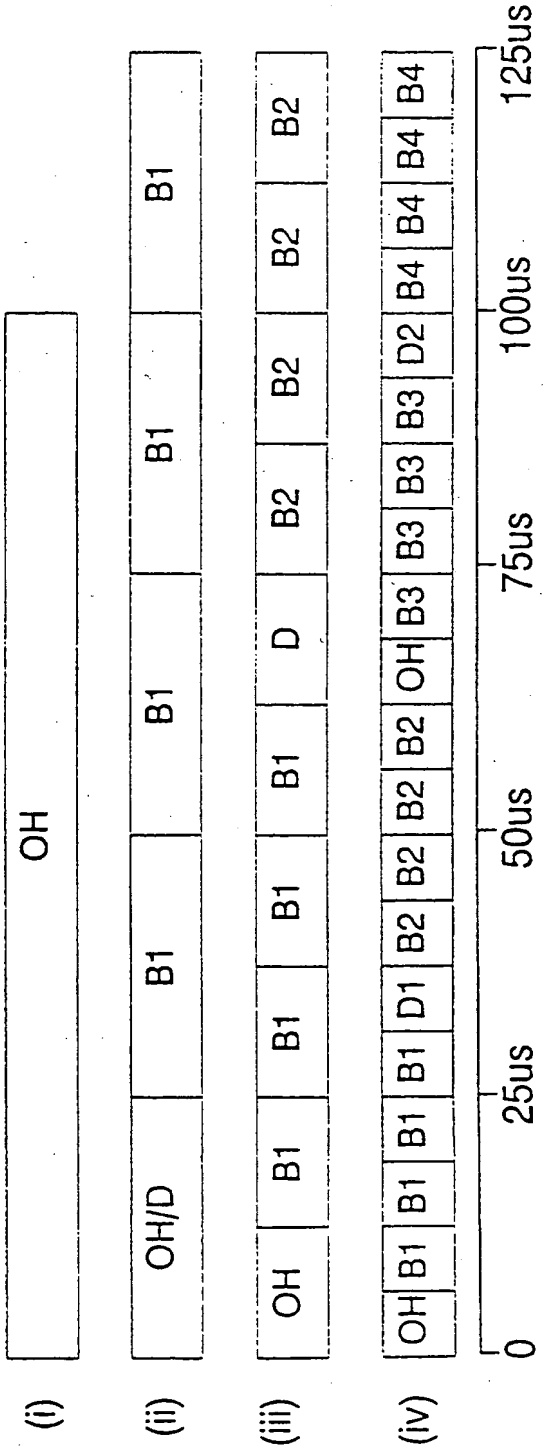


FIG. 13B

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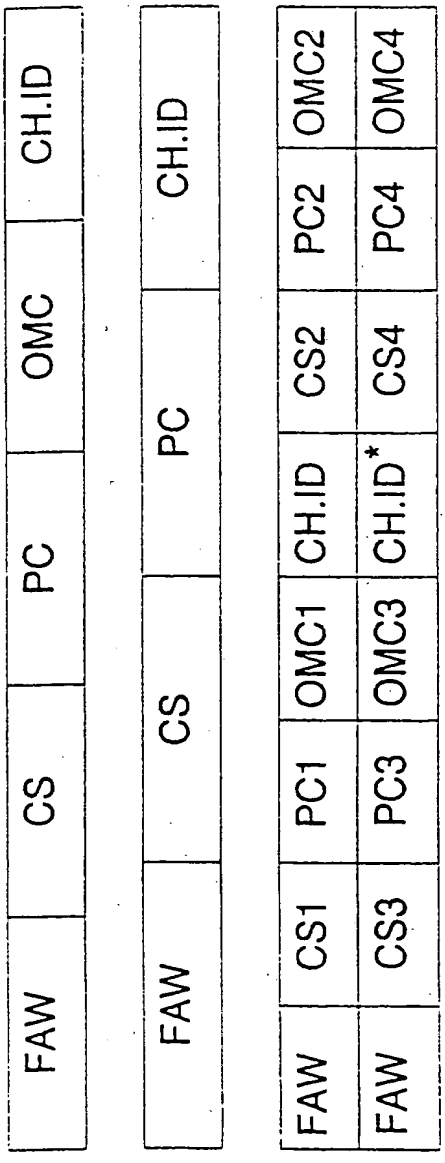


FIG. 14A

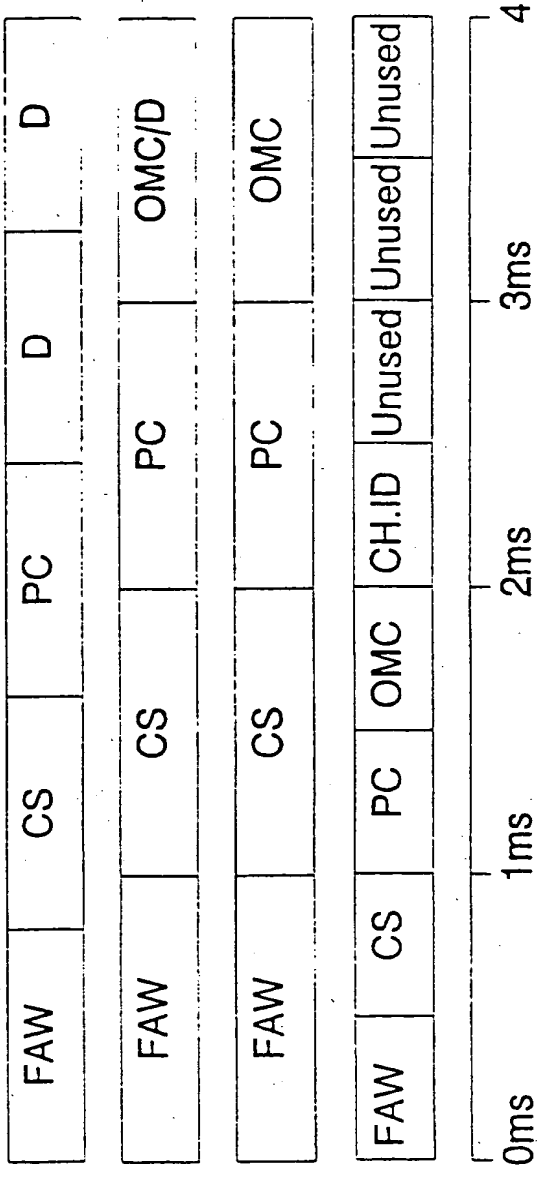


FIG. 14B

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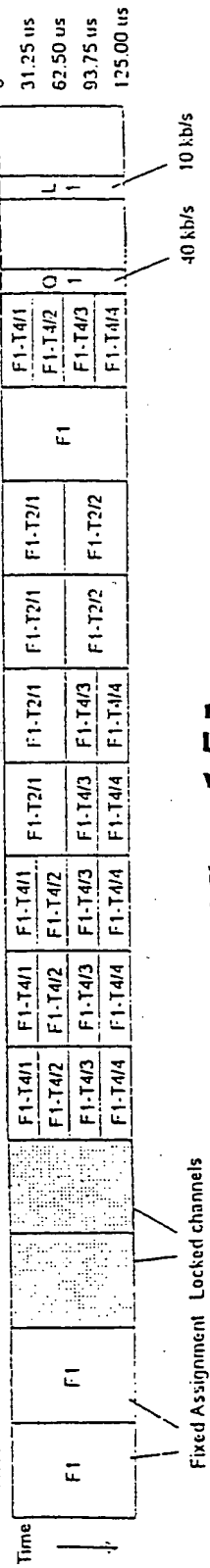


FIG. 15A

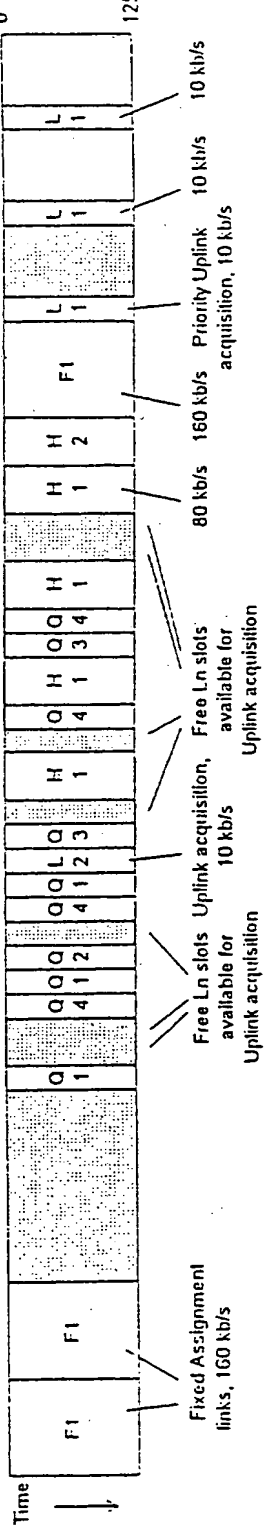


FIG. 15B

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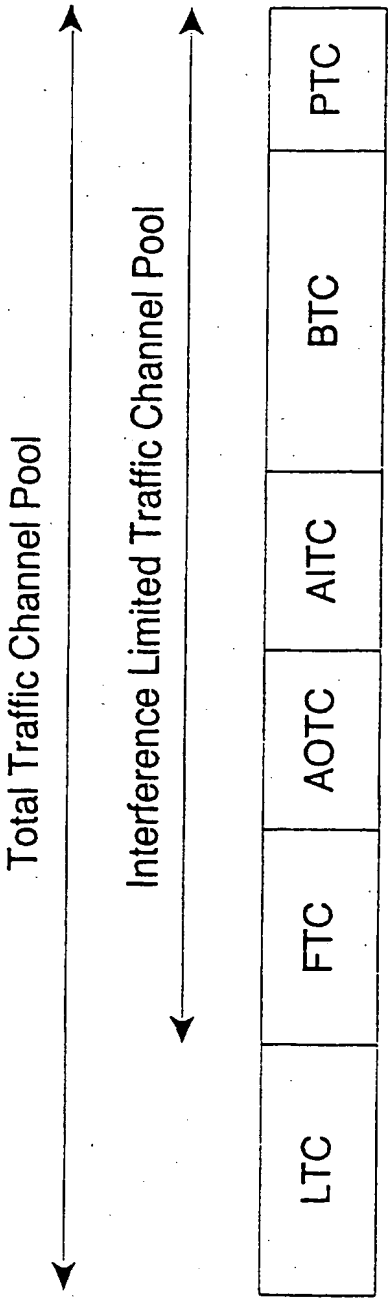


FIG. 16

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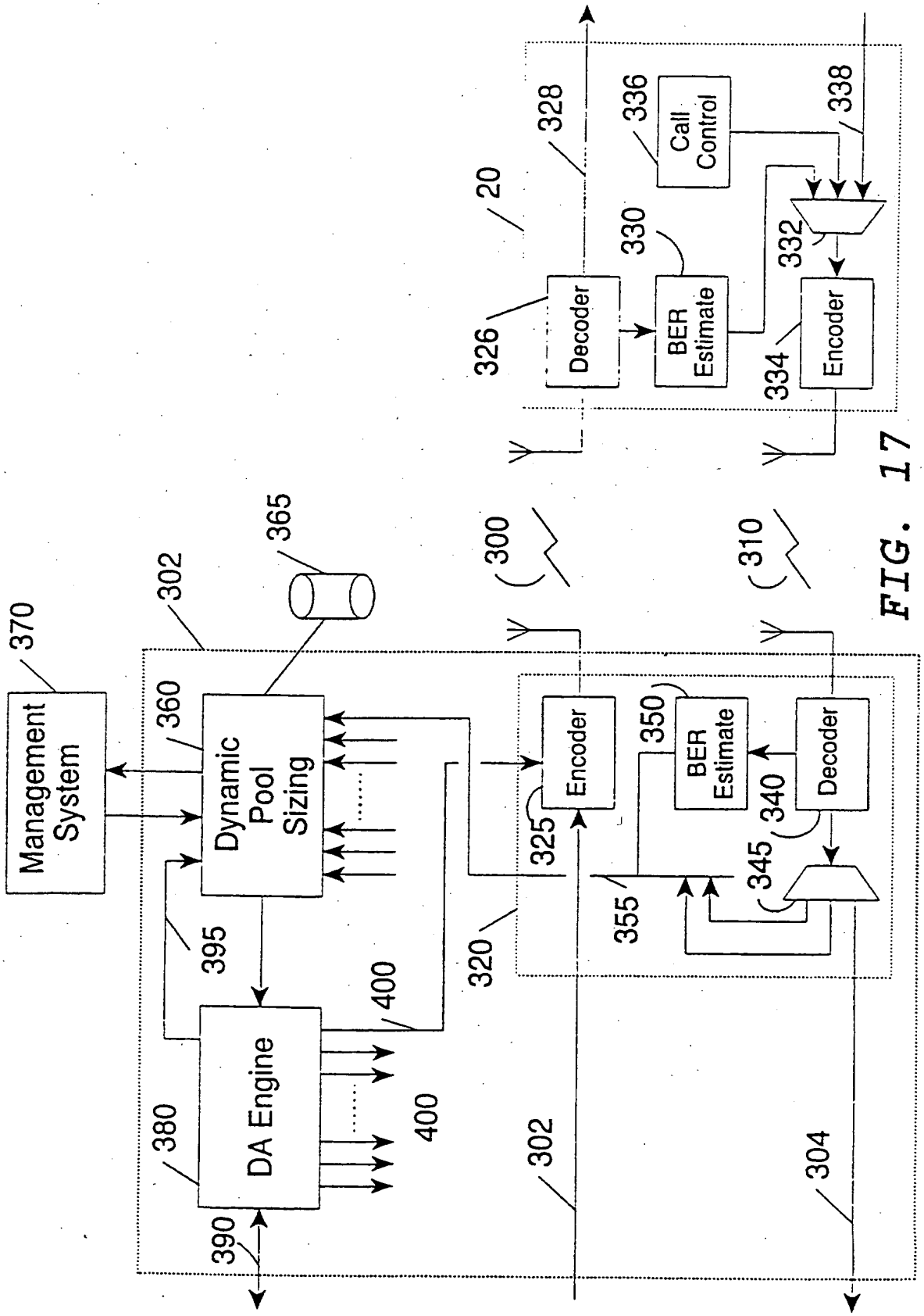
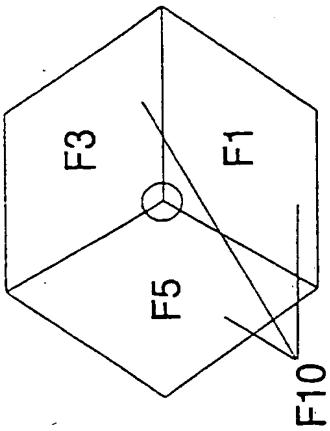
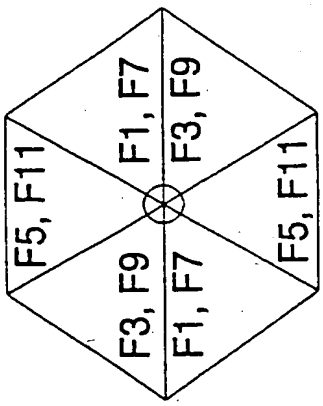


FIG. 17

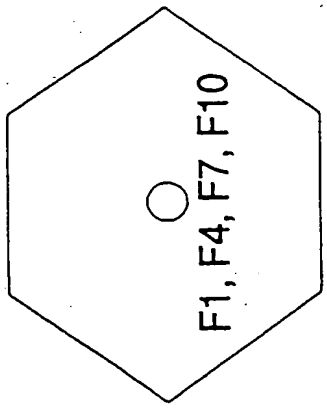
BNSDOCID: <GB___2320991A__I >



(iii)



(ii)



(i)

FIG. 18

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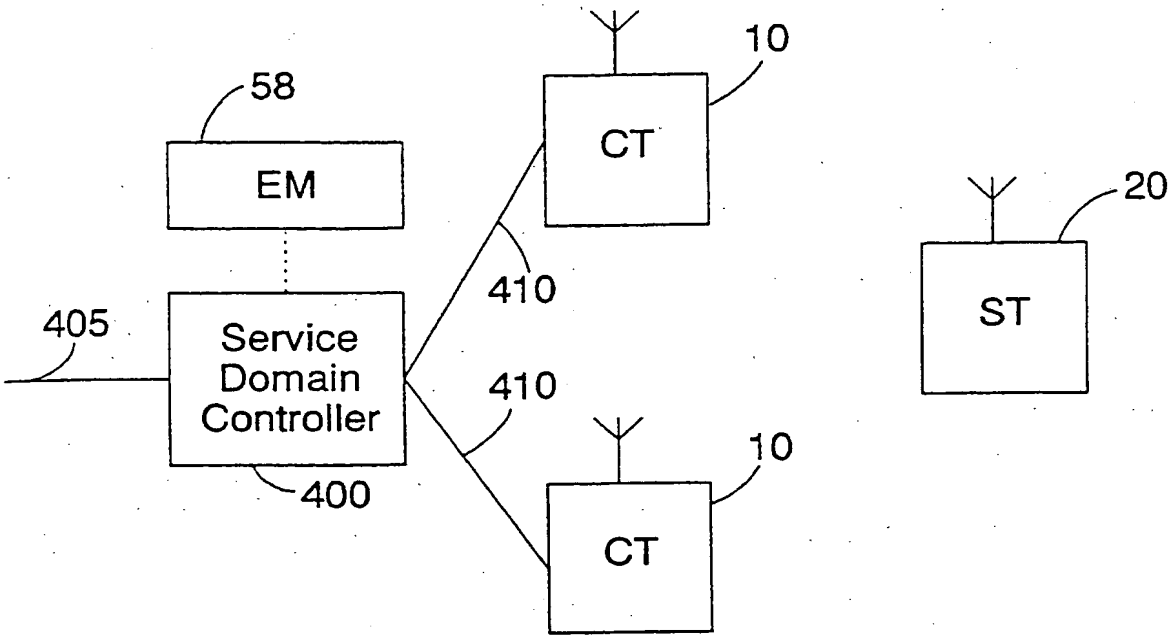


FIG. 19A

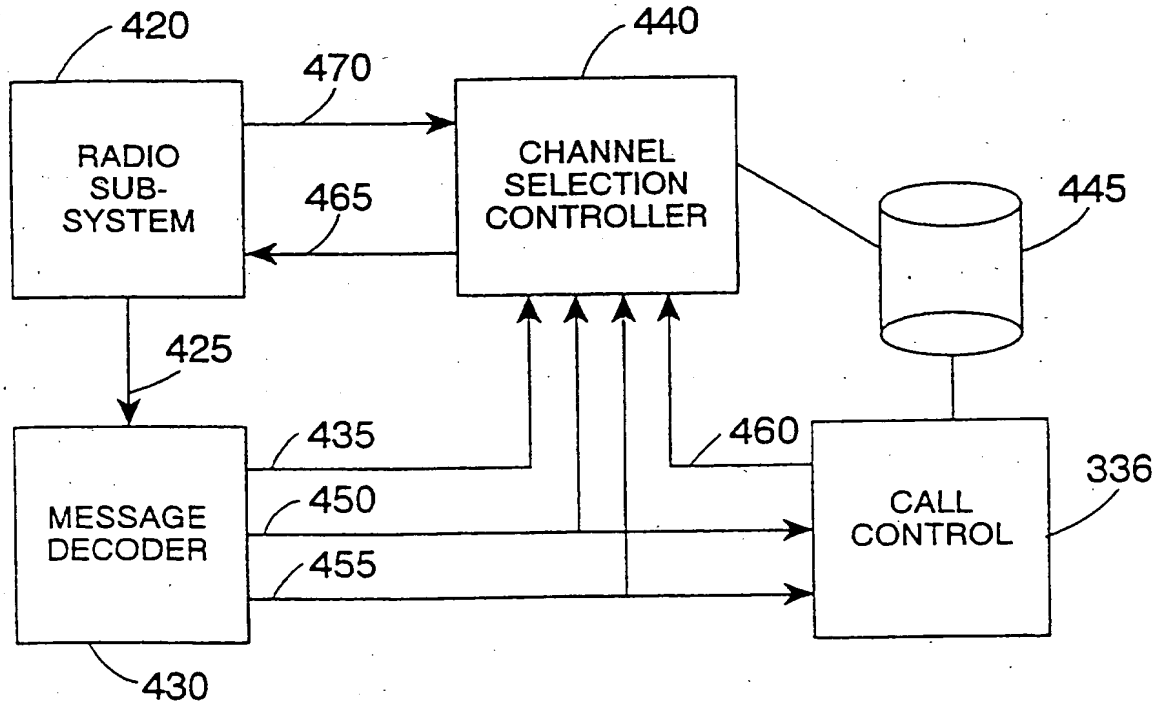


FIG. 19B

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ESTABLISHING A WIRELESS LINK CONNECTING A CENTRAL TERMINAL AND A SUBSCRIBER TERMINAL OF A WIRELESS TELECOMMUNICATIONS SYSTEM

Field of the Invention

The present invention relates in general to wireless telecommunications systems and more particularly to techniques for establishing a wireless link connecting a central terminal and a subscriber terminal of a wireless telecommunications system.

Background of the Invention

A wireless telecommunications system has been proposed in which a geographical area is divided in to cells, each cell having one or more central terminals (CTs) for communicating over wireless links with a number of subscriber terminals (STs) in the cell. These wireless links are established over predetermined frequency channels, a frequency channel typically consisting of one frequency for uplink signals from a subscriber terminal to the central terminal, and another frequency for downlink signals from the central terminal to the subscriber terminal.

A typical central terminal may have a number of modem shelves, each modem shelf operating with a different frequency channel. Due to bandwidth constraints, it is not practical for each individual subscriber terminal to have its own dedicated frequency channel for communicating with the central terminal. Hence, techniques need to be applied to enable data items relating to different wireless links to be passed over the same frequency channel without interfering with each other. In current wireless telecommunications systems, this can be achieved through the use of a 'Code Division Multiple Access' (CDMA) technique, whereby a set of orthogonal codes may be applied to the data items to be transmitted on a particular frequency channel, data items relating to different wireless links being combined with different orthogonal codes from the set.

Signals to which an orthogonal code has been applied can be considered as being transmitted over a corresponding orthogonal channel within a particular frequency channel. Hence, if, for example, a set of sixteen orthogonal codes is used,

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sixteen orthogonal channels can be created within a single frequency channel, and hence up to sixteen separate communication signals (corresponding to sixteen separate wireless links) can be transmitted simultaneously over the single frequency channel if different RW codes are applied to each communication signal. Thus, each modem shelf within the central terminal could support 16 wireless links.

Typically, each subscriber terminal would be arranged to always communicate on a particular orthogonal channel with a particular modem shelf of the central terminal, this arrangement often being referred to as a 'fixed assignment' arrangement.

As more subscribers subscribe to the wireless telecommunications network, it is becoming desirable to support more and more subscriber terminals from each central terminal. There are only a limited number of frequency channels that can be allocated to the wireless telecommunications system, and as it is desirable for neighbouring cells to use different frequency channels so as to reduce interference, the demand cannot be met by merely adding more modem shelves to each central terminal.

Hence, using the above fixed assignment arrangement, there is a limit as to how many subscriber terminals can be supported from one central terminal.

Summary of the Invention

Viewed from a first aspect, the present invention provides a channel selection controller for establishing a wireless link connecting a central terminal and a subscriber terminal of a wireless telecommunications system, at least two frequency channels being provided over which said wireless link could be established, the channel controller comprising: a storage for storing data identifying the at least two frequency channels; a selector for selecting a frequency channel from those listed in said storage; link acquisition logic for establishing a wireless link on the frequency channel selected by the selector; the selector being responsive to the link acquisition logic being unable to establish said wireless link, to select an alternative frequency channel from those listed in said storage.

By this approach, it is possible to increase the number of subscriber terminals that can be supported by the wireless telecommunications system, since if one frequency channel is fully used at the time that a wireless link connecting a particular

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subscriber terminal with a central terminal is required, then another frequency channel can be selected for the establishment of that wireless link. Formerly this would not have been possible, since the subscriber terminal would have been arranged to only communicate with a central terminal using one predefined frequency channel.

In preferred embodiments, the data in said storage identifies one of said at least two frequency channels as a preferred frequency channel, and the selector is arranged to select that preferred frequency channel first. Hence the channel selection controller will have a 'home' frequency channel which is the preferred channel over which to establish wireless links, the other frequency channels listed in the storage only being used if the home frequency channel is fully used at the time a wireless link is required. It will be appreciated by those skilled in the art that it is not necessary to define a home frequency channel, and any suitable logic may be provided for enabling the selector to select a frequency channel from those listed in said storage.

In preferred embodiments, the subscriber terminal may establish wireless links with a plurality of central terminals forming a service domain, and the controller further comprises a receiver for receiving a message from a central terminal of said service domain identifying the frequency channels for each central terminal in the service domain over which wireless links connecting said central terminals and said subscriber terminal can be established, the storage being arranged to store the information received by the receiver. Hence, a plurality of central terminals which can be used by the subscriber terminal for establishing wireless links can be arranged as a service domain, and the necessary information about that service domain passed to the channel selection controller. The provision of more than one central terminal with which a wireless link to a subscriber terminal can be established provides the wireless telecommunications system with improved fault tolerance. For example, if a particular central terminal has a fault which affects all modem shelves of that central terminal, then in prior art 'fixed assignment' systems, all subscriber terminals associated with that central terminal would be unable to establish communications until the fault is fixed. However, in accordance with preferred embodiments of the present invention, the channel selection controller will be able to connect those subscriber terminals to another central terminal, thereby reducing the effect of the fault.

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Preferably, the link acquisition logic attempts for a predetermined time to establish a wireless link on the frequency channel selected by the selector, and if the predetermined time elapses without the wireless link having been established, the link acquisition logic requests the selector to select an alternative frequency channel from those listed in said storage. It will be apparent that some other criteria, other than the elapse of a predetermined time, could be used to determine that the link acquisition controller has been unable to establish a wireless link on a particular frequency channel.

Viewed from a second aspect, the present invention provides a subscriber terminal of a wireless telecommunications system for communicating over wireless links with one or more central terminals provided by the wireless telecommunications system, the subscriber terminal including a channel selection controller in accordance with the present invention.

In one embodiment, one central terminal may be provided with which the subscriber terminal can establish a wireless link, a plurality of frequency channels being provided over which a wireless link between said subscriber terminal and said central terminal can be established, the storage being arranged to store data identifying said plurality of frequency channels. However, preferably, a plurality of central terminals are provided with which the subscriber terminal can establish a wireless link, each central terminal providing at least one frequency channel over which a wireless link between said subscriber terminal and that central terminal can be established, the storage being arranged to store data identifying said at least one frequency channel provided by each of the plurality of central terminals. By providing the subscriber terminal with the ability to use more than one central terminal, the fault tolerance of the wireless telecommunications system is increased, as discussed earlier.

In preferred embodiments, the subscriber terminal is located within a sector of a cell of the wireless telecommunications system, the cell having at least one central terminal with an antenna arrangement for providing said sector with a plurality of frequency channels, the storage being arranged to store said plurality of frequency channels.

Preferably, in response to a user of the subscriber terminal wishing to establish

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an outgoing call, the link acquisition logic attempts to establish a wireless link on the frequency channel selected by the selector, and if the link acquisition logic is unable to establish a wireless link on that frequency channel, the selector is arranged to select an alternative frequency channel from those listed in said storage, and the link acquisition logic is arranged to attempt to establish a wireless link for the outgoing call on that alternative frequency channel.

Further, in preferred embodiments, each frequency channel comprises a plurality of orthogonal channels, and the subscriber terminal is arranged to listen on a predetermined one of the orthogonal channels of a preferred frequency channel for a signal indicating that an incoming call is directed to the subscriber terminal, the signal identifying whether or not there is an available orthogonal traffic channel within that preferred frequency channel for the handling of that incoming call, the link acquisition logic being arranged to establish a wireless link on said preferred frequency channel if an orthogonal traffic channel is available, but if not, the selector is arranged to select an alternative frequency channel, and the link acquisition logic is arranged to establish a wireless link on said alternative frequency channel is there is an available orthogonal traffic channel for the handling of the incoming call on that alternative frequency channel.

In such an arrangement, the subscriber terminal, upon termination of the incoming call, preferably returns to listening on the predetermined orthogonal channel of the preferred frequency channel.

Viewed from a third aspect, the present invention provides a central terminal for communicating with a subscriber terminal in accordance with the second aspect of the present invention, the central terminal being arranged to be one of a plurality of central terminals forming a service domain of a wireless telecommunications system, and comprising: a storage for storing information about the other central terminals in the service domain; and a transmitter for broadcasting to the subscriber terminals in the service domain a service domain message identifying the frequency channels and central terminals which the subscriber terminals may use to establish a wireless link.

Preferably, the central terminal further comprises a receiver for receiving from

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a service domain controller information about the other central terminals in the service domain, this information being stored in the storage. Further, the storage is also arranged, in preferred embodiments, to store a database identifying for each subscriber terminal in the service domain, whether the central terminal is the primary central terminal for that subscriber terminal, or whether the central terminal is arranged to provide backup service to that subscriber terminal.

Viewed from a fourth aspect, the present invention provides a wireless telecommunications system comprising one or more cells, each cell comprising one or more central terminals and a plurality of subscriber terminals, the one or more central terminals being arranged to provide a plurality of frequency channels over which wireless links may be established connecting a subscriber terminal with said one or more central terminals, the wireless telecommunications system including a channel selection controller in accordance with the present invention to establish said wireless links. Preferably, a channel selection controller is provided within each of said plurality of subscriber terminals.

Viewed from a fifth aspect, the present invention provides a wireless telecommunications system comprising one or more cells, each cell comprising one or more central terminals and a plurality of subscriber terminals, the one or more central terminals being arranged to provide a plurality of frequency channels within at least one sector of the cell over which wireless links may be established connecting a subscriber terminal within said at least one sector with said one or more central terminals, the wireless telecommunications system including a channel selection controller in accordance with the present invention to establish said wireless links. Preferably, a channel selection controller is provided within each of the subscriber terminals within said at least one sector.

In preferred embodiments, the cell has a plurality of central terminals, each central terminal providing at least one frequency channel, and each central terminal providing a different at least one frequency channel to the at least one frequency channel provided by the other central terminals of the cell.

Viewed from a sixth aspect, the present invention provides a method of establishing a wireless link connecting a central terminal and a subscriber terminal of

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a wireless telecommunications system, at least two frequency channels being provided over which said wireless link could be established, the method comprising the steps of: (a) storing data identifying the at least two frequency channels; (b) employing a selector to select a frequency channel from those listed in said storage; (c) establishing a wireless link on the frequency channel selected by the selector; and (d) if at said step (c), said wireless link cannot be established, repeating said step (b) to select an alternative frequency channel, and repeating step (c) using said alternative frequency channel.

Brief Description of the Drawings

An embodiment of the invention will be described hereinafter, by way of example only, with reference to the accompanying drawings in which like reference signs are used for like features and in which:

Figure 1 is a schematic overview of an example of a wireless telecommunications system in which an example of the present invention is included;

Figure 2 is a schematic illustration of an example of a subscriber terminal of the telecommunications system of Figure 1;

Figure 3 is a schematic illustration of an example of a central terminal of the telecommunications system of Figure 1;

Figure 3A is a schematic illustration of a modem shelf of a central terminal of the telecommunications system of Figure 1;

Figure 4 is an illustration of an example of a frequency plan for the telecommunications system of Figure 1;

Figures 5A and 5B are schematic diagrams illustrating possible configurations for cells for the telecommunications system of Figure 1;

Figure 6 is a schematic diagram illustrating aspects of a code division multiplex system for the telecommunications system of Figure 1;

Figures 7A and 7B are schematic diagrams illustrating signal transmission processing stages for the telecommunications system of Figure 1;

Figures 8A and 8B are schematic diagrams illustrating signal reception processing stages for the telecommunications system of Figure 1;

Figures 9A and 9B are diagrams illustrating the uplink and downlink delivery

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methods when the system is fully loaded;

Figure 10 illustrates the CDMA channel hierarchy in accordance with preferred embodiments of the present invention;

Figure 11 is a schematic diagram illustrating downlink and uplink communication paths for the wireless telecommunications system;

Figure 12 is a schematic diagram illustrating the makeup of a downlink signal transmitted by the central terminal;

Figures 13A and 13B illustrate the structure of the frames of information sent over the downlink and uplink paths;

Figures 14A and 14B illustrate the overhead frame structure for the downlink and uplink paths;

Figures 15A and 15B illustrate typical downlink and uplink channel structures that might occur in a loaded system in accordance with preferred embodiments of the present invention;

Figure 16 illustrates how the available traffic channels are classified in preferred embodiments of the present invention;

Figure 17 illustrates the elements used by the central terminal to perform interference limiting;

Figure 18 illustrates possible antenna configurations that can be employed in a wireless telecommunications system in accordance with the preferred embodiment of the present invention; and

Figures 19A and 19B illustrate how channel switching is facilitated in preferred embodiments of the present invention.

Description of Preferred Embodiment

Figure 1 is a schematic overview of an example of a wireless telecommunications system. The telecommunications system includes one or more service areas 12, 14 and 16, each of which is served by a respective central terminal (CT) 10 which establishes a radio link with subscriber terminals (ST) 20 within the area concerned. The area which is covered by a central terminal 10 can vary. For example, in a rural area with a low density of subscribers, a service area 12 could cover an area with a radius of 15-20Km. A service area 14 in an urban environment

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where is there is a high density of subscriber terminals 20 might only cover an area with a radius of the order of 100m. In a suburban area with an intermediate density of subscriber terminals, a service area 16 might cover an area with a radius of the order of 1Km. It will be appreciated that the area covered by a particular central terminal 10 can be chosen to suit the local requirements of expected or actual subscriber density, local geographic considerations, etc, and is not limited to the examples illustrated in Figure 1. Moreover, the coverage need not be, and typically will not be circular in extent due to antenna design considerations, geographical factors, buildings and so on, which will affect the distribution of transmitted signals.

The central terminals 10 for respective service areas 12, 14, 16 can be connected to each other by means of links 13, 15 and 17 which interface, for example, with a public switched telephone network (PSTN) 18. The links can include conventional telecommunications technology using copper wires, optical fibres, satellites, microwaves, etc.

The wireless telecommunications system of Figure 1 is based on providing fixed microwave links between subscriber terminals 20 at fixed locations within a service area (e.g., 12, 14, 16) and the central terminal 10 for that service area. Each subscriber terminal 20 can be provided with a permanent fixed access link to its central terminal 10, but in preferred embodiments demand-based access is provided, so that the number of subscribers which can be supported exceeds the number of available wireless links. The manner in which demand-based access is implemented will be discussed in detail later.

Figure 2 illustrates an example of a configuration for a subscriber terminal 20 for the telecommunications system of Figure 1. Figure 2 includes a schematic representation of customer premises 22. A customer radio unit (CRU) 24 is mounted on the customer's premises. The customer radio unit 24 includes a flat panel antenna or the like 23. The customer radio unit is mounted at a location on the customer's premises, or on a mast, etc., and in an orientation such that the flat panel antenna 23 within the customer radio unit 24 faces in the direction 26 of the central terminal 10 for the service area in which the customer radio unit 24 is located.

The customer radio unit 24 is connected via a drop line 28 to a power supply

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unit (PSU) 30 within the customer's premises. The power supply unit 30 is connected to the local power supply for providing power to the customer radio unit 24 and a network terminal unit (NTU) 32. The customer radio unit 24 is also connected via the power supply unit 30 to the network terminal unit 32, which in turn is connected to telecommunications equipment in the customer's premises, for example to one or more telephones 34, facsimile machines 36 and computers 38. The telecommunications equipment is represented as being within a single customer's premises. However, this need not be the case, as the subscriber terminal 20 preferably supports either a single or a dual line, so that two subscriber lines could be supported by a single subscriber terminal 20. The subscriber terminal 20 can also be arranged to support analogue and digital telecommunications, for example analogue communications at 16, 32 or 64kbits/sec or digital communications in accordance with the ISDN BRA standard.

Figure 3 is a schematic illustration of an example of a central terminal of the telecommunications system of Figure 1. The common equipment rack 40 comprises a number of equipment shelves 42, 44, 46, including a RF Combiner and power amp shelf (RFC) 42, a Power Supply shelf (PS) 44 and a number of (in this example four) Modem Shelves (MS) 46. The RF combiner shelf 42 allows the modem shelves 46 to operate in parallel. If 'n' modem shelves are provided, then the RF combiner shelf 42 combines and amplifies the power of 'n' transmit signals, each transmit signal being from a respective one of the 'n' modem shelves, and amplifies and splits received signals 'n' way so that separate signals may be passed to the respective modem shelves. The power supply shelf 44 provides a connection to the local power supply and fusing for the various components in the common equipment rack 40. A bidirectional connection extends between the RF combiner shelf 42 and the main central terminal antenna 52, such as an omnidirectional antenna, mounted on a central terminal mast 50.

This example of a central terminal 10 is connected via a point-to-point microwave link to a location where an interface to the public switched telephone network 18, shown schematically in Figure 1, is made. As mentioned above, other types of connections (e.g., copper wires or optical fibres) can be used to link the central terminal 10 to the public switched telephone network 18. In this example the

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modem shelves are connected via lines 47 to a microwave terminal (MT) 48. A microwave link 49 extends from the microwave terminal 48 to a point-to-point microwave antenna 54 mounted on the mast 50 for a host connection to the public switched telephone network 18.

A personal computer, workstation or the like can be provided as a site controller (SC) 56 for supporting the central terminal 10. The site controller 56 can be connected to each modem shelf of the central terminal 10 via, for example, RS232 connections 55. The site controller 56 can then provide support functions such as the localisation of faults, alarms and status and the configuring of the central terminal 10. A site controller 56 will typically support a single central terminal 10, although a plurality of site controllers 56 could be networked for supporting a plurality of central terminals 10.

As an alternative to the RS232 connections 55, which extend to a site controller 56, data connections such as an X.25 links 57 (shown with dashed lines in Figure 3) could instead be provided from a pad 228 to a switching node 60 of an element manager (EM) 58. An element manager 58 can support a number of distributed central terminals 10 connected by respective connections to the switching node 60. The element manager 58 enables a potentially large number (e.g., up to, or more than 1000) of central terminals 10 to be integrated into a management network. The element manager 58 is based around a powerful workstation 62 and can include a number of computer terminals 64 for network engineers and control personnel.

Figure 3A illustrates various parts of a modem shelf 46. A transmit/receive RF unit (RFU – for example implemented on a card in the modem shelf) 66 generates the modulated transmit RF signals at medium power levels and recovers and amplifies the baseband RF signals for the subscriber terminals. The RF unit 66 is connected to an analogue card (AN) 68 which performs A-D/D-A conversions, baseband filtering and the vector summation of 15 transmitted signals from the modem cards (MCs) 70. The analogue unit 68 is connected to a number of (typically 1-8) modem cards 70. The modem cards perform the baseband signal processing of the transmit and receive signals to/from the subscriber terminals 20. This may include 1/2 rate convolution coding and x 16 spreading with "Code Division Multiplexed Access" (CDMA) codes

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on the transmit signals, and synchronisation recovery, de-spreading and error correction on the receive signals. Each modem card 70 in the present example has two modems, and in preferred embodiments there are eight modem cards per shelf, and so sixteen modems per shelf. However, in order to incorporate redundancy so that a modem may be substituted in a subscriber link when a fault occurs, only 15 modems on a single modem shelf 46 are generally used. The 16th modem is then used as a spare which can be switched in if a failure of one of the other 15 modems occurs. The modem cards 70 are connected to the tributary unit (TU) 74 which terminates the connection to the host public switched telephone network 18 (e.g., via one of the lines 47) and handles the signalling of telephony information to the subscriber terminals via one of 15 of the 16 modems.

The wireless telecommunications between a central terminal 10 and the subscriber terminals 20 could operate on various frequencies. Figure 4 illustrates one possible example of the frequencies which could be used. In the present example, the wireless telecommunication system is intended to operate in the 1.5-2.5GHz Band. In particular the present example is intended to operate in the Band defined by ITU-R (CCIR) Recommendation F.701 (2025-2110MHz, 2200-2290MHz). Figure 4 illustrates the frequencies used for the uplink from the subscriber terminals 20 to the central terminal 10 and for the downlink from the central terminal 10 to the subscriber terminals 20. It will be noted that 12 uplink and 12 downlink radio channels of 3.5MHz each are provided centred about 2155MHz. The spacing between the receive and transmit channels exceeds the required minimum spacing of 70MHz.

In the present example, each modem shelf supports 1 frequency channel (i.e. one uplink frequency plus the corresponding downlink frequency). Currently, in a wireless telecommunications system as described above, CDMA encoding is used to support up to 15 subscriber links on one frequency channel (one subscriber link on each modem). Hence, if a central terminal has four modem shelves, it can support 60 (15 x 4) subscriber links (ie. 60 STs can be connected to one CT). However, it is becoming desirable for more than 60 STs to be supported from one central terminal, and, in preferred embodiments of the present invention, enhancements to the CDMA encoding technique are provided to increase the number of subscriber links that can

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be supported by a central terminal. Both CDMA encoding, and the enhancements made to the CDMA encoding in accordance with preferred embodiments, will be discussed in more detail later.

Typically, the radio traffic from a particular central terminal 10 will extend into the area covered by a neighbouring central terminal 10. To avoid, or at least to reduce interference problems caused by adjoining areas, only a limited number of the available frequencies will be used by any given central terminal 10.

Figure 5A illustrates one cellular type arrangement of the frequencies to mitigate interference problems between adjacent central terminals 10. In the arrangement illustrated in Figure 5A, the hatch lines for the cells 76 illustrate a frequency set (FS) for the cells. By selecting three frequency sets (e.g., where: FS1 = F1, F4, F7, F10; FS2 = F2, F5, F8, F11; FS3 = F3, F6, F9, F12), and arranging that immediately adjacent cells do not use the same frequency set (see, for example, the arrangement shown in Figure 5A), it is possible to provide an array of fixed assignment omnidirectional cells where interference between nearby cells can be reduced. The transmitter power of each central terminal 10 is preferably set such that transmissions do not extend as far as the nearest cell which is using the same frequency set. Thus, in accordance with the arrangement illustrated in Figure 5A, each central terminal 10 can use the four frequency pairs (for the uplink and downlink, respectively) within its cell, each modem shelf in the central terminal 10 being associated with a respective RF channel (channel frequency pair).

Figure 5B illustrates a cellular type arrangement employing sectored cells to mitigate problems between adjacent central terminals 10. As with Figure 5A, the different type of hatch lines in Figure 5B illustrate different frequency sets. As in Figure 5A, Figure 5B represents three frequency sets (e.g., where: FS1 = F1, F4, F7, F10; FS2 = F2, F5, F8, F11; FS3 = F3, F6, F9, F12). However, in Figure 5B the cells are sectored by using a sectored central terminal (SCT) 13 which includes three central terminals 10, one for each sector S1, S2 and S3, with the transmissions for each of the three central terminals 10 being directed to the appropriate sector among S1, S2 and S3. This enables the number of subscribers per cell to be increased three fold, while still providing permanent fixed access for each subscriber terminal 20.

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Arrangements such as those in figures 5A and 5B can help reduce interference, but in order to ensure that cells operating on the same frequency don't inadvertently decode each others data, a seven cell repeat pattern is used such that for a cell operating on a given frequency, all six adjacent cells operating on the same frequency are allocated a unique pseudo random noise (PN) code. The use of PN codes will be discussed in more detail later. The use of different PN codes prevents nearby cells operating on the same frequency from inadvertently decoding each others data.

As mentioned above, CDMA techniques can be used in a fixed assignment arrangement (ie. one where each ST is assigned to a particular modem on a modem shelf) to enable each channel frequency to support 15 subscriber links. Figure 6 gives a schematic overview of CDMA encoding and decoding.

In order to encode a CDMA signal, base band signals, for example the user signals for each respective subscriber link, are encoded at 80-80N into a 160ksymbols/sec baseband signal where each symbol represents 2 data bits (see, for example the signal represented at 81). This signal is then spread by a factor of 16 using a spreading function 82-82N to generate signals at an effective chip rate of 2.56Msymbols/sec in 3.5MHz. The spreading function involves applying a PN code (that is specified on a per CT basis) to the signal, and also applying a Rademacher-Walsh (RW) code which ensures that the signals for respective subscriber terminals will be orthogonal to each other. Once this spreading function has been applied, the signals for respective subscriber links are then combined at step 84 and converted to radio frequency (RF) to give multiple user channel signals (e.g. 85) for transmission from the transmitting antenna 86.

During transmission, a transmitted signal will be subjected to interference sources 88, including external interference 89 and interference from other channels 90. Accordingly, by the time the CDMA signal is received at the receiving antenna 91, the multiple user channel signals may be distorted as is represented at 93.

In order to decode the signals for a given subscriber link from the received multiple user channel, a Walsh correlator 94-94N uses the same RW and PN codes that were used for the encoding for each subscriber link to extract a signal (e.g, as represented at 95) for the respective received baseband signal 96-96N. It will be

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noted that the received signal will include some residual noise. However, unwanted noise can be removed using a low pass filter and signal processing.

The key to CDMA is the application of the RW codes, these being a mathematical set of sequences that have the function of "orthonormality". In other words, if any RW code is multiplied by any other RW code, the results are zero. A set of 16 RW codes that may be used is illustrated in Table 1 below:

RW0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RW1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1
RW2	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
RW3	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
RW4	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
RW5	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1
RW6	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
RW7	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1
RW8	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
RW9	1	-1	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1
RW10	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
RW11	1	-1	-1	1	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1
RW12	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
RW13	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	1	-1	1	-1
RW14	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
RW15	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	1	-1	-1	1

Table 1

The above set of RW codes are orthogonal codes that allow the multiple user signals to be transmitted and received on the same frequency at the same time. Once the bit stream is orthogonally isolated using the RW codes, the signals for respective subscriber links do not interfere with each other. Since RW codes are orthogonal, when perfectly aligned all codes have zero cross-correlation, thus making it possible

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to decode a signal while cancelling interference from users operating on other RW codes.

In preferred embodiments of the present invention, it is desired to provide the central terminal with the ability to support more than 15 subscriber links on each channel frequency, and to achieve this the above set of 16 RW codes has been enhanced. In order to maintain compatibility with former products using the 16 RW codes, it was desirable that any enhancements should retain the same set of 16 RW codes.

The manner in which the enhancements have been implemented provides flexibility in the way the frequency channels are configured, with certain configurations allowing a greater number of subscriber links to be supported, but at a lower gross bit rate. In preferred embodiments, a channel can be selected to operate with the following gross bit rates:

160 kb/s	Full rate (F1)
80 kb/s	Half rate (H1, H2)
40 kb/s	Quarter rate (Q1, Q2, Q3, Q4)
10 kb/s	Low rate (L1, L2, L3, L4), for uplink acquisition

In preferred embodiments, the manner in which these channelisations are provided differs for the downlink (CT to ST) and uplink (ST to CT) communication paths. This is because it has been realised that different performance requirements exist for the downlink and uplink paths. On the downlink all signals emanate from a single source, namely the central terminal, and hence the signals will be synchronised. However, on the uplink path, the signals will emanate from a number of independent STs, and hence the signals will not be synchronised.

Given the above considerations, in preferred embodiments, on the uplink path full rate (160 kb/s) operation is implemented using the basic set of RW codes discussed earlier, but half and quarter rates are achieved through the use of 'Overlay Codes' which comprise RW coded high rate symbol patterns that are transmitted for

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each intermediate rate data symbol. For half rate operation, two 2-bit overlay codes are provide, whilst for quarter rate operation, four 4-bit overlay codes are provided.

When generating a signal for transmission, one of the overlay codes, where appropriate, is applied to the signal in addition to the appropriate RW code. When the signal is received, then at the CDMA demodulator the incoming signal is multiplied by the channel's PN, RW and Overlay codes. The correlator integration period is set to match the length of the Overlay code.

Overlay codes are used extensively to provide variable rate uplink traffic channels. Overlay codes will also be used to implement downlink control channels, these control channels being discussed in more detail later. However, as mentioned earlier, a different approach is taken for providing flexible channelisations on the downlink traffic channel paths. Downlink traffic channels will operate in high rate, 160 kb/s, mode, with lower data rates of 80 and 40 kb/s being supported by 'Time Division Multiplexing' (TDM) the available bandwidth.

In preferred embodiments, TDM timeslot bit numbering will follow the CCITT G.732 convention with bits transmitted in the sequence bit 1, bit 2 ... bit 8. Byte orientation is specified per channel as either most significant bit (MSB) first, least significant bit (LSB) first or N/A.

The provision of a hybrid CDMA/TDM approach for downlink traffic channels retains the benefits of CDMA access, ie. interference is reduced when traffic is reduced. Further, use of TDM ensures that the CDMA signal is limited to a 256 'Quadrature Amplitude Modulation' (QAM) constellation which reduces receiver dynamic range requirements. QAM constellations will be familiar to those skilled in the art.

On the uplink channels, the pure CDMA approach using overlay codes eliminates the need to time synchronise STs to a TDM frame reference. This has the advantage of eliminating TDM delays and the 'guard time' in between TDM frames. Another benefit is reduced peak power handling requirements in the ST RF transmit chain which would otherwise be needed when transmitting bursty TDM data. High dynamic range requirement is restricted to the CT receiver.

The manner in which the transmitted and received signals are processed in

BNSDOCID: <GB 2320991A I >

accordance with preferred embodiments of the present invention will be described with reference to figures 7 and 8. Figure 7A is a schematic diagram illustrating signal transmission processing stages as configured in a subscriber terminal 20 in the telecommunications system of Figure 1. In Figure 7A, an analogue signal from a telephone is passed via an interface such as two-wire interface 102 to a hybrid audio processing circuit 104 and then via a codec 106 to produce a digital signal into which an overhead channel including control information is inserted at 108. If the subscriber terminal supports a number of telephones or other telecommunications equipment, then elements 102, 104 and 106 may be repeated for each piece of telecommunications equipment.

At the output of overhead insertion circuit 108, the signal will have a bit rate of either 160, 80 or 40 kbits/s, depending on which channel has been selected for transmission of the signal.

The resulting signal is then processed by a convolutional encoder 110 to produce two signals with the same bit rate as the input signal (collectively, these signals will have a symbol rate of 160, 80 or 40 KS/s). Next, the signals are passed to a spreader 111 where, if a reduced bit rate channel has been selected, an appropriate overlay code provided by overlay code generator 113 is applied to the signals. At the output of the spreader 111, the signals will be at 160 KS/s irrespective of the bit rate of the input signal since the overlay code will have increased the symbol rate by the necessary amount.

The signals output from spreader 111 are passed to a spreader 116 where the Rademacher-Walsh and PN codes are applied to the signals by a RW code generator 112 and PN Code generator 114, respectively. The resulting signals, at 2.56MC/s (2.56 Mega chips per second, where a chip is the smallest data element in a spread sequence) are passed via a digital to analogue converter 118. The digital to analogue converter 118 shapes the digital samples into an analogue waveform and provides a stage of baseband power control. The signals are then passed to a low pass filter 120 to be modulated in a modulator 122. The modulated signal from the modulator 122 is mixed with a signal generated by a voltage controlled oscillator 126 which is responsive to a synthesizer 160. The output of the mixer 128 is then amplified in a

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low noise amplifier 130 before being passed via a band pass filter 132. The output of the band pass filter 132 is further amplified in a further low noise amplifier 134, before being passed to power control circuitry 136. The output of the power control circuitry is further amplified in a power amplifier 138 before being passed via a further band pass filter 140 and transmitted from the transmission antenna 142.

Figure 7B is a schematic diagram illustrating signal transmission processing stages as configured in a central terminal 10 in the telecommunications system of Figure 1. As will be apparent, the central terminal is configured to perform similar signal transmission processing to the subscriber terminal 20 illustrated in Figure 7A, but does not include elements 100, 102, 104 and 106 associated with telecommunications equipment. Further, the central terminal includes a TDM encoder 105 for performing time division multiplexing where required. The central terminal will have a network interface over which incoming calls destined for a subscriber terminal are received. When an incoming call is received, the central terminal will contact the subscriber terminal to which the call is directed and arrange a suitable channel over which the incoming call can be established with the subscriber terminal (in preferred embodiments, this is done using the call control channel discussed in more detail later). The channel established for the call will determine the time slot to be used for call data passed from the CT to the ST and the TDM encoder 105 will be supplied with this information.

Hence, when incoming call data is passed from the network interface to the TDM encoder 105 over line 103, the TDM encoder will apply appropriate TDM encoding to enable the data to be inserted in the appropriate time slot. From then on, the processing of the signal is the same as the equivalent processing performed in the ST and described with reference to Figure 7A, the overlay code generator producing a single overlay code of value '1' so that the signal output from spreader 111 is the same as the signal input to the spreader 111.

As mentioned earlier, in preferred embodiments, overlay codes, rather than TDM, are used to implement downlink control channels, and data relating to such channels is passed from a demand assignment engine (to be discussed in more detail later) over line 107 through switch 109 to the overhead insertion circuit 108, thereby

BNSDOCID: <GB__2320991A I >

bypassing the TDM encoder 105. The processing of the signal is then the same as the equivalent processing performed in the ST, with the overlay code generator providing appropriate overlay codes to the spreader 111. The overlay code generator will be controlled so as to produce the desired overlay code, in preferred embodiments, this control coming from the DA engine (to be discussed in more detail later).

Figure 8A is a schematic diagram illustrating the signal reception processing stages as configured in a subscriber terminal 20 in the telecommunications system of Figure 1. In Figure 8A, signals received at a receiving antenna 150 are passed via a band pass filter 152 before being amplified in a low noise amplifier 154. The output of the amplifier 154 is then passed via a further band pass filter 156 before being further amplified by a further low noise amplifier 158. The output of the amplifier 158 is then passed to a mixer 164 where it is mixed with a signal generated by a voltage controlled oscillator 162 which is responsive to a synthesizer 160. The output of the mixer 164 is then passed via the I/Q de-modulator 166 and a low pass filter 168 before being passed to an analogue to digital converter 170. The digital output of the A/D converter 170 at 2.56 MC/s is then passed to a correlator 178, to which the same Rademacher-Walsh and PN codes used during transmission are applied by a RW code generator 172 (corresponding to the RW code generator 112) and a PN code generator 174 (corresponding to PN code generator 114), respectively. The output of the correlator 178, at 160 KS/s, is then applied to correlator 179, where any overlay code used at the transmission stage to encode the signal is applied to the signal by overlay code generator 181. The elements 170, 172, 174, 178, 179 and 181 form a CDMA demodulator. The output from the CDMA demodulator (at correlator 179) is then at a rate of either 160, 80 or 40 KS/s, depending on the overlay code applied by correlator 179.

The output from correlator 179 is then applied to a Viterbi decoder 180. The output of the Viterbi decoder 180 is then passed to an overhead extractor 182 for extracting the overhead channel information. If the signal relates to call data, then the output of the overhead extractor 182 is then passed through TDM decoder 183 to extract the call data from the particular time slot in which it was inserted by the CT TDM encoder 105. Then, the call data is passed via a codec 184 and a hybrid circuit

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188 to an interface such as two wire interface 190, where the resulting analogue signals are passed to a telephone 192. As mentioned earlier in connection with the ST transmission processing stages, elements 184, 188, 190 may be repeated for each piece of telecommunications equipment 192 at the ST.

If the data output by the overhead extraction circuit 182 is data on a downlink control channels, then instead of passing that data to a piece of telecommunications equipment, it is passed via switch 187 to a call control logic 185, where that data is interpreted by the ST.

At the subscriber terminal 20, a stage of automatic gain control is incorporated at the IF stage. The control signal is derived from the digital portion of the CDMA receiver using the output of a signal quality estimator.

Figure 8B illustrates the signal reception processing stages as configured in a central terminal 10 in the telecommunications system of Figure 1. As will be apparent from the figure, the signal processing stages between the RX antenna 150 and the overhead extraction circuit 182 are the as those within the ST discussed in connection with figure 8A. However, in the case of the CT, call data output from the overhead extraction circuit is passed over line 189 to the network interface within the CT, whilst control channel data is passed via switch 191 to the DA engine 380 for processing. The DA engine is discussed in more detail later.

Overlay codes and channelisation plans are selected to ensure signal orthogonality – i.e. in a properly synchronised system, the contribution of all channels except the channel being demodulated sum to zero over the correlator integration period. Further, uplink power is controlled to maintain constant energy per bit. The exception to this is Low rate which will be transmitted at the same power as a Quarter rate signal. Table 2 below illustrates the overlay codes used for full, half and quarter rate operations:

Net Rate (kb/s)	Channel designation	ST Tx. power relative to F1-U (dB)	Overlay Code	Correlator integration period (us)	Acquisition overlay

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160	-F1-U	0	1	6.25	L1
80	-H1-U	-3	1 1	12.5	L1
80	-H2-U	-3	1 -1	12.5	L3
40	-Q1-U	-6	1 1 1 1	25	L1
40	-Q2-U	-6	1 -1 1 -1	25	L2
40	-Q3-U	-6	1 1 -1 -1	25	L3
40	-Q4-U	-6	1 -1 -1 1	25	L4

TABLE 2

In preferred embodiments, a 10 kb/s acquisition mode is provided which uses concatenated overlays to form an acquisition overlay; this is illustrated in table 3 below:

Acquisition overlay	Equivalent high rate pattern
L1-U	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
L2-U	1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1
L3-U	1 -1 1 -1 1 -1 1 -1 1 -1 1 -1 1 -1 1 -1
L4-U	1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1

TABLE 3

Figures 9A and 9B are diagrams illustrating the uplink and downlink delivery methods, respectively, when the system is fully loaded, and illustrate the difference between the use of overlay codes illustrated in figure 9A and the use of TDM as illustrated in Figure 9B. When using overlay codes, an RW code is split in the RW space domain to allow up to four sub channels to operate at the same time. In

BNSDOCID: <GB__2320991A__I_>

contrast, when using TDM, an RW code is split in the time domain, to allow up to four signals to be sent using one RW code, but at different times during the 125 us frame. As illustrated in Figures 9A and 9B, the last two RW codes, RW14 and RW15, are not used for data traffic in preferred embodiments, since they are reserved for call control and acquisition functions; this will be discussed in more detail later.

The CDMA channel hierarchy is as illustrated in Figure 10. Using this hierarchy, the following CDMA channelisations are possible:

F1
H1 + H2
H1 + Q3 + Q4
H2 + Q1 + Q2
Q1 + Q2 + Q3 + Q4

Having discussed how the CDMA codes are enhanced to enable flexible channelisations to be achieved, whereby the bit rates can be lowered to enable more subscriber links to be managed per channel frequency, a general overview of how the downlink and uplink paths are established will be provided with reference to figures 11 and 12.

Figure 11 is a block diagram of downlink and uplink communication paths between central terminal 10 and subscriber terminal 20. A downlink communication path is established from transmitter 200 in central terminal 10 to receiver 202 in subscriber terminal 20. An uplink communication path is established from transmitter 204 in subscriber terminal 20 to receiver 206 in central terminal 10. Once the downlink and the uplink communication paths have been established in wireless telecommunication system 1, telephone communication may occur between a user 208, 210 of subscriber terminal 20 and a user serviced through central terminal 10 over a downlink signal 212 and an uplink signal 214. Downlink signal 212 is transmitted by transmitter 200 of central terminal 10 and received by receiver 202 of subscriber terminal 20. Uplink signal 214 is transmitted by transmitter 204 of subscriber terminal 20 and received by receiver 206 of central terminal 10.

BNSDOCID <GB 2320991A I >

Receiver 206 and transmitter 200 within central terminal 10 are synchronized to each other with respect to time and phase, and aligned as to information boundaries. In order to establish the downlink communication path, receiver 202 in subscriber terminal 20 should be synchronized to transmitter 200 in central terminal 10. Synchronization occurs by performing an acquisition mode function and a tracking mode function on downlink signal 212. Initially, transmitter 200 of central terminal 10 transmits downlink signal 212. Figure 12 shows the contents of downlink signal 212. A frame information signal 218 is combined with an overlay code 217 where appropriate, and the resultant signal 219 is combined with a code sequence signal 216 for central terminal 10 to produce the downlink 212. Code sequence signal 216 is derived from a combination of a pseudo-random noise code signal 220 and a Rademacher-Walsh code signal 222.

Downlink signal 212 is received at receiver 202 of subscriber terminal 20. Receiver 202 compares its phase and code sequence to a phase and code sequence within code sequence signal 216 of downlink signal 212. Central terminal 10 is considered to have a master code sequence and subscriber terminal 20 is considered to have a slave code sequence. Receiver 202 incrementally adjusts the phase of its slave code sequence to recognize a match to master code sequence and place receiver 202 of subscriber terminal 20 in phase with transmitter 200 of central terminal 10. The slave code sequence of receiver 202 is not initially synchronized to the master code sequence of transmitter 200 and central terminal 10 due to the path delay between central terminal 10 and subscriber terminal 20. This path delay is caused by the geographical separation between subscriber terminal 20 and central terminal 10 and other environmental and technical factors affecting wireless transmission.

After acquiring and initiating tracking on the central terminal 10 master code sequence of code sequence signal 216 within downlink signal 212, receiver 202 enters a frame alignment mode in order to establish the downlink communication path. Receiver 202 analyzes frame information within frame information signal 218 of downlink signal 212 to identify a beginning of frame position for downlink signal 212. Since receiver 202 does not know at what point in the data stream of downlink signal 212 it has received information, receiver 202 must search for the beginning of frame

BNSDOCID: <GB___2320991A__I_>

position in order to be able to process information received from transmitter 200 of central terminal 10. Once receiver 202 has identified one further beginning of frame position, the downlink communication path has been established from transmitter 200 of central terminal 10 to receiver 202 of subscriber terminal 20.

The structure of the radio frames of information sent over the downlink and uplink paths will now be discussed with reference to figures 13 and 14. In figures 13 and 14, the following terms are used:

Bn Customer payload, 1 x 32 to 2 x 64 Kb/s

Dn Signalling Channel, 2 to 16 kb/s

OH Radio Overhead Channel

- 16 kb/s Traffic Mode
- 10 kb/s Acquisition/Standby Mode

Both Figures 13A and 13B show a 125us subframe format, which is repeated throughout an entire radio frame, a frame typically lasting for 4 milliseconds (ms). Figure 13A illustrates the radio frame structures that are used in preferred embodiments for the downlink path. Subframe (i) in Figure 13A shows the radio frame structure used for low rate, 10 Kb/s, acquisition mode (Ln-D) during which only the overhead channel is transmitted. Subframe (ii) in Figure 13A shows the radio frame structure employed for the call control channel operating in quarter rate, 40 Kb/s, mode (Qn-D), whilst subframe (iii) of Figure 13A illustrates the radio frame structure used for traffic channels operating in full rate, 160 kb/s, mode (F1-D).

Similarly, subframe (i) of Figure 13B shows the radio frame structure used for the uplink path when operating in low rate acquisition or call control mode (Ln-U). Sub-frames (ii) to (iv) show the radio frame structure used for traffic channels when operating in quarter rate mode (Qn-U), half rate mode (Hn-U), and full rate mode (F1-U), respectively.

Considering now the overhead channel in more detail, figures 14A and 14B show the overhead frame structure employed for various data rates. The overhead channel may include a number of fields - a frame alignment word (FAW), a code

BNSDOCID: <GB___2320991A_I_>

synchronization signal (CS), a power control signal (PC), an operations and maintenance channel signal (OMC), a mixed OMC/D-Channel (HDLC) signal (OMC/D), a channel identifier byte (Ch.ID), and some unused fields.

The frame alignment word identifies the beginning of frame position for its corresponding frame of information. The code synchronization signal provides information to control synchronization of transmitter 204 in subscriber terminal 20 to receiver 206 in central terminal 10. The power control signal provides information to control transmitting power of transmitter 204 in subscriber terminal 20. The operations and maintenance channel signal provides status information with respect to the downlink and uplink communication paths and a path from the central terminal to the subscriber terminal on which the communication protocol which operates on the modem shelf between the shelf controller and the modem cards also extends. The OMC/D signal is a combination of the OMC signal and a signalling signal (D), whilst the Ch. ID signal is used to uniquely identify an RW channel, this Ch. ID signal being used by the subscriber terminal to ensure that the correct channel has been acquired.

In preferred embodiments, the subscriber terminal will receive downlink traffic channel data at a rate of 160 kb/s. Depending on the B-channel rate, the ST will be allocated an appropriate share of the radio overhead. The following TDM mappings are created:

Rate (kb/s)	Channel designation	Bearer	CS	PC	OMC	Overhead rate
160	-F1-D-T1/1	B1, B2, B3, B4	CS1, CS3	PC1, PC3	OMC1, OMC3	4 ms
80	-F1-D-T2/1	B1, B2	CS1, CS3	PC1, PC3	OMC1, OMC3	4 ms
80	-F1-D-T2/2	B3, B4	CS2, CS4	PC2, PC4	OMC2, OMC4	4 ms
40	-F1-D-T4/1	B1	CS1	PC1	OMC1	8 ms
40	-F1-D-T4/2	B2	CS2	PC2	OMC2	8 ms
40	-F1-D-T4/3	B3	CS3	PC3	OMC3	8 ms
40	-F1-D-T4/4	B4	CS4	PC4	OMC4	8 ms

BNSDOCID: <GB_ 2320991A I >

TABLE 4

In the above chart, the scheme used to identify a channel is as follows. Rate code 'F1' indicates full rate, 160kb/s, 'D' indicates that the channel is a downlink channel, and 'Tn/t' indicates that the channel is time division multiplexed between STs, 'n' indicating the total number of TDM timeslots, and 't' indicating the selected traffic timeslot.

All ST's operating on a traffic channel will receive D-channel information at the 16 kb/s rate. The D-channel protocol includes an address field to specify which ST is to process the contents of the message.

The channel structure was illustrated earlier in Figures 9A and 9B. In preferred embodiments, the channel structure is flexible but comprises:

- At least one Link Acquisition Channel (LAC)
- At least one Call Control Channel (CCC)
- Typically one Priority Traffic Channels (PTC)
- 1 to 13 Traffic Channels (TC)

The manner in which the channelisation is provided ensures that former fixed assignment arrangements using the set of 16 RW codes discussed earlier are still supported, as well as demand access services that are available when using a system in accordance with the preferred embodiment. Figures 15A and 15B illustrate typical downlink and uplink channel structures that might occur in a loaded system in accordance with preferred embodiments of the present invention. As illustrated in Figure 15A, on the downlink path, some signals may be at 160 kb/s and utilise an entire RW channel. An example of such signals would be those sent over fixed assignment links to products which do not support the CDMA enhancements provided by systems in accordance with preferred embodiments of the present invention, as illustrated for RW1 and RW2 in Figure 15A. Alternatively, a user may have authority to utilise a whole RW channel, for example when sending a fax, as illustrated by RW12 in Figure 15A.

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As illustrated by RW5 to RW11, TDM can be used on the downlink traffic channels to enable more than one CT to ST communication to take place on the same RW channel during each frame. Further, as illustrated for RW3 and RW4, in preferred embodiments, certain channels can be locked to limit interference from other nearby cells, as will be discussed in more detail later.

Similar channelisations can be achieved for the uplink paths, but as illustrated in Figure 15B, overlay codes are used instead of TDM to enable more than one ST to CT communication to take place on the same RW channel during each frame (as shown in Figure 15B for RW5 to RW11). It should be noted that, in both figures 15A and 15B, the channels RW14 and RW15 are reserved as a call control channel and an link acquisition channel, respectively, and overlay codes are employed on these channels, irrespective of whether the path is a downlink or an uplink path. These two channels will be discussed in more detail below.

Acquisition / net entry will take place via the Link Acquisition Channel (LAC). Following power-up an ST will automatically attempt downlink acquisition of the LAC on a pre-determined 'home' RF channel. The LAC downlink channel (eg. RW15 in preferred embodiments) will operate at 10 kb/s, full single user power. Downlink acquisition will be simultaneous for all STs.

Each CT Modem Shelf will maintain a database holding the serial numbers of all STs that could possibly be supported by that CT. The state of each ST will recorded with top level states as follows:

cold
idle
call_in_progress

Transition states will also be defined. An ST is considered *cold* if the ST is newly provisioned, the CT has lost management communications with the ST or the CT has been power cycled. Over the LAC, the CT broadcasts individual ST serial numbers and offers an invitation to acquire the LAC uplink. Cold uplink acquisition will be carried out on the Link Acquisition Channel at low rate. The CT will invite

BNSDOCID: <GB___2320991A__I_>

specific ST's to cold start via the management channel.

Assuming an uplink channel is available, the appropriate acquisition overlay will be selected, and acquisition will be initiated.

'Rapid' downlink RW channel switching may be supported at rates other than Ln-D. Rapid means that coherent demodulation is maintained, and only convolutional decoding and frame synchronisation processes need be repeated.

On acquisition, management information will be exchanged. The ST will be authenticated and allocated a short *ST_identifier* (between 12 and 16 bits) which will be used for subsequent addressing. The ST uplink will operate for long enough for the uplink to be parametised by the ST in terms of code phase and transmit power. These parameters will be used by the ST for subsequent warm start acquisitions and will also be held by the CT to allow the CT to force a cold ST to warm start. On successful completion of net entry, the ST will be placed in the idle state and instructed to cease uplink communications and move to the Call Control Channel (CCC) (RW14 in preferred embodiments).

The time taken for net entry to be achieved can be monitored, and the following techniques can be used to decrease net entry time if desired:

(i) Prioritise so that high GOS (Grade Of Service) users are offered net entry first.

(ii) Convert Traffic Channels to LACs.

(iii) In the event of a CT restart, invite STs to attempt uplink warm start. A reduction in net entry time of a factor of 4 could be achieved. This mechanism would need to be safeguarded against possible deterioration of uplink warm start parameters – i.e. it should only be allowed provided no CT RF related parameters have been modified. The CT would need to broadcast an ID to allow an ST to validate that the uplink warm start parameters were valid for this CT.

(iv) ST restart – the CT will keep copies of the ST warm start parameters so that a cold ST may have warm start parameters downloaded in the invitation to acquire and then be instructed to warm start.

Following Net Entry, all STs listen to the CCC. This channel broadcasts management and call control information via a 32 kb/s HDLC channel. In order to

BNSDOCID: <GB__2320991A_I>

maintain management communication, the CT polls each ST in sequence. Each poll comprises a broadcast invitation for an addressed ST to acquire the CCC Uplink followed by an exchange of management information (authentication, ST alarm update, warm start parameters, downlink radio performance data etc).

A Management Poll may fail for one of the following reasons:

(i) The ST is or has been powered down. An EM alarm may be flagged if this persists and the database for that ST should be marked *cold*. The Net Entry process will follow.

(ii) The ST is either making a call or in the process of making a call. The poll cycle may be suspended and management communications effected on the appropriate traffic channel.

When a Management Poll fails it should be followed up by a number of faster polls until either the ST responds or it is marked *cold*. The CCC is required to transmit all copies of the invitations to acquire the LAC so that an ST can be forced to acquire the LAC uplink.

Traffic Channel Uplink Acquisition Procedure

The basic acquisition process from the ST side is as follows;

(i) Switch the downlink (receiver) circuitry to 10 kb/s rate, and select the appropriate Traffic Channel RW and Overlay codes. Acquisition of the TC downlink is limited to achieving frame alignment.

(ii) The downlink PC/CS channel will be decoded to create a busy / idle flag. If PC/CS reports busy, then this means that another ST is using that traffic channel and the ST aborts the acquisition process.

(iii) Switch uplink to 10 kb/s rate, and select the appropriate Traffic Channel RW and Overlay codes. Enable the ST transmitter at a level of nominal full rate power minus 18 dB. While PC/CS reports idle the ST will continue uplink fast codesearch, stepping the uplink power level by +2 dB at the end of each search. The uplink should acquire at nominal full rate power minus 6 dB. Uplink acquisition is aborted if maximum transmit level is reached and PC/CS continues to report idle.

(iv) PC/CS reports busy. At this point the ST may have genuinely acquired the

BNSDOCID: <GB__2320991A_I >

traffic channel, or instead may be observing PC/CS go busy because another ST has acquired the traffic channel. The ST is sent an authentication request and responds with it's *ST_identifer*. The CT grants uplink access by returning the *ST_identifier*. The ST aborts the acquisition process if the returned *ST_identifier* is not recognised (ie. is not the *ST_identifer* that it sent). This authentication process arbitrates between two STs contending for outgoing access and it also keeps STs from acquiring TCs that have been reserved from incoming access.

Incoming Call

A number of TCs will be reserved for incoming calls, and incoming call processing is as follows:

(i) Check the CT database – if the ST is in the *call_in_progress* state the call is rejected.

(ii) Check that an uplink TC of the required bandwidth is available. If there is bandwidth then a TC is reserved.

(iii) An incoming call setup message is broadcast over the CCC to inform the addressed ST of the incoming call and specify the TC on which to receive the call. If no TC is available but the CT forms part of a Service Domain, then the incoming call setup message is sent with a null TC otherwise the call is rejected. Service domains will be discussed in more detail later. The incoming call setup message is repeated a number of times.

(iv) The ST attempts uplink acquisition. The ST listens to the downlink and keeps trying for uplink acquisition until the CT sends a message to the ST to return the ST to the CCC. The ST will also run a timer to return it back to the CCC in the event of an incoming call failing to complete.

(v) On successful uplink acquisition, the CT authenticates the ST.

(vi) Rate switching is originated from the CT modem. A command is sent via the PC/CS to switch the downlink to the required bandwidth. The ST returns the rate switch command via the uplink PC/CS. The link is now of the required bandwidth.

Outgoing Call

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Outgoing calls are supported by allowing slotted random access to the TC uplinks. The outgoing call processing is as follows:

(i) The CT publishes a 'free list' of available Traffic Channels and Priority Traffic Channels with their respective bandwidths. This list is published periodically (in preferred embodiments, every 500ms) and is used to mark uplink access slots.

(ii) An off-hook condition is detected by the ST. The ST starts a call setup timer.

(iii) The ST waits for the next free list to be received over the CCC. If the Free list is empty the outgoing call is blocked. The ST will generate a congestion tone.

(iv) If the Free list has available channels, the ST picks a channel from the free list at random. The algorithm that the ST uses to pick a channel will need to be specified in the free list. For example, the ST may be required to always choose from a pool of minimum bandwidth channels so that high bandwidth channels remain available for high GOS users. Alternatively the ST may be allowed to choose any channel regardless of bandwidth for minimum blocking. In preferred embodiments, STs will not choose low bandwidth channels and negotiate the rate up.

(v) The ST attempts uplink acquisition on the specified TC, this process having been described earlier. If acquisition is successful then the outgoing call is processed. Otherwise the ST returns to the CCC and waits for the next available free list. To avoid a number of STs repetitively attempting to acquire the same TC, and blocking each other, a suitable protocol can be employed to govern how individual STs will act upon receipt of the free list.

(vi) The ST may be unable to acquire a TC by the time the call setup timer expires. The ST may in such cases cease attempting outgoing access and generate congestion tone.

Outgoing Priority Call

It is recognised that the random access protocol used to setup normal outgoing calls could lead to blocking. In preferred embodiments, access to a largely non-blocking Priority Traffic Channel will be allowed. Priority calling is complicated

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because the ST must:

(i) Capture and decode dialled digits.

(ii) Regenerate digits when a blocking condition occurs.

(iii) Allow transparent network access in a non-blocking condition.

(iv) Categorise all outgoing calls as priority or normal so that normal calls are dropped in favour of priority calls.

The priority call procedure in preferred embodiments is as follows:

(i) The CT will publish Directory Numbers (DNs) for a number of emergency services over the CCC.

(ii) The ST will attempt uplink access according to the normal algorithms. If the outgoing access is successful then the customer is able to dial as normal. All dialled digits are check against the emergency DN list so that calls may be categorised normal or priority at the CT.

(iii) If congestion tone is returned the customer is allowed to dial the emergency number into the ST. If the ST detects an emergency DN sequence then uplink access via the Priority Traffic Channel (PTC) is attempted.

(iv) On PTC acquisition, the ST relays the dialled digit sequence to the CT for dialling into the PSTN.

(iv) The CT converts the PTC to a TC and reallocates another TC to become the PTC, dropping a normal call in progress if necessary.

Interference Limiting (Pool Sizing)

Across a large scale deployment of cells, optimum capacity is achieved by minimising radio traffic while maintaining an acceptable grade of service. Lowest possible radio traffic results in improved 'carrier to interference' (C/I) ratios for users within the cell of interest and to co-channel users in nearby cells. The C/I ratio is a measure (usually expressed in dB) of how high above interference the transmitted signal needs to be to be decoded effectively. In preferred embodiments, the central terminal is provided with the ability to trade traffic for C/I, thereby allowing network planning to be carried out less rigidly. This feature can be realised by a system using CDMA as in preferred embodiments of the present invention, and is a benefit that

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CDMA offers over TDMA and FDMA systems.

In preferred embodiments, the CT will control the number of Traffic Channels to minimise access noise. TCs will be classified as:

(i) Busy – carrying traffic;

(ii) Access, Incoming (Access_In) – reserved for incoming access;

(iii) Access, Outgoing (Access_Out) – reserved for outgoing access – such TCs appear on the Free list;

(iv) Priority – reserved for priority outgoing access – such TCs appear in the Free list;

(v) Free – available for any purpose; and

(vi) Locked – not available due to interference limiting.

This classification scheme is illustrated in figure 16. The CT will allocate traffic on the following basis:

(i) The CT will monitor incoming and outgoing call setup–times and convert Access TCs from Free TCs in order to achieve a required grade of service.

(ii) When a call is setup, an Access TC is converted to a Busy TC. If a Free TC is available, it is converted to a new Access TC. If there are no Free TCs then the Access TC is lost until a call clears.

(iii) When a call clears the Busy TC is converted to a Free TC. If a previous call setup resulted in a lost Access TC then the Busy TC is converted back into an Access TC.

(iv) When the PTC is accessed, a new PTC is created by converting a Free, Access or Busy (normal call) TC.

(v) The CT will monitor the Busy TC downlink and uplink soft error counts in an attempt to establish link quality. If the CT records a lower than average soft error count and long call setup times are being recorded, a Locked TC may be converted to a Free TC. Conversely, if the CT records a higher than average soft error count, a Free or Access TC may be converted to a Locked TC.

Figure 17 illustrates how the central terminal performs the above interference limiting function. When incoming call data arrives at a central terminal modem 320, encoder 325 encodes the data for transmission over the wireless link 300 to the

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subscriber terminal 20. At the subscriber terminal 20, the decoder 326 decodes the data, and passes the decoded user data over line 328 to the subscriber telecommunications equipment. As the decoder 326 decodes the data, it is able to establish a bit error rate (BER) estimate 330 associated with the signal transmission over the wireless link 300, which can be passed to the multiplexer 332 for combining with other signals, such as those from a call control function 336 or user data on line 338, before being passed to an encoder 334. Here, the BER estimate is encoded and passed on the OMC channel over the wireless link 310 to the decoder 340 within the central terminal modem 320. Once decoded by the decoder 340, the signal passes to the multiplexer 345, where the BER estimate from the subscriber terminal is detected and passed over line 355 to the dynamic pool sizing function 360.

Further, as at the subscriber terminal 20, the decoder 340 within the central terminal modem 320 is able to establish a bit error rate estimate 350 associated with the signal transmission over the wireless link 310. This BER estimate 350 is also passed over line 355 to the dynamic pool sizing function 360. The dynamic pool sizing function 360 is provided on the CT modem shelf 302, and receives BER estimates from each of the modems on that shelf indicated by the lines entering the bottom of the dynamic pool sizing function 360.

In addition to BER estimates, grade of service (GOS) data is obtained from two sources. Firstly, at each subscriber terminal 20, the call control function 336 will note how readily it is able to establish traffic channels for transmitting and receiving data, and from this can provide a GOS estimate to the multiplexer 332 for encoding by the encoder 334 for subsequent transmission over the wireless link 310 to the central terminal modem 320. Here, the GOS estimate is decoded by decoder 340, passed through multiplexer 345, and then the GOS estimate is passed over line 355 to the dynamic pool sizing function 360.

Additionally, incoming call information to the central terminal, other than call information from the subscriber terminals 20 connected to the central terminal, is provided over the concentrated network interface 390 to the DA engine 380. The DA engine 380 includes a call control function, similar to the call control function 336 in each of the subscriber terminals 20, for each of the modems on the modem shelf.

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Hence, in a similar fashion to the call control function 336 at the subscriber terminals 20, the call control functions within the DA engine 380 are also able to provide GOS estimates for incoming calls, and these GOS estimates are passed over line 395 to the dynamic pool sizing function 360.

At set up, the management system 370 within the element manager will have connected to the central terminal, and provided the dynamic pool sizing function 360 within the modem shelf with data identifying a BER goal, a GOS goal, and a pool size limit (i.e. the number of channels that can be used for data traffic). The dynamic pool sizing function 360 then compares this data from the management system with the actual BER, actual GOS, and the actual pool size information that it receives. A suitable algorithm can be provided within the dynamic pool sizing function 360 to determine, based on this information, whether pool sizing is appropriate. For example, if the actual bit error rate exceeds the BER goal provided by the management system 370, then the dynamic pool sizing function 360 may be arranged to send a pool sizing request to the demand assignment engine 380.

The demand assignment engine 380 provides modem enable signals over lines 400 to each of the modems on the CT modem shelf. If the dynamic pool sizing function 360 has requested that the DA engine 380 perform pool sizing, then the DA engine 380 can disable one or more of the modems, this causing the interference, and hence the actual BER, to be reduced. Apart from being used for interference limiting, the DA engine is also responsible, in preferred embodiments, for providing the encoders 325 with instructions on which set of overlay codes or how many TDM slots to be used for signals to be transmitted to the STs 20.

The dynamic pool sizing function can store the BER and GOS information received in the storage 365, and periodically may pass that data to the management system 370 for analysis. Further, if the system is unable to attain the BER or GOS goal with the allocated pool size, the dynamic pool sizing function can be arranged to raise an alarm to the management system. The receipt of this alarm will indicate to personnel using the management system that manual intervention may be required to remedy the situation, eg by the provision of more central terminal hardware to support the STs.

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The CDMA approach used in preferred embodiments exhibits the property that the removal of any of the orthogonal channels (by disabling the modem) will improve the resistance of the other channels to interference. Hence, a suitable approach for the demand assignment engine 380, upon receipt of pool sizing request from the dynamic pool sizing function 360, is to disable the modem that has the least traffic passing through it.

RF Channel Switching

In preferred embodiments, it has been realised that if an ST is allowed to operate from more than one CT Modem Shelf / RF Channel then the following benefits may be realised:

(i) Fault tolerance – should a CT Modem Shelf sub–system fault occur, an ST may switch to an alternative frequency for service.

(ii) Call blocking – an ST denied service from one CT shelf may choose to switch to an alternative frequency for service.

(iii) Traffic load balancing – the Element Manager may on the basis of call blocking statistics choose to move STs between CT shelves.

(iv) Frequency diversity – in the presence of channel selective fading (slow multipath) an ST may operate on the frequency channel offering highest signal strength and lowest soft error count.

RF channel switching is only possible where there are two or more co–located CT shelves serving the same geographical area on different RF frequency channels within the same RF band. A deployment that meets this criterion may be configured as a 'Service Domain'. Possible deployment scenarios are illustrated in Figure 18. Figure 18(i) shows an arrangement where omni antennae are used to provide the entire cell with four frequency channels, eg F1, F4, F7, F10. Figure 18(ii) shows an arrangement where sectored antennae are used to provide six separate sectors within a cell, each sector being covered by two frequency channels. Figure 18(iii) shows an alternative arrangement where three sectored antennae are used to divide the cell in to three sectors, each sector being covered by a separate frequency channel, and then an omni antenna is used to provide an 'umbrella' coverage for the entire cell, this coverage employing a frequency channel different to the three frequency channels used

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by the sectored antennae.

For the system to work effectively, the STs must be able to switch channels quickly, and fast channel switching necessitates that CT shelf synchronisation be provided at the following levels:

(i) CDMA PN code. This preserves uplink code phase across RF channels during warm start; and

(ii) RF carrier frequency. This eliminates the need for the coarse frequency search on a downlink RF channel switch.

On installation, an ST will be programmed with an RF channel and PN code, these codes specifying the ST's initial home channel.

The manner in which channel switching is facilitated in preferred embodiments will be described with reference to figures 19A and 19B. A service domain controller 400 is preferably provided to act as an interface between the exchange connected to the service domain controller over path 405 and a number of central terminals 10 connected to the service domain controller over paths 410. The central terminals connected to the service domain controller form a 'service domain' of central terminals that may be used by a subscriber terminal 20 for handling communications.

In preferred embodiments, the service domain controller 400 is used to provide each CT 10 with appropriate information about the other CTs within the service domain. Each CT can then broadcast a 'Service Domain' message comprising a list of RF frequencies and CT Identifiers that form a Service Domain to be used by the STs for subsequent RF switching functions. The ST then stores this information for future reference when establishing a link with one of the CTs. It is preferable for each CT to broadcast the service domain message since an ST may be listening to any of the CTs at the time that the message is broadcast.

Each CT database will hold an entry for every ST located within the Service Domain. Each database entry describes how the CT views it's relationship with the ST and may be marked as:

(i) Primary service provider – the CT is the ST's home channel. All management communication with an ST is via it's home CT.

(ii) Supplying backup service – the CT is providing service to the ST.

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(iii) Available for backup service – the CT will provide service to the ST if required.

It should be noted that the ST need not switch to an entirely different CT, but can instead switch to a different CT shelf (and hence different RF frequency channel) within the same CT. However, in preferred embodiments, the ST will typically switch to a different CT, since some errors experienced by one CT shelf may also affect other shelves within the same CT, and so for fault tolerance (described in more detail below), it is preferable for the ST to switch to a separate CT.

Database consistency across CT shelves is preferably supported through the service domain controller 400. Database consistency needs to be real–time so that an ST entering the network is allowed full Service Domain access immediately (the Service Domain message is broadcast to all STs, and so a new ST will expect access across the full Service Domain).

Incoming access via backup CTs requires some function to be provided to broadcast duplicate incoming call setup messages to all CTs that form a Service Domain. Preferably this is handled by the service domain controller 400, which forwards incoming call setup messages to each CT operating in the service domain. All CTs will allocate Access_In Traffic Channels and relay the incoming call setup message via the Call Control Channel. On successful uplink access, one CT will respond to the service domain controller with a call accepted message, the other CTs will eventually respond with call setup failed messages. Outgoing access via a backup CT is similar to normal outgoing access.

Another job which can be performed by the service domain controller is to assist the element manager 58 in reconfiguring equipment in the event of a fault. For example, if one CT is taken out of commission because of a fault, a different CT can be brought 'on–line', and the service domain controller can provide that new CT with the necessary information about the other CTs in the service domain.

Figure 19B illustrates those elements of the subscriber terminal used to implement RF channel switching. The radio subsystem 420, which incorporates the transmission and reception signal processing stages, will pass any data received on the call control channel over line 425 to the message decoder 430. If the decoder 430

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determines that the data on the call control channel forms a service domain message, then this is passed over line 435 to the channel selection controller 440, where the information within the service domain message is stored in storage 445.

Similarly, if the message decoder identifies the data as a 'free list' identifying the available traffic channels on a particular RF frequency, then this data is passed to the call control function 336 and the channel selection controller 440 over path 450. The call control function 336 stores the free list in the storage 445 for subsequent use by the call control function 336 and the channel selection controller 440.

If the message decoder 430 determines that the data forms an incoming call setup message, then that information is supplied over line 455 to the call control function 336 and the channel selection controller 440 for processing. The incoming call setup message will typically specify a TC on the current frequency channel which should be used to access the incoming call, and the channel selection controller will attempt to establish a link on that TC. The channel selection controller will in such cases instruct the radio sub-system 420 over line 465 to use the current frequency channel to establish the required link. If, on the other hand, the traffic channel specified in the call setup message is 'null', the channel selection controller has the option to change RF frequency using the information stored in storage 445 about the other CTs in the service domain.

To enable the channel selection controller 440 to receive information about the status of links, a link operating status signal can be supplied over line 470 from the radio sub-system. This signal will give an indication of the radio link quality, and may be a simple 'OK' or 'failed' indication, or alternatively may include extra information such as BER values for the link. This information can be used by the channel selection controller to determine whether a particular frequency channel should be used or not.

To enable the call control function to specify a specific Access-Out channel for outgoing calls, a line 460 is provided between the call control function 336 and the channel selection controller 440. The call control function 336 may choose an access-out channel from the free list in storage 445, and instruct the channel selection controller over line 460 to attempt acquisition of that channel.

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The following examples indicate how the above described structure may be used to perform channel switching in particular circumstances.

RF Channel Switching for Fault Tolerance

Should one RF channel suffer complete loss of downlink, the following process takes place in preferred embodiments:

(i) The ST will attempt downlink re-acquisition for a period of time, say 20 seconds.

(ii) If acquisition fails, the channel selection controller 440 of the ST will select the next available channel from the Service Domain information in storage 445 and attempt downlink acquisition. This process will be repeated until a downlink signal is acquired.

(iii) Once a backup RF channel is located, the ST will 'camp' on the Call Control Channel and may subsequently be granted traffic access.

(iv) If the CT fault persists, the EM 58 may use the service domain controller 400 to reconfigure the Service Domain so that the functioning CT shelves become primary service providers for the pool of 'homeless' STs.

A fault that does not result in complete loss of downlink signal will not result in RF channel switching 'en mass'. Rather, a fault may result in excessive or total call blocking, as discussed below.

RF Channel Switching for Call Blocking

If Incoming access traffic channels are being blocked, the following process is employed in preferred embodiments:

(i) The call setup message sent over the Call Control Channel will specify a TC on which to access the call.

(ii) In the case of incoming access being blocked, the CT will specify a null TC. The channel selection controller 440 of the ST will in such cases switch to the next RF channel from the Service Domain information in storage 445 and monitor the Call Control Channel.

(iii) If the ST receives a call setup message with a valid TC, then the call is processed as normal.

(iv) When the call clears, the ST downlink preferably switches back to the home

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CT.

If Outgoing access traffic channels are being blocked, the following process is employed in preferred embodiments:

(i) The ST registers an off-hook. The Free List in storage 445 is checked and if a traffic channel is available, then the call control function 336 asserts a channel request on line 460 to the channel selection controller 440 and normal uplink access is attempted.

(ii) If the Free List shows no Access_Out channels are available on the current frequency channel, then the channel selection controller will be used to switch the ST to the next RF channel in the Service Domain, whereupon the ST will wait for the next Free List.

(iii) When the ST finds a Free List with an available Access_Out channel, then uplink access is attempted and the call is processed as normal.

(iv) When the call clears, the ST downlink preferably switches back to the home CT.

RF Channel Switching for Traffic Load Balancing

Traffic load balancing is, in preferred embodiments, provided by static configuration via the EM 58. Call blocking and setup time statistics may be forwarded to the EM where an operator may decide to move an ST to another RF channel.

RF Channel Switching for Frequency Diversity

Frequency diversity is, in preferred embodiments, provided by static configuration via the EM 58. Radio link statistics may be forwarded to the EM where an operator may decide to move an ST to another RF channel.

Although a particular embodiment has been described herein, it will be appreciated that the invention is not limited thereto and that many modifications and additions thereto may be made within the scope of the invention. For example, various combinations of the features of the following dependent claims could be made with the features of the independent claims without departing from the scope of the present invention.

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CLAIMS

1. A channel selection controller for establishing a wireless link connecting a central terminal and a subscriber terminal of a wireless telecommunications system, at least two frequency channels being provided over which said wireless link could be established, the channel controller comprising:

a storage for storing data identifying the at least two frequency channels;

a selector for selecting a frequency channel from those listed in said storage;

link acquisition logic for establishing a wireless link on the frequency channel selected by the selector;

the selector being responsive to the link acquisition logic being unable to establish said wireless link, to select an alternative frequency channel from those listed in said storage.

2. A controller as claimed in Claim 1, wherein said data identifies one of said at least two frequency channels as a preferred frequency channel, and the selector is arranged to select that preferred frequency channel first.

3. A controller as claimed in Claim 1 or Claim 2, wherein the subscriber terminal may establish wireless links with a plurality of central terminals forming a service domain, and the controller further comprises a receiver for receiving a message from a central terminal of said service domain identifying the frequency channels for each central terminal in the service domain over which wireless links connecting said central terminals and said subscriber terminal can be established, the storage being arranged to store the information received by the receiver.

4. A controller as claimed in any of claims 1 to 3, wherein the link acquisition logic attempts for a predetermined time to establish a wireless link on the frequency channel selected by the selector, and if the predetermined time elapses without the wireless link having been established, the link acquisition logic requests the selector to select an alternative frequency channel from those listed in said storage.

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5. A subscriber terminal of a wireless telecommunications system for communicating over wireless links with one or more central terminals provided by the wireless telecommunications system, the subscriber terminal including a controller as claimed in any preceding claim.

6. A subscriber terminal as claimed in Claim 5, wherein one central terminal is provided with which the subscriber terminal can establish a wireless link, a plurality of frequency channels being provided over which a wireless link between said subscriber terminal and said central terminal can be established, the storage being arranged to store data identifying said plurality of frequency channels.

7. A subscriber terminal as claimed in Claim 5, wherein a plurality of central terminals are provided with which the subscriber terminal can establish a wireless link, each central terminal providing at least one frequency channel over which a wireless link between said subscriber terminal and that central terminal can be established, the storage being arranged to store data identifying said at least one frequency channel provided by each of the plurality of central terminals.

8. A subscriber terminal as claimed in any of claims 5 to 7, wherein the subscriber terminal is located within a sector of a cell of the wireless telecommunications system, the cell having at least one central terminal with an antenna arrangement for providing said sector with a plurality of frequency channels, the storage being arranged to store said plurality of frequency channels.

9. A subscriber terminal as claimed in any of claims 5 to 8, wherein, responsive to a user of the subscriber terminal wishing to establish an outgoing call, the link acquisition logic attempts to establish a wireless link on the frequency channel selected by the selector, and if the link acquisition logic is unable to establish a wireless link on that frequency channel, the selector is arranged to select an alternative frequency channel from those listed in said storage, and the link acquisition logic is arranged to attempt to establish a wireless link for the outgoing call on that alternative

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frequency channel.

10. A subscriber terminal as claimed in any of claims 5 to 9, wherein each frequency channel comprises a plurality of orthogonal channels, and the subscriber terminal is arranged to listen on a predetermined one of the orthogonal channels of a preferred frequency channel for a signal indicating that an incoming call is directed to the subscriber terminal, the signal identifying whether or not there is an available orthogonal traffic channel within that preferred frequency channel for the handling of that incoming call, the link acquisition logic being arranged to establish a wireless link on said preferred frequency channel if an orthogonal traffic channel is available, but if not, the selector is arranged to select an alternative frequency channel, and the link acquisition logic is arranged to establish a wireless link on said alternative frequency channel is there is an available orthogonal traffic channel for the handling of the incoming call on that alternative frequency channel.

11. A subscriber terminal as claimed in Claim 10, wherein, upon termination of the incoming call, the subscriber terminal returns to listening on the predetermined orthogonal channel of the preferred frequency channel.

12. A central terminal for communicating with a subscriber terminal as claimed in any of claims 5 to 11, the central terminal being arranged to be one of a plurality of central terminals forming a service domain of a wireless telecommunications system, and comprising:

a storage for storing information about the other central terminals in the service domain; and

a transmitter for broadcasting to the subscriber terminals in the service domain a service domain message identifying the frequency channels and central terminals which the subscriber terminals may use to establish a wireless link.

13. A central terminal as claimed in Claim 12, further comprising a receiver for receiving from a service domain controller information about the other central

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terminals in the service domain, this information being stored in the storage.

14. A central terminal as claimed in Claim 12 or claim 13, wherein the storage is also arranged to store a database identifying for each subscriber terminal in the service domain, whether the central terminal is the primary central terminal for that subscriber terminal, or whether the central terminal is arranged to provide backup service to that subscriber terminal.

15. A wireless telecommunications system comprising one or more cells, each cell comprising one or more central terminals and a plurality of subscriber terminals, the one or more central terminals being arranged to provide a plurality of frequency channels over which wireless links may be established connecting a subscriber terminal with said one or more central terminals, the wireless telecommunications system including a channel selection controller as claimed in any of claims 1 to 4 to establish said wireless links.

16. A wireless telecommunications system as claimed in Claim 15, wherein a channel selection controller is provided within each of said plurality of subscriber terminals.

17. A wireless telecommunications system comprising one or more cells, each cell comprising one or more central terminals and a plurality of subscriber terminals, the one or more central terminals being arranged to provide a plurality of frequency channels within at least one sector of the cell over which wireless links may be established connecting a subscriber terminal within said at least one sector with said one or more central terminals, the wireless telecommunications system including a channel selection controller as claimed in any of claims 1 to 4 to establish said wireless links.

18. A wireless telecommunications system as claimed in Claim 17, wherein a channel selection controller is provided within each of the subscriber terminals within

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said at least one sector.

19. A wireless telecommunications system as claimed in any of claims 15 to 18, wherein the cell has a plurality of central terminals, each central terminal providing at least one frequency channel, and each central terminal providing a different at least one frequency channel to the at least one frequency channel provided by the other central terminals of the cell.

20. A method of establishing a wireless link connecting a central terminal and a subscriber terminal of a wireless telecommunications system, at least two frequency channels being provided over which said wireless link could be established, the method comprising the steps of:

(a) storing data identifying the at least two frequency channels;

(b) employing a selector to select a frequency channel from those listed in said storage;

(c) establishing a wireless link on the frequency channel selected by the selector; and

(d) if at said step (c), said wireless link cannot be established, repeating said step (b) to select an alternative frequency channel, and repeating step (c) using said alternative frequency channel.

21. A method as claimed in Claim 20, wherein said data identifies one of said at least two frequency channels as a preferred frequency channel, and during a first iteration of said step (b), the selector is arranged to select that preferred frequency channel.

22. A method as claimed in Claim 20 or Claim 21, wherein the subscriber terminal may establish wireless links with a plurality of central terminals forming a service domain, and the method further comprises the steps of:

receiving a message from a central terminal of said service domain identifying the frequency channels for each central terminal in the service domain over which

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wireless links connecting said central terminals and said subscriber terminal can be established; and

employing said step (a) to store the information received by the receiver.

23. A method as claimed in any of claims 20 to 22, wherein said step (c) is attempted for a predetermined time to establish a wireless link on the frequency channel selected by the selector, and if the predetermined time elapses without the wireless link having been established, said step (d) is performed to select an alternative frequency channel from those stored.

24. A channel selection controller as claimed in Claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

25. A subscriber terminal as claimed in Claim 5, substantially as hereinbefore described with reference to the accompanying drawings.

26. A central terminal as claimed in Claim 12, substantially as hereinbefore described with reference to the accompanying drawings.

27. A wireless telecommunications system as claimed in Claim 15, substantially as hereinbefore described with reference to the accompanying drawings.

28. A wireless telecommunications system as claimed in Claim 17, substantially as hereinbefore described with reference to the accompanying drawings.

29. A method of establishing a wireless link as claimed in Claim 20, substantially as hereinbefore described with reference to the accompanying drawings.

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The Patent Office

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Application No: GB 9626588.9
Claims searched: 1-11 & 15-23

Examiner: Gareth Griffiths
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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4L (LDFC, LDSJ)

Int Cl (Ed.6): H04B 1/74, 7/26, H04Q 7/20, 7/32, 7/38

Other: Online Database: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2277849 A	(SPECTRONICS) whole document	1-9, 15, 16, 20-23
X	GB2255474 A	(VODAFONE) whole document	1, 2, 15, 19-21
X	GB2245126 A	(BAND THREE RADIO) p.10 - p.21	1-5, 7, 9, 15, 16, 20-23
X	EP0635989 A1	(NEC) whole document	1, 4, 15, 17, 19, 20, 23
X	WO93/23963 A1	(MOTOROLA) p.7 line 6 - p.8 line 14	1, 2, 4-7, 9, 15-18, 20-23
X	US5396647	(THOMPSON) whole document	1-5, 7, 9, 15, 16, 20-23
X	US4977612	(WILSON) whole document	1, 3-7, 9, 15, 16, 19, 20, 22, 23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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50

Application No: GB 9626588.9 **Examiner:** Gareth Griffiths
Claims searched: 1-11 & 15-23 **Date of search:** 5 March 1997

Category	Identity of document and relevant passage	Relevant to claims

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Databases searched:

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Documents considered to be relevant:

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X	GB2277849 A	(SPECTRONICS) p.6 para 2 - p.7 para 4	12 at least
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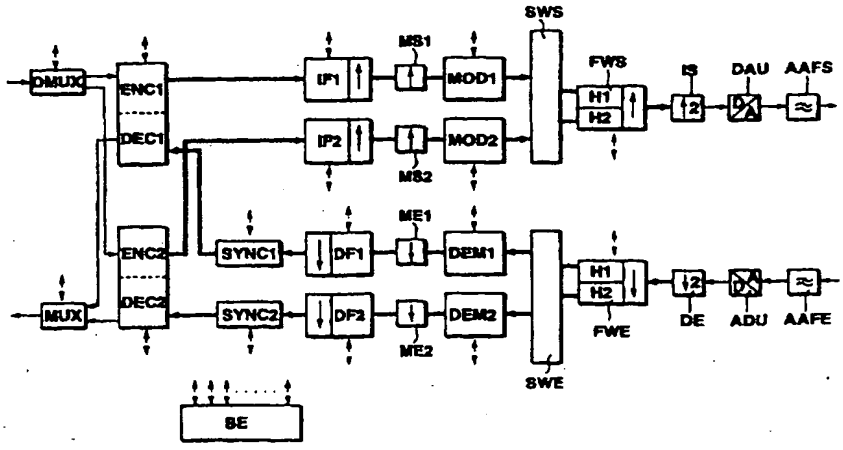
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(54) Title: POINT-MULTIPOINT RADIO TRANSMISSION SYSTEM

(54) Bezeichnung: PUNKT-ZU-MEHRPUNKT FUNKÜBERTRAGUNGSSYSTEM

(57) Abstract

The aim is to facilitate a flexible allocation of transmission capacities in a point-multipoint radio transmission system without interrupting or disrupting existing links. This is done as follows: a control device (SE) is provided to adjust one or more transmission parameters in the event of changes in the transmission channels in the central station and affected subscriber stations in such a way as to ensure optimal use of the band width of the available channel. To that end, the modems in the central station and subscriber stations are provided with two transmission signal pathways and two reception signal pathways ((ENC1, ENC2, IF1, IF2, MOD1, MOD2, DEM1, DEM2, DF1, DF2, DEC1, DEC2) of which only one in each case is connected for signal transmission. The outputs of the transmission signal pathways and the inputs of the reception signal pathways are switched by diplexers (FWS, FWE). In the event of changes in the transmission channels, the signal pathway which is not connected is adjusted to the new transmission parameters and, following acquisition of the new transmission parameters, is switched to the signal pathway in question.



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(57) Zusammenfassung

Um bei einem Punkt-zu-Mehrpunkt Funkübertragungssystem eine flexible Zuweisung von Übertragungskapazitäten zu ermöglichen, ohne daß bestehende Funkverbindungen unterbrochen oder gestört werden, ist eine Steuereinrichtung (SE) vorgesehen, welche bei Veränderung der Übertragungskanäle in einer Zentralstation und in betroffenen Teilnehmerstationen ein oder mehrere Übertragungsparameter so einstellt, daß die Bandbreite des zur Verfügung stehenden Funkkanals optimal ausgenutzt wird. Dazu sind die in der Zentralstation und in den Teilnehmerstationen vorhandenen Modems mit zwei Sende- und zwei Empfangs-Signalpfaden (ENC1, ENC2, IF1, IF2, MOD1, MOD2, DEM1, DEM2, DF1, DF2, DEC1, DEC2) ausgestattet, von denen jeweils nur einer für eine Signalübertragung eingeschaltet ist. Die Ausgänge der Sende-Signalpfade und die Eingänge der Empfangs-Signalpfade sind mit Frequenzweichen (FWS, FWE) beschaltet. Bei Änderung der Übertragungskanäle erfolgt in dem gerade nicht eingeschalteten Signalpfad die Einstellung auf die neuen Übertragungsparameter, und nach abgeschlossener Akquisition der neuen Übertragungsparameter wird auf diesen Signalpfad umgeschaltet.

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Punkt-zu-Mehrpunkt Funkübertragungssystem

Stand der Technik

Die vorliegende Erfindung betrifft ein Punkt-zu-Mehrpunkt Funkübertragungssystem, bestehend aus einer Zentralstation und mehreren Teilnehmerstationen, wobei die Übertragungskanäle zwischen der Zentralstation und den Teilnehmerstationen bedarfsweise zuteilbar sind.

Funkübertragungssysteme, seien es terrestrische Richtfunksysteme oder Satellitenübertragungssysteme, erlauben es, neue Funkverbindungen sehr schnell zu installieren oder bestehende zu ergänzen. Bei solchen Funkübertragungssystemen soll das zur Verfügung stehende Frequenzspektrum möglichst optimal ausgenutzt werden. Diese Forderung läßt sich mit Punkt-zu-Mehrpunkt Funkübertragungssystemen (Richtfunk, Satellitenfunk) verwirklichen.

Ein Punkt-zu-Mehrpunkt Richtfunksystem ist im Mikrowellenmagazin Vol. 10, Nummer 6, 1984, S. 629, 630 dargelegt. Danach läßt sich die Ausnutzung des Frequenzbandes des zur Verfügung stehenden Funkkanals durch eine nur bedarfsweise Belegung des erforderlichen Frequenzbandes verbessern. Die Kommunikation zwischen der Zentralstation und den einzelnen Teilnehmerstationen erfolgt

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entweder durch Vielfachzugriff im Frequenzmultiplex (FDMA) oder im Zeitmultiplex (TDMA), wobei die Frequenzkanäle oder Zeitschlitze je nach Bedarf der Teilnehmer zugeteilt werden.

Bei einem Punkt-zu-Mehrpunkt Richtfunksystem gemäß der deutschen Anmeldung DE 44 26 183 A1 wird die Übertragungskapazität dadurch flexibel an den Bedarf der Teilnehmer angepaßt, daß die Bandbreite der einzelnen Übertragungskanäle auf die von den einzelnen Teilnehmern jeweils geforderte Datenübertragungsrate eingestellt wird. Auch ist eine veränderbare Einstellung der Modulationsart oder des Modulationsgrades (zum Beispiel n-PSK mit n = 2 ... 16 oder M-QAM mit M = 4 ... 256) auf den einzelnen Übertragungskanälen vorgesehen.

Der Erfindung liegt nun die Aufgabe zugrunde, ein Punkt-zu-Mehrpunkt Funkübertragungssystem der eingangs genannten Art anzugeben, das eine flexible Zuweisung und Anpassung von Übertragungskapazitäten auf die zugeschalteten Teilnehmerstationen ermöglicht, ohne daß bestehende Funkverbindungen unterbrochen oder gestört werden.

Vorteile der Erfindung

Die gestellte Aufgabe wird mit den Merkmalen des Patentanspruchs 1 dadurch gelöst, daß eine Steuereinrichtung vorhanden ist, welche bei einer Veränderung der Übertragungskanäle in Modems, mit denen sowohl die Zentralstation als auch jede Teilnehmerstation ausgestattet ist, ein oder mehrere Übertragungsparameter so einstellt, daß die Bandbreite des zur Verfügung stehenden Funkkanals optimal ausgenutzt wird. Dabei weist jedes Modem zwei Sende- und zwei Empfangskanäle auf, und die Signalübertragung im Modem erfolgt nur über einen der beiden Sende- bzw. Empfangskanäle. Bei Änderung der Übertragungskanäle erfolgt

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in dem gerade nicht in Betrieb befindlichen Sende- bzw. Empfangskanal die Einstellung auf die neuen Übertragungsparameter, während die Signalübertragung in dem anderen Sende- bzw. Empfangskanal fortgesetzt wird. Nach abgeschlossener Akquisition der neuen Übertragungsparameter wird auf den zuvor nicht in Beterieb befindlichen Sende- bzw. Empfangskanal umgeschaltet. Es ist eine erste Frequenzweiche vorgesehen, welche das gesamte für das Aussenden von Signalen zur Verfügung stehende Frequenzband in mindestens zwei Teilbänder aufteilt, wobei die Signale der Sendekanäle den Teilbändern wahlweise zuteilbar sind. Außerdem ist eine zweite Frequenzweiche vorgesehen, welche das für Empfangssignale zur Verfügung stehende gesamte Frequenzband in mindestens zwei Teilbänder aufteilt, wobei die Signale der Teilbänder wahlweise den Empfangskanälen zuteilbar sind.

Mit den genannten Maßnahmen kann bei einem Punkt-zu-Mehrpunkt Funkübertragungssystem der zur Verfügung stehende Funkkanal sehr flexibel an die erforderlichen Übertragungskanäle der einzelnen Teilnehmer angepaßt werden, ohne daß Funkverbindungen unterbrochen werden müssen oder gestört werden. Es können alle Übertragungsparameter mit dem Ziel sowohl einer effizienten Nutzung des Funkkanals als auch einer Optimierung der Signalübertragungsqualität gesteuert werden. Der Einsatz der digitalen Frequenzweichen, deren Teilbänder den Sende- bzw. Empfangskanälen wahlweise zugeordnet werden können, ermöglicht eine sehr flexible Aufteilung der Sende- und Empfangskanäle. Außerdem kann die digitale Frequenzweiche die Abtastfrequenz ihres Eingangssignals reduzieren bzw. erhöhen (zum Beispiel halbieren bzw. verdoppeln), so daß nachfolgende Interpolatoren oder Dezimatoren geringere Interpolations- oder Dezimationsfaktoren realisieren müssen, wodurch sich der Schaltungsaufwand verringert.

BNSDOCID: <WO__9736433A1_I_>

Zweckmäßige Weiterbildungen der Erfindung gehen aus den Unteransprüchen hervor.

Beschreibung eines Ausführungsbeispiels

Anhand eines in der Zeichnung dargestellten Ausführungsbeispiels wird nachfolgend die Erfindung näher erläutert. Es zeigen:
Figur 1 ein Blockschaltbild eines Punkt-zu-Mehrpunkt Funkübertragungssystems,
Figur 2 ein Blockschaltbild eines Modems und
Figuren 3,4,5,6 Blockschaltbilder von Modems mit verschiedenartig gemultiplexten Sende- bzw. Empfangskanälen.

Das in Figur 1 prinzipiell dargestellte Punkt-zu-Mehrpunkt Funkübertragungssystem besteht aus einer Zentralstation ZS und mehreren Teilnehmerstationen TS1, TS2 ..., TSn. Die Zentralstation ZS weist soviele parallel geschaltete Modems MDM auf, wie maximal Teilnehmerstationen TS1, TS2 ..., TSn eine Funkverbindung mit der Zentralstation ZS aufnehmen können. Alle Modems MDM der Zentralstation ZS sind an beiden Ausgängen über Multiplexer/Demultiplexer MX1 und MX2 zusammengeschaltet. Der erste Multiplexer/Demultiplexer MX1 stellt die Verbindung zu anderen Nachrichtennetzen her. An den zweiten Multiplexer/Demultiplexer MX2 ist ein Schaltblock ZF angeschlossen, der die Umsetzung der auszusendenden oder empfangenen Signale in eine Zwischenfrequenzebene vornimmt. Daran schließt sich eine Sende-/Empfangseinheit (Frontend) RF an.

Einen ähnlichen Aufbau weisen die einzelnen Teilnehmerstationen TS1, TS2 ..., TSn auf. An eine Sende-/Empfangseinheit RF schließt sich eine

BNSDOCID: <WO _9736433A1 I >

Zwischenfrequenzschaltung ZF an, die wiederum mit einem Modem MDM verbunden ist. Ein Terminal-Multiplexer/Demultiplexer TMX stellt die Verbindung zwischen dem Modem MDM und Endstelleneinrichtungen (zum Beispiel Telefon) oder öffentlichen oder privaten Nachrichtennetzen (zum Beispiel ISDN, PABX) her.

Die Figur 2 zeigt ein Beispiel für den Aufbau eines Modems MDM, wie es in gleicher Weise in der Zentralstation ZS und in den einzelnen Teilnehmerstationen TS1, TS2 ..., TSn eingesetzt ist. Das Modem weist zwei Sende- und zwei Empfangskanäle auf. Dabei ist für jeden Sendekanal und für jeden Empfangskanal in dem hier dargestellten Ausführungsbeispiel ein eigener schaltungstechnisch relisierter Signalpfad vorgesehen.

In Senderichtung schaltet ein Demultiplexer DMUX ein auszusendendes Datensignal an einen von zwei Encodern ENC1 oder ENC2 durch. Jeder Encoder ENC1, ENC2 gehört zu einem der beiden Sende-Signalpfade, deren Verbindungsleitungen doppellinig gezeichnet sind, weil hier die Datensignale komplex sind, also einen Real- und einen Imaginärteil besitzen. Auf jeden Encoder ENC1, ENC2 folgt jeweils ein digitales Interpolationsfilter IF1, IF2 mit variablem Interpolationsfaktor. Daran schließt sich in jedem Signalpfad ein Modulator MOD1, MOD2 an, dem aber noch ein Interpolator MS1, MS2 mit festem Interpolationsfaktor vorgeschaltet sein kann. Jeder der beiden Modulatoren MOD1, MOD2 ist auf einen von zwei Sendekanälen abgestimmt. Die Ausgänge beider Modulatoren MOD1 und MOD2 sind über einen Schalter SWS einer Frequenzweiche FWS mit zwei Teilband-Filtern H1, H2 zugeführt. Eine solche Frequenzweiche, bestehend aus zwei komplexen Halbbandfiltern, ist beispielsweise aus der Zeitschrift „Frequenz", 42 (1988), Nummer 6-7, S. 181-189, bekannt. Die Teilfrequenzbänder der

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Teilband-Filter H1, H2 sind so gewählt, daß sie das gesamte für das Aussenden von Signalen zur Verfügung stehende Frequenzband abdecken. Es ist zweckmäßig, wenn sich die Teilfrequenzbänder gegenseitig überlappen, so daß auch Signale mit einer in der Mitte des Gesamtfrequenzbandes liegenden Frequenz von der Frequenzweiche FWS übertragen werden können. Die Mittenfrequenzen fm der beiden Teilband-Filter H1, H2 können zum Beispiel bei fm = (2m-1) fa/8 mit m = 1, 2, 3 oder 4 liegen, wobei fa die Abtastfrequenz des Ausgangssignals der Frequenzweiche FWS ist. Beispielsweise kann das erste Teilband-Filter H1 die Mittenfrequenz fm = 3fa/8 und das zweite Teilband-Filter H2 die Mittenfrequenz fm = 5fa/8 haben. Die Frequenzweiche FWS führt außerdem eine Abtastratenerhöhung (Interpolation) durch, so daß der Interpolationsfaktor der variablen Interpolationsfilter IF1, IF2 niedriger gewählt werden kann.

Der Schalter SWS kann wahlweise die einzelnen Sendekanäle auf das eine oder andere Teilband-Filter H1 oder H2 der Frequenzweiche FWS durchschalten. Gesteuert wird der Schalter SWS von einer unten noch näher beschriebenen Steuereinheit SE.

Das komplexe digitale Ausgangssignal der Frequenzweiche FWS wird von einem Interpolator IS mit festem Interpolationsfaktor 2 in ein reelles digitales Signal umgesetzt (vgl. z.B. DE 36 21 737 C2). Danach wird das reelle digitale Datensignal von einem Digital/Analog-Umsetzer DAU in ein analoges Signal gewandelt, das anschließend über ein Antialiasing-Filter AAFS geführt wird.

In entgegengesetzter Richtung - in Empfangsrichtung - gelangt ein empfangenes, analoges Datensignal über ein Antialiasing-Filter AAFE an einen Analog/Digital-Umsetzer ADU. Ein Dezimator DE mit festem Dezimationsfaktor 2 (vgl. z.B. DE 36 21 737 C2) setzt das

BNSDOCID: <WO___9736433A1_I_>

reelle digitale Ausgangssignal des Analog/Digital-Umsetzers ADU in ein komplexes digitales Signal um. Dieses komplexe Digitalsignal wird von einer Frequenzweiche FWE und einem anschließenden Schalter SWE auf jeweils einen von zwei Empfangs-Signalpfaden durchgeschaltet. Was die Lage der Teilfrequenzbänder der Frequenzweiche FWE angeht, gilt das bereits im Zusammenhang mit der Frequenzweiche FWS für die Sendekanäle Gesagte. Die Frequenzweiche FWE führt eine Abtastratenverminderung (Dezimation) durch. Wegen der von der Frequenzweiche veranlaßten Aufteilung des gesamten für die Empfangssignale zur Verfügung stehenden Frequenzbandes in schmalere Teilbänder wird für die einzelnen Empfangskanäle das Abtasttheorem erfüllt. Es gibt also bei der Demodulation keine störenden Überfaltungen, weil die Bedingung eingehalten wird, daß die Abtastfrequenz mindestens so groß sein muß wie die Signalbandbreite (entspricht einem Teilband der Frequenzweiche). Das hier im Zusammenhang mit den Empfangskanälen zum Abtasttheorem Gesagte gilt in analoger Weise auch für die Sendekanäle.

Der Schalter SWE kann die Ausgangssignale der Teilband-Filter H1, H2 der Frequenzweiche FEW in beliebiger Kombination auf die nachfolgenden Empfangs-Signalpfade durchschalten.

In jedem Empfangs-Signalpfad befindet sich ein komplexer digitaler Demodulator DEM1 und DEM2, von denen jeder auf einen von zwei Empfangskanälen abgestimmt ist. Jedem Demodulator DEM1, DEM2 ist ein Dezimationsfilter DF1, DF2 mit variablem Dezimationsfaktor (matched filter) - eventuell unter Zwischenschaltung eines Dezimators ME1, ME2 mit festem Dezimationsfaktor - nachgeschaltet. Da bereits die Frequenzweiche FWE eine Abtastratenverminderung durchführt, kann der Dezimationsfaktor des variablen Dezimationsfilters DF1, DF2 niedriger gewählt werden.

BNSDOCID: <WO___9736433A1_I_>

Die Interpolatoren und Dezimatoren zur Änderung der Abtastfrequenz um einen festen Faktor sind vorzugsweise als nichtrekursive (FIR) Filter mit bedarfsweise linearer Phase ausgebildet, wobei im linearphasigen Fall durch Nutzung der Koeffizientensymmetrie besonders aufwandsgünstige Schaltungen resultieren. Weitergehende Aufwandsverminderungen sind erzielbar durch die Ausbildung dieser Filter als Halbband-Filter. Schließlich kann die Operationsrate (Zahl der Operationen pro Zeiteinheit) auf ein Minimum gebracht werden, indem diese Interpolatoren und Dezimatoren als Polyphasenfilter realisiert werden. Eine weitere Verminderung des Schaltungsaufwandes und auch der Verlustleistung erreicht man dadurch, daß bei den festen Dezimatoren und Interpolatoren die allgemeinen Multiplikationen durch stellenrichtige Addition und/oder Subtraktion der Zustandsgrößen ersetzt weden (CSD-Code Darstellung der Koeffizienten).

Die Dezimationsfilter DF1, DF2, wie auch die Interpolationsfilter IF1, IF2 erfüllen die Wurzel-Nyquist-Bedingung. Der Aufbau und die Funktionsweise solcher variabler Dezimations- und Interpolationsfilter sind in den „Proceedings Second European Conference on Satellite Communications" Liege/Belgien, Oktober 1991, ESA SP-332, S. 457-464, beschrieben.

In den beiden Empfangs-Signalpfaden befinden sich Synchronisierschaltungen SYNC1 und SYNC2, wie sie ebenfalls aus „Proceedings Second European Conference on Satellite Communications" bekannt sind. Sie synchronisieren die Schaltungen im jeweiligen Signalpfad auf die Trägerfrequenz, die Trägerphase und den Abtasttakt des empfangenen Datensignals auf. Damit ist das Modem unabhängig von Synchronisationssignalen, die ansonsten zusammen mit den Empfangssignalen übertragen werden müßten.

BNSDOCID: <WO__9736433A1 I >

Am Ende eines jeden Empfangs-Signalpfades befindet sich ein Decoder DEC1, DEC2. Sowohl die Codierung in den Sende-Signalpfaden als auch die Decodierung in den Empfangs-Signalpfaden geschieht vorzugsweise mit Viterbi-Codern/Decodern. Die Ausgänge beider Decoder DEC1, DEC2 führen zu einem Multiplexer MUX.

Die komplexen Trägerschwingungen für die komplexen digitalen Modulatoren MOD1, MOD2 und Demodulatoren DEM1, DEM2 werden zweckmäßigerweise mit der Methode der direkten digitalen Synthese (DDS) (vergleiche „An Analysis of the Output Spectrum of Direct Digital Frequency Synthesizers in the Presence of Phase-Accumulator Truncation", IEEE 1987, 41st. Annual Frequency Control Symposium, S. 495 ff) oder der linearen interpolierten digitalen Synthese erzeugt.

Das Punkt-zu-Mehrpunkt Funkübertragungssystem soll, wie eingangs angegeben, eine sehr flexible Zuteilung von Übertragungskanälen zwischen der Zentralstation und Teilnehmerstationen ermöglichen, wobei der zur Verfügung stehende Funkkanal optimal ausgenutzt wird. Verändert sich die Zahl der benötigten Übertragungskanäle, weil ein oder mehrere Teilnehmerstationen einen Datenaustausch mit der Zentralstation neu aufnehmen oder die Datenübertragung abbrechen, so werden von einer in der Zentralstation ZS vorhandenen Steuereinrichtung SE aus die Übertragungsparameter in den von der Änderung der Übertraungskanäle betroffenen Modems in der Zentralstation und in Teilnehmerstationen so verändert, daß die Übertragungskanäle den Funkkanal effizient belegen. Zu den veränderbaren Übertragungsparametern gehören beispielsweise die Datenrate, die Modulationsart oder der Modulationsgrad (zum Beispiel n-PSK mit n = 2 ... 16 oder M-QAM mit M = 4 ... 256), die Codierung, die Kanalfrequenz oder auch der Sendepegel und Parameter zur Signalqualitätsbeurteilung, um eine vorgegebene

BNSDOCID: <WO _ 9736433A1_I_>

Datenübertragungsqualität (zum Beispiel Bitfehlerrate $<10^{-7}$) sicherzustellen und Funkfeldeinflüsse (fadings, Reflexionen) zu minimieren.

Die Steuereinrichtung SE berechnet also bei einer Änderung der Zahl der erforderlichen Übertragungskanäle die Übertragungsparameter nach den genannten Gesichtspunkten der effizienten Ausnutzung der Gesamtbandbreite des Funkkanals und einer optimalen Signalübertragungsqualität. Diese veränderten Übertragungsparameter gibt die Steuereinrichtung SE als Steuersignale (als strichlierte Doppelpfeil-Linien in den Figuren angedeutet) an die betreffenden Schaltblöcke in den Modems ab. Die Steuersignale für die Modems in den Teilnehmerstationen werden beispielsweise über einen Signalisierungskanal übertragen, der entweder an einen oder mehrere Nutzsignalkanäle angehängt ist oder als eigener Broadcast-Kanal ausgestrahlt wird.

Von den Übertragungsparametern wird die Datenrate in den variablen Interpolationsfiltern IF1, IF2 und Dezimationsfiltern DF1, DF2 eingestellt. Änderungen der Kanalfrequenz werden in den Modulatoren MOD1, MOD2 und Demodulatoren DEM1, DEM2 vorgenommen, und Änderungen der Modulation und der Codierung erfolgen in den Encodern ENC1, ENC2 und den Decodern DEC1, DEC2.

Wie oben beschrieben, gibt es in jedem Modem zwei Sende- und zwei Empfangskanäle. Die Signalübertragung erfolgt immer nur in einem Sende- und einem Empfangskanal. Der andere Sende- bzw. Empfangskanal ist dann nicht aktiv. Wenn die Steuereinrichtung SE eine Anforderung für eine Änderung der Übertragungskanäle erhält und sie darauf die Übertragungsparameter dementsprechend neu berechnet, gibt sie ihre neuen Übertragungsparameter als Steuersignale an die betreffenden Schaltblöcke für den nicht eingeschalteten Sende- bzw. Empfangkanal ab. Sobald die neuen

BNSDOCID: <WO___9736433A1_I_>

Übertragungsparameter in den betreffenden Modems der Zentralstation eingestellt worden sind und auch die Teilnehmerstationen die Akquisition der neuen Übertragungsparameter über den Signalisierungskanal bei der Steuereinrichtung SE bestätigt haben, wird die Signalübertragung und -verarbeitung in allen betroffenen Modems in dem anderen Kanal, in dem die Umstellung auf die geänderten Übertragungsparameter erfolgt ist, fortgesetzt. Wenn also eine Änderung der Übertragungsparameter nötig ist, weil zum Beispiel ein oder mehrere zusätzliche Übertragungskanäle angefordert werden oder ein anderer Bedarf an Frequenzbändern vorliegt, wird die Signalübertragung so lange mit den alten Übertragungsparametern fortgeführt, bis die neuen Übertraungsparameter in dem noch nicht aktivierten Sende- bzw. Empfangskanal eingestellt worden sind, und erst dann wird abrupt auf diesen Kanal umgeschaltet. Dadurch werden störende Unterbrechungen bei der Signalübertragung vermieden.

Die Auswahl des Sende- und Empfangskanals in den betreffenden Modems trifft die Steuereinheit SE, indem sie die Modulations- beziehungsweise Demodulationsfrequenz desjenigen Sende- bzw. Empfangskanals vorgibt, der nach Änderung der Übertragungsparameter die Übertragung fortsetzen sollen.

In den vorangehend beschriebenen Ausführungsbeispielen ist jedem Sende- beziehungsweise Empfangskanal ein eigener Signalpfad zugeordnet, d.h. für die Sende- und für die Empfangsrichtung sind ein großer Teil der Schaltungsblöcke doppelt vorhanden. Dieser Aufwand an Schaltungen kann dadurch verringert werden, daß Teile sowohl der beiden

BNSDOCID: <WO_ 9736433A1_I_>

Sende-Signalpfade als auch der beiden Empfangs-Signalpfade im Zeitmultiplex betrieben werden.

In der Figur 3 ist ein Signalpfad für die beiden Sendekanäle und ein Signalpfad für die beiden Empfangskanäle dargestellt. Der Sende-Signalpfad besitzt für beide Sendekanäle einen Encoder ENC, ein variables Interpolationsfilter IF und einen Modulator MOD. Außerdem kann zwischen dem variablen Interpolationsfilter IF und dem Modulator MOD noch ein weiterer Interpolator MSS mit einem festen Interpolationsfaktor eingefügt werden, wie der Figur 3 zu entnehmen ist. Auf die Funktion der einzelnen Schaltblöcke ENC, IF, MSS, MOD und der sich an die umschaltbare Frequenzweiche SWS, FWS anschließenden Schaltblöcke (Interpolator IS, Digital/Analog-Umsetzer DAU, Antialiasing-Filter AAFS) wird hier nicht näher eingegangen, weil sie im Zusammenhang mit dem in Figur 2 dargestellten Ausführungsbeispiel schon näher beschrieben worden ist.

Dasselbe gilt für die einzelnen Schaltblöcke des in Figur 3 dargestellten Empfangs-Signalpfades. Ebenso ist dieser eine Empfangs-Signalpfad, in dem alle Schaltblöcke nur einfach vorkommen, für die Übertragung beider Empfangskanäle vorgesehen.

Die an die einzelnen Schaltungseinheiten angefügten, strichlierten Blöcke sollen verdeutlichen, daß die beiden Sendekanäle KS1 und KS2 im Zeitmultiplex über den einen Sende-Signalpfad und die beiden Empfangskanäle KE1 und KE2 im Zeitmultiplex über den einen Empfangs-Signalpfad übertragen werden können.

In dem einen Sende-Signalpfad, der im Zeitmultiplex die beiden Sendekanäle verarbeitet und in dem einen

BNSDOCID: <WO___9736433A1_I_>

Empfangs-Signalpfad, der die beiden Empfangskanäle im Zeitmultiplex verarbeitet, entsteht ein Frequenzmultiplex-Signal (FDM), weil jedem Sende- beziehungsweise Empfangskanal im Modulator MOD beziehungsweise Demodulator DEM eine indivuduelle Kanalfrequenz zugewiesen wird. Im Sende-Signalpfad erfolgt durch einen Multiplexer, der Bestandteil der Frequenzweiche FWS ist, eine Auflösung der Zeitmultiplexverarbeitung. Die Zeitmultiplexverarbeitung im Empfangs-Signalpfad wird durch einen Demultiplexer ermöglicht, der Bestandteil der Frequenzweiche FWE ist. Mit anderen Worten: das Zeitmultiplex wird jeweils aufgelöst, bevor das Frequenzmultiplex stattfindet.

Eine weitere Konzentration der Schaltungseinheiten kann dadurch erfolgen, daß, wie in der Figur 4 dargestellt, bezüglich der variablen Dezimation und der variablen Interpolation beide Sendekanäle und beide Empfangskanäle gemultiplext werden. Dazu ist eine Funktionseinheit DI vorgesehen, die sowohl ein variables Dezimationsfilter DF als auch ein variables Interpolationsfilter IF enthält. Multiplexer/Demultiplexer DMX1 und DMX2 an beiden Toren der Funktionseinheit DI bewirken, daß sowohl die beiden Sendekanäle als auch die beiden Empfangskanäle im Zeitmultiplex über die Funktionseinheit DI übertragen werden können. Alle anderen Schaltungseinheiten, welche dieselben Bezugszeichen wie in Figur 3 aufweisen, haben auch dieselbe Funktion wie bei dem dort dargestellten Ausführungsbeispiel eines Modems.

Bei dem in Figur 5 dargestellten Modem sind auch der Demodulator DEM und der Modulator MOD in einer gemeinsamen Funktionseinheit DM zusammengefaßt, welche sowohl die Sende-

BNSDOCID: <WO 9736433A1 I >

als auch die Empfangskanäle im Zeitmultiplex verarbeitet. Diese Schaltungsvariante des Modems bringt nochmals eine Reduzierung des Schaltungsaufwandes. Ungünstig dabei ist allerdings, daß der Interpolator MSS und der Dezimator MEE komplexe Koeffizienten aufweisen. Bei dem in Figur 6 dargestellten Ausführungsbeispiel ist daher die Reihenfolge von Modulator MOD und Interpolator MSS und die Reihenfolge von Demodulator DEM und Dezimator MEE vertauscht. Dadurch lassen sich der Interpolator MSS und der Dezimator MEE, die beide in einer Funktionseinheit MES zusammengefaßt sind, mit reellen Koeffizienten realisieren. Die Vorteile der Zeitmultiplexabarbeitung der Sende- und Empfangs-Signalpfade bleiben erhalten.

BNSDOCID: <WO___9736433A1_I_>

Ansprüche

1. Punkt-zu-Mehrpunkt Funkübertragungssystem, bestehend aus einer Zentralstation und mehreren Teilnehmerstationen, wobei die Übertragungskanäle zwischen der Zentralstation und den Teilnehmerstationen bedarfsweise zuteilbar sind, dadurch gekennzeichnet,

- daß die Zentralstation (ZS) für jeden der maximal zur Verfügung stehenden Übertragungskanäle ein Modem (MDM) aufweist und ebenfalls jede Teilnehmerstation (TS1, TS2 ... TSn) mit einem Modem (MDM) ausgestattet ist,

- daß eine Steuereinrichtung (SE) vorhanden ist, welche bei einer Veränderung der Übertragungskanäle in jedem betroffenen Modem (MDM) einen oder mehrere der Übertragungsparameter - Kanalträgerfrequenz, Datenrate, Modulation, Codierung, Sendepegel, Parameter zur Signalqualitätsbeurteilung - so einstellt, daß die Bandbreite des zur Verfügung stehenden Funkkanals optimal ausgenutzt wird,

- daß jedes Modem (MDM) zwei Sende- und zwei Empfangskanäle aufweist, wobei die Signalübertragung im Modem nur über einen der beiden Sende- beziehungsweise Empfangskanäle erfolgt,

BNSDOCID: <WO__9736433A1 I >

- daß bei Änderung der Übertragungskanäle die Steuereinrichtung (SE) in dem jeweils nicht in Betrieb befindlichen Sende- beziehungsweise Empfangskanal die Einstellung der neuen Übertragungsparameter vornimmt, während die Signalübertragung in dem anderen Sende- beziehungsweise Empfangskanal fortgesetzt wird, und nach abeschlossener Akquisition der neuen Übertragungsparameter eine Umschaltung auf den zuvor nicht in Betrieb befindlichen Sende- beziehungsweise Empfangskanal erfolgt,

- daß eine erste Frequenzweiche (FWS) vorgesehen ist, welche das gesamte für das Aussenden von Signalen zur Verfügung stehende Frequenzband in mindestens zwei Teilbänder aufteilt, wobei die Signale der Sendekanäle den Teilbändern wahlweise zuteilbar sind,

- und daß eine zweite Frequenzweiche (FWE) vorgesehen ist, welche das für Empfangssignale zur Verfügung stehende gesamte Frequenzband in mindestens zwei Teilbänder aufteilt, wobei die Signale der Teilbänder wahlweise den Empfangskanälen zuteilbar sind.

2. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß für jeden der beiden Sendekanäle ein Encoder (ENC1, ENC2) und ein Modulator (MOD1, MOD2) vorhanden sind und daß jedem Modulator (MOD1, MOD2) ein Interpolationsfilter mit einstellbarem Interpolationsfaktor (IF1, IF2) vorgeschaltet ist.

3. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß der Frequenzweiche (FWS) für die Sendekanäle ein Interpolator (IS) nachgeschaltet ist, welcher das komplexe

BNSDOCID: <WO _ 9736433A1 I >

digitale Ausgangssignal der Frequenzweiche (FWS) in ein reelles digitales Signal umwandelt.

4. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß die digitale Frequenzweiche (FWS) für die Sendekanäle die Abtastfrequenz ihres Eingangssignals verdoppelt.

5. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß für jeden der beiden Empfangskanäle ein Demodulator (DEM1, DEM2) und ein Decoder (DEC1, DEC2) vorgesehen sind und daß jedem Demodulator (DEM1, DEM2) ein Dezimationsfilter mit einstellbarem Dezimationsfaktor (DF1, DF2) nachgeschaltet ist.

6. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß der Frequenzweiche (FWE) für die Empfangskanäle ein Dezimator (DE) vorgeschaltet ist, der reelle digitale Empfangssignale in komplexe digitale Signale umwandelt.

7. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß die digitale Frequenzweiche (FWE) für die Empfangskanäle die Abtastfrequenz ihres Ausgangssignals halbiert.

8. Punkt-zu-Mehrpunkt Funkübertragungssystem nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß sich die Durchlaßbereiche der beiden Teilband-Filter (H1, H2) der Frequenzweichen (FWS, FWE) überlappen.

9. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß für beide

BNSDOCID: <WO_ 9736433A1_I_>

Sendekanäle ein Encoder (ENC), ein Modulator (MOD) und ein zwischen beiden eingefügtes Interpolationsfilter mit veränderbarem Interpolationsfaktor (IF) vorgesehen sind und daß beide Sendekanäle im Zeitmultiplex über den Encoder (ENC), den Modulator (MOD) und das variable Interpolationsfilter (IF) übertragbar sind.

10. Punkt-zu-Mehrpunkt Funkübertragungssystem nach Anspruch 1, dadurch gekennzeichnet, daß für beide Empfangskanäle ein Demodulator (DEM), ein Decoder (DEC) und ein zwischen beiden eingefügtes Dezimationsfilter mit veränderbarem Dezimationsfaktor (DF) vorgesehen sind und daß beide Empfangskanäle im Zeitmultiplex über den Demodulator (DEM), das Dezimationsfilter (DF) und den Decoder (DEC) übertragbar sind.

11. Punkt-zu-Mehrpunkt Funkübertragungssystem nach einem der Ansprüche 3 oder 6, dadurch gekennzeichnet, daß der Interpolator (IS) beziehungsweise der Dezimator (DE) als komplexes Halbbandfilter ausgeführt ist.

12. Punkt-zu-Mehrpunkt Funkübertragungssystem nach einem der Ansprüche 9 oder 10, dadurch gekennzeichnet, daß Multiplexer/Demultiplexer (DMX1, DMX2) sowohl die Sendekanäle als auch die Empfangskanäle im Zeitmultiplex über eine gemeinsame Funktionseinheit (DI) mit einem variablen Dezimations- und einem variablen Interpolationsfilter übertragen.

13. Punkt-zu-Mehrpunkt Funkübertragungssystem nach einem der Ansprüche 9 oder 10, dadurch gekennzeichnet, daß Multiplexer/Demultiplexer (DMX1, DMX2) sowohl die Sendekanäle als auch die Empfangskanäle im Zeitmultiplex über eine erste Funktionseinheit (DI) mit einem variablen

BNSDOCID: <WO___9736433A1_I_>

Dezimations- und einem variablen Interpolationsfilter und über eine zweite Funktionseinheit (DM) mit einem Modulator und einem Demodulator übertragen.

14. Punkt-zu-Mehrpunkt Funkübertragungssystem nach einem der Ansprüche 9 oder 10, dadurch gekennzeichnet, daß Multiplexer/Demultiplexer (DMX1, DMX2) sowohl die Sendekanäle als auch die Empfangskanäle im Zeitmultiplex über eine erste Funktionseinheit (DI) mit einem variablen Dezimations- und einem variablen Interpolationsfilter und über eine zweite Funktionseinheit (MES) mit einem Interpolator und einem Dezimator mit festem Interpolationsfaktor beziehungsweise Dezimationsfaktor übertragen.

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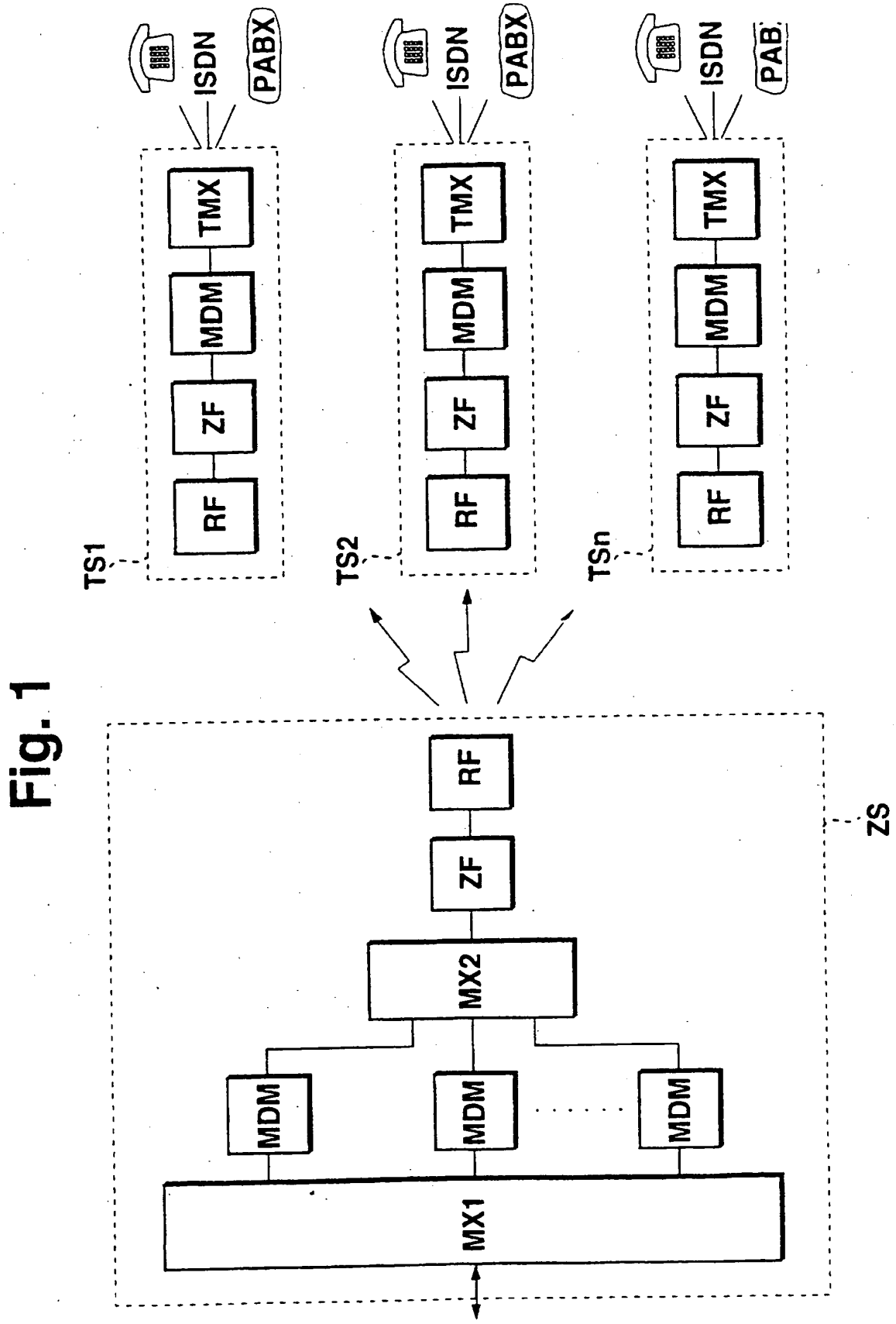
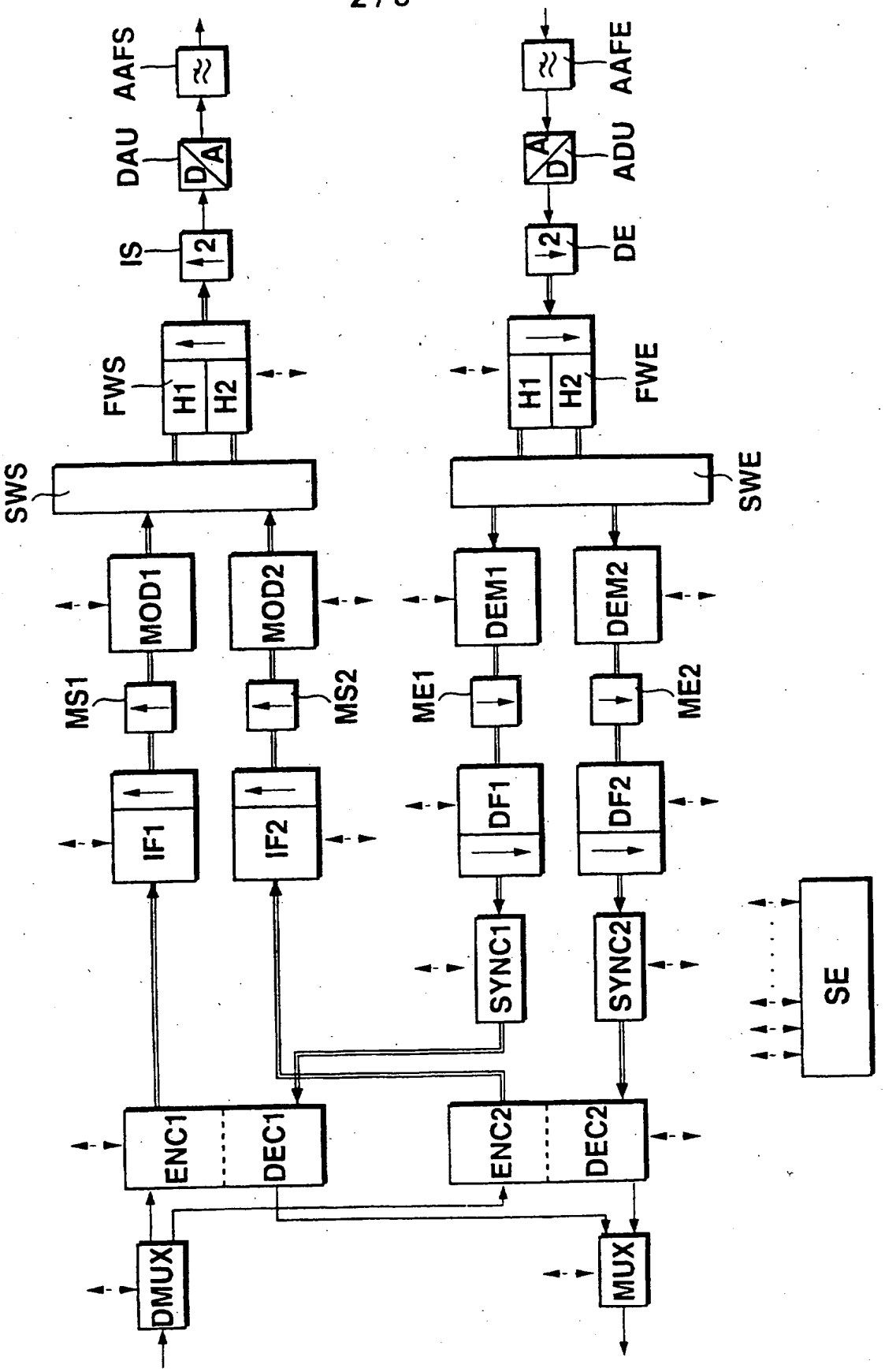


Fig. 1

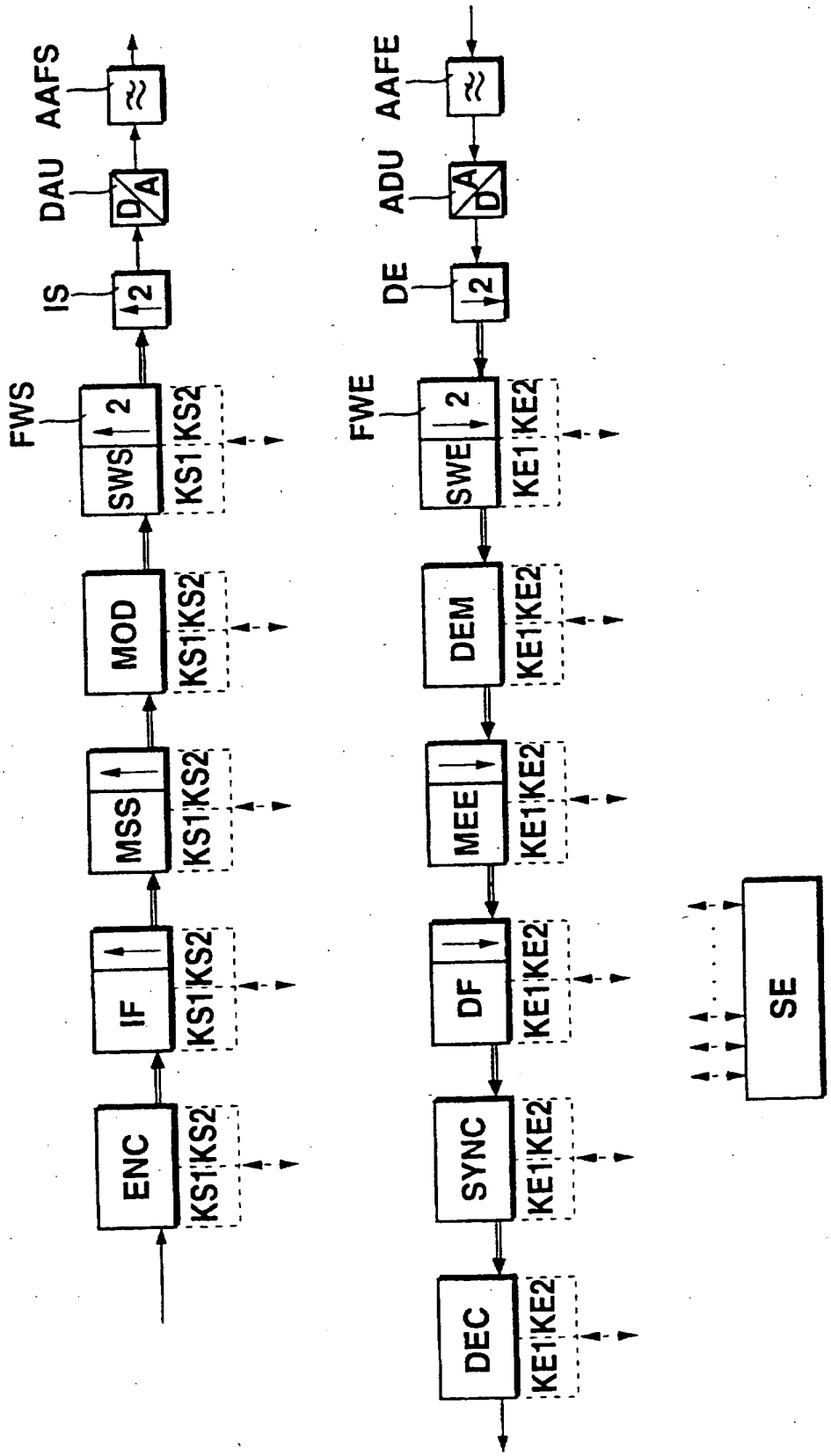
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Fig. 2



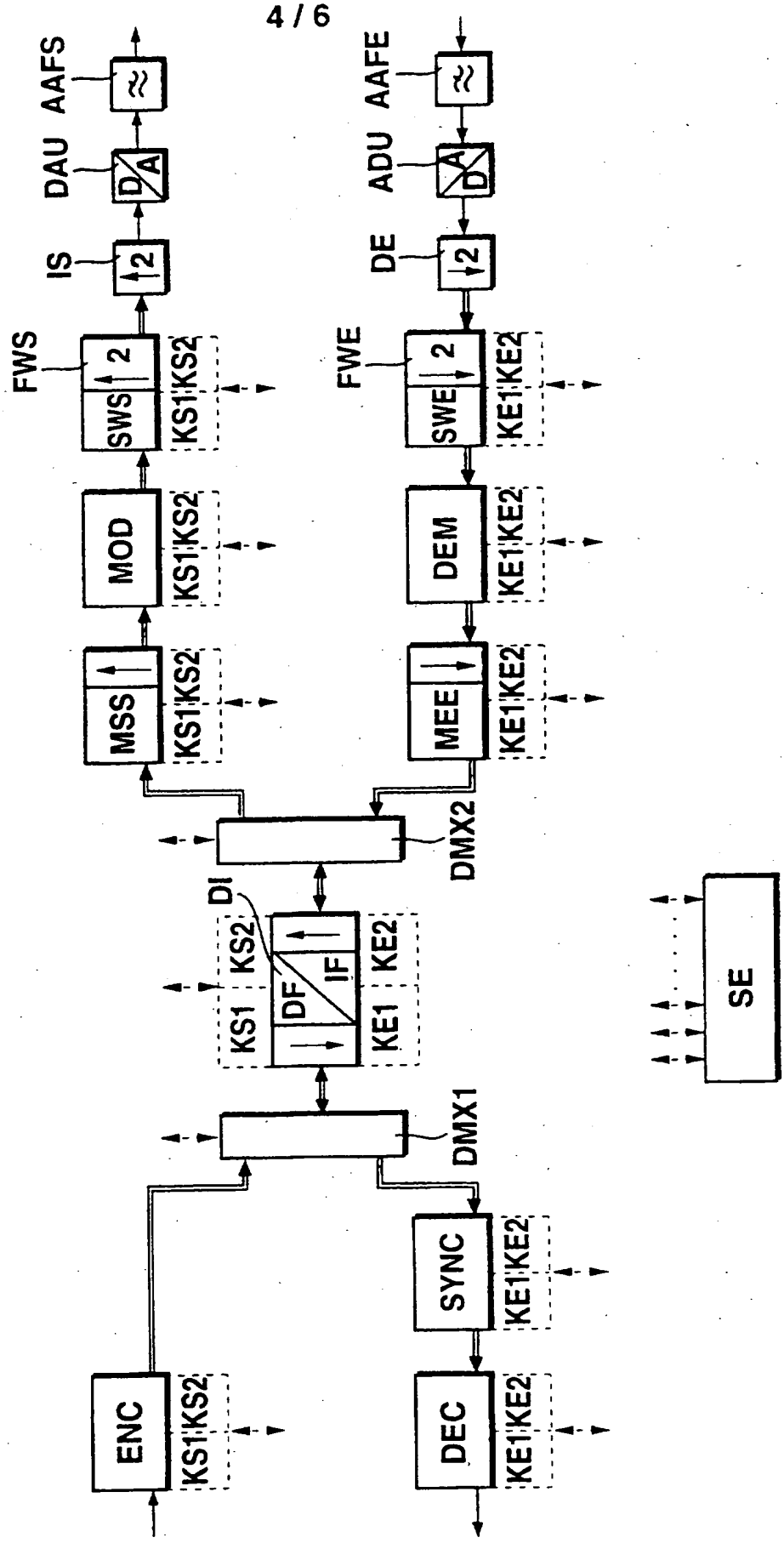
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Fig. 3



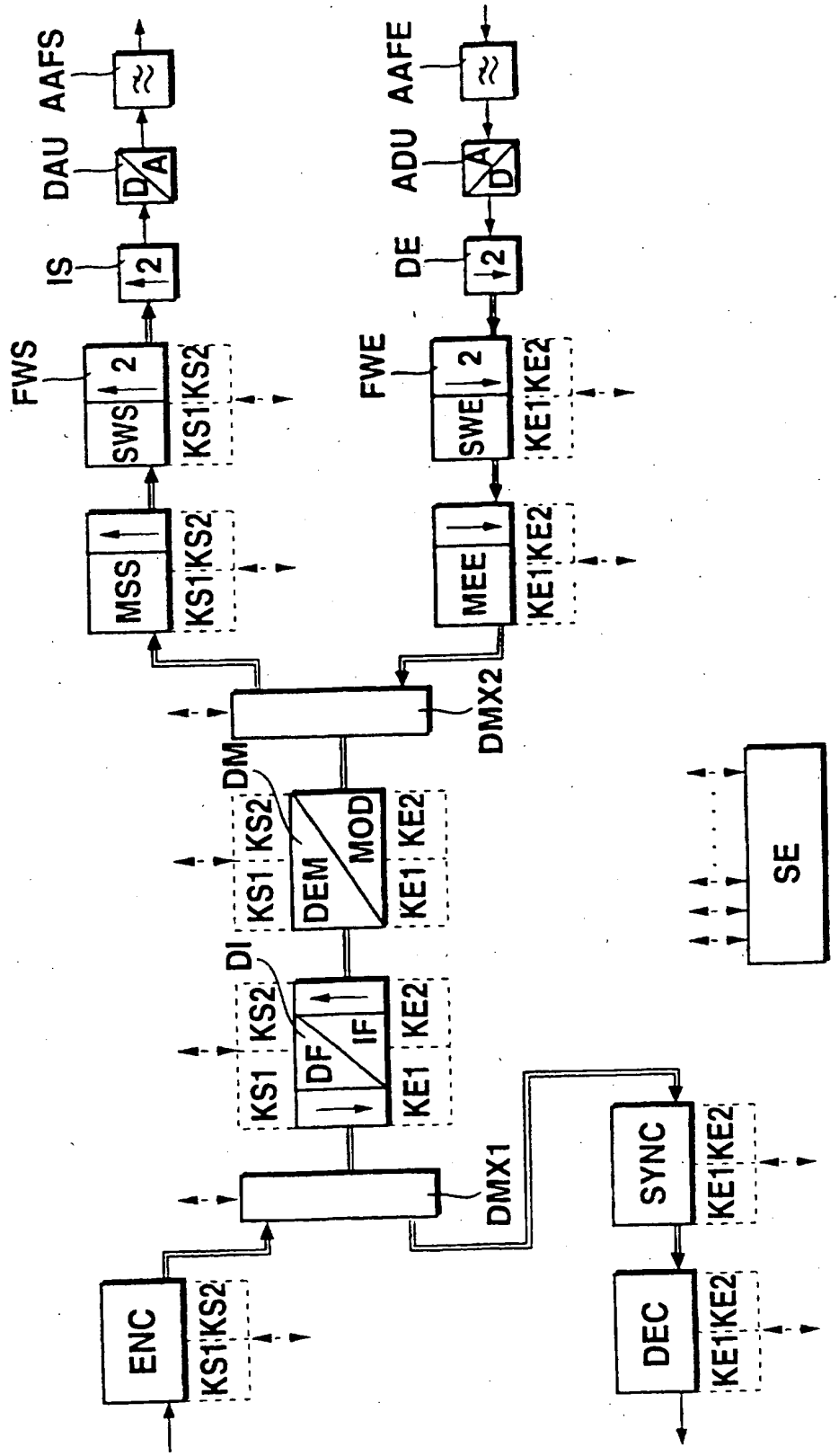
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Fig. 4



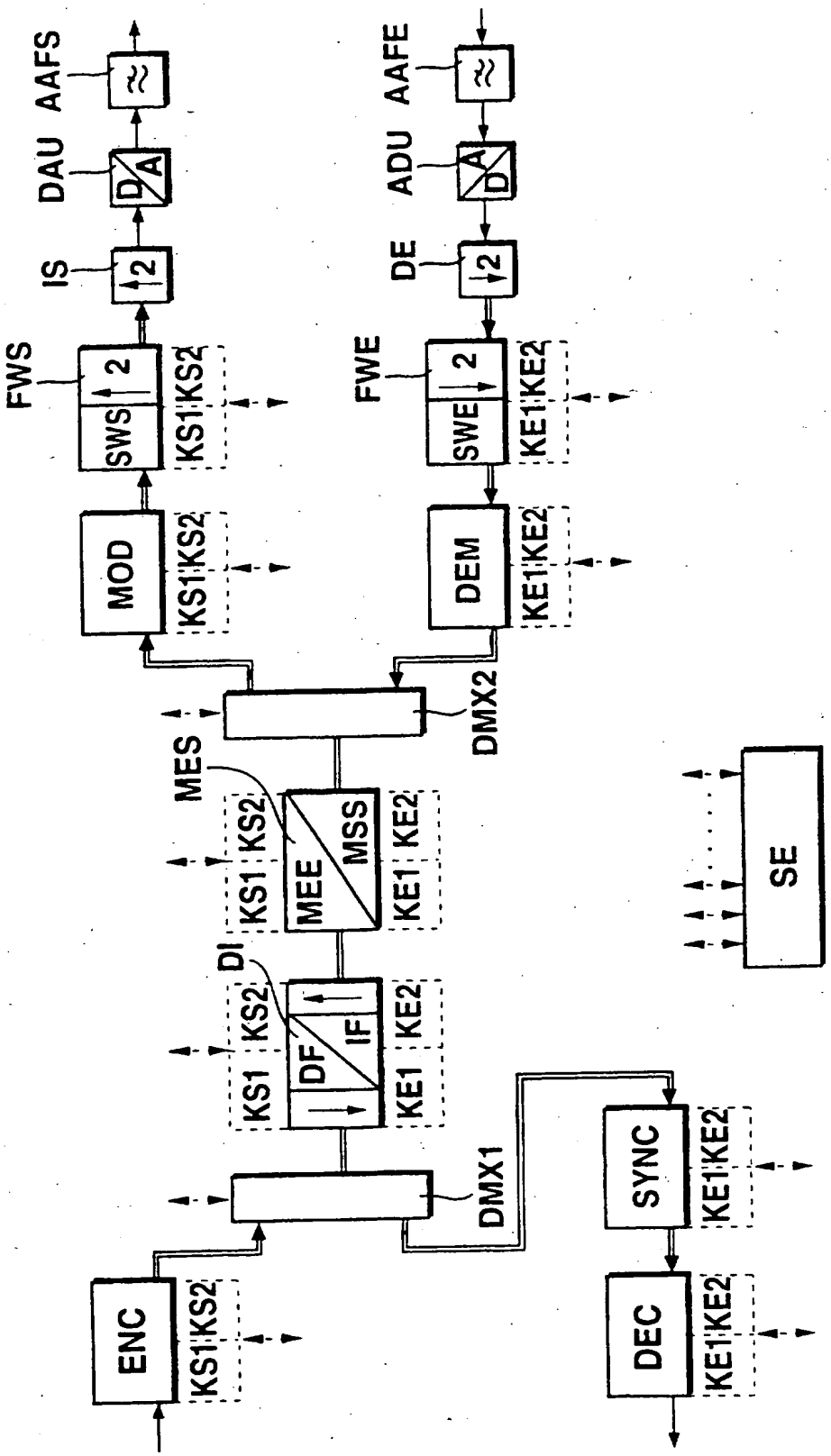
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Fig. 5



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Fig. 6



BNSDOCID: <WO 9736433A1 I >

INTERNATIONAL SEARCH REPORT

International Application No
PCT/DE 96/02349

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/20

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)
IPC 6 H04Q H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 August 1997	27.08.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (- 31-70) 340-2040, Tx. 31 651 epo nl, Fax (- 31-70) 340-3016	Roberti, V

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PCT/DE 96/02349

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/DE 96/02349

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 H04Q7/20

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 6 H04Q H04B H04L

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Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	US 4 385 392 A (ANGELL GARY W ET AL) 24.Mai 1983 siehe das ganze Dokument ---	1
A	DE 44 26 183 C (ANT NACHRICHTENTECH) 19.Oktober 1995 in der Anmeldung erwähnt siehe das ganze Dokument ---	1
A	GB 2 098 029 A (WESTERN ELECTRIC CO) 10.November 1982 siehe Seite 2, Zeile 42 - Seite 3, Zeile 120 --- -/--	1

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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1

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
19.August 1997	27.08.97

Name und Postanschrift der Internationale Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Roberti, V

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

Ex-1002.00268

BNSDOCID: <WO__9736433A1_I_>

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	US 4 785 450 A (BOLGIANO DUANE R ET AL) 15.November 1988 siehe Spalte 3, Zeile 12 - Spalte 4, Zeile 18 siehe Spalte 5, Zeile 45 - Spalte 5, Zeile 61 siehe Spalte 6, Zeile 4 - Spalte 6, Zeile 26	1
A	US 4 965 852 A (SASAKI SUSUMU) 23.Oktober 1990 siehe Spalte 3, Zeile 28 - Spalte 3, Zeile 55 siehe Spalte 4, Zeile 14 - Spalte 6, Zeile 14	1
A	US 4 706 239 A (ITO YASUHIKO ET AL) 10.November 1987 siehe Spalte 1, Zeile 56 - Spalte 2, Zeile 3 siehe Spalte 2, Zeile 52 - Spalte 3, Zeile 27	1
A	US 5 208 804 A (WILSON TIMOTHY J ET AL) 4.Mai 1993 siehe Spalte 2, Zeile 43 - Spalte 3, Zeile 55 siehe Spalte 3, Zeile 66 - Spalte 5, Zeile 14 siehe Spalte 5, Zeile 59 - Spalte 6, Zeile 7	1
A	MCGUIRE R J: "TECHNOLOGIES FOR AN EXCHANGE RADIO" PROCEEDINGS OF THE NATIONAL COMMUNICATIONS FORUM, Bd. 43, Nr. 2, 2.Oktober 1989, Seiten 869-882, XP000224999 siehe das ganze Dokument	1
A	THO LE-NGOC ET AL: "ISDN IMPLEMENTATION FOR A POINT-TO-MULTIPOINT SUBSCRIBER RADIO SYSTEM" COMPUTER COMMUNICATIONS, Bd. 13, Nr. 3, 1.April 1990, Seiten 131-135, XP000116538 siehe das ganze Dokument	1

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BNSDOCID: <WO__9736433A1_I_>

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, ...ur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/DE 96/02349

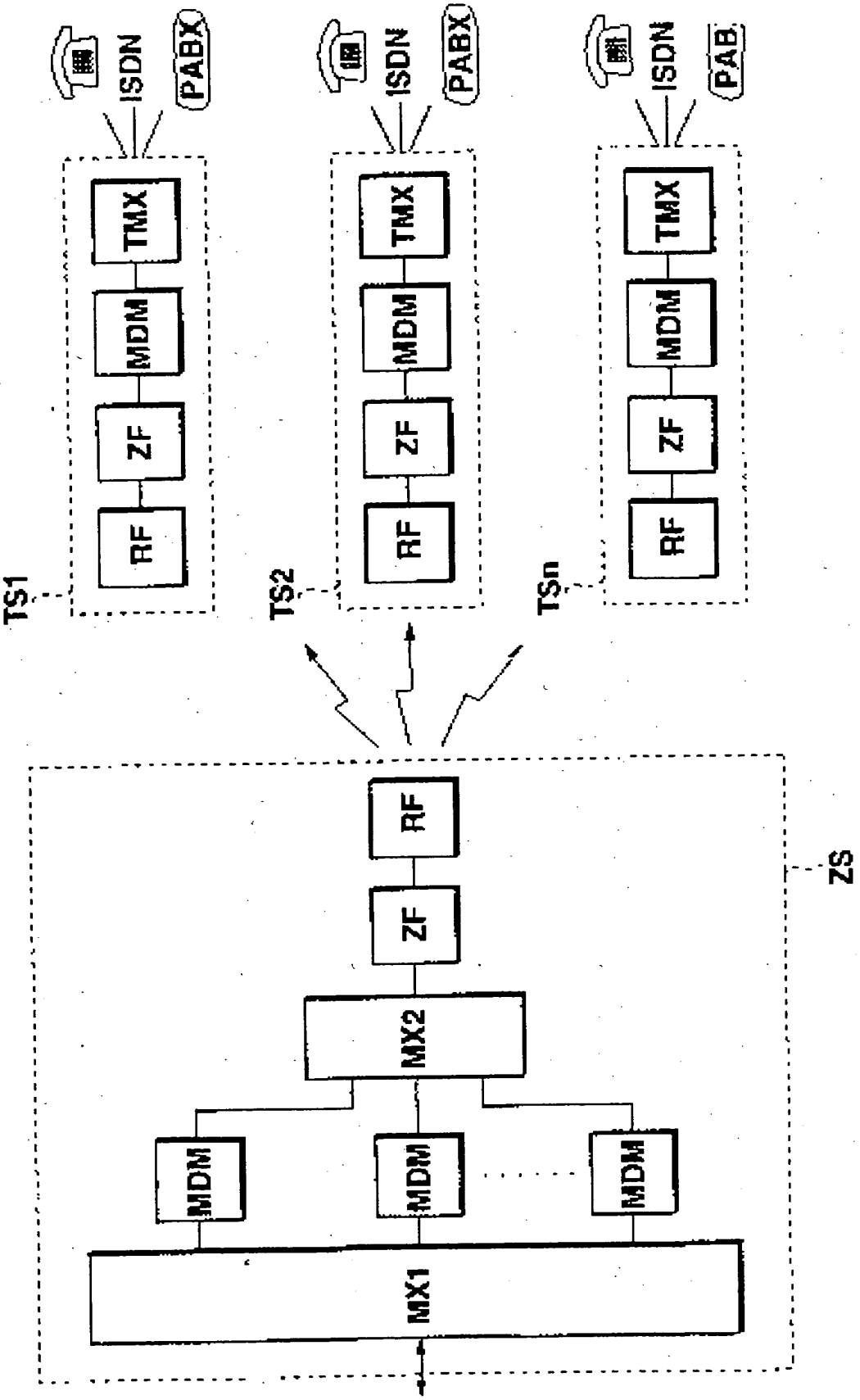
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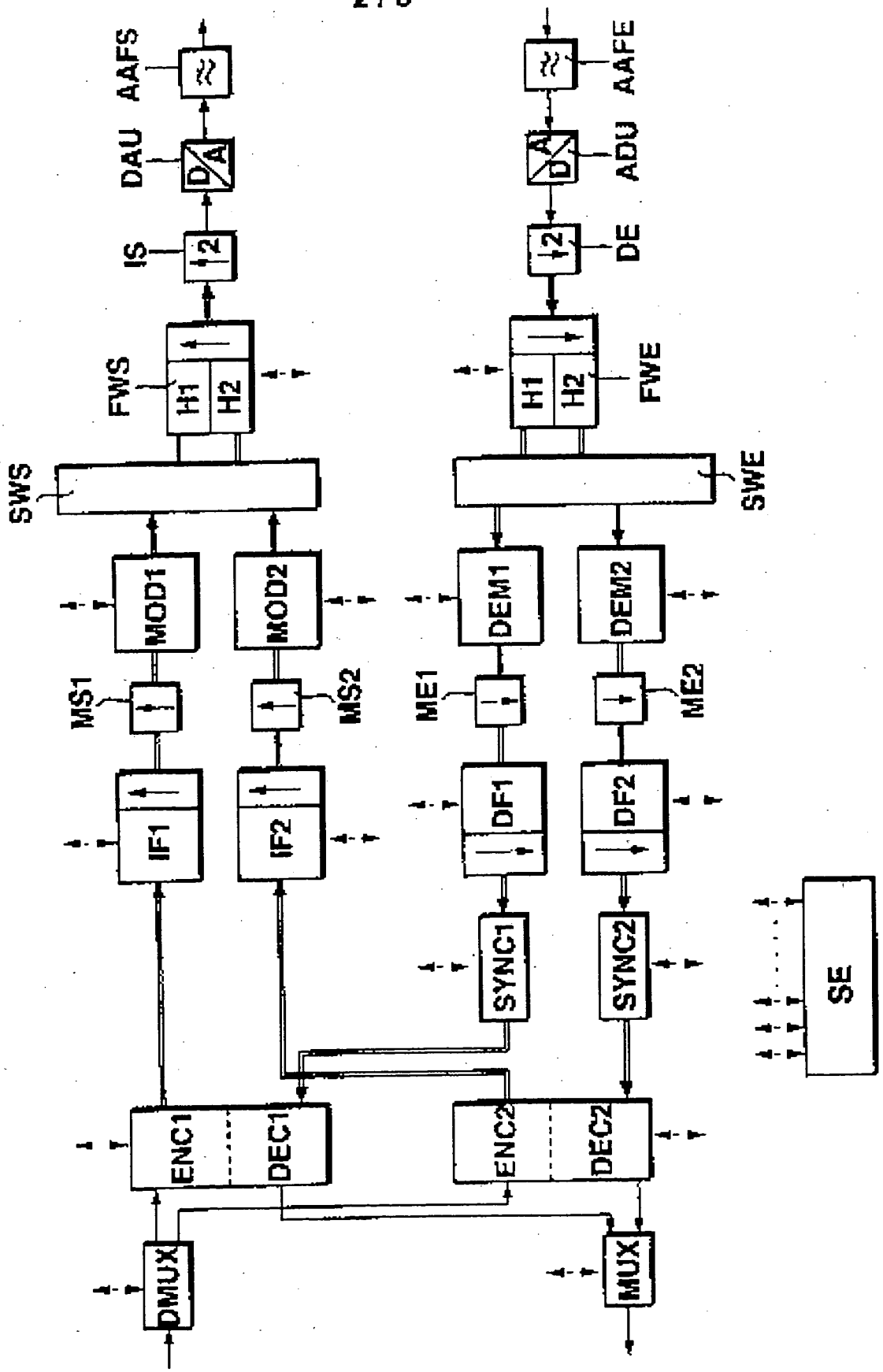
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Fig. 1



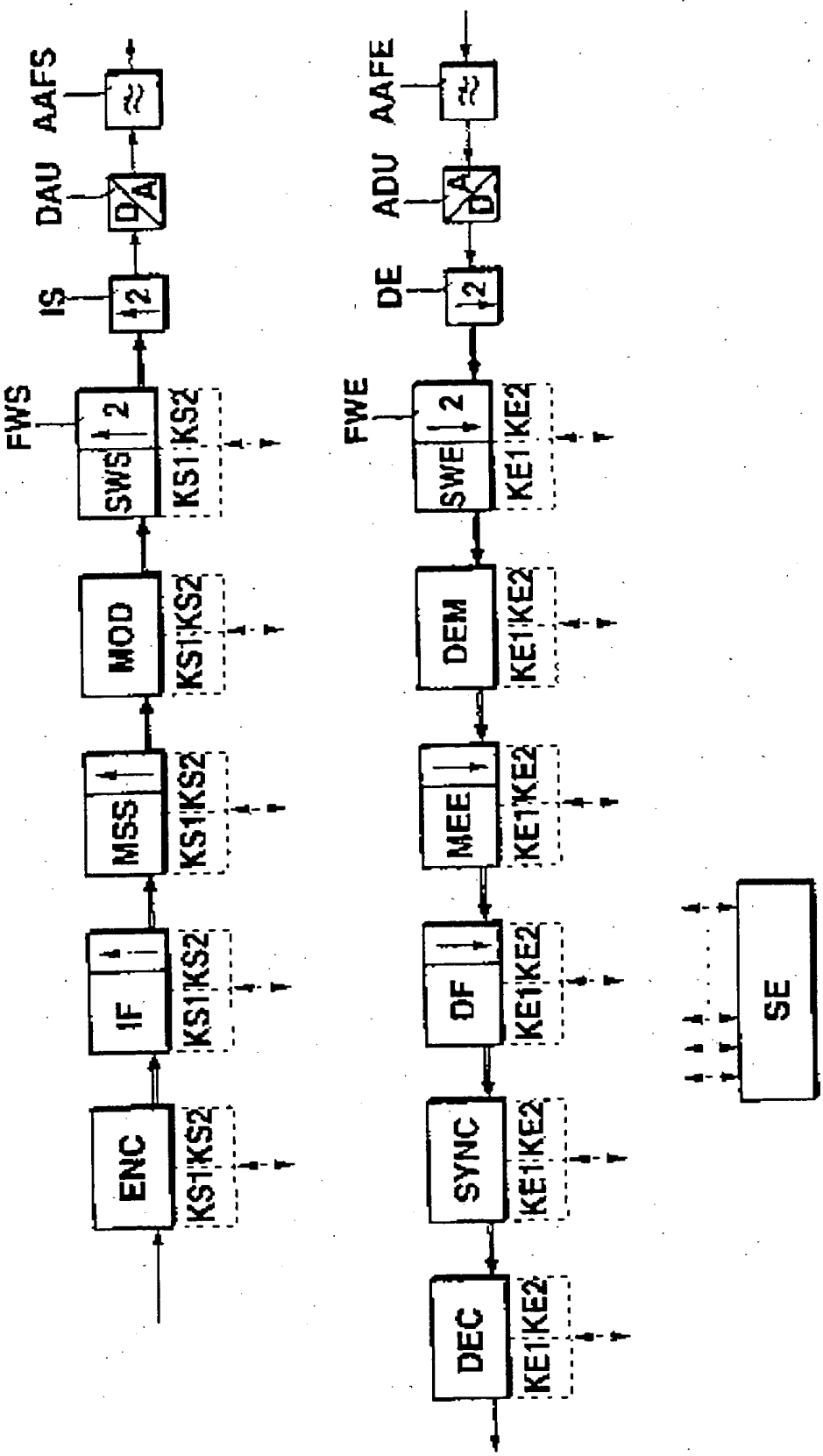
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Fig. 2



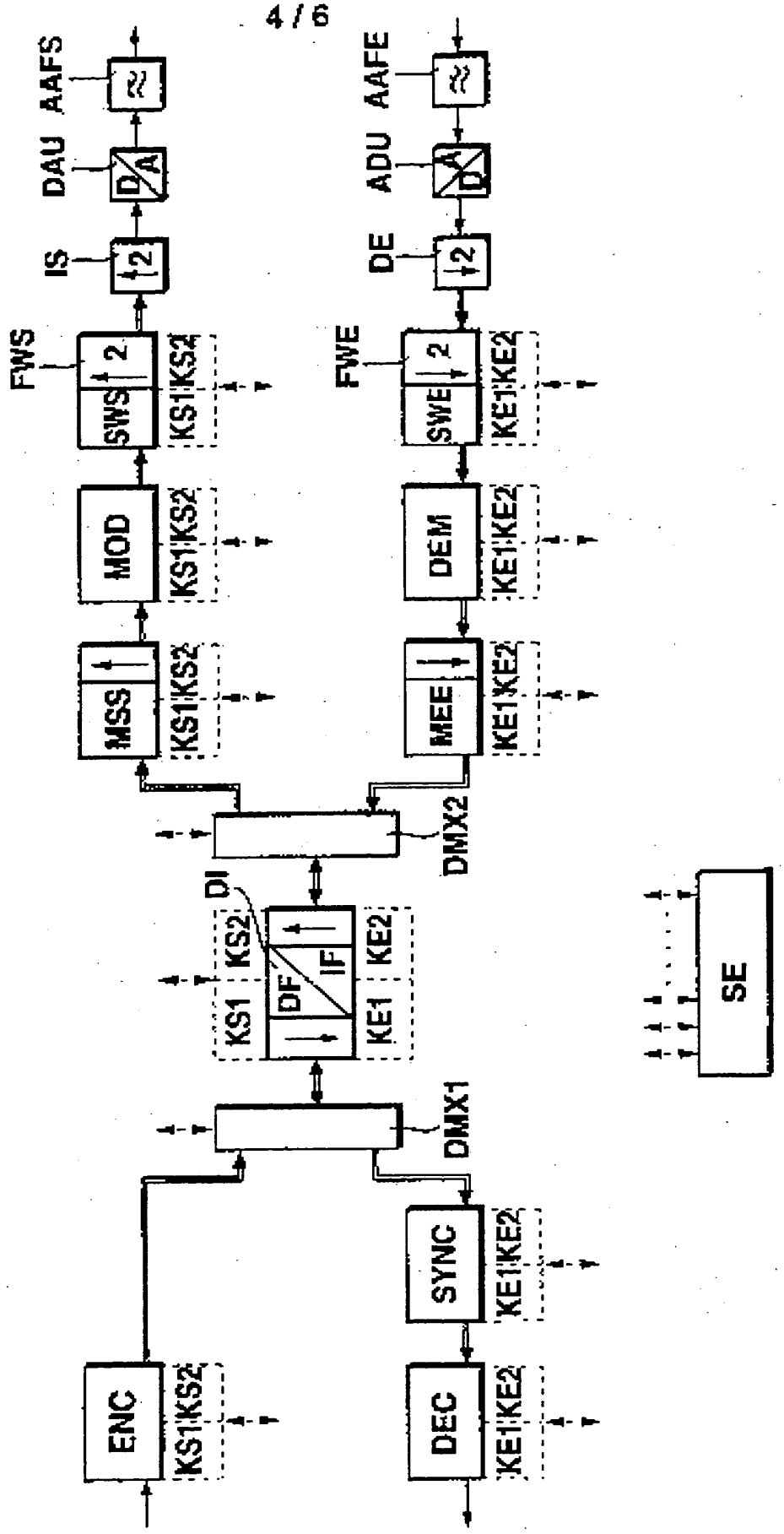
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Fig. 3



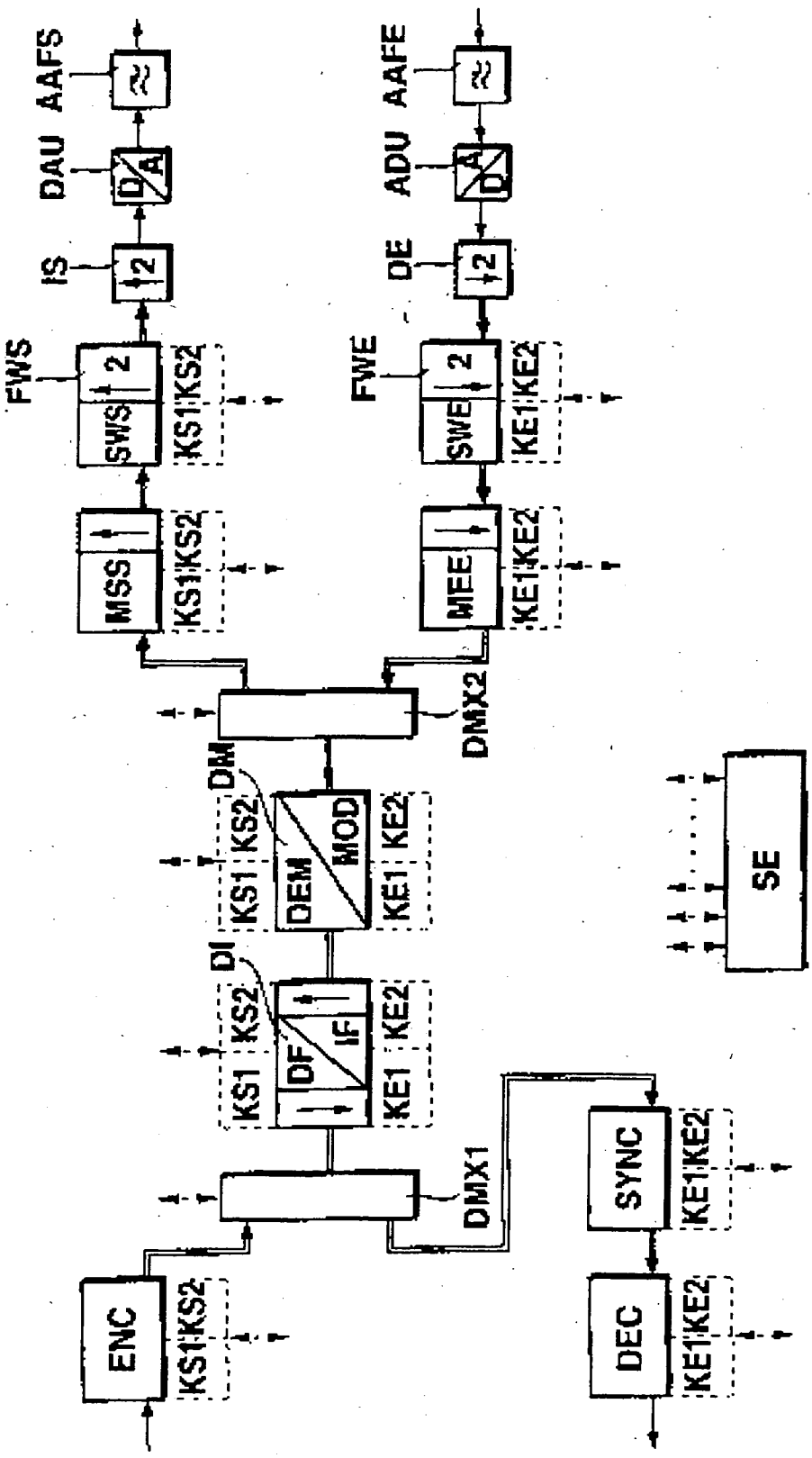
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Fig. 4



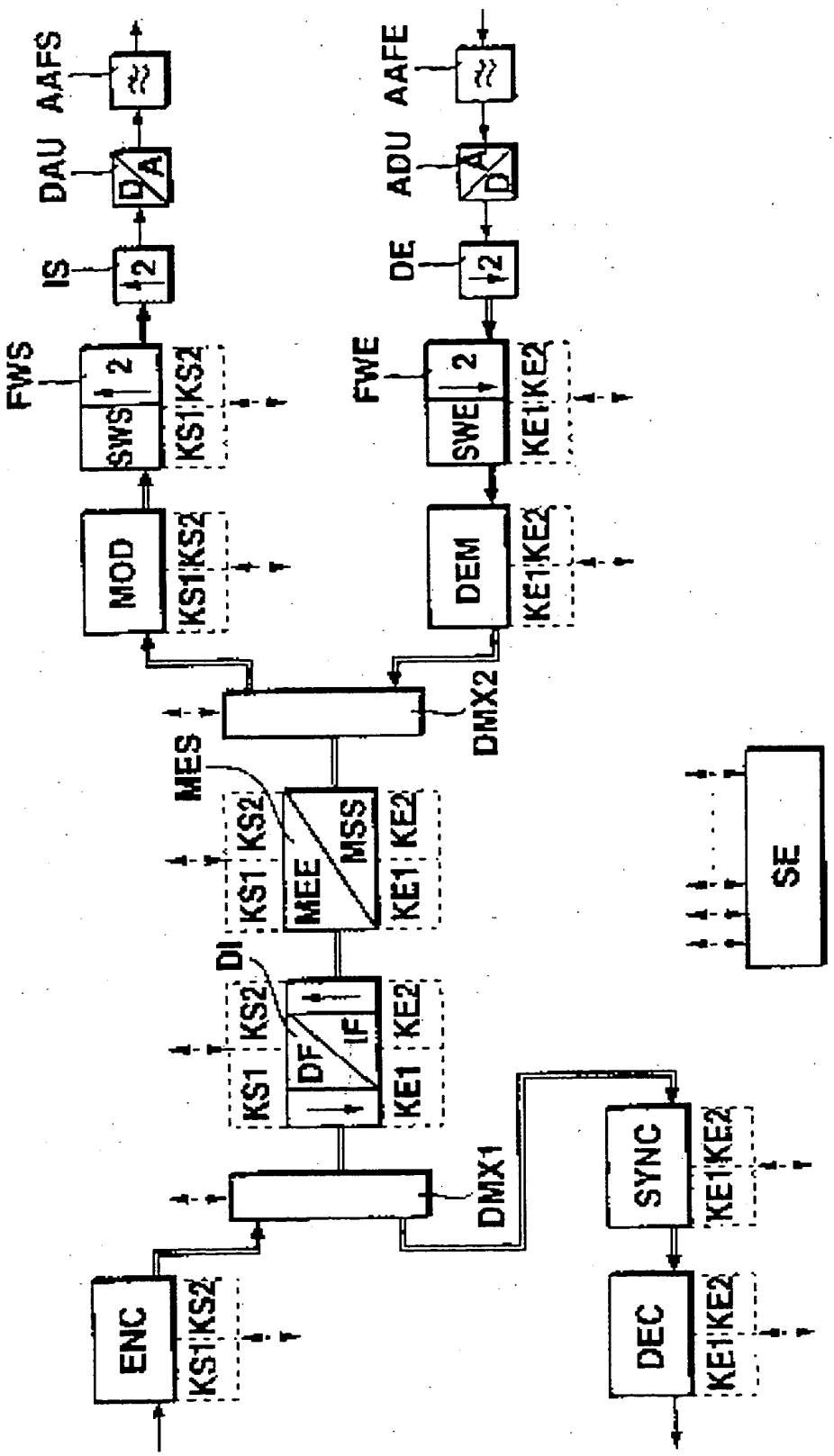
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Fig. 5



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Fig. 6



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DOCKET NO.: WEST14-00014 **PATENT**
Customer No.: 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	Not Yet Assigned

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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Pursuant to the duty of disclosure under 37 C.F.R. § 1.56, Applicant submits this statement. This submittal is made in accordance with 37 C.F.R. §§ 1.97 and 1.98 and § 609 of the Manual of Patent Examining Procedure. The patent is listed below and on the attached Form PTO/SB/08A. A copy of the listed patent is submitted herewith.

U.S. Patent No.	Inventor	Date
6,016,313	Foster, Jr. et al.	January 18, 2000

Applicant hereby expressly reserves the right to swear behind the effective dates of any of the above Patents and to question the relevance and materiality of the Patents and Publications listed herein, in whole, in part, or in combination, subsequent to filing this Information Disclosure Statement.

In accordance with 37 C.F.R. 1.97(e), the undersigned certifies 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; or

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Respectfully submitted,

DAVIS MUNCK, P.C.

Date: Aug. 13, 2004

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William A. Munck
Registration No. 39,308

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2682

DOCKET NO.: WEST14-00014
Customer No.: 23990

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	PAUL F. STRUHSAKER ET AL.
U.S. Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2682
Examiner	:	Not Yet Assigned

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Date: Aug 16, 2004

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Mailer

Date: Aug 13, 2004

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Sheet 1 of 1

Complete if Known	
Application Number	09/839,726
Filing Date	April 20, 2001
First Named Inventor	Paul F. Struhsaker
Art Unit	2682
Examiner Name	Not Yet Assigned
Attorney Docket Number	WEST14-00014

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6,016,313	01/18/2000	Foster, Jr. et al.	
		US-			
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-	753	@ad<20010305 and fixed near2 wireless and base near2 station	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 12:19
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-	474	@ad<20010305 and fixed near2 wireless and base near2 station and subscrib$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 12:19
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-	69	@ad<20010305 and fixed adj wireless and base near2 station same multiplex$7 and subscrib$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 12:20
-	0	@ad<20010305 and fixed adj wireless and base near2 station same multiplex$7 with demod$9 and subscrib$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 12:20

Ex.1002.00282

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Ex.1002.00283

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-	18	("6016313" 5,440,589 6,011,785 5,638,371 5,684,791 5,694,424 5,809,086 5,991,292 6,188,873).pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 13:56
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-	5	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$).did.) and fixed	USPAT	2004/09/10 14:33
-	3	@ad<20010305 and mmds and lmds and modem near2 select$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 14:55
-	17	@ad<20010305 and (mmds lmds) and modem near2 select$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 14:55
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Ex.1002.00284

-	2	@ad<20010305 and (fixed adj wireless).ab. and select$3 near2 $5modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:10
-	0	@ad<20010305 and (fixed adj wireless).ab. and plural$6 near3 $5modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:10
-	2	@ad<20010305 and (fixed adj wireless).ab. and plural$6 with $5modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:08
-	2	@ad<20010305 and (fixed adj wireless).ab. and plural$6 with $5modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:11
-	21	@ad<20010305 and (fixed adj wireless).ab. and modems	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:11
-	779	@ad<20010305 and (fixed adj wireless)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:23
-	9	(@ad<20010305 and (fixed adj wireless)) and select$5 near2 modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:23
-	9	(@ad<20010305 and (fixed adj wireless)) and select$5 near2 modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:24
-	9	(@ad<20010305 and (fixed adj wireless)) and select$5 near2 $5modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:24
-	12	@ad<20010305 and 802.16	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:37
-	13	@ad<20010305 and 802.16$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:37
-	13	@ad<20010305 and 802.16$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:37
-	64	@ad<20010305 and canopy and modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:38
-	32	@ad<20010305 and canopy and motorola	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:39

Ex.1002.00285

-	2860	@ad<20010305 and (mmds lmds PMP)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:39
-	0	(@ad<20010305 and (mmds lmds PMP)) and (hub basestation) same modedm	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:42
-	39	(@ad<20010305 and (mmds lmds PMP)) and (hub basestation) same modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:42
-	39	(@ad<20010305 and (mmds lmds PMP)) and (hub basestation) same modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 15:42
-	86	"channel selection control".ti.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:04
-	0	"channel selection control in a cellular radio".ti.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:04
-	668	dsc.as.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:04
-	272	"dsc telecom".as.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:05
-	16	"dsc telecom".as. and cellular	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:13
-	2	6011785.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:13
-	12	(US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.	USPAT; US-PGPUB; EPO; DERWENT	2004/09/10 16:24
-	6	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.) and fixed adj wireless	USPAT; US-PGPUB; EPO; DERWENT	2004/09/10 16:24
-	7	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.) and modems	USPAT; US-PGPUB; EPO; DERWENT	2004/09/10 16:25

Ex.1002.00286

-	8	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.) and controller	USPAT; US-PGPUB; EPO; DERWENT	2004/09/10 16:37
-	18	@ad<20010305 and fixed adj wireless and controller with modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:38
-	779	@ad<20010305 and fixed adj wireless	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:38
-	18	(@ad<20010305 and fixed adj wireless) and controller with modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:39
-	18	(@ad<20010305 and fixed adj wireless) and controller with modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 16:39
-	0	5625876.pn. and subscribers	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:27
-	2	5625876.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:29
-	0	5625876.pn. and feedback	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:29
-	2	5625876.pn. and controller	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:07
-	0	5625876.pn. and uplink	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:54
-	0	5625876.pn. and burst	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:54
-	2	5625876.pn. and data	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 17:54
-	39	@ad<20010305 and (fixed adj wireless).ab. and pattern	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:08
-	191	@ad<20010305 and (fixed adj wireless)and pattern	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:08

Ex.1002.00287

-	7	@ad<20010305 and (fixed adj wireless)and pattern same modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:09
-	7	@ad<20010305 and (fixed adj wireless)and pattern same modem	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:17
-	25530	@ad<20010305 and $5receiv$5 near multipl$6	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:22
-	0	@ad<20010305 and basestation same signal adj profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:23
-	5	@ad<20010305 and base near2 station same signal adj profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:24
-	118	@ad<20010305 and base near2 station near2 controller same pattern	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:26
-	2	@ad<20010305 and base near2 station near2 controller same subscriber near2 pattern	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/10 18:26
-	1	20020097793.did. and pattern	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:49
-	0	@ad<20010305 and fixed adj wireless and hub same demodulat5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:27
-	2	5625876.pn. and mobile near2 unit	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:07
-	11	@ad<20010305 and fixed adj wireless and hub same demodulators	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:16
-	1	"6650649" and controller	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:16
-	0	"6650649" and controller same feedback	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:16
-	1	"6650649" and feedback	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:16

Ex.1002.00288

-	0	@ad<20010305 and fixed adj wireless and contoller same feedback	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:17
-	15	@ad<20010305 and fixed adj wireless and controller same feedback	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:25
-	97	@ad<20010305 and fixed near2 wireless and tdd samev	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:25
-	0	@ad<20010305 and fixed near2 wireless and tdd same times near2 arrival	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:25
-	0	@ad<20010305 and fixed near2 wireless and tdd same time near2 arrival	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:25
-	1	@ad<20010305 and fixed near2 wireless and tdd and time near2 arrival	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:25
-	14	(US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$ or US-6650649-$ or US-6735630-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.	USPAT; US-PGPUB; EPO; DERWENT	2004/09/11 15:26
-	2	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$ or US-6650649-$ or US-6735630-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.) and times near2 arrival	USPAT; US-PGPUB; EPO; DERWENT	2004/09/11 15:26
-	2	((US-6463290-$ or US-6131016-$ or US-5953676-$ or US-6016313-$ or US-6011785-$ or US-5625876-$ or US-6553209-$ or US-6393290-$ or US-6650649-$ or US-6735630-$).did. or (US-20020115421-$).did. or (GB-2320991-$).did. or (GB-2320661-$ or GB-2318253-$).did.) and time near2 arrival	USPAT; US-PGPUB; EPO; DERWENT	2004/09/11 15:26
-	26	@ad<20010305 and fixed adj wireless and time near2 arrival	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:29
-	1	@ad<20010305 and fixed adj wireless and time near2 arrival and burst near2 direction	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:29
-	17	@ad<20010305 and fixed adj wireless and time near2 arrival and direction	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:29

Ex.1002.00289

-	12	@ad<20010305 and fixed adj wireless and time adj2 arrival and direction	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:32
-	129	@ad<20010305 and fixed adj wireless and burst	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:37
-	0	20010018326.did. and bursts	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:33
-	0	20010018326.did. and tdd	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:33
-	2	20010018326.did.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:33
-	1	@ad<20010305 and fixed adj2 wireless and signal near profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:38
-	42	@ad<20010305 and fixed adj2 wireless and subscriber near2 profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:38
-	10	@ad<20010305 and fixed adj2 wireless and subscriber near2 profile same memory	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:03
-	0	@ad<20010305 and fixed adj2 wireless and subscriber near2 profile same memory same hub	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:38
-	10	@ad<20010305 and fixed adj2 wireless and subscriber near2 profile same memory	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:43
-	2	@ad<20010305 and fixed adj2 wireless and controller same profile same memory	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:50
-	0	6272333.pn. and channel	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:48
-	0	6272333.pn. and path	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:48
-	0	5625876.pn. and equlaizer	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:49

Ex.1002.00290

-	0	5625876.pn. and equalizer	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:49
-	0	6272333.pn. and equalizer	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:01
-	0	6272333.pn. and equaliz$9	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:49
-	0	5625876.pn. and equaliz$7	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:49
-	0	@ad<20010305 and fixed adj2 wireless and controller same profile same equaliz$9	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:43
-	9	@ad<20010305 and fixed adj2 wireless and controller same equaliz$9	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:51
-	1	@ad<20010305 and fixed adj2 wireless and controller same equaliz$9 same weights	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:51
-	1	@ad<20010305 and fixed adj2 wireless and subscriber same equaliz$9 same weights	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 15:51
-	2	6272333.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:01
-	1	@ad<20010305 and fixed adj2 wireless and subscriber same channel near2 profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:03
-	0	@ad<20010305 and fixed adj2 wireless and client same channel near2 profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:04
-	0	@ad<20010305 and fixed adj2 wireless and remote same channel near2 profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:04
-	3	@ad<20010305 and fixed adj2 wireless and channel near2 profile	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:13
-	0	@ad<20010305 and fixed adj2 wireless and channel near2 chracteristics	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:13

Ex.1002.00291

-	59	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:14
-	0	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics same ec	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:14
-	0	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics same fec	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:14
-	7	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics same subscriber	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:20
-	59	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:20
-	0	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics same fec	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:20
-	6	@ad<20010305 and fixed adj2 wireless and channel near2 characteristics and fec	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:33
-	1	20020036985.did. and error	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:35
-	1	20020036985.did. and channel near2 characteristics and fec	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:33
-	1	20020036985.did. and modulation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:33
-	0	6272333.pn. and 5625876.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:41
-	0	6272333.pn. and 5625876.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:41
-	4	6272333.pn. 5625876.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:41
-	0	5625876.pn. and diversitu	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:41

Ex.1002.00292

-	1	5625876.pn. and diversity	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:41
-	19	@ad<20010305 and bwa and wireless	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/11 16:43
-	0	@ad<20010305 and fixed adj wireless and band near2 timing	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:06
-	1	20020097793.did. and band	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:07
-	1	20020097793.did. and timing	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:07
-	0	5625876.pn. and timing	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:08
-	0	5625876.pn. and pll	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:08
-	1	5625876.pn. and phase	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:09
-	1	6272333.pn. and timing	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:16
-	0	6272333.pn. and phase	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:16
-	1	6272333.pn. and adjust$6	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:16
-	2	@ad<20010305 and fixed adj wireless and phase near2 adjust$6 and carrier near2 adjust$8	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:19
-	2	@ad<20010305 and fixed adj wireless and phase near2 adjust$6 with carrier	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/09/14 14:19

Ex.1002.00293

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

7590 09/21/2004

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EXAMINER	
VARTANIAN, HARRY	

ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 09/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Harry Vartanian	2634	

-- 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) 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 the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- 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 *20 April 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-20* is/are rejected.

7)☒ Claim(s) *5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 April 2001* 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).

11)☐ 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

12)☐ 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-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/01, 12/02, 8/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 167-169, 308. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

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.

2. Claims 1-4, 18, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Gilhousen et al (USPAT 5,625,876). Regarding Claim 1, Gilhousen et al meets the following limitations of the claim:

> a first demodulator selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; **fig 1, items 10 and 30; fig 3**

> at least a second demodulator also selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; **fig 1, items 10 and 30; fig 3**
>
> a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller at least for selecting which of the first and second data signals, respectively, are applied to said first demodulator and for selecting which of the first and second data signals, respectively, are applied to said second demodulator. **(Column 7, lines 49-59);**

To further explain, in Figure 1 a communication system is shown with two subscribers sending separate radio data signals in a cellular network. In Figure 3, a basestation's is shown to have a plurality of demodulators which receive multiple signals. The selection or combining of the signals by a controller is explained in Column 7, Lines 49-59.

Regarding Claim 2, Gilhousen et al does not explicitly mention that his system be used in a fixed wireless system. However, fixed wireless is a special case of a mobile wireless system. The technology used in mobile wireless systems also will work in fixed wireless environments. Therefor Gilhousen et al does meet the first limitation in claim 2. The second limitation is also met:

> the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem. **Claim 1**

Regarding Claim 3, Gilhousen et al meets the following limitations of the claim:

> second demodulator is embodied at a second modem. **fig 3, item 204B**

Regarding Claim 4, Gilhousen et al meets the following limitations of the claim:

> at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern. **(Column 7, lines 49-59); Look in (Column 6, Lines 44-47) for the disclosure of multiple subscribers using one basestation.**

Regarding Claim 18, the rejection of Claim 1 above also meets the limitations of the Claim 18.

Regarding Claim 19, the rejection of Claim 4 above also meets the limitations of the Claim 19.

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:

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.

3. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Link (US PGPUB 2001/0018326). Gilhousen et al meets all the limitations of claim 6(See above paragraphs), except disclosing the use of sending bursts of data of selected time durations and determining times of arrival and time directions of such signals.

However, Link's fixed wireless system meets the following limitations of the claim:

> the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals. **Para 0035, 0068 Note: TDMA uses time bursts of selected lengths**

Therefor it would have been prima facie obvious for Gilhousen et al's system to use TDMA and measure time of arrival and burst direction at the time of the invention. A motivation

to combine is that TDMA is well-known access system used in fixed wireless(see 802.16 standard). Regarding the motivation to use time of arrival and received direction, Link states in Para 0068 that these two parameters can be used to determine the location of a fixed wireless terminal.

4. Claims 7, 15, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333). Gilhousen et al meets all the limitations of claims 7 and 20(See above paragraphs), except disclosing the use of "profiles" and storing such profiles.

However, Smith meets the following limitations of the claim:

> controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller. **(Column 4, lines 12-66)**

Therefore it would have been prima facie obvious to store subscriber station profiles at a basestation. A motivation to combine is stated by Smith in the following paragraph:

> "As subscriber units become increasingly **user customizable with enhanced software application upgradability**, it is impractical to expect that a class-of-service distinction or a subscriber unit class can define all the types of data that the applications accessible to a specific subscriber unit can support. Further, it is unlikely **that all subscriber units of a specific type will have identical applications** ...Thus, what is needed is a method and apparatus for controlling the delivery of data from the fixed portion of the messaging system to the subscriber unit...**The controller** further comprises a base station interface coupled to the processing system for controlling a base station to transmit the data. **The processing system is programmed to keep in the memory a current copy of the application registry of the subscriber unit, and to check the current copy of the application registry in response to having the data to send to the subscriber unit. The processing system is further programmed to send the data only when the checking step determines that an application compatible with the data is accessible to the subscriber unit." (Column 1, Line 20 to Column 2, Line 9)**

Regarding Claim 15, Gilhousen et al meets the following limitations of the claim:

> the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **(Column 9, lines 14-21)**

5. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of McNicol (USPAT 5,940,454). Gilhousen et al and Smith meet all the limitations of claim 9(See above paragraphs), except storing channel related parameters for each subscriber.

However, McNicol's fixed wireless system meets the following limitation of claim 8:

> wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively. **(Column 8, lines 27-39)**

Therefor it would have been prima facie obvious to store subscriber channel-related parameters in a fixed wireless controller. A motivation to combine is disclosed by McNicol's in Column 1, Lines 20-25 wherein he explains that channels related information, in this case sync words, are needed to:

> "...adjust its phase and/or frequency response to compensate as far as possible for multipath interference or channel distortion in the wireless transmission." **(Column 1, Lines 20-25)**

Regarding Claim 9, it would have been obvious for each of the demodulators shown by Gilhousen et al to have separate equalizer with the support of McNicols disclosing the use of equalizers in fixed wireless modems. (Also see McNicols Column 7, line 63 to Column 8, line 6)

Regarding Claim 10, McNicol meets the following limitations of the claim:

> wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof. **fig 5, item 46**

6. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of Jonas (US PGPUB 20020036985). Gilhousen et al and Smith meet all the limitations of claim 11(See above paragraphs), except disclosing the storage of at least one signal-related parameter.

However, Jonas meets the following limitation:

wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively. **Claim 1, Para 0030, 0032**

Therefor it would have been prima facie obvious to store signal related parameters in a fixed wireless controller. A motivation to combine is suggested by Jonas wherein he states that channel parameters must be analyzed and monitored in order to:

"...make the upstream channel allocations in such a way that will utilize as much of the upstream channel capacity as possible. Further, it is desired that should communication with each node on an upstream channel is maintained as having as high of performance capabilities as possible..." Para 0017

Regarding Claim 12, Jonas meets the following limitations of the claim:

the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Para 0011**

Regarding Claim 13, Jonas meets the following limitations of the claim:

wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Para 0011, [Para 0035 Note: QPSK is an orthogonal modulation scheme]**

Regarding Claim 14, Jonas meets the following limitations of the claim:

wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Claim 1 para 0030**

7. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of Greenstein et al(USPAT 6,131,016). Gilhousen et al and Smith meet all the limitations of claim 11(See above paragraphs), except disclosing the storage of band timing and carrier adjustment values.

However, Greenstein et al meets the following limitations of claims 16 and 17:

said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals. **Claim 3, 4**

profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals. **Claim 3, 4**

Therefor it would have been prima facie obvious to store carrier and phase related information in a fixed wireless controller. A motivation to combine is that it is well known in that art that phase and carrier adjustment is a typical step in the receiving process of a wireless system in order to correct any channel impairments like multipath.

Allowable Subject Matter

8. Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Vartanian whose telephone number is 571.272.3048. The examiner can normally be reached on 10:00-6:30 Mondays to Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 571.272.3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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).

Harry Vartanian

Examiner
Art Unit 2634

HV

STEPHEN CHIN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

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AUG 2 0 2004
PATENT & TRADEMARK OFFICE

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	09/839,726
Filing Date	April 20, 2001
First Named Inventor	Paul F. Struhsaker
Art Unit	2682
Examiner Name	Not Yet Assigned
Attorney Docket Number	WEST14-00014

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
FLV		US- 6,016,313	01/18/2000	Foster, Jr. et al.	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	9/10/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

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 2 hours 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, 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 (1-800-786-9199) and select option 2.

FORM PTO-1449 (REV. 7.80)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. WEST14-00014	SERIAL NO. 09/839,726
LIST OF REFERENCES CITED BY APPLICANT (Use several sheets if necessary)		APPLICANT Paul F. Struhsaker, et al.	
		FILING DATE April 20, 2001	GROUP 2682

OIPE JC157 JUL 23 2001 PATENT & TRADEMARK OFFICE

RECEIVED JUL 26 2001 Group 2600

U. S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (if appropriate)
H.V.	AA	5,638,371	06/10/1997	Raychaudhuri, et al.	370	347	June 27, 1995
H.V.	AB	5,684,791	11/04/1997	Raychaudhuri, et al.	370	278	Nov. 7, 1995
H.V.	AC	5,694,424	12/02/1997	Ariyavisitakul	375	233	Mar. 15, 1996
H.V.	AD	5,809,086	09/15/1998	Ariyavisitakul	375	332	Mar. 20, 1996
H.V.	AE	5,991,292	11/23/1999	Focsaneanu, et al.	370	352	Mar. 6, 1997
H.V.	AF	6,188,873	02/13/2001	Wickman, et al.	455	11.1	June 9, 1999

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED
	9/9/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Dra if not in conformance and not considered. Include copy of this form with next communication to applican

FORM PTO-1449 (REV. 7.80)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. WEST14-00014	SERIAL NO. 09/839,726
LIST OF REFERENCES CITED BY APPLICANT (Use several sheets if necessary)		APPLICANT Paul F. Struhsaker	
		FILING DATE April 20, 2001	GROUP 2682

OIPE JC29 DEC 16 2002 PATENT & TRADEMARK OFFICE

U. S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (if appropriate)
H.V.	AA	5,440,589	08/08/1995	Kaku, et al.	375	344	08/13/1993
H.V.	AB	6,011,785	01/04/2000	Carney, et al.	370	330	10/30/1996

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FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
H.V.	AC	WO 95/12296	05/04/1995	PCT				
H.V.	AD	WO 00/28753	05/18/2000	PCT				
H.V.	AE	GB 2320991	07/08/1998	United Kingdom				
H.V.	AF	EP 0890271	01/13/1999	Europe			Yes (Abstract	

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED
	9/9/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line if not in conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited	Application/Control No. 09/839,726	Applicant(s)/Patent Under Reexamination STRUHSAKER ET AL.	
	Examiner Harry Vartanian	Art Unit 2634	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,463,290	10-2002	Stilp et al.	455/456.1
	B	US-6,131,016	10-2000	Greenstein et al.	455/69
	C	US-5,953,676	09-1999	Berry et al.	455/564
	D	US-6,016,313	01-2000	Foster et al.	370/330
	E	US-6,011,785	01-2000	Carney et al.	370/330
	F	US-5,625,876	04-1997	Gilhousen et al.	370/331
	G	US-6,553,209	04-2003	Hornsby et al.	455/76
	H	US-6,393,290	05-2002	Ufongene, Charles M.	455/446
	I	US-6,650,649	11-2003	Muhammad et al.	370/402
	J	US-6,735,630	05-2004	Gelvin et al.	709/224
	K	US-6,272,333	08-2001	Smith, Dwight Randall	455/418
	L	US-5,940,454	08-1999	McNicol et al.	375/347
	M	US-6,657,983	12-2003	Surazski et al.	370/337

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 09/839,726	Applicant(s)/Patent Under Reexamination STRUHSAKER ET AL.	
	Examiner Harry Vartanian	Art Unit 2634	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-2002/0115421	08-2002	Shahar et al.	455/403
	B	US-2002/0036985	03-2002	Jonas et al.	370/235
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	X	

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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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Bib Data Sheet

CONFIRMATION NO. 1219

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/839,726	04/20/2001 RULE	455	2682	WEST14-00014

APPLICANTS

Paul F. Struhsaker, Plano, TX;
Russell C. McKown, Richardson, TX;

**** CONTINUING DATA ***************************

THIS APPLN CLAIMS BENEFIT OF 60/262,825 01/19/2001 H.V.
AND CLAIMS BENEFIT OF 60/262,712 01/19/2001 H.V.
AND CLAIMS BENEFIT OF 60/262,698 01/19/2001
AND CLAIMS BENEFIT OF 60/262,826 01/19/2001
AND CLAIMS BENEFIT OF 60/262,951 01/19/2001
AND CLAIMS BENEFIT OF 60/262,824 01/19/2001
AND CLAIMS BENEFIT OF 60/263,101 01/19/2001
AND CLAIMS BENEFIT OF 60/263,097 01/19/2001
AND CLAIMS BENEFIT OF 60/273,579 03/05/2001
AND CLAIMS BENEFIT OF 60/262,955 01/19/2001
AND CLAIMS BENEFIT OF 60/262,708 01/19/2001
AND CLAIMS BENEFIT OF 60/273,689 03/05/2001
AND CLAIMS BENEFIT OF 60/273,757 03/05/2001
AND CLAIMS BENEFIT OF 60/270,378 02/21/2001
AND CLAIMS BENEFIT OF 60/270,385 02/21/2001
AND CLAIMS BENEFIT OF 60/270,430 02/21/2001

**** FOREIGN APPLICATIONS *********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 06/14/2001

		STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed	☐ yes ☑ no	TX	4	20	2
35 USC 119 (a-d) conditions met	☐ yes ☒ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature / Initials H.V.				

ADDRESS

William A. Munck, Esq.
NOVAKOV DAVIS & MUNCK, P.C.
900 Three Galleria Tower
13155 Noel Road
Dallas ,TX 75240

TITLE

Apparatus and associated method for operating upon data signals received at a receiving station of a fixed wireless access communication system

☐ All Fees

Search Notes

Application No.	Applicant(s)	
09/839,726	STRUHSAKER ET AL.	
Examiner	**Art Unit**	
Harry Vartanian	2634	

SEARCHED			
Class	Subclass	Date	Examiner
375	222	9/10/2004	HV
455	33.3	9/10/2004	HV
455	101	9/10/2004	HV
455	69	9/14/2004	HV

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
375	**222**	**9/10/2004**	**HV**

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
East:USPAT, PGPUB, EPO, JPO, IBM, Derwent	9/10/2004	HV
Inventorship	9/10/2004	HV

Index of Claims

Application No.	Applicant(s)	
09/839,726	STRUHSAKER ET AL.	
Examiner	**Art Unit**	
Harry Vartanian	2634	

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	9/14/04
	1	√
	2	√
	3	√
	4	√
	5	O
	6	√
	7	√
	8	√
	9	√
	10	√
	11	√
	12	√
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Claim		Date
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Claim		Date
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2634

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

OIPE JC105 DEC 27 2004 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Harry Vartanian

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

AMENDMENT AND RESPONSE TO OFFICE ACTION

No fees are believed to be necessary; however, in the event that any fees are required for the prosecution of this application, please charge any necessary fees to Deposit Account No. 50-0208. No extension of time is believed to be necessary. If, however, an extension of time is needed, the extension is requested and please charge the fee for this extension to Deposit Account No. 50-0208.

In response to the Office Action dated September 21, 2004, please amend the above-identified application as follows:

AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph on page 26 at lines 6–21 of the specification with the following:

FIGURE 3 illustrates a functional block diagram of a portion of the present invention comprising two modems and a controller in an embodiment of the present invention. Modem 302 and modem 304 are selectively coupled to receive uplink signals sent by different ones of subscriber stations to the base station (not shown). Here, IF/RF (intermediate frequency/radio frequency) receive circuitry 306 of the base station is shown to pass the uplink signals to the modems. Circuitry 306 is operable to down-convert in frequency uplink signals received from receive circuitry 304. Thereafter, the down-converted signals, bursts sub3...sub1 and bursts subN...sub2 are operated upon by modems 304 and 302 respectively. The modems are shown to be functionally coupled to controller ~~308~~ 316 via lines 310, for receiving contention results, and 312 for passing parameters, frame times and weight values for the modems to apply to the received signals. Controller 314 includes control CPU 316 and memory device 318.

AMENDMENTS TO THE CLAIMS:

Please amend the claims as follows, substituting any amended claim(s) for the corresponding pending claim(s):

1. (Currently Amended) Apparatus for a communication station operable in a wireless communication system at least to receive first and second successive data signals transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations ~~and at least second data signals transmitted thereto by at least a second subscriber station~~, said apparatus comprising:

a first demodulator selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively;

at least a second demodulator also selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; and

a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller ~~at least for~~ alternately selecting ~~which of~~ the first ~~and second~~ data signals~~, respectively, are applied~~ for application to said first demodulator and ~~for selecting~~

~~which of~~ the ~~first and~~ second data signals~~, respectively, are applied~~ for application to said second demodulator.

2. (Original) The apparatus of Claim 1 wherein the wireless communication system comprises a fixed wireless access system, wherein the communication station comprises a base station of the fixed wireless access system in which the data signals transmitted thereto by the first subscriber station comprise first uplink burst data signals and the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem.

3. (Original) The apparatus of Claim 2 wherein said second demodulator is embodied at a second modem.

4. (Original) The apparatus of Claim 1 wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern.

5. (Original) The apparatus of Claim 4 wherein the selected pattern according to which said first demodulator and said second demodulator receive the first and at least second data signals comprise alternately coupling said first demodulator and said second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

6. (Original) The apparatus of Claim 1 wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals.

7. (Original) The apparatus of Claim 1 wherein said controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller.

8. (Original) The apparatus of claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively.

9. (Original) The apparatus of claim 8 wherein said first demodulator and said second demodulator each include equalizer portions for equalizing the at least one of the first and second data signals selectably applied to said first demodulator and said second demodulator, respectively.

10. (Original) The apparatus of claim 9 wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof.

11. (Original) The apparatus in claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively.

12. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

13. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

14. (Original) The apparatus of claim 11 wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

15. (Original) The apparatus of claim 7 wherein the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

16. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals.

17. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals.

18. (Currently Amended) A method for acting upon first and second successive data signals transmitted to a communication station operable in a wireless communication system by a first subscriber station and at least a second subscriber station, said method comprising:

selecting at which of a first demodulator and at least a second demodulator to apply at least one of the first data signals and ~~the at least~~ the second data signals, wherein the first and second successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;

demodulating the at least one of the first and at least second data signals at the first demodulator when the first demodulator is selected during said operation of selecting; and

demodulating the at least one of the first and at least second data signals at the second demodulator when the second demodulator is selected during said operation of selecting.

19. (Original) The method of claim 18 wherein selections made during said operation of selecting are made according to a selected pattern.

20. (Original) The method of claim 18 further comprising the operation of maintaining profiles associated with each of the first and at least second data signals transmitted upon the first and at least second channels, respectively, and wherein said operations of demodulating further comprise accessing the profiles.

REMARKS

Claims 1–20 are pending in the present application.

Claims 1 and 18 were amended herein for clarity.

Reconsideration of the claims is respectfully requested.

35 U.S.C. § 102 (Anticipation)

Claims 1–4 and 18–19 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,625,876 to *Gilhousen et al.* This rejection is respectfully traversed.

A claim is anticipated only if each and every element is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as complete detail as is contained in the claim. MPEP § 2131 at p. 2100-73 (8th ed. rev. 2 May 2004).

Independent claims 1 and 18 each recite that first and second successive data signals from first and second subscriber stations, and subsequent data signals, if any, are alternately applied to first and second demodulators. In an exemplary embodiment of the invention, two modems are alternately employed to demodulate separate, successive uplink bursts from different subscriber stations, so that one modem is utilized to demodulate a received data burst while the second, currently unused modem is configured using profiles values associated with the next subsequent data burst expected to be received, to avoid delay in demodulation and increase overall throughput. Such a feature is not found in the cited reference.

Therefore, the rejection of claims 1–4 and 18–19 under 35 U.S.C. § 102 has been overcome.

35 U.S.C. § 103 (Obviousness)

Claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of U.S. Patent Application Publication No. 2001/0018326 to *Link, II.* Claims 7, 15 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of U.S. Patent No. 6,272,333 to *Smith.* Claims 8–10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of *Smith* and further in view of U.S. Patent No. 5,940,454 to *McNicol.* Claims 11–14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of *Smith* and further in view of U.S. Patent Application Publication No. 2002/0036985 to *Jonas et al.* Claims 16–17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of *Smith* and further in view of U.S. Patent No. 6,131,016 to *Greenstein et al.* These rejections are respectfully traversed.

In *ex parte* examination of patent applications, the Patent Office bears the burden of establishing a *prima facie* case of obviousness. MPEP § 2142, p. 2100-128 (8th ed. rev. 2 May 2004). Absent such a *prima facie* case, the applicant is under no obligation to produce evidence of nonobviousness. *Id.*

To establish a *prima facie* case of obviousness, three basic criteria must be met: First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference

(or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *Id.*

As noted above, independent claims 1 and 18 each recite a limitation not found in *Gilhousen et al.* Such a limitation is also not found in the other cited references.

Therefore, the rejection of claim 6–17 and 20 under 35 U.S.C. § 103 has been overcome.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***dvenglarik@davismunck.com***.

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 12-21-04

Daniel E. Venglarik
Registration No. 39,409

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OIPE JC105 DEC 27 2004 PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Harry Vartanian

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

Sir:

The undersigned hereby certifies that the following documents:

1. Amendment and Response to Office Action;
2. Proposed Drawing Changes (w/1 sheet redlined drawings); and
3. A postcard receipt;

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to MAIL STOP AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on December 21, 2004.

Date: 12/21/04 Kathy Cedar
Mailer

Date: 12-21-04
Daniel E. Venglarik
Reg. No. 39,409

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OIPE
DEC 27 2004
PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

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Group No.	:	2634
Examiner	:	Harry Vartanian

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

PROPOSED DRAWING CHANGES

In response to the Office Action dated September 21, 2004, Applicants propose to amend the drawings as shown in the attached sketches in red ink, by insertion of reference characters 166–169 in FIGURE 1. No new matter is being added by these changes. Replacement formal drawings will be provided upon approval of the changes.

Approval of the changes is respectfully requested.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 12-21-04

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OIPE
DEC 27 2004
PATENT & TRADEMARK OFFICE
JC105

REPLACEMENT

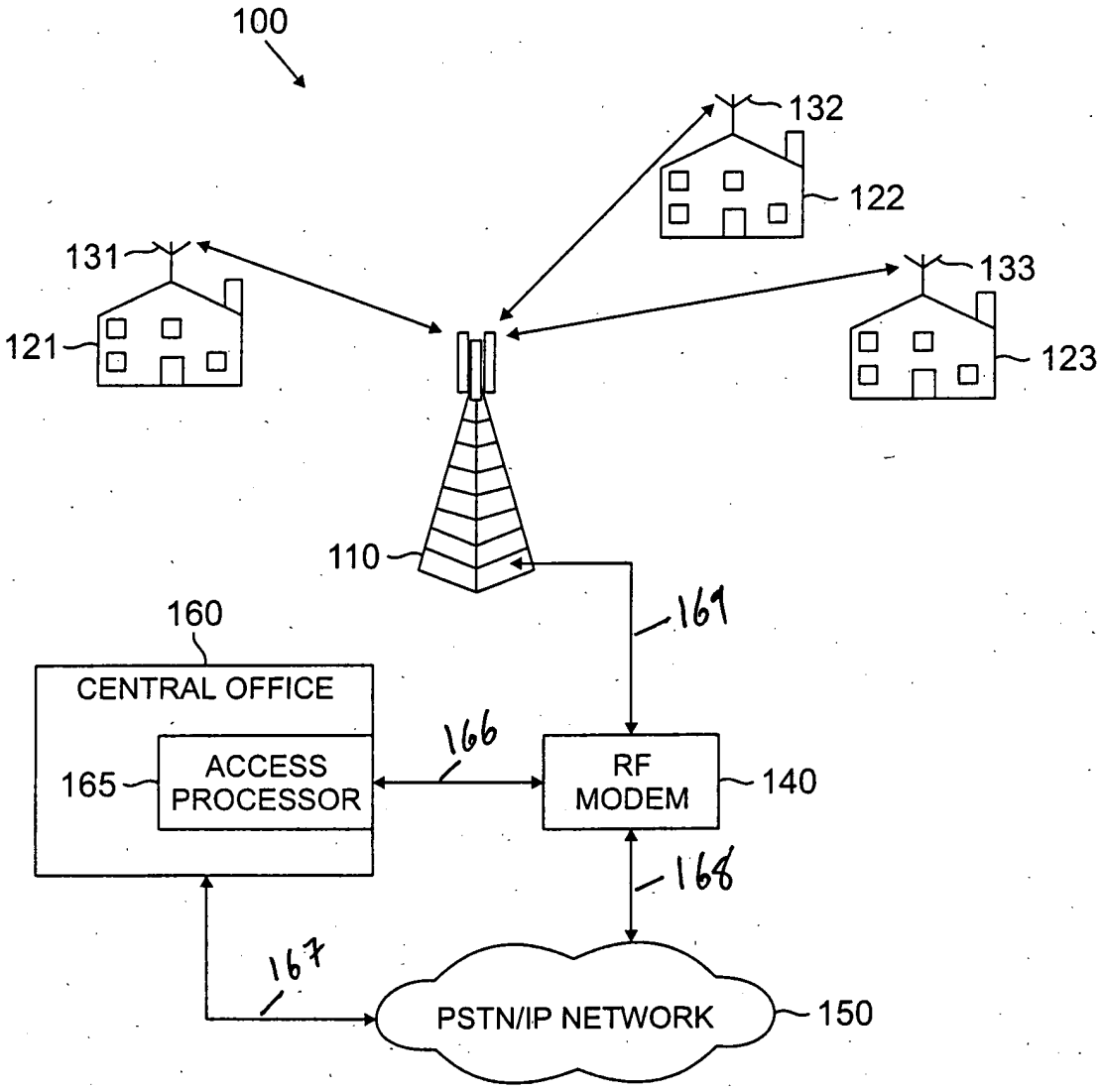


FIG. 1

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number
09/839,728
WEST 14-0014

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	20	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL	355.00	OR	TOTAL	

12-27-04

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	=
Independent	* 2	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

7590 05/12/2005

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

EXAMINER	
VARTANIAN, HARRY	
ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 05/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Harry Vartanian	2634	

-- 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) 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 the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- 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 *27 December 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ 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

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-20* is/are rejected.

7)☒ Claim(s) *5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 December 2004* 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).

11)☐ 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

12)☐ 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-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 12/27/2005 have been fully considered but they are not persuasive. The applicant argues the following two points as lacking from Gilhousen et al:

> "Independent claims 1 and 18 each **recite that first and second successive data signals from first and second subscriber stations, and subsequent data signals, if any, are alternately applied to first and second demodulators**. In an exemplary embodiment of the invention, two modems are alternately employed to demodulate separate, successive uplink bursts from different subscriber stations, so that one modem is utilized to demodulate a received data burst while the second, currently unused modem is configured **using profiles values associated with the next subsequent data burst expected to be received**, to avoid delay in demodulation and increase overall throughput. Such a feature is not found in the cited reference."

Gilhousen et al shows discloses a basestation receiver that uses multiple modulation and demodulation elements(fig 3). He also shows in figure 3 that each demodulation element will decode a different uplink message which is later combined for decoding. In figure 1 Gilhousenn et al shows that the base station can receive signals from multiple subscribers. Moreover, Gilhousenn et al states that "demodulation elements 204A-204N are controlled by controller 200 through interconnection 212."(Column 10, lines 3-5) Gilhousenn states that his base station uses "at least one searcher element...**The searcher element identifies a set of available signals and passes the information to the controller. The controller may use the set of available signals to assign or re-assign the demodulation elements to the most advantageous signals available." (Column 10, lines 24-38)** Therefor the controller uses the searcher as a form of feedback for choosing one of the demodulation elements.

Regarding Claim 18, the limitation "successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;" is shown in figure 2 where three messages are selectively demodulated by three different demodulators.

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 1-4, 18, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Gilhousen et al (USPAT 5,625,876). Regarding Claim 1, Gilhousen et al meets the following limitations of the claim:

> a first demodulator selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; **fig 1, items 10 and 30; fig 3**
>
> at least a second demodulator also selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; **fig 1, items 10 and 30; fig 3**
>
> a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller at least for selecting which of the first and second data signals, respectively, are applied to said first demodulator and for selecting which of the first and second data signals, respectively, are applied to said second demodulator. **(Column 7, lines 49-59);**

To further explain, in Figure 1 a communication system is shown with two subscribers sending separate radio data signals in a cellular network. In Figure 3, a basestation's is shown to have a plurality of demodulators which receive multiple signals. The selection or combining of the signals by a controller is explained in Column 7, Lines 49-59.

Regarding Claim 2, Gilhousen et al does not explicitly mention that his system be used in a fixed wireless system. However, fixed wireless is a special case of a mobile wireless system. The technology used in mobile wireless systems also will work in fixed wireless

environments. Therefor Gilhousen et al does meet the first limitation in claim 2. The second limitation is also met:

> the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem. **Claim 1**

Regarding Claim 3, Gilhousen et al meets the following limitations of the claim:

> second demodulator is embodied at a second modem. **fig 3, item 204B**

Regarding Claim 4, Gilhousen et al meets the following limitations of the claim:

> at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern. **(Column 7, lines 49-59); Look in (Column 6, Lines 44-47) for the disclosure of multiple subscribers using one basestation.**

Regarding Claim 18, the rejection of Claim 1 above also meets the limitations of the Claim 18.

Regarding Claim 19, the rejection of Claim 4 above also meets the limitations of the Claim 19.

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:

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 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Link (US PGPUB 2001/0018326). Gilhousen et al meets all the limitations of claim 6(See above paragraphs), except disclosing the use of sending bursts of data of selected time durations and determining times of arrival and time directions of such signals.

However, Link's fixed wireless system meets the following limitations of the claim:

> the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals. **Para 0035, 0068 Note: TDMA uses time bursts of selected lengths**

Therefor it would have been prima facie obvious for Gilhousen et al's system to use TDMA and measure time of arrival and burst direction at the time of the invention. A motivation to combine is that TDMA is well-known access system used in fixed wireless(see 802.16 standard). Regarding the motivation to use time of arrival and received direction, Link states in Para 0068 that these two parameters can be used to determine the location of a fixed wireless terminal.

3. Claims 7, 15, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333). Gilhousen et al meets all the limitations of claims 7 and 20(See above paragraphs), except disclosing the use of "profiles" and storing such profiles.

However, Smith meets the following limitations of the claim:

> controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller. **(Column 4, lines 12-66)**

Therefore it would have been prima facie obvious to store subscriber station profiles at a basestation. A motivation to combine is stated by Smith in the following paragraph:

> "As subscriber units become increasingly **user customizable with enhanced software application upgradability**, it is impractical to expect that a class-of-service distinction or a subscriber unit class can define all the types of data that the applications accessible to a specific subscriber unit can support. Further, it is unlikely **that all subscriber units of a specific type will have identical applications** ...Thus, what is needed is a method and apparatus for controlling the delivery of data from the fixed portion of the messaging system to the subscriber unit...**The controller** further comprises a base station interface coupled to the processing system for controlling a base station to transmit the data. **The processing system is programmed to keep in the memory a current copy of the application registry of the subscriber unit, and to check the current copy of the application registry in response to having the data to send to the subscriber unit. The processing system is further programmed to send the data only when the checking step determines that an application compatible with the data is accessible to the subscriber unit."** **(Column 1, Line 20 to Column 2, Line 9)**

Regarding Claim 15, Gilhousen et al meets the following limitations of the claim:

> the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **(Column 9, lines 14-21)**

4. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of McNicol (USPAT 5,940,454). Gilhousen et al and Smith meet all the limitations of claim 9(See above paragraphs), except storing channel related parameters for each subscriber.

However, McNicol's fixed wireless system meets the following limitation of claim 8:

> wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively. **(Column 8, lines 27-39)**

Therefor it would have been prima facie obvious to store subscriber channel-related parameters in a fixed wireless controller. A motivation to combine is disclosed by McNicol's

in Column 1, Lines 20-25 wherein he explains that channels related information, in this case sync words, are needed to:

> "...adjust its phase and/or frequency response to compensate as far as possible for multipath interference or channel distortion in the wireless transmission." **(Column 1, Lines 20-25)**

Regarding Claim 9, it would have been obvious for each of the demodulators shown by Gilhousen et al to have separate equalizer with the support of McNicols disclosing the use of equalizers in fixed wireless modems. (Also see McNicols Column 7, line 63 to Column 8, line 6)

Regarding Claim 10, McNicol meets the following limitations of the claim:

> wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof. **fig 5, item 46**

5. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of Jonas (US PGPUB 20020036985). Gilhousen et al and Smith meet all the limitations of claim 11(See above paragraphs), except disclosing the storage of at least one signal-related parameter.

However, Jonas meets the following limitation:

> wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively. **Claim 1, Para 0030, 0032**

Therefor it would have been prima facie obvious to store signal related parameters in a fixed wireless controller. A motivation to combine is suggested by Jonas wherein he states that channel parameters must be analyzed and monitored in order to:

> **"...make the upstream channel allocations in such a way that will utilize as much of the upstream channel capacity as possible. Further, it is desired that should communication with each node on an upstream channel is maintained as having as high of performance capabilities as possible..." Para 0017**

Regarding Claim 12, Jonas meets the following limitations of the claim:

the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Para 0011**

Regarding Claim 13, Jonas meets the following limitations of the claim:

wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Para 0011, [Para 0035 Note: QPSK is an orthogonal modulation scheme]**

Regarding Claim 14, Jonas meets the following limitations of the claim:

wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller. **Claim 1 para 0030**

6. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilhousen et al (USPAT 5,625,876) in view of Smith (USPAT 6,272,333) further in view of Greenstein et al(USPAT 6,131,016). Gilhousen et al and Smith meet all the limitations of claim 11(See above paragraphs), except disclosing the storage of band timing and carrier adjustment values.

However, Greenstein et al meets the following limitations of claims 16 and 17:

said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals. **Claim 3, 4**

profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals. **Claim 3, 4**

Therefor it would have been prima facie obvious to store carrier and phase related information in a fixed wireless controller. A motivation to combine is that it is well known in that art that phase and carrier adjustment is a typical step in the receiving process of a wireless system in order to correct any channel impairments like multipath.

Allowable Subject Matter

7. Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

2. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Vartanian whose telephone number is 571.272.3048. The examiner can normally be reached on 10:00-6:30 Mondays to Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 571.272.3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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).

Harry Vartanian
Examiner
Art Unit 2634

HV

STEPHEN CHIN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
09/839,726	STRUHSAKER ET AL.
Examiner	**Art Unit**
Harry Vartanian	2634

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date
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To:	Examiner Harry Vartanian	Fax:	571-273-8300
From:	Daniel E. Venglarik, Esq.	Time:	1:59 PM
Date:	July 13, 2005	Client/Matter:	WEST14-00014

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U.S. Serial No. 09/839,726 filed April 20, 2001

Group No.: 2634

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DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Harry Vartanian

MAIL STOP AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION BY FACSIMILE

Sir:

The undersigned hereby certifies that the following documents:

1. Amendment and Response to Final Office Action

relating to the above application was faxed to (571) 273-8300 on July 13, 2005.

Date: 7/13/05 Kathy Cedar
Faxer

Date: 7-13-05 Daniel E. Venglarik
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DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Group No.	:	2634
Examiner	:	Harry Vartanian

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Alexandria, VA 22313-1450

Sir:

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

No fees are believed to be necessary; however, in the event that any fees are required for the prosecution of this application, please charge any necessary fees to Deposit Account No. 50-0208. No extension of time is believed to be necessary. If, however, an extension of time is needed, the extension is requested and please charge the fee for this extension to Deposit Account No. 50-0208.

In response to the final Office Action dated May 12, 2005, please amend the above-identified application as follows:

PENDING CLAIMS:

1. (Previously Presented) Apparatus for a communication station operable in a wireless communication system at least to receive first and second successive data signals transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations, said apparatus comprising:

a first demodulator selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively;

at least a second demodulator also selectably coupled to receive at least one of the first data signals and the second data signals transmitted to the communication station by the first subscriber station and by the second subscriber station, respectively; and

a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller alternately selecting the first data signal for application to said first demodulator and the second data signal for application to said second demodulator.

PAGE 4/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

2. (Original) The apparatus of Claim 1 wherein the wireless communication system comprises a fixed wireless access system, wherein the communication station comprises a base station of the fixed wireless access system in which the data signals transmitted thereto by the first subscriber station comprise first uplink burst data signals and the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem.

3. (Original) The apparatus of Claim 2 wherein said second demodulator is embodied at a second modem.

4. (Original) The apparatus of Claim 1 wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern.

PAGE 5/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

5. (Original) The apparatus of Claim 4 wherein the selected pattern according to which said first demodulator and said second demodulator receive the first and at least second data signals comprise alternately coupling said first demodulator and said second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

6. (Original) The apparatus of Claim 1 wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals.

7. (Original) The apparatus of Claim 1 wherein said controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller.

PAGE 6/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

8. (Original) The apparatus of claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively.

9. (Original) The apparatus of claim 8 wherein said first demodulator and said second demodulator each include equalizer portions for equalizing the at least one of the first and second data signals selectably applied to said first demodulator and said second demodulator, respectively.

10. (Original) The apparatus of claim 9 wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof.

11. (Original) The apparatus in claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively.

PAGE 7/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

12. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

13. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

14. (Original) The apparatus of claim 11 wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

PAGE 8/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

15. (Original) The apparatus of claim 7 wherein the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

16. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals.

17. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals.

PAGE 9/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

18. (Previously Presented) A method for acting upon first and second successive data signals transmitted to a communication station operable in a wireless communication system by a first subscriber station and at least a second subscriber station, said method comprising:

selecting at which of a first demodulator and at least a second demodulator to apply at least one of the first data signals and the second data signals, wherein the first and second successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;

demodulating the at least one of the first and at least second data signals at the first demodulator when the first demodulator is selected during said operation of selecting; and

demodulating the at least one of the first and at least second data signals at the second demodulator when the second demodulator is selected during said operation of selecting.

19. (Original) The method of claim 18 wherein selections made during said operation of selecting are made according to a selected pattern.

20. (Original) The method of claim 18 further comprising the operation of maintaining profiles associated with each of the first and at least second data signals transmitted upon the first and at least second channels, respectively, and wherein said operations of demodulating further comprise accessing the profiles.

PAGE 10/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

REMARKS

Claims 1–20 are pending in the present application.

Claim 5 was objected to as being dependent upon a rejected base claim, but was indicated to be allowable if rewritten in independent form including all limitations of the base claim and any intervening claims.

Reconsideration of the claims is respectfully requested.

35 U.S.C. § 102 (Anticipation)

Claims 1–4 and 18–19 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,625,876 to *Gilhousen et al.* This rejection is respectfully traversed.

A claim is anticipated only if each and every element is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as complete detail as is contained in the claim. MPEP § 2131 at p. 2100-73 (8th ed. rev. 2 May 2004).

Independent claims 1 and 18 each recite that first and second successive data signals from first and second subscriber stations, and subsequent data signals, if any, are alternately applied to first and second demodulators. In an exemplary embodiment of the invention, two modems are alternately employed to demodulate separate, successive uplink bursts from different subscriber stations, so that one modem is utilized to demodulate a received data burst while the second, currently unused modem is configured using profiles values associated with the next subsequent data

PAGE 11/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

burst expected to be received, to avoid delay in demodulation and increase overall throughput. Such a feature is not found in the cited reference.

The final Office Action states:

> Gilhousen et al shows discloses [sic] a basestation receiver that uses multiple modulation and demodulation elements (fig 3). He also shows in figure 3 that each demodulation element will decode a different uplink message which is later combined for decoding. In figure 1 Gilhousenn [sic] et al shows that the base station can receive signals from multiple subscribers. Moreover, Gilhousenn et al states that "demodulation elements 204A-204N are controlled by controller 200 through interconnection 212." (Column 10, lines 3-5) Gilhousenn states that his base station uses "at least one searcher element...**The searcher element identifies a set of available signals and passes the information to the controller. The controller may use the set of available signals to assign or re-assign the demodulation elements to the most advantageous signals available." (Column 10, lines 24-38)** Therefor the controller uses the search as a form of feedback for choosing one of the demodulation elements.
>
> Regard Claim 18, the limitation "successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;" is shown in figure 2, where three messages are selectively demodulated by three different demodulators.

Paper No. 05092005, page 2 (emphasis in original). However, *Gilhousen et al* does not, as asserted in the final Office Action, teach use of the demodulation element in Figure 3 to demodulate different uplink messages which are later combined for decoding. Instead, the combination in *Gilhousen et al* is of the same data signals concurrently detected in multiple sectors:

> The combination process in softer handoff allows demodulated data from different sectors to be combined before decoding and thus produce a single soft decision output value. The combination process can be performed based on the relative signal level of each signal thus providing the most reliable combination process.

PAGE 12/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

> Combining signals from sectors of a common base station also allows a sectorized base station to make a single power adjustment command for mobile unit power control. Thus the power adjustment command from each sector of a common base station is the same. This uniformity in power control allows flexible handoff operation in that sector diversity at the mobile unit is not critical to the power control process.

Gilhousen et al, column 5, lines 35–48. *Gilhousen et al* teaches that the same combination of demodulated data prior to decoding may be performed for either separate base stations, or for different sectors associated with a single base station:

> For each mobile unit operating in soft handoff in the system, the cellular or personal communication system controller receives decoded data from at least two base stations. For example, in FIG. 1 the cellular or personal communications system controller would receive decoded data from mobile unit 30 from base stations 40, 100, and 110. Combining the decoded data does not yield the great advantage of combining the data prior to decoding. A typical cellular or personal communication system controller may choose not to combine the decoded data from each base station and instead select the decoded data from the base station having the highest signal quality index and discard the data from any other base station.
>
> The method of soft handoff could be directly applied to a sectorized base station by treating each sector of a common base station as a separate, independent base station. Each sector of the base station could combine and decode multipath signals from a common mobile unit. The decoded data could be sent directly to the cellular or personal communication system controller by each sector of the base station or it could be compared and selected at the base station and the result sent to the cellular or personal communication system controller.

Gilhousen et al, column 7, lines 7–29. In applying the combination to sectors in a first embodiment, *Gilhousen et al* recognizes that the same signal from a single mobile unit may arrive concurrently at more than one of the three different antennas 310, 326 and 344 each serving different but overlapping sectors for the base station:

PAGE 13/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

> In FIG. 2, each of antennas 310, 326, and 344 is the receive antenna for one sector of a common base station. FIG. 2 represents a typical sectorized base station in that antennas 310, 326, and 344 have overlapping coverage areas such that a single mobile unit signal may be present at more than one antenna at a time.

Gilhousen et al, column 7, lines 32–37. Thus, during operation other than soft handoff, the three sets of N demodulation elements 316A-316N, 332A-332N and 350A-350N corresponding to the three different antennas 310, 326 and 344 depicted in Figure 2 of *Gilhousen et al* each operate, under the control of separate controllers 318, 334 and 352, respectively, on a message (Message 1, Message 2 and Message 3, respectively) from different mobile units:

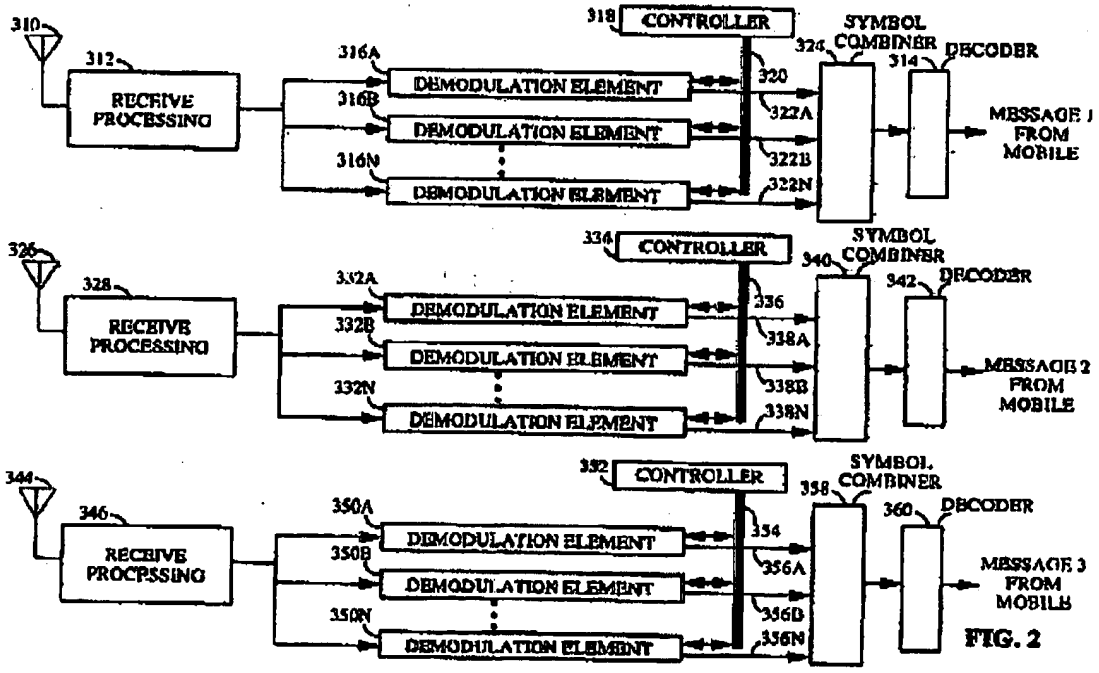


FIG. 2

PAGE 14/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

Antennas 310, 326, and 344 supply a receive signal to receive processings 312, 328, and 346 respectively. Receive processings 312, 328, and 346 process the RF signal and convert the signal to digital bits. Receive processings 312, 328, and 346 may also filter the digital bits. Receive processing 312 provides the filtered digital bits to demodulation elements 316A-316N. Receive processing 328 provides the filtered digital bits to demodulation elements 332A-332N. Likewise, receive processing 346 provides the filtered digital bits to demodulation elements 350A-350N.

Demodulation elements 316A-316N are controlled by controller 318 through interconnection 320. Controller 318 assigns demodulation elements 316A-316N to one of the plurality of information signals from a single mobile unit. Demodulation elements 316A-316N produce data bits 322A-322N that are combined in symbol combiner 324. The output of symbol combiner 324 may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 314 and output Message 1 from the mobile unit is passed to the cellular or personal communications system controller.

. . . .

Demodulation elements 332A-332N are controlled by controller 334 through interconnection 336. Controller 334 assigns demodulation elements 332A-332N to one of the plurality of information signals from a single mobile unit. Demodulation elements 332A-332N produce data bits 338A-338N that are combined in symbol combiner 340. The output of symbol combiner 340 may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 342 and output Message 2 from the mobile unit is passed to the cellular or personal communications system controller.

. . . .

Demodulation elements 350A-350N are controlled by controller 352 through interconnection 354. Controller 352 assigns demodulation elements 350A-350N to one of the plurality of information signals from a single mobile unit from the corresponding sector. Demodulation elements 350A-350N produce data bits 356A-356N that are combined in symbol combiner 352. The output of symbol combiner may be aggregate soft decision data suitable for Viterbi decoding. The combined data is decoded by decoder 360 and the output Message 3 from the mobile unit is passed to the cellular or personal communications system controller.

Gilhousen et al, Figure 2, column 7, lines 38–59, column 7, line 66 through column 8, line 9, column 8, lines 16–27 (emphasis added). Each set of demodulation elements thus operates on successive

PAGE 15/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

information signals from a **single** mobile unit, NOT from different mobile units. *Gilhousen et al* does not teach or suggest that a set of demodulation elements operates on successive information signals from **different** mobile units, only on successive information signals from a single mobile unit. In fact, *Gilhousen et al* does not even teach or suggest that the information signals received from different mobile units (i.e., those corresponding to Message 1, Message 2, and Message 3) are successive (i.e., occurring in succession) rather than concurrent.

In the second embodiment disclosed in *Gilhousen et al* – that corresponding to the portions cited in the above quote from the final Office Action – sector antennas 222A-222C are coupled to demodulation elements 204A-204N:

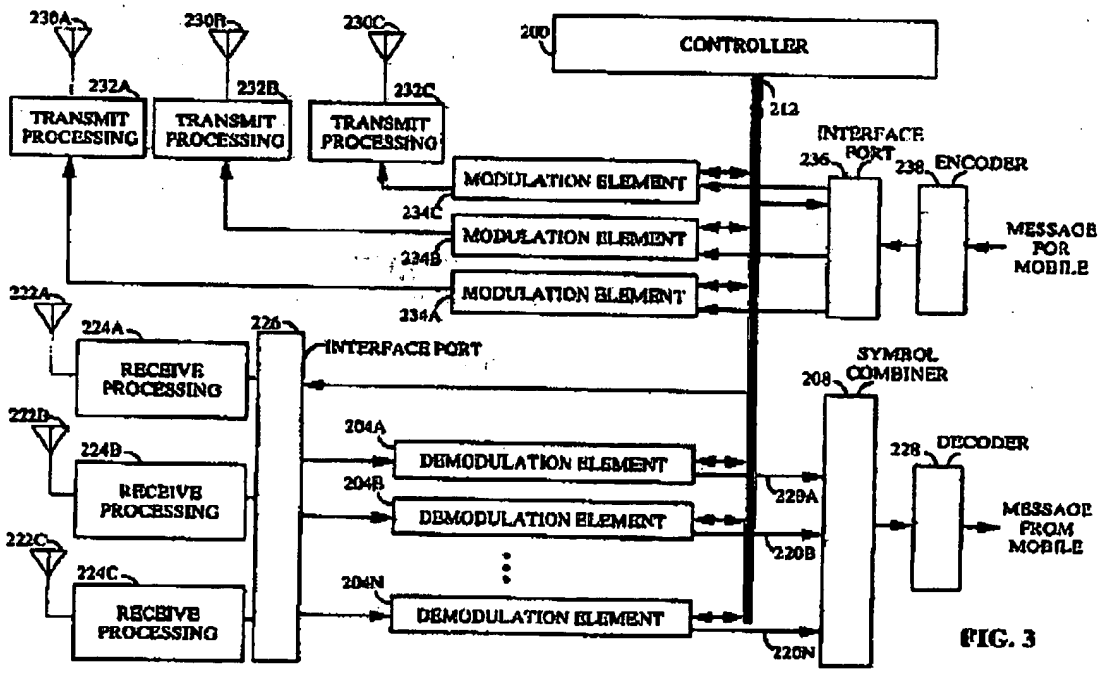


FIG. 3

PAGE 16/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

Gilhousen et al, Figure 3, column 9, line 52 through column 10, line 2. In this embodiment, however, *Gilhousen et al* once again teaches that only successive information signals from a single mobile unit are applied to separate demodulators, not successive information signals from different mobile units:

> Continuing in with the preferred embodiment, demodulation elements 204A-204N are controlled by controller 200 through interconnection 212. Controller 200 assigns demodulation elements 204A-204N to one of the plurality of information signals from a single mobile unit from any one of the sectors. Demodulation elements 204A-204N produce data bits 220A-220N each representing an estimate of the data from the single mobile unit. Data bits 220A-220N are combined in symbol combiner 208 to produce a single estimate of the data from the mobile unit. The output of symbol combiner 208 may be aggregate soft decision data suitable for Viterbi decoding. The combined symbols are passed to decoder 228.
>
> Demodulation elements 204A-204N also provide several output control signals to controller 200 through interconnection 212. The information passed to controller 200 includes an estimate of the signal strength of the signal assigned to a particular demodulator. Each one of demodulation elements 204A-204N measures a signal strength estimation of the signal that it is demodulating and provides the estimation to controller 200.
>
> In many applications, an actual base station also comprises at least one searcher element. The searcher element is also capable of demodulating a signal and is used to continually scan the time domain in search of available signals. The searcher element identifies a set of available signals and passes the information to the controller. The controller may use the set of available signals to assign or re-assign the demodulation elements to the most advantageous signals available. The placement of the searcher element is the same as the placement of the demodulating elements in FIG. 2. As such the searcher elements may also be assigned to a signal from a plurality of sectors of a common base station. In the most general case, demodulation elements 204A-204N can be assumed to comprise some elements that are capable of performing the searching function.
>
> Notice that symbol combiner 208 can combine signals from just one sector to produce an output or it can combine symbols from multiple sectors as selected by the interface port 226. A single power control command is created by the controller from the estimated signal strengths independent of the sector through which the

PAGE 17/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

> signal is received. The controller can pass this information to the transmit circuitry of each sector of the base station. Thus each sector in the base station transmits the same power control information to a single mobile unit.
>
> When symbol combiner 208 is combining signal from a mobile unit that is communicating through more than one sector, the mobile unit is in softer handoff. The base station may send the output of decoder 228 to a cellular of personal communication system controller. At the cellular or personal communication system controller, signal from this base station and from other base stations are used produce a single output (soft handoff.)

Gilhousen et al, column 10, lines 3–56 (emphasis added). In the case of the "softer" handoff in which signals from multiple antennas serving overlapping sectors are combined for decoding, the signals combined are not successive signals, but the same signal received at two different antennas.

In sum, *Gilhousen et al* does not teach receiving successive signals from two different subscriber units, and does not teach applying such successive signals alternately to first and second modulators.

Therefore, the rejection of claims 1–4 and 18–19 under 35 U.S.C. § 102 has been overcome.

35 U.S.C. § 103 (Obviousness)

Claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of U.S. Patent Application Publication No. 2001/0018326 to *Link, II*. Claims 7, 15 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of U.S. Patent No. 6,272,333 to *Smith*. Claims 8–10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of *Smith* and further in view of U.S. Patent No. 5,940,454 to *McNicol*. Claims 11–14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over

PAGE 18/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

Gilhousen et al in view of *Smith* and further in view of U.S. Patent Application Publication No. 2002/0036985 to *Jonas et al.* Claims 16–17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Gilhousen et al* in view of *Smith* and further in view of U.S. Patent No. 6,131,016 to *Greenstein et al.* These rejections are respectfully traversed.

In *ex parte* examination of patent applications, the Patent Office bears the burden of establishing a *prima facie* case of obviousness. MPEP § 2142, p. 2100-128 (8th ed. rev. 2 May 2004). Absent such a *prima facie* case, the applicant is under no obligation to produce evidence of nonobviousness. *Id.*

To establish a *prima facie* case of obviousness, three basic criteria must be met: First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *Id.*

As noted above, independent claims 1 and 18 each recite one or more limitation(s) not found in *Gilhousen et al.* Such limitation(s) are also not found in the other cited references.

Therefore, the rejection of claim 6–17 and 20 under 35 U.S.C. § 103 has been overcome.

PAGE 19/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at *dvenglarik@davismunck.com*.

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 7-13-05

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PAGE 20/20 * RCVD AT 7/13/2005 3:01:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/26 * DNIS:2738300 * CSID:972 628 3619 * DURATION (mm-ss):06-22

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number
09/839,729
WEST 14-0001

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	20	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL	355.00	OR	TOTAL	

CLAIMS AS AMENDED - PART II

12-27-04

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	=
Independent	* 2	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

7/13/05

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	=
Independent	* 5	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

7590 08/11/2005

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

EXAMINER	
FILE, ERIN M	

ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 08/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 09/839,726	**Applicant(s)** STRUHSAKER ET AL.	
	Examiner Erin M. File	**Art Unit** 2634	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 13 July 2005 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☐ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: 5.
   Claim(s) rejected: 1-4,6-20.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

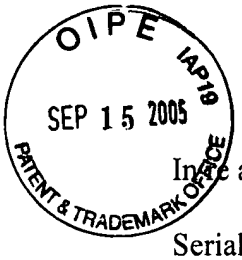
11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: see attached.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08 or PTO-1449) Paper No(s). _____
13. ☐ Other: _____.

ADVISORY ACTION

The action filed by applicant traverses the rejection of Claims 1-4 and 6-20. The applicant argues Independent Claims 1 and 18 contain the limitation of alternately applying successive upburst links from different subscriber stations, so that one modem is utilized to demodulate a received data burst. The applicant argues that the Gilhousen reference does not contain this limitation and is therefore overcome. However, this limitation is not contained in the Claim language. The limitation regarding successive data signals in independent claims 1 and 18 is contained within the preamble, stating "apparatus for a communication station operable in a wireless communication system at least to receive first and second successive data signals transmitted thereto by a first subscriber station". The examiner is not persuaded that the independent claims overcome the reference and therefore the claims will not be entered.

STEPHEN CHIN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

AMENDMENT AND RESPONSE TO OFFICE ACTION

This Amendment is filed in response to the final Office Action mailed May 12, 2005. Applicant respectfully requests a one (1) month extension of time for filing a Request for Continued Examination (RCE) in response to the final Office Action. The response period is presently set to expire on August 12, 2005, and if this Request for Extension of Time is granted, the new response date will be September 12, 2005.

Prior to examination, please amend the above-identified application as follows:

AMENDMENTS TO THE CLAIMS:

Please amend the claims as follows, substituting any amended claim(s) for the corresponding pending claim(s):

1. (Currently Amended) Apparatus for a communication station operable in a wireless communication system at least to receive first and second ~~successive~~ data signals successively transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations, said apparatus comprising:

a first demodulator selectably coupled to receive ~~at least one of~~ the first data signals ~~and the second data signals~~ transmitted to the communication station ~~by the first subscriber station and by the second subscriber station, respectively~~;

at least a second demodulator also selectably coupled to receive ~~at least one of the first data signals and~~ the second data signals transmitted to the communication station ~~by the first subscriber station and by the second subscriber station, respectively~~; and

a controller, coupled to said first demodulator and to said at least second demodulator in a feedback arrangement, said controller alternately selecting the first data signal for application to said first demodulator and the second data signal for application to said second demodulator.

2. (Original) The apparatus of Claim 1 wherein the wireless communication system comprises a fixed wireless access system, wherein the communication station comprises a base station of the fixed wireless access system in which the data signals transmitted thereto by the first subscriber station comprise first uplink burst data signals and the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, said first demodulator embodied at a first modem.

3. (Original) The apparatus of Claim 2 wherein said second demodulator is embodied at a second modem.

4. (Original) The apparatus of Claim 1 wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selects to which of said first demodulator and said second demodulator that the first data signals and the at least second data signals are applied according to a selected pattern.

5. (Original) The apparatus of Claim 4 wherein the selected pattern according to which said first demodulator and said second demodulator receive the first and at least second data signals comprise alternately coupling said first demodulator and said second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

6. (Original) The apparatus of Claim 1 wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein said controller further determines times of arrival and time directions of the bursts which form the data signals.

7. (Original) The apparatus of Claim 1 wherein said controller further comprises a memory portion, said controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of said controller.

8. (Original) The apparatus of claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively.

9. (Original) The apparatus of claim 8 wherein said first demodulator and said second demodulator each include equalizer portions for equalizing the at least one of the first and second data signals selectably applied to said first demodulator and said second demodulator, respectively.

10. (Original) The apparatus of claim 9 wherein the filter weight values form portions of the profiles maintained by said controller and stored at the memory portion thereof.

11. (Original) The apparatus in claim 7 wherein the profiles maintained at the memory portion of said controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively.

12. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

13. (Original) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

14. (Original) The apparatus of claim 11 wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

15. (Original) The apparatus of claim 7 wherein the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by said controller and stored at the memory portion of said controller.

16. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals.

17. (Original) The apparatus of Claim 7 wherein profiles maintained by said controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals.

18. (Previously Presented) A method for acting upon first and second successive data signals transmitted to a communication station operable in a wireless communication system by a first subscriber station and at least a second subscriber station, said method comprising:

selecting at which of a first demodulator and at least a second demodulator to apply at least one of the first data signals and the second data signals, wherein the first and second successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;

demodulating the at least one of the first and at least second data signals at the first demodulator when the first demodulator is selected during said operation of selecting; and

demodulating the at least one of the first and at least second data signals at the second demodulator when the second demodulator is selected during said operation of selecting.

19. (Original) The method of claim 18 wherein selections made during said operation of selecting are made according to a selected pattern.

20. (Original) The method of claim 18 further comprising the operation of maintaining profiles associated with each of the first and at least second data signals transmitted upon the first and at least second channels, respectively, and wherein said operations of demodulating further comprise accessing the profiles.

REMARKS

Claims 1–20 are pending in the present application.

Claim 1 was amended herein.

Reconsideration of the claims is respectfully requested.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***dvenglarik@davismunck.com***.

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 9-12-05

Daniel E. Venglarik
Registration No. 39,409

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OIPE
SEP 15 2005
PATENT & TRADEMARK OFFICE

PTO/SB/30 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	09/839,726
Filing Date	April 20, 2001
First Named Inventor	Paul F. Struhsaker
Art Unit	2634
Examiner Name	Erin M. File
Attorney Docket Number	WEST14-00014

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☑ Other Cert. of Mailing; Petition for Extension of Time - one month (in dup.); postcard

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, or credit any overpayments, to Deposit Account No. 50-0208. I have enclosed a duplicate copy of this sheet.

      i. ☑ RCE fee required under 37 CFR 1.17(e) [$395.00]

      ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17) [$60.00]

      iii. ☐ Other _____

   b. ☑ Check in the amount of $ 455.00 enclosed

   c. ☐ Payment by credit card (Form PTO-2038 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.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	Sept. 12, 2005
Name (Print/Type)	Daniel E. Venglarik	Registration No.	39,409

CERTIFICATE OF MAILING OR TRANSMISSION

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 RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)	Kathy Cedor	Date	Sept. 12, 2005

This collection of information is required by 37 CFR 1.114. 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 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 RCE, 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.

09/16/2005 YPOLITE1 00000029 09839726

01 FC:2801 395.00 OP

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

OIPE IAP19
SEP 15 2005
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

PETITION FOR EXTENSION OF TIME

Applicant respectfully requests a one (1) month extension of time for filing a Request for Continued Examination (RCE) in response to the final Office Action mailed May 12, 2005. The response period is presently set to expire on August 12, 2005, and if this Petition for Extension of Time is granted, the new response date will be September 12, 2005.

A check in the amount of $455.00 is enclosed for the RCE filing fee ($395.00) and one (1) month extension fee ($60.00). The Commissioner is hereby authorized to charge any additional fees

09/16/2005 YPOLITE1 00000029 09839726
02 FC:2251 60.00 OP

which may be required, or credit any overpayment to Davis Munck Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 9-12-05

Daniel E. Venglarik
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DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

OIPE IAP19 SEP 15 2005 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

Sir:

The undersigned hereby certifies that the following documents:

1. Request for Continued Examination (RCE) Transmittal;
2. Amendment and Response to Office Action;
3. Petition for Extension of Time - one month (in duplicate);
4. Check in the amount of $455.00 for the RCE filing fee ($395.00) and one-month extension fee ($60.00); and
5. A postcard receipt;

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to MAIL STOP RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on September 12, 2005.

Date: 9/12/05 Kathy Ceder
Mailer

Date: 9-12-05 Daniel E. Venglarik
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PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number
09/839,720
WEST 14-0001

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	20	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL	355.00	OR	TOTAL	

CLAIMS AS AMENDED - PART II

12-27-04

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	= /
Independent	* 2	Minus	*** 3	= /
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

7/13/05

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	= /
Independent	* 3	Minus	*** 3	= /
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

9/15/05 RCE

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	= /
Independent	* 2	Minus	*** 3	= /
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
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.

FORM PTO-875 (Rev. 8/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
*U.S. GPO: 2000-460-P0630/100

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Ex.1002.00379

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	175	first adj demodulator same second adj demodulator same (select selectively selecting switch switching)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:17
L2	32	first adj demodulator same second adj demodulator same (select selectively selecting switch switching) and pattern	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:17
L3	2622	375/222.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:52

Ex.1002.00380

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

7590 10/17/2005

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

EXAMINER	
FILE, ERIN M	
ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 10/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Erin M. File	2634	

-- 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 *15 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,18 and 19* is/are rejected.

7)☒ Claim(s) *5-17 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 December 2004* 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).

11)☐ 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

12)☐ 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-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Claim Rejections - 35 USC § 102

1. 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.

2. Claims 1-4, 18, 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Siwiak.

Claims 1, 18, Siwiak discloses a dual mode communication receiver that comprises a first demodulator (fig. 1, 108) for detecting information transmitted in an FM modulation format on a first channel, and a second demodulator (112),responsive to the information detected in the FM modulation format, for detecting information transmitted in a linear modulation format on a second channel. The first and second demodulators(108,112) share a common receiver front end. A power conservation circuit(104) is provided for selectively supplying power to the first and second demodulators, effectively, selecting the first and second demodulators for demodulatioing first and second data.

Claim 2, inherits the limitations of Claim 1, Siwiak further discloses that the system described is used in a paging system, a type of wireless communication system.

Further, the first and second type of data sources are demodulated by FM and linear demodulators, both of which are well known for demodulating burst data.

Claim 3, inherits the limitations of Claim 2, further the limitation of a demodulator embodied at a modem is well known in the art, as a modem is a type of demodulator.

Claims 4, 19, inherit the limitations of Claim 1 and 18 respectively. Further, Siwiak discloses that the different data modes are known to arrive in a pattern (col. 6, line 561-col. 7, line 37, fig. 2b). If the data are known to arrive in a pattern then it is obvious that the selection between the two modems would occur in a pattern.

Allowable Subject Matter

3. Claims 5-17, 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin M. File whose telephone number is (571)272-6040. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571)272-3056. 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).

Erin M. File

10/10/2005

STEPHEN CHIN
SUPERVISORY PATENT EXAMINE
TECHNOLOGY CENTER 2600

Notice of References Cited	Application/Control No. 09/839,726	Applicant(s)/Patent Under Reexamination STRUHSAKER ET AL.	
	Examiner Erin M. File	Art Unit 2634	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	EP 792030 A2	08-1997	European Patent	SIWIAK et al.	H04B 07/00
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 792 030 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.08.1997 Bulletin 1997/35

(51) Int. Cl.[6]: **H04B 7/00**, H04B 1/00

(21) Application number: **97107006.5**

(22) Date of filing: **29.06.1992**

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU MC NL SE

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
92914890.6 / 0 738 442

(71) Applicant: **MOTOROLA, INC.**
Schaumburg, IL 60196 (US)

(72) Inventors:
- **Siwiak, Kazimierz**
  Coral Springs, Florida 33071 (US)
- **Leitch, Clifford Dana**
  Coral Springs, Florida 33071 (US)
- **Schwendeman, Robert**
  Pompano Beach, Florida 33060 (US)

(74) Representative: **Morgan, Marc et al**
Motorola Eur. Intel. Prop. Op.,
Midpoint,
Alencon Link
Basingstoke, Hampshire RG21 7PL (GB)

Remarks:
This application was filed on 28 - 04 - 1997 as a divisional application to the application mentioned under INID code 62.

(54) Dual mode receiver having battery saving capability

(57) A dual mode communication receiver comprises a first demodulator (108) for detecting information transmitted in an FM modulation format on a first channel, and a second demodulator (112),responsive to the information detected in the FM modulation format, for detecting information transmitted in a linear modulation format on a second channel. The first and second demodulators(108,112) share a common receiver front end.

A power conservation circuit(104) is provided for selectively supplying power to the first and second demodulators for enabling the detecting of the information received in the FM modulation format and the linear modulation format, respectively.

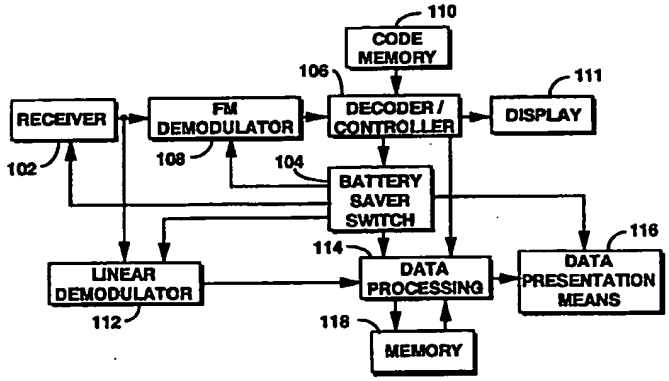


FIG. 1

EP 0 792 030 A2

Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

This invention relates to the field of communication receivers, and more particularly to a selective call communication receiver providing high speed data and voice communication with battery saving capability.

DESCRIPTION OF THE PRIOR ART:

There are many communication systems in operation today, including virtually all of today's paging systems, which utilize frequency (FM) modulation for addressing, and for data and voice transmission. The current communication receivers, including paging receivers, utilize sophisticated receiver architectures, and today's paging systems utilize well known and established signaling formats. The current receiver architectures and signaling formats have been optimized to provide both high receiver sensitivities and excellent battery saving capabilities.

In many metropolitan areas, many paging systems were being operated at, or near, the maximum system capacity, in both the number of subscribers that can be accommodated, and the message transmission time that was available. Such paging system operation has resulted in reduced customer satisfaction due to extended holding, or "camp-on" times required to access the paging system, and also due to extended delays in message delivery due to equally extended paging system message transmission queues. In an effort to improve the message throughput in such prior art systems, such services as voice paging, were eliminated on many systems, and were replaced by newer services, such as numeric and alphanumeric messaging. These newer services greatly increased the number of subscribers which could be accommodated on the paging system, by greatly reducing the air-time requirements for message transmission. However, as the demand for even more improved paging services has increased, such as for improved methods for handling and processing large alphanumeric data messages, many paging systems are again nearing the maximum system capacity. In an effort to continue to improve the grade of service being provided in such paging systems, new signaling formats, such as the 1200 baud POCSAG signaling format, have been implemented to ease the burden on the paging system by providing ever increasing message throughput.

When used in simulcast transmission systems, standard FM modulation is not suitable for data transmission at high bit rates due to transmitter equalization problems. Because of the limitations of FM modulation for high speed message transmission, other forms of modulation, such as linear modulation techniques are required to provide for transmission at the higher data rates. While linear modulation techniques are available to provide the increased message transmission speeds, such modulation techniques generally are incompatible for use with existing receiver architectures, are incompatible with present day signaling protocols, and require significantly more current drain for operation than required for circuits receiving and demodulating existing signaling protocols transmitted using standard FM modulation techniques. There is a need to provide a receiver architecture which retains compatibility within existing FM modulated paging signaling protocols, thereby taking advantage of the battery saving capabilities of these existing paging signaling protocols. Furthermore, there is a need to provide a receiver architecture which includes linear demodulation for voice and high speed data capability, to provide the increased message throughput required for these ever expanding services, without compromising the battery saving performance of the existing paging signaling protocols.

Prior art document US-A-5054052 concerns a mobile telephone device with a separate paging signal channel in addition to the conventional transceiver channels which process voice signals. A power supply control device shuts off power to the conventional transceiver channels when in a standby mode, i.e. when waiting for an incoming call, and applies power to the paging signal channel instead. A message for the user can be received in the paging signal channel. Such a message is displayed to the user. A calling party's telephone number can also be received in the paging signal channel. This is stored and displayed. If the user wishes to call this number, then the user presses a button, causing the stored number to be transmitted to the base station of a cellular system to instigate the call. Alternatively, a control unit can automatically return the calling party's call.

SUMMARY OF THE INVENTION

A dual mode communication receiver is described comprising a first receiver for receiving and detecting information transmitted in a first modulation format, and a second receiver, responsive to the information detected in the first modulation format, for receiving and detecting information transmitted in a second modulation format. The first and second receiving means share a common receiver front end.

In an alternate embodiment of the present invention, the dual mode communication receiver is described comprising a first receiver for receiving and detecting information transmitted in a first modulation format, and a second receiver for receiving and detecting information transmitted in a second modulation format. A power conservation circuit is provided for supplying power to the first receiver for enabling the receiving and detecting of the information transmitted in the first modulation format. The power conservation circuit is further responsive to the information received and detected in the first mudulation format for supplying

power to the second receiver for enabling the receiving and detecting of the information transmitted in the second modulation format. The first and second receiving means share a common receiver front end to which power is supplied by the power conservation circuit is response to a battery saving protocol established for information transmitted in the first modulation format, and further in response to information intended for the dual mode communication receiver which is transmitted in the second modulation format.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, together with its further objects and advantages thereof, may be best understood by reference to the following description when taken in conjunction with the accompanying drawings, in the several figures of which like reference numerals identify identical elements, in which, and wherein:

FIG. 1 is an electrical block diagram of the dual mode communication receiver of the present invention.

FIGS. 2A and 2B are timing diagrams describing a signaling format for a dual mode communication receiver.

FIG. 2C is a timing diagram showing the battery saving operation of the dual mode receiver of the present invention.

FIG. 2D is a timing diagram describing the signaling format for the dual mode receiver of the present invention.

FIG. 3 is an expanded electrical block diagram of the dual mode communication receiver of the present invention.

FIG. 4 is an electrical block diagram showing details of the battery saving features of the dual mode communication receiver of the present invention.

FIGS. 5A and 5B are flow charts describing the operation of the dual mode communication receiver of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As has been described above, prior art communication systems, such as paging systems, have provided address and message transmission in a predetermined signaling protocol using a single modulation format. Analog signaling protocols, such as two tone and five tone signaling protocols, and analog voice messages were modulated using either phase or angle modulation formats, or a direct frequency modulation format in FM modulated carrier systems which are prevalent in the industry today. Other signaling protocols, such as digital signaling protocols, have typically utilized a frequency shift keying (FSK) modulation format for both the address and message transmissions. The existing signaling protocols, such as the POCSAG signaling protocol at 512 and 1200 bits per second, or the Golay Sequential Code protocol at 600 bits per second, were developed to provide superior performance in wide area communication systems, such as those systems providing simulcast message transmission. However, as previously described, there is a limit at which transmission of information at high data bit rates using an FM modulation format becomes impractical, due largely to problems encountered in equalizing simulcast transmission systems for such transmissions, and due to the frequency spectrum required to utilize conventional frequency modulation formats to provide such higher speed data communications.

Alternate modulation formats are available to provide improved throughput of message information. These alternate modulation formats include those modulation formats which are often termed linear modulation formats. Such linear modulation formats enable the modulation of the carrier signal whereby the message information is encoded in both the amplitude and the instantaneous phase angle of the carrier. Examples of linear modulation formats include, but are not limited to, quadrature amplitude modulation (QAM modulation), and spectrally efficient data modulation (SEDM modulation), such as described in U.S. Patent No. 4,737,969 to Steel et al., entitled "Spectrally Efficient Digital Modulation Method and Apparatus" which is assigned to the assignee of the present invention. Other forms of linear modulation include those modulation formats which simultaneously modulate both the amplitude and the phase of the transmitted signal to encode the message information, and also shape the transmitted spectrum to provide adjacent channel protection. An example of such modulation format is the QPSK signaling format. While such linear modulation formats are available for the transmission of message information at very high data rates, well in excess of that which can be provided by convention frequency modulation formats, such linear modulation formats are generally incompatible for use with the established paging signaling protocols which have been developed to provide both excellent receiver sensitivities and battery saving performance. This incompatibility is due largely to the requirement of providing linear receivers which require significantly more power to operate than that required for selective call receivers operating in paging systems which employ such well known signaling formats as the POCSAG, or Golay Sequential Code signaling protocols.

FIG. 1 is an electrical block diagram of a dual mode communication receiver of the present invention which overcomes the problems described, and which is compatible for use on existing paging systems, using existing paging signaling protocols. The dual mode communication receiver of the present invention, enables the transmission of data at very high data bit rates, such as eight kilobits per second and higher. The dual mode communication receiver of the present invention

is compatible with the existing paging signaling protocols to provide excellent battery saving performance characteristics, and to maintain the receiver sensitivity characteristics of the prior art communication receivers using the conventional paging signaling protocols. The dual mode communication receiver of the present invention is capable of the operation described above by providing a first receiving means for receiving and detecting information transmitted in a first modulation format, such as in the conventional FM modulated format, and by providing a second receiving means which is responsive to the information detected by the first receiving means in the first modulation format for receiving and detecting information transmitted in a second modulation format, such as in one of the linear modulation formats which enables the high speed transmission of message information. The transmission format is described in FIG.2D, and will be described in detail below.

The transmission protocol of Figs. 2A,2B does not fall within the terms of the invention claimed in appended claim 1, and is shown for illustrative purposes. The transmission protocol of FIGS. 2A, 2B enables the transmission of information which is modulated in a conventional FM modulation format, and further enables the transmission of message information which is modulated in a linear modulation format to enable high speed data transmission.

Referring to FIG. 1, the information modulated in either the FM modulation format, or the linear modulation format, is received by receiver 102. A battery saving switch 104, under the control of a decoder/ controller 106, supplies power to the receiver 102 to enable the reception of the transmitted information. The battery saving switch 104 also couples to an FM demodulator 108 to enable FM modulated information received by receiver 102 to be demodulated. The demodulated information is provided to the decoder/controller 106. A code memory 110 is provided which couples to the decoder/controller 106, and which stores address information assigned to the dual mode communication receiver. When an address is detected in the demodulated information which corresponds to the predetermined address information assigned to the communication receiver, one of two operations will occur, which will be described in greater detail below. In the first instance, the battery saving switch 104, under the control of the decoder/controller 106 will maintain the supply of power to the FM demodulator 108 to enable further demodulation of message information received in the FM modulation format. The received message information is temporarily stored in a memory, such as a random access memory, which is generally located within the decoder/controller 106. The stored message information is recalled by the user for display on display 111. The receiving operating and the decoding of the address information is well known to one of ordinary skill in the art.

However, unlike the prior art receivers, power to the FM demodulator 108 is suspended by battery saver switch 104, under the control of the decoder/controller 106, and power is then supplied to the linear demodulator 112, to enable the demodulation of information received in the second modulation format. The information received in the second modulation format is received by receiver 102, which then couples the received information to the linear demodulator 112. The demodulated message information is coupled from the output of the linear demodulator 112, to the input of a data processing unit 114. When the linear demodulator 112 is enabled, battery saving switch 104 also supplies power to the data processing unit 114, and to the data presentation means 116. The decoder/controller 106 is coupled to the data processing circuit 114, enabling the data processing circuit 114 to process the message information received in the second modulation format. The processed message information is temporarily stored in memory 118, and can be recalled by the user and displayed on the presentation means 116.

FIGS. 2A and 2B are timing diagrams describing a signaling format for the dual mode communication receiver, but which does not fall within the terms of the invention claimed in appeded claim 1. As shown in FIG. 2A, when a message transmission is initiated on the channel, a preamble 202, modulated in the FM modulation format, is transmitted on the channel, followed by a plurality of message batches 204 - 206. Each of the message batches 204 - 206 has a predetermined transmission time interval, and enables the transmission of address and message information which is modulated in the FM modulation format, or for high speed data, which is modulated in a linear modulation format. The modulation of address and message information in the FM modulation format is well known in the art. The modulation of data in a linear modulation format, such as the SEDM modulation format, is described in U.S. Patent No. 4,737,969 to Steel et al, entitled "Spectrally Efficient Digital Modulation Method and Apparatus" which is assigned to the assignee of the present invention. All information transmitted in a given batch is modulated in a common modulation format. As will be described in further detail below, one or more batches of information are modulated in the FM modulation format and can be interleaved with one or more batches of information which are modulated in a linear modulation format. Depending upon the channel loading, a break 208 in the transmission can occur, after which the preamble 202 is again transmitted to enable the receivers to re-synchronize with the batch transmission.

FIG. 2B shows in further detail the interleaving of batches modulated in the FM modulation format with batches modulated in the linear modulation format. The preamble 202 is a sequence of alternating one and zero bits which are modulated using the FM modulation format. The preamble 202 enables the receiver to awake from a battery saving time interval, recognize that a transmission on the channel has been initiated, and enables the receiver to obtain bit synchronization with

the transmitted signal. Following the preamble 202 transmission, each batch comprises a synchronization code word 214, followed by address 210 and message 212 information, or by high speed data 216. The synchronization code word 214 is modulated in the modulation format appropriate for the type of data being transmitted in the batch, and enables synchronization with the transmitted information. In the example shown in FIG. 2B, the synchronization code word 214 is modulated in the FM modulation format, followed by addresses 210 and messages 212 which are also modulated in the FM modulation format. Each transmission batch is coded using a coded synchronization code word and allows for the transmission of a predetermined number of address and/or message information code words, which, as for example, is sixteen. As shown, the address 210 of a first receiver and the associated message 212 are transmitted, followed by the address 210' of a second receiver and the associated message 212', and so forth. Message 212' for the second receiver is not a normal message information code word, but is a predetermined "batch" pointer, directing the receiver to the transmission batch in which the high speed message information directed to the receiver is to be transmitted, which as shown is in the next transmission batch 218'. As shown, batch 218' contains the high speed message information 216 which is modulated in a linear modulation format. Batch 218' begins with the synchronization code word 214' which is used to signal the start of the message information, as will be described below. Following the transmission of batch 218', additional high speed message information can be transmitted in additional batches, other conventionally modulated address and message information can be transmitted in additional batches, or as shown, the batch transmission can be terminated until a later time when additional address and message information is available for transmission.

FIG. 2C is a timing diagram describing the battery saver operation for the dual mode communication receiver of the present invention. Power is initially supplied to the receiver section, during time interval 220, and to the FM demodulator, during time interval 222, to enable receiving the preamble and synchronization code word information modulated in the FM modulation format. The supply of power to the linear demodulator is inhibited during time interval 224, thereby conserving power within the receiver. After having detected the preamble and synchronization code word, the supply of power to the receiver is maintained during time interval 220', and to the FM demodulator during time interval 222', in order to receive any additional address and message information transmitted in the first transmission batch. The supply of power to the receiver section is maintained during time interval 230 since the next transmission batch includes the high speed data directed to the receiver. However, the supply of power to the FM demodulator is suspended during time interval 228, and power is supplied to the linear demodulator, during time interval 232. After receiving the high speed data information during time interval 232, the supply of power is suspended during time interval 234 to the receiver section, and during time interval 236 to the linear demodulator. Power is again supplied to the receiver section during time interval 238, and to the FM demodulator, during time interval 240, to again enable reception of the message information in the next sequence of message batch transmissions.

In summary, power is regularly supplied to the receiver and to the FM demodulator to enable reception of an address and message information using a signaling protocol which provides battery saving capability to the receiver. When the message information indicates a high speed data transmission is forthcoming, the supply of power to the FM demodulator is suspended, and power is supplied to the linear demodulator to enable the reception of the high speed data. By supplying power to the linear demodulator and high speed data storage sections only during the transmission of high speed data, the receiver battery life can be greatly extended as compared to receiving all information in the linear modulation format.

An embodiment of the signaling format for the dual mode receiver of the present invention is shown in FIG. 2D. In this embodiment, information is transmitted on two channels, a first channel 250 which is utilized for the transmission of low speed message information modulated in an FM modulation format, and a second channel 252 which is utilized for the transmission of high speed message information modulated in a linear modulation format. The batches of low speed data 204A-206A overlay in time the batches of high speed data 204B-206B. The dual mode receiver of the present invention operates on the first channel receiving message information, which can include conventional numeric or alphanumeric messages intended for the dual mode receiver. When long alphanumeric messages or voice messages are to be transmitted, the message pointer information is transmitted on the first channel directing the dual mode receiver to a predetermined message batch to be transmitted on the second channel. After having received the pointer information, the dual mode receiver selects the second channel for receiving the high speed message information during the predetermined batch identified by the pointer. After having received the high speed message, the receiver again selects the first channel.

The embodiment of the present invention shown in FIG. 2D allows a very efficient method of mixing conventional paging receivers which receive information modulated in an FM modulation format, with the dual mode receivers of the present invention by maintaining all low speed message transmission on the first channel, and all high speed message transmission on the second channel. This enables the use of conventional signaling formats to be utilized for the transmission of information in the batches 204A-206A on the first channel, enabling both conventional receivers and dual mode receivers to be readily intermixed.

FIG. 3 is an expanded electrical block diagram which will be used to describe the receiver operation of the dual mode communication receiver of the present invention. The transmitted information signal, modulated in the FM modulation format, or in a linear modulation format, is intercepted by the antenna 302 which couples the information signal to the receiver section 102, and in particular to the input of the radio frequency (RF) amplifier 306. The message information is transmitted on any suitable RF channel, such as those in the high band, UHF band, and 900 MHz band, The RF amplifier 306 amplifies the received information signal, such as that of a signal received on a 930 MHz paging channel frequency, coupling the amplified information signal 306A to the input of the first mixer 308. A first oscillator signal 310A, which is generated in the preferred embodiment of the present invention by a frequency synthesizer 310, also couples to the first mixer 308. The first mixer 308 mixes the amplified information signal 306A and the first oscillator signal 310A, to provide a first intermediate frequency, or IF, signal 308A, such as a 45 MHz IF signal, which is coupled to the input of the first IF filter 312. It will be appreciated that other IF frequencies can be utilized as well, especially when other paging channel frequencies are utilized. The output of the IF filter 312 which is the on-channel information signal 312A, is coupled to the input of the second conversion section 314, which will be described in further detail below. The second conversion section 314 mixes the on-channel information signal 312A to a lower intermediate frequency, such as at 455 KHz, using a second oscillator signal 310B, which is also generated by the synthesizer 310. The second conversion section 314 amplifies the resultant intermediate frequency signal, to provide a second IF signal which is suitable to be coupled to either the FM demodulator section 108, or to the linear output section 324.

Receiver section 304 operates in a manner similar to a conventional FM receiver, however, unlike a conventional FM receiver, the receiver section 304 of the present invention also includes an automatic frequency control section 316 which is coupled to the second conversion section 314, and which appropriately samples the second IF signal to provide a frequency correction signal 316A which is coupled to the frequency synthesizer 310 to maintain the receiver tuning to the assigned channel. The maintenance of receiver tuning is especially important for the proper reception of the high speed data information which is transmitted in the linear modulation format. The use of a frequency synthesizer to generate the first and second oscillator frequencies enables the operation selection of the receiver on multiple operating frequencies, selected such as by code memory programming. It will be appreciated that other oscillator circuits, such as fixed frequency oscillator circuits which can be adjusted by a frequency correction signal from the automatic frequency control section 316, can be utilized as well.

An automatic gain control 320 is also coupled to the second conversion section 314 of the dual mode receiver of the present invention. The automatic gain control 320 samples the second IF signal, providing a gain correction signal 320A which is coupled to the RF amplifier 306 to maintain a predetermined gain for the RF amplifier 306. The gain correction signal also couples to the second conversion section 314 to maintain a predetermined gain for the second conversion section 314. The maintenance of the gain of the RF amplifier 306 and the second conversion section 314 is required for proper reception of the high speed data information transmitted in the linear modulation format, and further distinguished the dual mode receiver of the present invention from a conventional FM receiver.

When the message information is transmitted in the FM modulation format, the second IF signal is coupled to the FM demodulator section 108, as will be explained in detail below. The FM demodulator section 108 demodulates the second IF signal in a manner well known to one of skill in the art, to provide a recovered data signal 108A which is a stream of binary information corresponding to the received address and message information transmitted in the FM modulation format. The recovered data signal 108A couples to the input of a microcomputer 106, which functions as a decoder and controller, through a single data input line of input/output port, or I/O port 328. The microcomputer 106 provides complete operational control of the communication receiver 300, providing such functions as decoding, message storage and retrieval, display control, and alerting, just to name a few. The microcomputer 106 is preferably a single chip microcomputer, such as the MC68HC05 microcomputer manufactured by Motorola, and includes a CPU 340 for operational control. An internal bus 330 connects each of the operational elements of the microcomputer 106. I/O port 328 (shown split in FIG. 3) provides a plurality of control and data lines providing communications to microcomputer 106 from external circuits, such as the battery saver switch 104, audio processor 114, a display 111, and digital storage 368. A timing means, such as timer 334 is used to generate the timing signals required for the operation of the communication receiver, such as for battery saver timing, alert timing and message storage and display timing. Oscillator 332 provides the clock for operation of CPU 340, and provides the reference clock for timer 334. RAM 338 is used to store information utilized in executing the various firmware routines controlling the operation of the communication receiver 300, and can also be used to store short messages, such as numeric messages. ROM 336 contains the firmware routines used to control the microcomputer 106 operation, including such routines as required for decoding the recovered data signal 322A, battery saver control, message storage and retrieval in the digital storage section 368, and general control of the pager operation and message presentation. An alert generator 342 provides an alerting signal 106G in response to decoding the FM modulated signalling information. A code memory 110

10/10/2005, EAST Version: 2.0.1.4

(not shown in FIG. 3) couples to microcomputer 106 through the I/O port 328. The code memory is preferably an EEPROM (Electrically Erasable Programmable Read Only Memory) which stores one or more predetermined addresses to which communication receiver 300 is responsive.

When the FM modulated signaling information is received, it is decoded by the microcomputer 106, functioning as a decoder in a manner well known to one skilled in the art. When the information in the recovered data signal 322A matches any of the stored predetermined addresses, the subsequently received information is decoded to determine if additional information is directed to the receiver which is modulated in the FM modulation format, or if the additional information is modulated in the linear modulation format. When the additional information is transmitted in the FM modulation format, the recovered message information is received and stored in the microcomputer RAM 338, or in the digital storage section 368, as will be explained in further detail below, and an alerting signal 106G is generated by alert generator 342. The alerting signal 106G is coupled to the audio processing circuit 344 which drives a transducer 346, delivering an audible alert. Other forms of sensible alerting, such as a tactile or vibrating alert, can also be provided to alert the user as well.

When additional information is to be transmitted in the linear modulation format, the microcomputer 106 decodes the pointer information. The microcomputer 106 maintains the operation of monitoring and decoding information transmitted in the FM modulation format, until the end of the current batch, at which time the supply of power is suspended to the receiver until the next assigned batch, or until the batch identified by the pointer is reached, during which high speed data is transmitted. The microcomputer 106, through I/O port 328 generates a battery saving control signal 106D which couples to battery saver switch 104 to suspend the supply of power to the FM demodulator 108, and to supply power to the linear demodulator 112, including linear output section 324, the quadrature demodulator 350, and the digital storage section 368, as will be described in detail below.

The second IF output signal, which now carries the high speed data information is coupled to the linear output section 324. The output of the linear output section 324 is coupled to the quadrature detector 350, specifically to the input of the third mixer 352. A third local oscillator also couples to the third mixer 352, which is preferably in the range of frequencies from 35-150 KHz, although it will be appreciated other frequencies may be utilized as well. The signal from the linear output section 324 is mixed with the third local oscillator signal 354, producing a third IF signal at the output of the third mixer 352, which is coupled to a third IF amplifier 356. The third IF amplifier is a low gain amplifier which buffers the output signal from the input signal. The third output signal is coupled to an I channel mixer 358 and a Q channel mixer 360. An I/Q oscillator 362 provides quadrature oscillator signals at the third IF frequency which are mixed with the third output signals in the I channel mixer 358 and the Q channel mixer 360, to provide baseband I channel signals and Q channel signals at the mixer outputs. The baseband I channel signal is coupled to low pass filter 364, and the baseband Q channel signal is coupled to low pass filter 366, to provide a pair of baseband audio signals which represent a stream of information symbol pairs corresponding to the encoded high speed data information.

The stream of information symbol pairs are coupled to the digital storage section 368, in particular to the inputs of an analog to digital (A/D) converter 370. The A/D converter 370 samples the pair of information symbols at a rate at least twice the highest frequency component (in Hz) at the output of 364 and 366. For three kilohertz voice information encoded on the I and Q channels, the sampling rate is preferably six kilohertz per I and Q channel, or twelve kilohertz in total. It will be appreciated, the data sampling rate indicated is for example only, and other sampling rates may be used depending upon the rate at which the message information is originally encoded.

During the batch during which the high speed data is transmitted, the microcomputer 106 provides a count enabling signal 106A which is coupled to the address counter 372. The A/D converter 370 is also enabled to allow sampling of the information symbol pairs. The A/D converter 370 generates high speed sample clock signals 370A which are used to clock the address counter 372 which in turn sequentially generates addresses for loading the sampled information symbol pairs into a dual port random access memory 374 through data lines 370B. The information symbol pairs which have been loaded at high speed into the dual port RAM 374 in real time, are processed by the microcomputer 106 after all high speed data has been received, thereby producing a significant reduction in the energy consumed by not requiring the microcomputer 106 to process the information in real time. The microcomputer 106 accesses the stored information symbol pairs through data lines 106C and address lines 106B, and in the preferred embodiment of the present invention, processes the information symbol pairs to generate either ASCII encoded information in the case of alphanumeric data having been transmitted, or CVSD encoded data in the case voice data was transmitted. Other data formats, such as a BCD data format for numeric messages or LPC encoded data format for voice messages, may be utilized as well. The ASCII encoded or CVSD encoded data is stored in the dual port RAM until the information is requested for presentation by the communication receiver user. The stored ASCII encoded data is recovered by the user using switches (not shown) to select and read the stored messages. When the stored ASCII encoded message is to be read, the user selects the message to be read and actuates a read switch which enables the microcomputer 106 to recover the data, and

10/10/2005, EAST Version: 2.0.1.4

to present the recovered data 106E to a display 111, such as a liquid crystal display. When a CVSD encoded message is to be read, the user selects the message to be read and actuates the read switch which enables the microcomputer 106 to recover the data from the dual port RAM, and to present the recovered data 106E to the audio processor 114 which functions as a CVSD decoder, converting the digital voice information into an analog voice signal which is coupled to a speaker 116 for presentation of the voice message to the user. The microcomputer 106 can also generate a frequency selection signal 106H which is coupled to frequency synthesizer 310 to enable the selection of different operating frequencies as described above.

FIG. 4 is an electrical block diagram showing details of the battery saving features of the dual mode communication receiver of the present invention. The microcomputer 106 controls the battery saving operation of the communication receiver through battery saver controls signals 106D coupled to the battery saver switch 104. The battery saver switch 104 enables power to be selectively supplied to the receiver section 102 via receiver supply line 104A, to the quadrature detector 350 via quadrature detector supply line 104B, to the digital storage section 368 via digital storage supply line 104C, to the FM demodulator section 108 which includes a data limiter 380 coupled to an FM demodulator 322 via FM demodulator supply line 104D, and to the linear output section 324 via linear output supply line 104E. Elements for selectively switching the supply of power to each of the receiver sections are well known, and include such switching devices as transistor switches and switched current source references, just to name a few. The microcomputer 106 controls the supply of power to the receiver section 102 which includes such elements as the RF amplifier 306, the first mixer 308, the frequency synthesizer 310, the IF filter 312, the second mixer 382, the second IF amplifier 384, the automatic gain control section 320, and the automatic frequency control section 316, and to the FM demodulator 108 during the transmission of FM modulated message information. The microcomputer 106 also controls the supply of power to the receiver section, the linear demodulator and the digital storage during the transmission of linearly modulated message information. The microcomputer 326 also controls the supply of power to the the digital storage section during the processing of the stored high speed message information, and during the reading of the stored message. In summary, the battery saver switch 104 under the control of the microcomputer 106, supplies power only to those circuits which are currently utilized in the receiving or processing of information, thereby minimizing the energy consumption of the battery.

FIGS. 5A and 5B are flow charts describing the operation of the dual mode communication receiver of the present invention. Referring to FIG. 5A, when the user turns power on to the receiver, at step 500, the microcomputer is initialized, at step 502, enabling the battery saving routine. Power is supplied to the receiver, at step 504, and is also supplied to the FM demodulator section, at step 506 to begin the preamble search and acquisition routine. The decoder monitors the information received on the channel, searching for a preamble signal, at step 508, or some other signal by which bit synchronization can be obtained. When a preamble signal, or other signal is not detected within a predetermined search window time interval, at step 508, the microcomputer suspends the supply of power to the receiver and to the FM demodulator, at step 510, and returns to the battery saving routine, at step 512, until the next time interval during which power is again supplied to the receiver and to the FM demodulator.

When preamble is detected, at step 508, and bit synchronization is obtained, in a manner well known in the art, the microcomputer begins the synchronization code word acquisition routine, at step 514. When the synchronization code word is not detected within a predetermined period of time, at step 514, the microcomputer suspends the supply of power to the receiver and to the FM demodulator, at step 510, and returns to the battery saving routine, at step 512, until the next time interval during which power is again supplied to the receiver and to the FM demodulator.

When the synchronization code word is detected, at step 514, corresponding to the batch to which the receiver is assigned, the microcomputer monitors the received address and message information, in order that any addresses and messages directed to the receiver can be detected, at step 516. When an address is not detected within the current batch, the microcomputer monitors the received signal for the synchronization code word, at step 514.

When an address is detected, at step 516, the microcomputer evaluates the next received code word, at step 518 to determine if the message information being transmitted is low speed or high speed message information. When the information transmitted is low speed message information, the microcomputer recalls information from the code memory identifying the received address as either a data address, or a tone only address, at step 520. When the address is a data address, at step 520, the message information following the address is stored, at step 522, and the user is alerted to indicate a message was received. When the address is identified as a tone only address, at step 520, the user is alerted to indicate a page was received. After having received and processed the message, at steps 522, or 524, the microcomputer returns to the battery saving routine, suspending the supply of power to the receiver, at step 510, when no other information is to be received in the current batch.

When the information received in the first modulation format indicates a high speed data message is to be received in the second modulation format, at step 518, the microcomputer decodes the data pointer, at step 526 of FIG. 5B. When the end of the current batch is detected, the supply of power to the FM demodulator

is suspended, at step 528. The microcomputer determines if the high speed message information is transmitted on the second channel, at step 530. The high speed message information is transmitted on the second channel in the arrangement claimed in appended claim 1. When the high speed message is transmitted on a second channel, the second channel is selected at step 532. When a second channel is not selected at step 530, or is selected at step 532, power is next supplied to the linear demodulator during the batch indicated by the pointer, at step 534, and to the digital storage section, at step 536. The microcomputer provides an enable signal to the address counter and to the D/A converter, at step 538, which enables the high speed sampling and storage of the received data, at step 540. When an end of message (EOM) character is received, or after a predetermined number of message bits have been received, at step 540, the user is alerted that a message has been received, at step 544. The microcomputer suspends the supply of power to the linear demodulator, at step 546. Power is maintained to the digital storage section during which time the received high speed data is processed. Upon the completion of the processing of the high speed message information, the supply of power is then suspended to the digital storage section, at step 548. The microcomputer determines if a second channel was selected for receiving the high speed message information at step 550. When a second channel was selected, at step 550, the microcomputer reselects the first channel at step 552. When the first channel was selected at steps 550 or 552, the microcomputer returns to the normal battery saving routine, at step 512 of FIG. 5A.

A dual mode receiver has been described which is capable of receiving addresses and messages which are transmitted in an FM modulation format, and further which is capable of receiving high speed data messages which are transmitted in a linear modulation format on either the same or a different radio frequency channel. The dual mode receiver includes a battery saving function which individually controls the supply of power to the FM demodulator, the linear demodulator, and to the digital storage section, thereby minimizing the supply of power being consumed during normal receiver operation in the FM modulation mode. When high speed message information is being received, the digital storage section samples and stores the high speed message information in real time, after which the stored message information is processed by the microcomputer decoder to prepare the information for display.

While specific embodiments of this invention have been shown and described, further modifications and improvements will occur to those skilled in the art. All modifications which retain the basic underlying principles disclosed and claimed herein are with the scope of the present invention.

Claims

1. A dual mode communication receiver, characterised by

   means(102) for receiving information transmitted in a first and second modulation format, and
   first means (108) for detecting information transmitted in an FM modulation format on a first channel; and
   second means(112), responsive to the information detected in the FM modulation format, for detecting information transmitted in a predetermined batch in a linear modulation format on a second channel.

2. The dual mode communication receiver according to claim 1, wherein the first means (108) detects message pointer information transmitted on the first channel.

3. The dual mode communication receiver according to claim 1 or claim 2, wherein the FM modulation format is frequency shift keyed FM modulation.

4. The dual mode communication receiver according to any previous claim, wherein the linear modulation format is spectrally efficient data modulation (SEDM).

5. The dual mode communication receiver according to any of claims 1-3, wherein the linear modulation format is quadrature amplitude modulation (QAM).

6. The dual mode communication receiver according to any previous claim further comprising:

   third means (104) for supplying power to said receiving means (102) for enabling the receiving of the information transmitted in the first and second modulation formats, said third means (104) further supplying power to said first means (108) for enabling the detecting of the information transmitted in the FM modulation format;
   said third means (104) further, in response to the information detected in the FM modulation format, for supplying power to said second means (112) for enabling the detecting of the information transmitted in the linear modulation format.

7. A communication system comprising a mixture of communication receivers, the mixture of communication receivers comprising FM paging receivers which receive information on the first channel and dual mode communication receivers according to any previous claim.

10/10/2005, EAST Version: 2.0.1.4

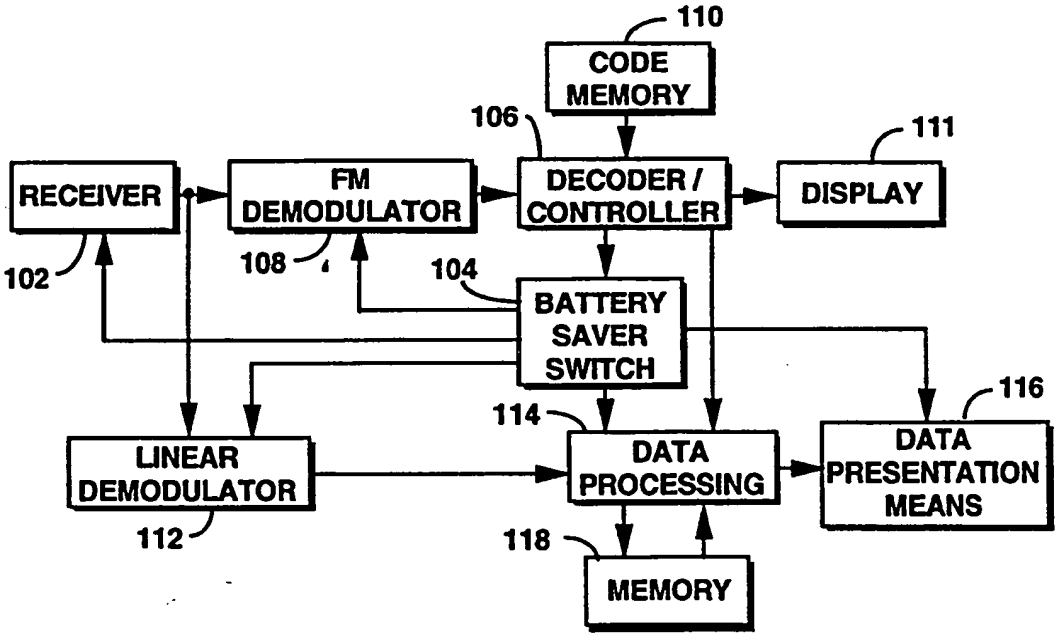

110
CODE MEMORY
106
111
RECEIVER
FM DEMODULATOR
DECODER / CONTROLLER
DISPLAY
102
108
104
BATTERY SAVER SWITCH
116
114
LINEAR DEMODULATOR
DATA PROCESSING
DATA PRESENTATION MEANS
112
118
MEMORY

FIG. 1

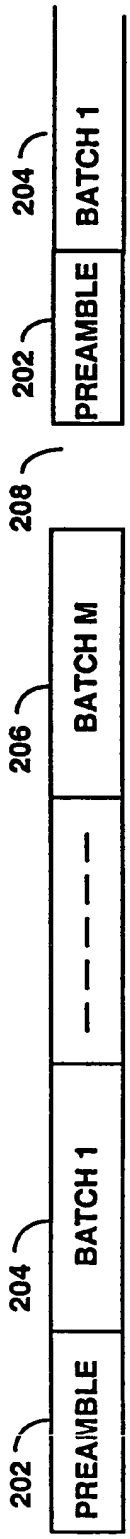


FIG. 2A

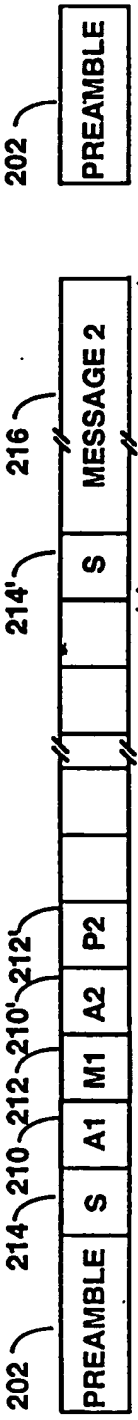


FIG. 2B

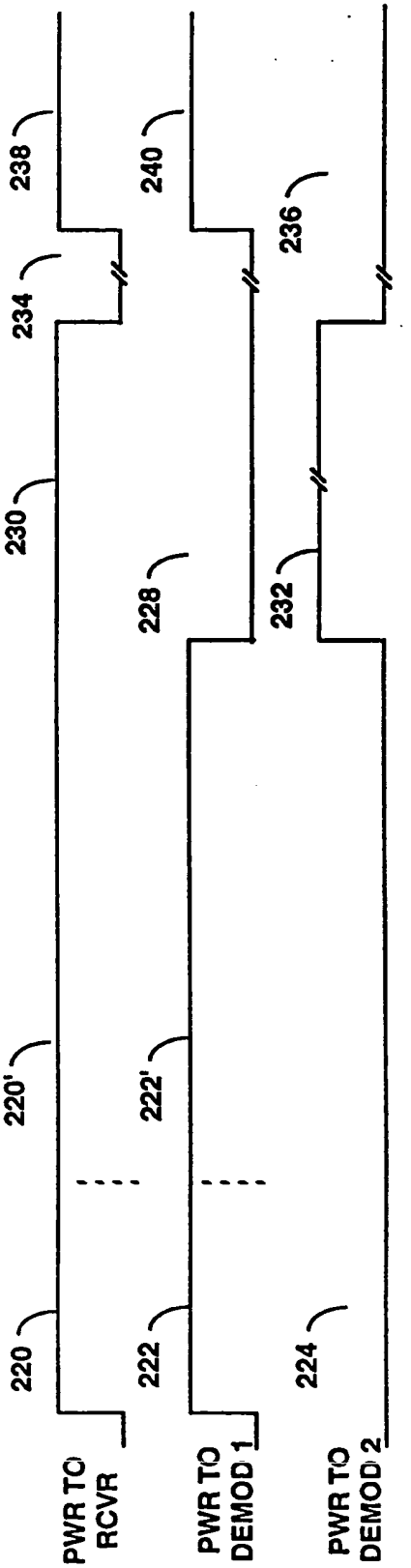


FIG. 2C

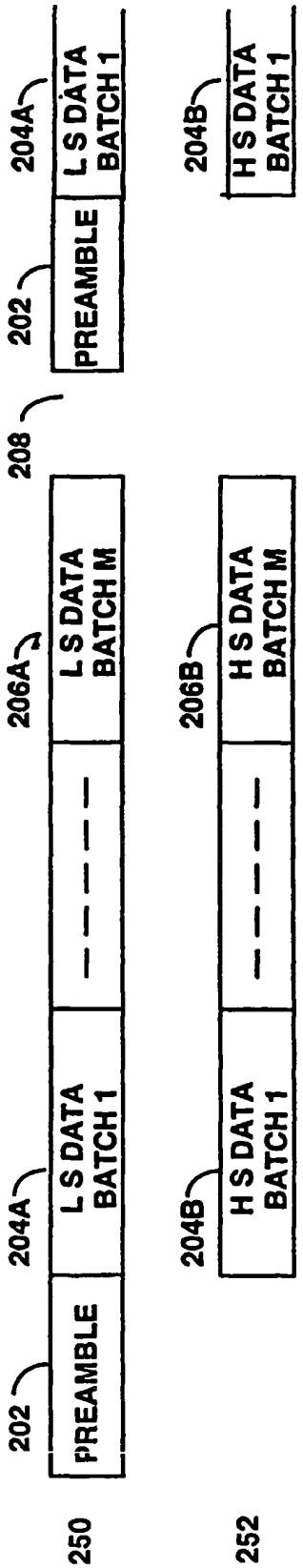

250
252
202
PREAMBLE
204A
LS DATA BATCH 1
206A
LS DATA BATCH M
208
204B
HS DATA BATCH 1
206B
HS DATA BATCH M

FIG. 2D

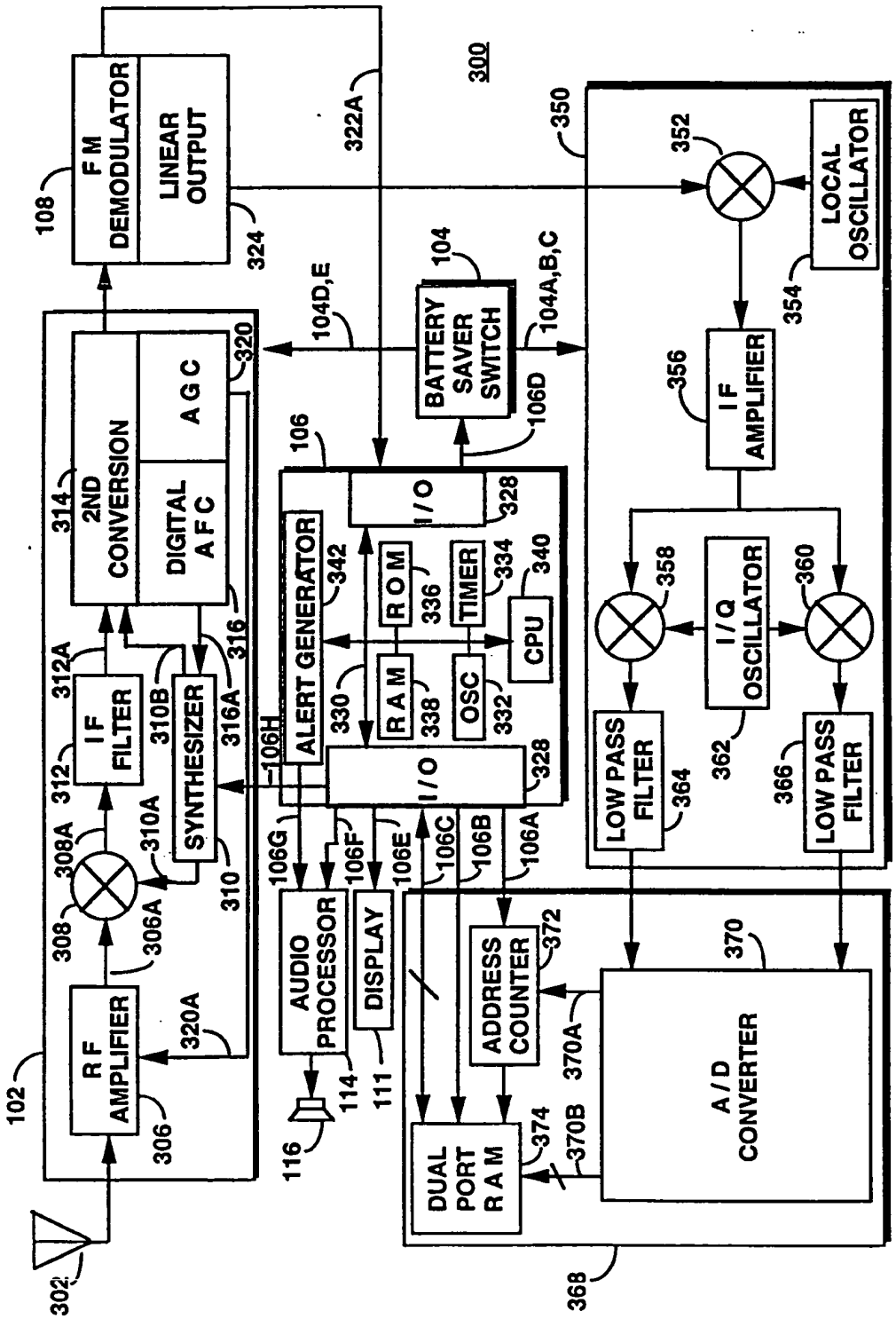

300
F M DEMODULATOR
LINEAR OUTPUT
108
324
322A
350
352
LOCAL OSCILLATOR
354
BATTERY SAVER SWITCH
104
104A,B,C
104D,E
106D
106
I/O
328
ALERT GENERATOR
342
ROM
336
TIMER
334
340
CPU
RAM
338
OSC
332
330
I/O
328
106H
106G
106F
106E
106C
106B
106A
2ND CONVERSION
AGC
DIGITAL AFC
314
320
316
312A
IF FILTER
312
310B
SYNTHESIZER
316A
310A
310
308A
308
306A
RF AMPLIFIER
306
320A
102
302
AUDIO PROCESSOR
DISPLAY
114
111
116
ADDRESS COUNTER
372
DUAL PORT RAM
374
370A
370B
A/D CONVERTER
370
368
IF AMPLIFIER
356
I/Q OSCILLATOR
358
360
362
LOW PASS FILTER
364
LOW PASS FILTER
366

FIG. 3

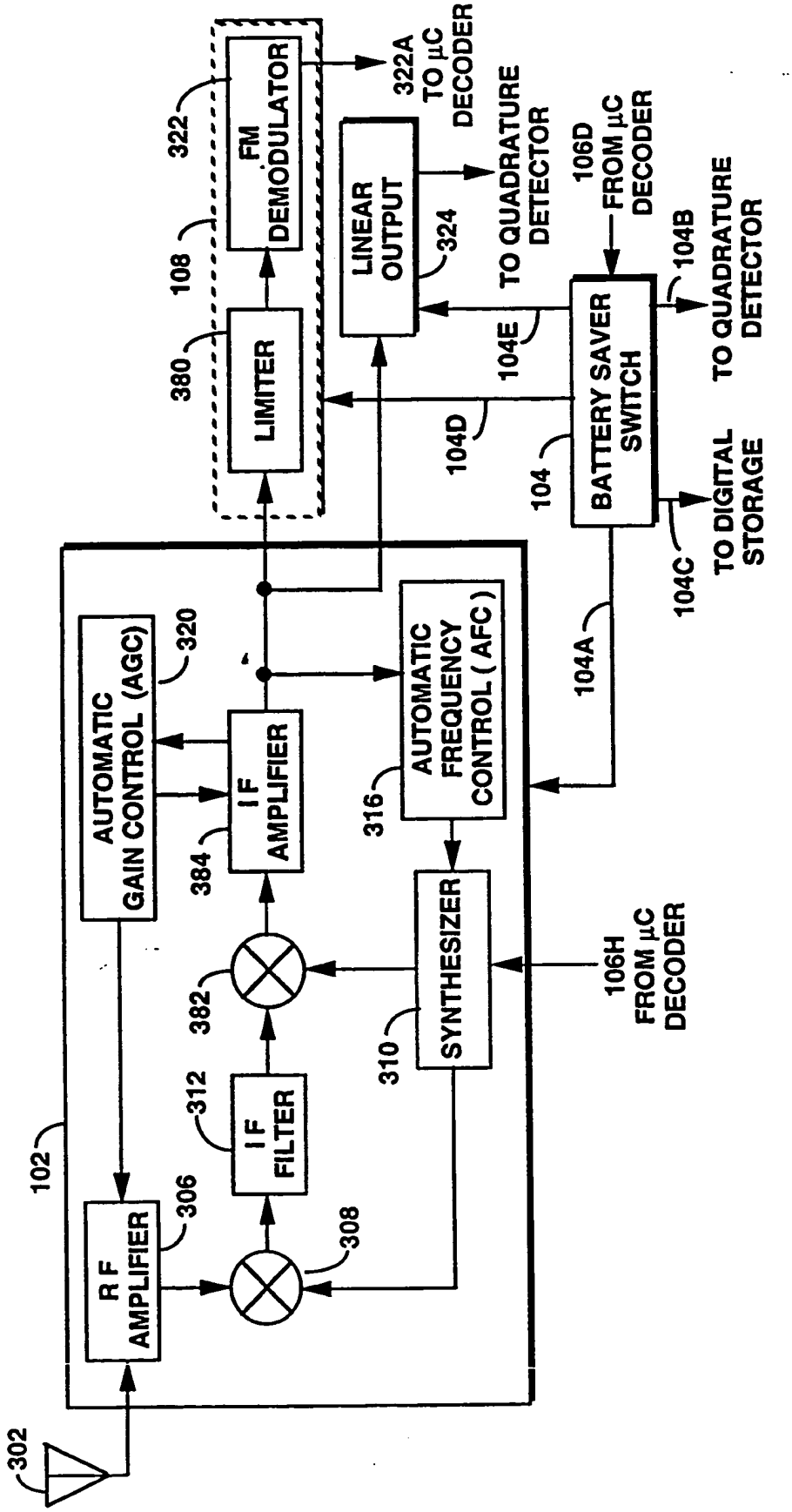

302
102
RF AMPLIFIER
306
IF FILTER
312
308
382
384
IF AMPLIFIER
AUTOMATIC GAIN CONTROL (AGC)
320
SYNTHESIZER
310
AUTOMATIC FREQUENCY CONTROL (AFC)
316
106H FROM µC DECODER
104A
380
LIMITER
108
FM DEMODULATOR
322
322A TO µC DECODER
LINEAR OUTPUT
324
TO QUADRATURE DETECTOR
104E
104D
104
BATTERY SAVER SWITCH
106D FROM µC DECODER
104B
TO QUADRATURE DETECTOR
104C
TO DIGITAL STORAGE

FIG. 4

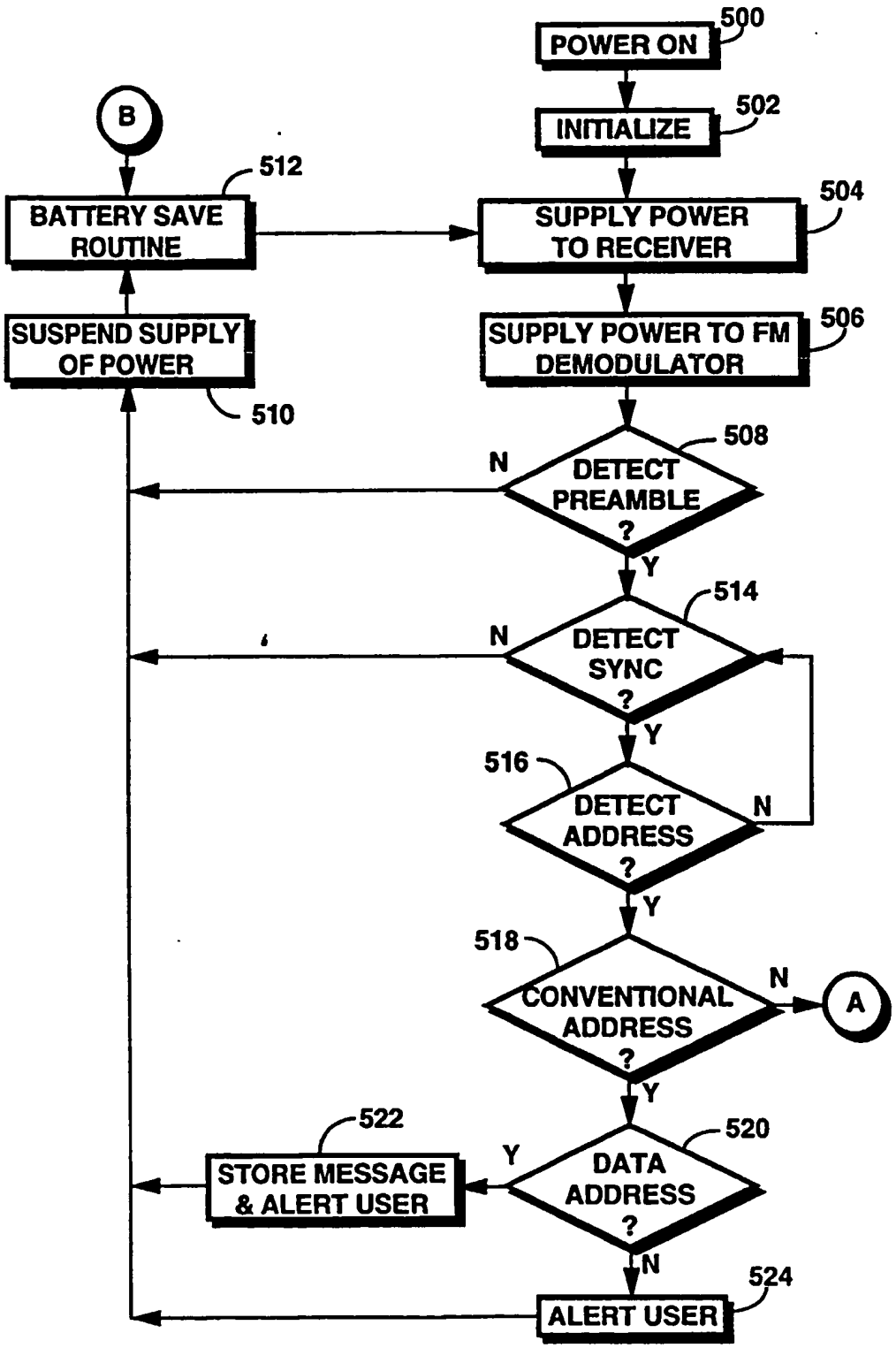

POWER ON
500
INITIALIZE
502
SUPPLY POWER TO RECEIVER
504
SUPPLY POWER TO FM DEMODULATOR
506
DETECT PREAMBLE ?
508
N
Y
DETECT SYNC ?
514
N
Y
DETECT ADDRESS ?
516
N
Y
CONVENTIONAL ADDRESS ?
518
N
A
Y
DATA ADDRESS ?
520
Y
STORE MESSAGE & ALERT USER
522
N
ALERT USER
524
SUSPEND SUPPLY OF POWER
510
BATTERY SAVE ROUTINE
512
B

FIG. 5A

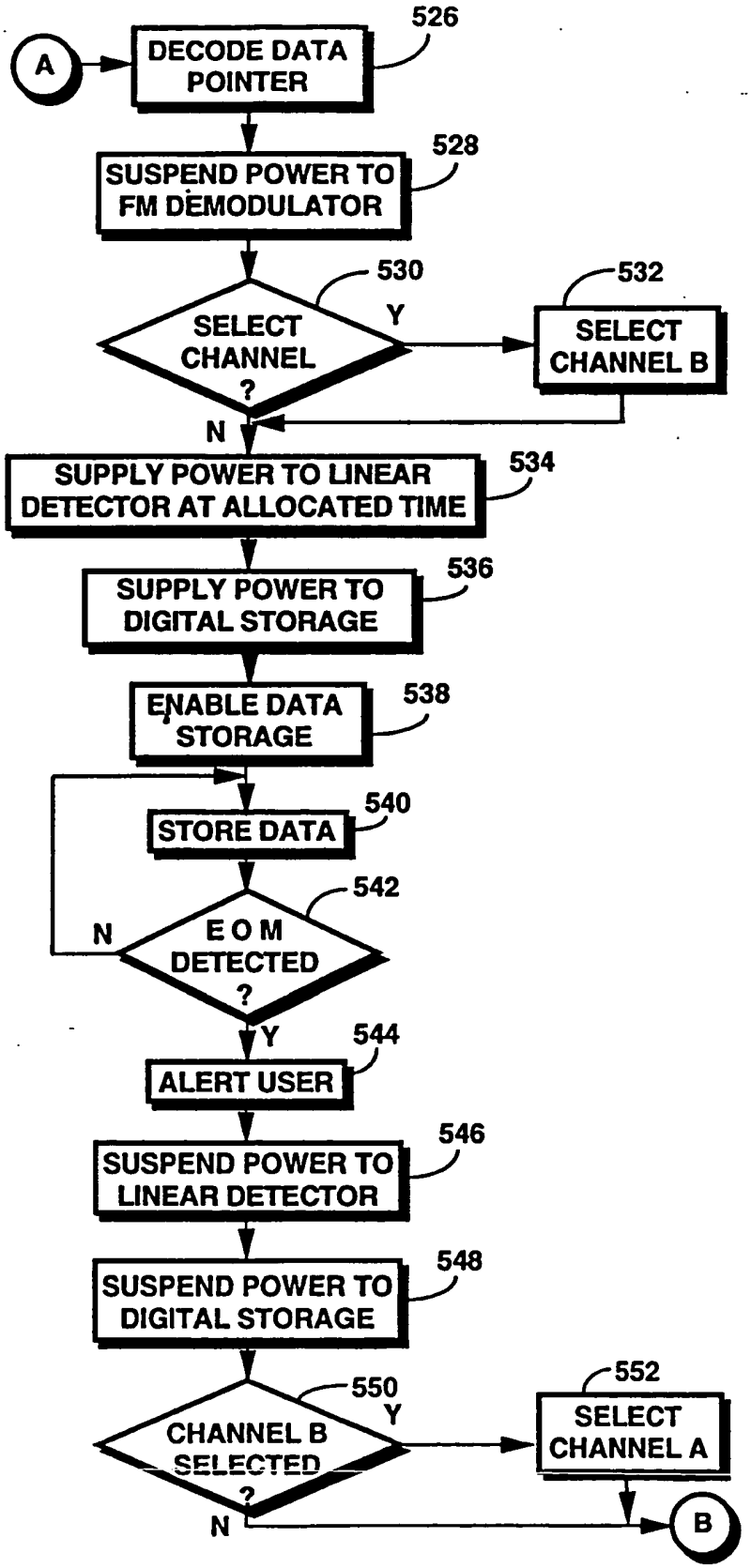

A
DECODE DATA POINTER
526
SUSPEND POWER TO FM DEMODULATOR
528
SELECT CHANNEL ?
530
Y
SELECT CHANNEL B
532
N
SUPPLY POWER TO LINEAR DETECTOR AT ALLOCATED TIME
534
SUPPLY POWER TO DIGITAL STORAGE
536
ENABLE DATA STORAGE
538
STORE DATA
540
E O M DETECTED ?
542
N
Y
ALERT USER
544
SUSPEND POWER TO LINEAR DETECTOR
546
SUSPEND POWER TO DIGITAL STORAGE
548
CHANNEL B SELECTED ?
550
Y
SELECT CHANNEL A
552
N
B

FIG. 5B

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 1219

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/839,726	04/20/2001 RULE	455	2682	WEST14-00014

APPLICANTS

Paul F. Struhsaker, Plano, TX;
Russell C. McKown, Richardson, TX;

** CONTINUING DATA **********

THIS APPLN CLAIMS BENEFIT OF 60/262,825 01/19/2001

** FOREIGN APPLICATIONS **********

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 06/14/2001

** SMALL ENTITY **

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☒ no	TX	4	20	2
35 USC 119 (a-d) conditions met: ☐ yes ☒ no ☐ Met after Allowance				
Verified and Acknowledged: Examiner's Signature / Initials				

ADDRESS

William A. Munck, Esq.
NOVAKOV DAVIS & MUNCK, P.C.
900 Three Galleria Tower
13155 Noel Road
Dallas , TX 75240

TITLE

Apparatus and associated method for operating upon data signals received at a receiving station of a fixed wireless access communication system

FILING FEE RECEIVED		
355	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
09/839,726	STRUHSAKER ET AL.
Examiner	**Art Unit**
Erin M. File	2634

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date								
Final	Original	10/10/05								
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	2	√								
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Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination
09/839,726	STRUHSAKER ET AL.
Examiner	**Art Unit**
Erin M. File	2634

SEARCHED			
Class	Subclass	Date	Examiner
375	222	10/10/2005	EMF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST US PAT, USPGPUB, EPO, JPO DERWENT, IBM (text search only— see search history printout)	10/10/2005	EMF

TFW 2634

DOCKET NO. WEST14-00014 PATENT
Customer No. 23990

OIPE JAP62
MAR 16 2006
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

AMENDMENT AND RESPONSE TO OFFICE ACTION

A fee of $100.00 for one (1) independent claim in excess of three is believed to be required.

A two month extension of time is believed to be required. An appropriate petition and fee ($225.00) are enclosed.

No further fees are believed to be required. However, in the event that any additional fee are required for prosecution of this application, please charge the fee to Deposit Account No. 50-0208. No further extension of time is believed to be required. However if an additional extension of time is required for prosecution of this application, such extension is respectfully requested and please charge the fee for such extension to Deposit Account No. 50-0208.

In response to the Office Action dated October 17, 2005, please amend the above-identified application as follows:

03/17/2006 LWONDIM1 00000002 09839726 100.00 OP
01 FC:2201

AMENDMENTS TO THE CLAIMS:

Please cancel claims 4–5 and 20 without prejudice. Please amend the remaining claims as follows, substituting any amended claim(s) for the corresponding pending claim(s):

1. (Currently Amended) Apparatus for a communication station operable in a wireless communication system at least to receive first and second data signals successively transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations, ~~said~~ the apparatus comprising:

a first demodulator selectably coupled to receive the first data signals transmitted to the communication station;

at least a second demodulator also selectably coupled to receive the second data signals transmitted to the communication station; and

a controller, coupled to ~~said~~ the first demodulator and to ~~said~~ the at least second demodulator in a feedback arrangement, ~~said~~ the controller alternately selecting the first data signal for application to ~~said~~ the first demodulator and the second data signal for application to ~~said~~ the second demodulator,

wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein the controller selectively applies the first and second data signals to the first and second demodulators according to a selected pattern by alternately coupling the first demodulator and the second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

2. (Currently Amended) The apparatus of Claim 1 wherein the wireless communication system comprises a fixed wireless access system, wherein the communication station comprises a base station of the fixed wireless access system in which the data signals transmitted thereto by the first subscriber station comprise first uplink burst data signals and the data signals transmitted thereto by the second subscriber station comprise second uplink burst data signals, ~~said~~ the first demodulator embodied at a first modem.

3. (Currently Amended) The apparatus of Claim 2 wherein ~~said~~ the second demodulator is embodied at a second modem.

4. (Canceled).

5. (Canceled).

6. (Currently Amended) ~~The apparatus of Claim 1~~ Apparatus for a communication station operable in a wireless communication system at least to receive first and second data signals successively transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations, the apparatus comprising:

a first demodulator selectably coupled to receive the first data signals transmitted to the communication station;

at least a second demodulator also selectably coupled to receive the second data signals transmitted to the communication station; and

a controller, coupled to the first demodulator and to the at least second demodulator in a feedback arrangement, the controller alternately selecting the first data signal for application to the first demodulator and the second data signal for application to the second demodulator,

wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein ~~said~~ the controller further determines times of arrival and time directions of the bursts which form the data signals.

7. (Currently Amended) ~~The apparatus of Claim 1~~ Apparatus for a communication station operable in a wireless communication system at least to receive first and second data signals successively transmitted thereto by a first subscriber station and a second subscriber station, respectively, within a plurality of subscriber stations, the apparatus comprising:

a first demodulator selectably coupled to receive the first data signals transmitted to the communication station;

at least a second demodulator also selectably coupled to receive the second data signals transmitted to the communication station; and

a controller, coupled to the first demodulator and to the at least second demodulator in a feedback arrangement, the controller alternately selecting the first data signal for application to the first demodulator and the second data signal for application to the second demodulator,

wherein ~~said~~ the controller further comprises a memory portion, ~~said~~ the controller further for maintaining profiles associated with each of the first and at least second data signals transmitted upon first and at least second channels, respectively, the profiles stored at the memory portion of ~~said~~ the controller.

8. (Original) The apparatus of claim 7 wherein the profiles maintained at the memory portion of ~~said~~ the controller comprise at least one channel-related parameter associated with the first and at least second channels upon which the first and at least second data signals are communicated, respectively.

9. (Currently Amended) The apparatus of claim 8 wherein ~~said~~ the first demodulator and ~~said~~ the second demodulator each include equalizer portions for equalizing the at least one of the first and second data signals selectably applied to ~~said~~ the first demodulator and ~~said~~ the second demodulator, respectively.

10. (Currently Amended) The apparatus of claim 9 wherein the filter weight values form portions of the profiles maintained by ~~said~~ the controller and stored at the memory portion thereof.

11. (Currently Amended) The apparatus in claim 7 wherein the profiles maintained at the memory portion of ~~said~~ the controller comprise at least one signal-related parameter associated with the first and at least second data signals, respectively.

12. (Currently Amended) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation indexes, and wherein values of the modulation indexes form portions of the profiles maintained by ~~said~~ the controller and stored at the memory portion of ~~said~~ the controller.

13. (Currently Amended) The apparatus of claim 11 wherein the first and at least second data signals are characterized by modulation orthogonalizations and wherein values of the modulation orthogonalizations form portions of the profiles maintained by ~~said~~ the controller and stored at the memory portion of ~~said~~ the controller.

14. (Currently Amended) The apparatus of claim 11 wherein the first and at least second data signals include FEC (forward error correction), the FEC characterized by FEC parameters and wherein values of the FEC parameters form portions of the profiles maintained by ~~said~~ the controller and stored at the memory portion of ~~said~~ the controller.

15. (Currently Amended) The apparatus of claim 7 wherein the communication station to which the first and at least second data signals are transmitted by the first ant at least second subscriber stations, respectively, exhibits antenna diversity provided by a first antenna transducer and at least a second antenna transducer, the first and at least second data signals transduced by the first and at least second antenna transducer, respectively, combined utilizing antenna combining parameters, and wherein the antenna combining parameters form portions of the profiles maintained by ~~said~~ the controller and stored at the memory portion of ~~said~~ the controller.

16. (Currently Amended) The apparatus of Claim 7 wherein profiles maintained by ~~said~~ the controller and stored at the memory portion thereof comprise values of Band timing adjustments by which to adjust the first and at least second data signals.

17. (Currently Amended) The apparatus of Claim 7 wherein profiles maintained by ~~said~~ the controller and stored at the memory portion thereof comprise values of residual carrier adjustments by which to adjust the first and at least second data signals.

18. (Currently Amended) A method for acting upon first and second successive data signals transmitted to a communication station operable in a wireless communication system by a first subscriber station and at least a second subscriber station, ~~said~~ the method comprising:

selecting at which of a first demodulator and at least a second demodulator to apply at least one of the first data signals and the second data signals, wherein the first and second successive data signals and any subsequent data signals are alternately applied to the first and second demodulators;

demodulating the at least one of the first and at least second data signals at the first demodulator when the first demodulator is selected during ~~said~~ the operation of selecting; and

demodulating the at least one of the first and at least second data signals at the second demodulator when the second demodulator is selected during ~~said~~ the operation of selecting; and

maintaining profiles associated with each of the first and at least second data signals transmitted upon the first and at least second channels, respectively, and wherein ~~said~~ the operations of demodulating further comprise accessing the profiles.

19. (Currently Amended) The method of claim 18 wherein selections made during ~~said~~ the operation of selecting are made according to a selected pattern.

20. (Canceled).

REMARKS

Claims 1–3 and 6–19 are pending in the present application.

Claims 4–5 and 20 have been canceled. Claims 1–3 and 6–19 were amended herein.

Claims 5–17 and 20 were objected to as being based upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all limitations of the base claim and any intervening claims. Claim 1 has been amended herein to incorporate all limitation(s) of claim 5, including the limitation(s) of claim 4. Claims 6–7 were rewritten in independent form to include all limitations of the base claim (claim 1). Claim 18 was amended to incorporate all limitations of claim 20.

Reconsideration of the claims is respectfully requested.

35 U.S.C. § 102 (Anticipation)

Claims 1–3 and 18–19 were rejected under 35 U.S.C. § 102(b) as being anticipated by EP 0 792 030 to *Siwiak et al.* This rejection is respectfully traversed.

A claim is anticipated only if each and every element is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as complete detail as is contained in the claim. MPEP § 2131 at p. 2100-76 (8th ed. rev. 3 August 2005).

Independent claims 1 and 18 each recite a controller coupled to the first and second demodulators in a feedback arrangement and alternately selecting the first and second data signals for application to the first and second demodulator, respectively, where the first and second data signals are successively transmitted by first and second subscriber stations. Such a feature is not found in the cited reference. *Siwiak et al* discloses a receiver 102 detecting whether a received signal

was transmitted in a frequency modulated (FM) modulation format or a linear modulation (e.g., quadrature amplitude modulation or "QAM") format, and applying an appropriate demodulator 108 or 112. However, *Siwiak et al* does not teach alternately applying the demodulators to signals alternately transmitted by different stations, as recited in the claims.

Therefore, the rejection of claims 1–3 and 18–19 under 35 U.S.C. § 102 has been overcome.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***dvenglarik@davismunck.com***.

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK BUTRUS, P.C.

Date: 3-13-06

Daniel E. Venglarik
Registration No. 39,409

P.O. Drawer 800889
Dallas, Texas 75380
(972) 628-3621 (direct dial)
(972) 628-3600 (main number)
(972) 628-3616 (fax)
E-mail: *dvenglarik@davismunck.com*

OTRE
MAR 16 2006
PATENT & TRADEMARK OFFICE

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

PETITION FOR EXTENSION OF TIME

Applicant respectfully requests a two (2) month extension of time for filing a response to the Office Action mailed October 17, 2005. The response period is presently set to expire on January 17, 2006, and if this Petition for Extension of Time is granted, the new response date will be March 17, 2006.

A check in the amount of $325.00 is enclosed for one additional independent claim fee and two (2) month extension fee ($225.00). The Commissioner is hereby authorized to charge any

03/17/2006 LWONDIM1 00000002 09839726
02 FC:2252 225.00 OP

additional fees which may be required, or credit any overpayment to Davis Munck Deposit Account No. 50-0208.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 3-13-06

Daniel E. Venglarik
Registration No. 39,409

P.O. Drawer 800889
Dallas, Texas 75380
Tel: (972) 628-3600
FAX: (972) 628-3616
email: dvenglarik@davismunck.com

OIPE IAP62
MAR 16 2006
PATENT & TRADEMARK OFFICE

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Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

Sir:

The undersigned hereby certifies that the following documents:

1. Amendment Transmittal Letter (in duplicate);
2. Amendment and Response to Office Action;
3. Petition for Extension of Time - two months (in duplicate);
4. Check in the amount of $325.00 for one additional independent claims fee ($100.00) and two-month extension fee ($225.00); and
5. A postcard receipt;

relating to the above application, were deposited as "First Class Mail" with the United States Postal Service, addressed to MAIL STOP AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on March 13, 2006.

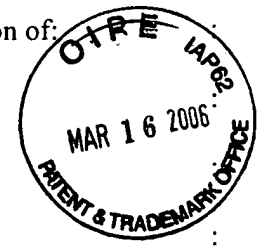
Date: 3/13/06 Kathy Cedar
Mailer

Date: 3-13-06 Daniel E. Venglarik
Reg. No. 39,409

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
E-mail: *dvenglarik@davismunck.com*

DOCKET NO. WEST14-00014 **PATENT**
Customer No. 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



In re application of:	:	Paul F. Struhsaker, et al.
Serial No.	:	09/839,726
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Group No.	:	2634
Examiner	:	Erin M. File

MAIL STOP AMENDMENT
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

AMENDMENT TRANSMITTAL LETTER

Transmitted herewith is an Amendment and Response to Office Action in the above-identified application. The fee has been calculated as shown below.

CLAIMS AS AMENDED					SMALL ENTITY	
(1)	(2) CLAIMS REMAINING AFTER AMENDMENT	(3)	(4) HIGHEST NUMBER PREVIOUSLY PAID FOR	(5) NUMBER OF EXTRA CLAIMS PRESENT	(6) RATE	(7) ADDITIONAL FEE
TOTAL CLAIMS	17	-	20	-0-	X 25.00 =	$-0-
IND. CLAIMS	4	-	3	1	X 100.00 =	$100.00
			TOTAL ADDITIONAL FEE FOR THIS AMENDMENT			$100.00

✔ A check in the amount of $325.00 is enclosed for one additional independent fee ($100.00) and two-month extension fee ($225.00).

____ A check in the amount of $_____ for a _____-month extension of time is attached.

✔ Please charge any additional fees or credit any overpayment to the Davis Munck Deposit Account No. 50-0208.

A DUPLICATE COPY OF THIS SHEET IS ENCLOSED.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 3-13-06

Daniel E. Venglarik
Registration No. 39,409

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
Email: dvenglarik@davismunck.com

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number
09/839,726
WEST 14-00014

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	20	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐			OTHER THAN SMALL ENTITY	
RATE	FEE	OR	RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL	355	OR	TOTAL	

CLAIMS AS AMENDED - PART II

12-27-04

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	= 1
Independent	* 2	Minus	*** 3	= 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY			OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

7/13/05

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 20	Minus	** 20	= 1
Independent	* 3	Minus	*** 3	= 1
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY			OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

3/23/06

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 17	Minus	** 20	= 0
Independent	* 4	Minus	*** 3	= 1
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY			OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
~~X40=~~ 100	100	OR	~~X80=~~	
+135=		OR	+270=	
TOTAL ADDIT. FEE	100	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.

FORM PTO-875 (Rev. 8/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
U.S. GPO: 2000-469-[illegible]/00163

BEST AVAILABLE COPY

Interference Search – 09/839,726

WEST Search History

Hide Items | Restore

DATE: Friday, March 24, 2006

Hide?	Set Name	Query	Hit Count
	DB=USPT; PLUR=YES; OP=OR		
☐	L4	(second adj modem and pattern).clm.	19
☐	L3	(second adj modem and second adj (data signal) and pattern).clm.	2
☐	L2	(second adj demodulat$3 and pattern).clm.	49
☐	L1	(second adj demodulat$3 and second adj (data signal) and pattern).clm.	13

END OF SEARCH HISTORY

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	175	first adj demodulator same second adj demodulator same (select selectively selecting switch switching)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:17
S2	32	first adj demodulator same second adj demodulator same (select selectively selecting switch switching) and pattern	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:17
S3	2622	375/222.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/10 21:52
S4	2737	375/222.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/24 11:26
S5	1393	379/90.01.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/24 11:26
S6	1188	710/1.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/24 11:26
S7	1379	375/219.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/24 11:27
S8	2	("20050083998").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/03/24 12:07

EAST Search History

S9	2	("20040153679").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/03/24 12:07
S10	35	first adj demodulator same second adj demodulator same (select selectively selecting switch switching) and pattern	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/24 12:47
S11	1617	455/21,293,312,337.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/31 12:22

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 04/05/2006

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

EXAMINER	
FILE, ERIN M	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 04/05/2006

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

TITLE OF INVENTION: APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	07/05/2006

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

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.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 04/05/2006

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
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.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

TITLE OF INVENTION: APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	07/05/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
FILE, ERIN M	2611	375-222000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information 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.

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.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

7590 04/05/2006

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

EXAMINER	
FILE, ERIN M	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 04/05/2006

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 741 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 741 day(s).

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 Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Ex.1002.00429

Notice of Allowability	Application No.	Applicant(s)	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Erin M. File	2611	

-- 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 *3/16/2006*.

2. ☒ The allowed claim(s) is/are *1-3,6-19, renumbered as claims 1-17*.

3. ☐ 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 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 EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ 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. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

JEAN B. CORRIELUS
PRIMARY EXAMINER
4-3-06

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Daniel Venglarik on March 31, 2006.

The application has been amended as follows:

Specification, page 1, line 11, "Docket No. WEST14-00005" has been changed to -- 60/262,712--.

Specification, page 1, line 14, "Docket No. WEST14-00015" has been changed to -- 60/262,698--.

Specification, page 1, line 17, "Docket No. WEST14-00016" has been changed to -- 60/262,827--.

Specification, page 1, line 20, "Docket No. WEST14-00017" has been changed to -- 60/262,826--.

Specification, page 2, line 2, "Docket No. WEST14-00018" has been changed to -- 60/262,951--.

Specification, page 2, line 5, "Docket No. WEST14-00019" has been changed to --60/262,824--.

Specification, page 2, line 8, "Docket No. WEST14-00020" has been changed to --60/263,101--.

Specification, page 2, line 12, "Docket No. WEST14-00021" has been changed to --60/263,097--.

Specification, page 2, line 15, "Docket No. WEST14-00022" has been changed to --60/273,579--.

Specification, page 2, line 19, "Docket No. WEST14-00023" has been changed to --60/262,955--.

Specification, page 2, line 21, "Docket No. WEST14-00024" has been changed to --60/262,708--.

Specification, page 3, line 2, "Docket No. WEST14-00026" has been changed to --60/273,689--.

Specification, page 3, line 4, "Docket No. WEST14-00027" has been changed to --60/273,757--.

Specification, page 3, line 8, "Docket No. WEST14-00028" has been changed to --60/270,378--.

Specification, page 3, line 11, "Docket No. WEST14-00029" has been changed to --60/270,385--.

Specification, page 3, line 15, "Docket No. WEST14-00030" has been changed to --60/270,430--.

Specification, page 3, line 18, "Docket No. WEST14-00033" has been changed to – 09/839,513--.

Claim 1, line 1, "Apparatus" has been changed to --An apparatus--.

Claim 1, line 10, "signal" has been changed to --signals--.

Claim 1, line 11, "signal" has been changed to --signals--.

6 (amended). An apparatus [Apparatus] for a communication station operable in a wireless communication system at least to receive first and second data signals successively transmitted thereto by a first subscriber station a second subscriber station, respectively, within a plurality of subscriber stations, the apparatus comprising:

a first demodulator selectably coupled to receive the first data signals transmitted to the communication station;

at least a second demodulator also selectably coupled to receive the second data signals transmitted to the communication station; and

a controller, coupled to the first demodulator and to the at least second demodulator in a feedback arrangement, the controller alternately selecting the first data signals for application to the first demodulator and the second data signals for application to the second demodulator,

wherein the first and at least second data signals transmitted to the communication station by the first and at least second subscriber stations are transmitted in bursts of selected time durations and wherein the controller further determines times of arrival and time directions of the bursts which form the data signals[.],

wherein the at least the second subscriber station comprises a plurality of subscriber stations and wherein said controller selectively applies the first and second data signals to the first and second demodulators according to a selected pattern by alternately coupling the first demodulator and the second demodulator to receive, selectably, the first and at least second data signals communicated by alternating ones of the plurality of subscriber stations.

Claim 7, line 10, "signal" has been changed to --signals--.

Claim 7, line 11, "signal" has been changed to --signals--.

Claim 10, line 1, "wherein the" has been changed to --wherein--.

2. The following is an examiner's statement of reasons for allowance:

The limitation of first and second demodulators selectably coupled to receive first second data signals transmitted by a first subscriber station and a second subscriber station, and a controller selecting which of the first and second data signals, are applied to first and second demodulators, wherein the second subscriber station comprises a plurality of subscriber stations and the controller selects to which of said first demodulator and said second demodulator that the first and second data signals are applied according to a selected pattern is not found in the prior art of record.

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."

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin M. File whose telephone number is (571)272-6040. The examiner can normally be reached on M-F 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on (571) 272-3021. 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).

Erin M. File

EF

4/3/2006

JEAN B. CORRIELUS
PRIMARY EXAMINER
4-3-06

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Erin M. File	2611	

All Participants:

(1) *Erin M. File*.

(2) *Daniel Venglarik, Reg. No. 39,409*.

Status of Application: *pending*

(3) _____.

(4) _____.

Date of Interview: *3 April 2006*

Time: *10:35 AM*

Type of Interview:
☒ Telephonic
☐ Video Conference
☐ Personal (Copy given to: ☐ Applicant ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes ☐ No
If Yes, provide a brief description:

Part I.

Rejection(s) discussed:
6

Claims discussed:
1,6,7

Prior art documents discussed:
U.S. Patent No. 6,088,593

Part II.

SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:
See Continuation Sheet

Part III.

☒ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.
☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

(Examiner/SPE Signature)

(Applicant/Applicant's Representative Signature – if appropriate)

Continuation of Substance of Interview including description of the general nature of what was discussed: Examiner indicated that reference has been found covering subject matter previously indicated allowable material in Claim 6. Attorney proposed further limitation to make this claim allowable. Examiner further asked for changes for claim informalities in claims 1, 6, and 7, which were found agreeable to the attorney.

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	09/839,726	STRUHSAKER ET AL.	
	Examiner	Art Unit	
	Erin M. File	2611	

ISSUE CLASSIFICATION

ORIGINAL CLASS	ORIGINAL SUBCLASS		CROSS REFERENCE(S) CLASS	CROSS REFERENCE(S) SUBCLASS (ONE SUBCLASS PER BLOCK)						
375	222		375	219						
INTERNATIONAL CLASSIFICATION			710	1						
H 04 B	1/38		379	90.01						
H 04 L	5/16		455	21	293	312	337			
	/									
	/									
	/									

Erin M. File 3/31/2006
(Assistant Examiner) (Date)

(Legal Instruments Examiner) 4/4/06 (Date)

JEAN B. CORRIELUS
PRIMARY EXAMINER
(Primary Examiner) (Date) 4-3-06

Total Claims Allowed: 17

O.G. Print Claim(s)	O.G. Print Fig.
1	3

☒ 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
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
4	6		36		66		96		126		156		186
5	7		37		67		97		127		157		187
6	8		38		68		98		128		158		188
7	9		39		69		99		129		159		189
8	10		40		70		100		130		160		190
9	11		41		71		101		131		161		191
10	12		42		72		102		132		162		192
11	13		43		73		103		133		163		193
12	14		44		74		104		134		164		194
13	15		45		75		105		135		165		195
14	16		46		76		106		136		166		196
15	17		47		77		107		137		167		197
16	18		48		78		108		138		168		198
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	22		52		82		112		142		172		202
	23		53		83		113		143		173		203
	24		54		84		114		144		174		204
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	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Ex.1002.00439

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Bib Data Sheet

CONFIRMATION NO. 1219

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/839,726	04/20/2001 RULE	375	2611	WEST14-00014

APPLICANTS

Paul F. Struhsaker, Plano, TX;

Russell C. McKown, Richardson, TX;

** CONTINUING DATA **********

This appln claims benefit of 60/262,825 01/19/2001
and claims benefit of 60/262,712 01/19/2001
and claims benefit of 60/262,698 01/19/2001
and claims benefit of 60/262,826 01/19/2001
and claims benefit of 60/262,951 01/19/2001
and claims benefit of 60/262,824 01/19/2001
and claims benefit of 60/263,101 01/19/2001
and claims benefit of 60/263,097 01/19/2001
and claims benefit of 60/273,579 03/05/2001
and claims benefit of 60/262,955 01/19/2001
and claims benefit of 60/262,708 01/19/2001
and claims benefit of 60/273,689 03/05/2001
and claims benefit of 60/273,757 03/05/2001
and claims benefit of 60/270,378 02/21/2001
and claims benefit of 60/270,385 02/21/2001
and claims benefit of 60/270,430 02/21/2001

OK EF

** FOREIGN APPLICATIONS **********

None EF

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 06/14/2001

Foreign Priority claimed	STATE OR	SHEETS	TOTAL	INDEPENDENT
☐ yes ☒ no				
35 USC 119 (a-d) conditions met ☐ yes ☑ no ☐ Met after Allowance	COUNTRY	DRAWING	CLAIMS	CLAIMS
Verified and Acknowledged Examiner's Signature Initials	TX	4	~~20~~ 17	2

ADDRESS
DOCKET CLERK
PO DRAWER 800889
DALLAS , TX
75380

TITLE
Apparatus and associated method for operating upon data signals received at a receiving station of a fixed wireless access communication system

FILING FEE RECEIVED 455	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination
09/839,726	STRUHSAKER ET AL.
Examiner	**Art Unit**
Erin M. File	2611

SEARCHED			
Class	Subclass	Date	Examiner
375	219	3/24/2006	EMF
375	222	3/24/2006	EMF
379	90.01	3/24/2006	EMF
710	1	3/24/2006	EMF
455	21	3/31/2006	EMF
455	293	3/31/2006	EMF
455	312	3/31/2006	EMF
455	337	3/31/2006	EMF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PBPUB Text Search-See Search History Printout		3/24/2006	EMF

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST US PAT, USPGPUB, EPO, JPO DERWENT, IBM (text search only— see search history printout)	3/24/2006	EMF

OIPE
JUL 05 2006
PATENT & TRADEMARK OFFICE

07-06-06

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 04/05/2006

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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
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.

KATHLEEN PORTIS	(Depositor's name)
Kathleen Portis	(Signature)
July 5, 2006	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014	1219

TITLE OF INVENTION: APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	07/05/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
FILE, ERIN M	2611	375-222000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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.

(A) NAME OF ASSIGNEE: Raze Technologies, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Plano, Texas

07/10/2006 AWONDAF2 00000060 09839726
01 FC:2501 700.00 OP
02 FC:1504 300.00 OP
03 FC:8001 30.00 OP

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☒ Advance Order - # of Copies 10

4b. Payment of Fee(s):
- ☒ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 50-0208 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)
- ☒ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature William C Munck Date July 5, 2006

Typed or printed name William A. Munck Registration No. 39,308

This collection of information 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.

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OIPE JUL 05 2006 PATENT & TRADEMARK OFFICE

DOCKET NO.: WEST14-00014 PATENT
CUSTOMER NO.: 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker et al.
Application No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Art Unit	:	2611
Examiner	:	Erin M. File

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

CERTIFICATE OF MAILING BY EXPRESS MAIL

The undersigned hereby certifies that the following documents:

1) Part B Issue Fee Transmittal (in duplicate);
2) Check in the amount of $1,030.00 for issue fee ($700.00), publication fee ($300.00) and soft copies of patent ($30.00);
3) Fee Transmittal for FY 2006 (in duplicate);
4) Letter to Official Draftsman;
5) Four (4) sheets of replacement drawings; and
6) A Postcard receipt

relating to the above application, were deposited as "Express Mail", Label No. EV915226773US with the United States Postal Service, addressed to Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on July 5, 2006.

Date: July 5, 2006 Kathleen Portus
Mailer

Date: July 5, 2006 William A. Munck
Reg. No. 39,308

P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
E-mail: *wmunck@munckbutrus.com*

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JUL 0 5 2006
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PTO/SB/17 (12-04)
Approved for use through 07/31/2006. OMB 0651-0032
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.

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,030.00

Complete if Known	
Application Number	09/839,726
Filing Date	April 20, 2001
First Named Inventor	Paul F. Struhsaker
Examiner Name	Erin M. File
Art Unit	2611
Attorney Docket No.	WEST14-00014

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☑ Deposit Account Deposit Account Number: 50-0208 Deposit Account Name: Munck Butrus, P.C.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 20 or HP =	_____	x _____	= _____

HP = highest number of total claims paid for, if greater than 20

Indep. Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 3 or HP =	_____	x _____	= _____

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

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).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____ (round up to a whole number)	x _____	= _____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other: Issue Fee ($700), Publication Fee ($300) copies of patent ($30)	$1,030.00

SUBMITTED BY

Signature	William A. Munck	Registration No. (Attorney/Agent) 39,308	Telephone 972-628-3600
Name (Print/Type)	William A. Munck		Date July 5, 2006

This collection of information is required by 37 CFR 1.136. 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 30 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.**

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DOCKET NO.: WEST14-00014 **PATENT**
Customer No.: 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	:	Paul F. Struhsaker et al.
Application No.	:	09/839,726
Filing Date:	:	April 20, 2001
Title	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Art Unit	:	2611
Examiner	:	Erin M. File

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

LETTER TO OFFICIAL DRAFTSMAN

In response to the Notice of Allowance mailed April 5, 2006, Applicant submits four (4) sheets of replacement drawings (Figures 1-4) in the above-identified patent application.

Respectfully submitted,

MUNCK BUTRUS, P.C.

Date: July 5, 2006

William A. Munck
Registration No. 39,308

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Dallas, Texas 75380
Tel: (972) 628-3600
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Email: *wmunck@munckbutrus.com*

JUL 0 5 2006
PATENT & TRADEMARK OFFICE

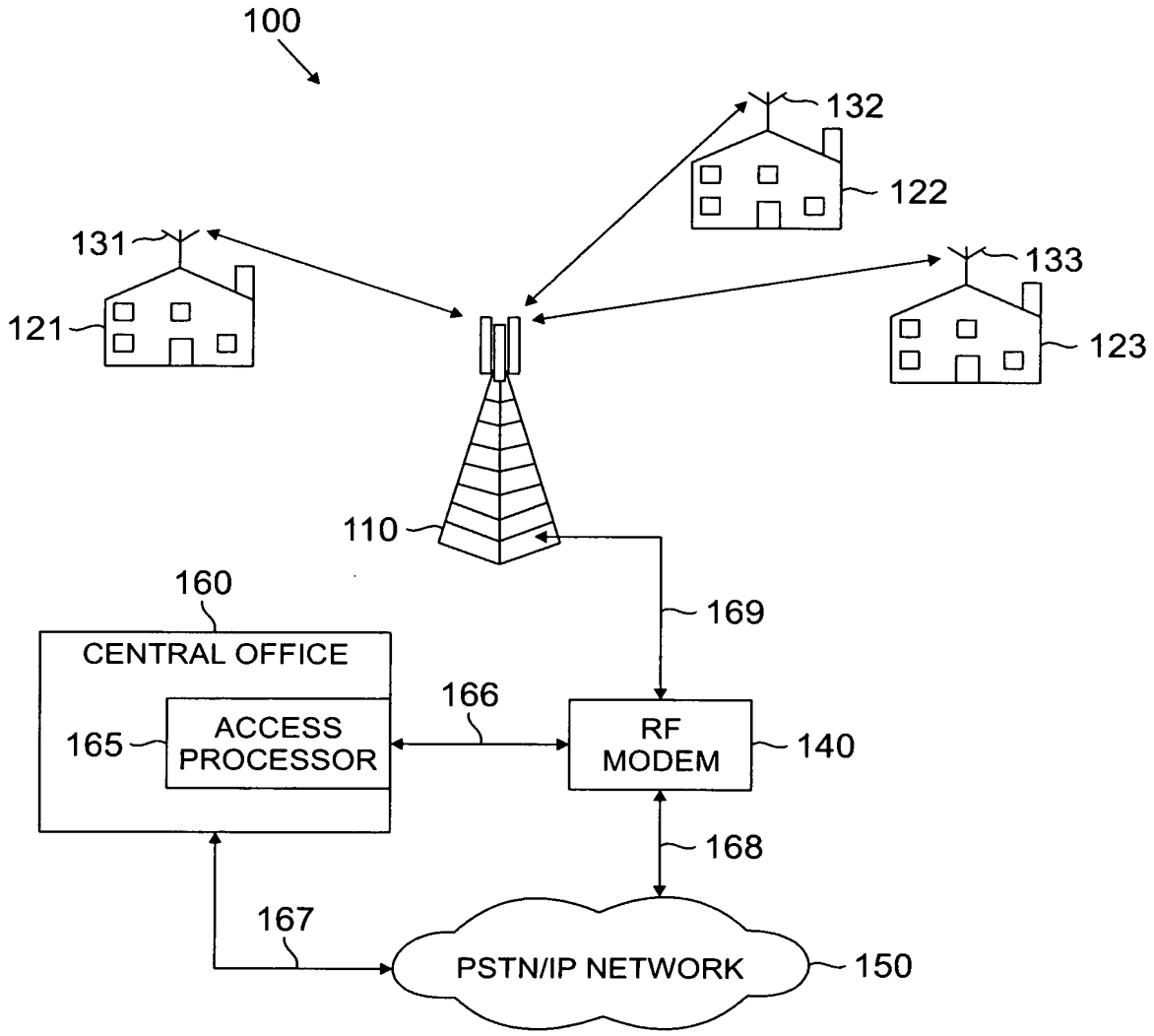


FIG. 1

REPLACEMENT

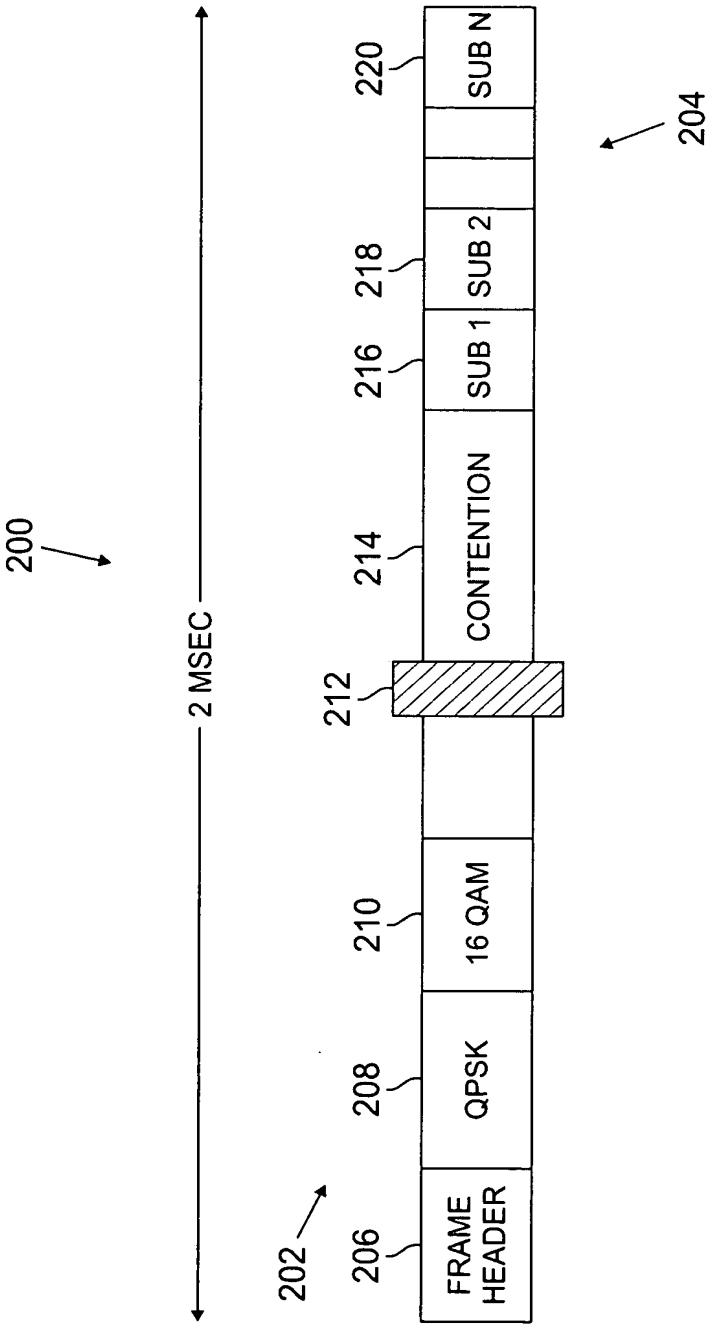


FIG. 2

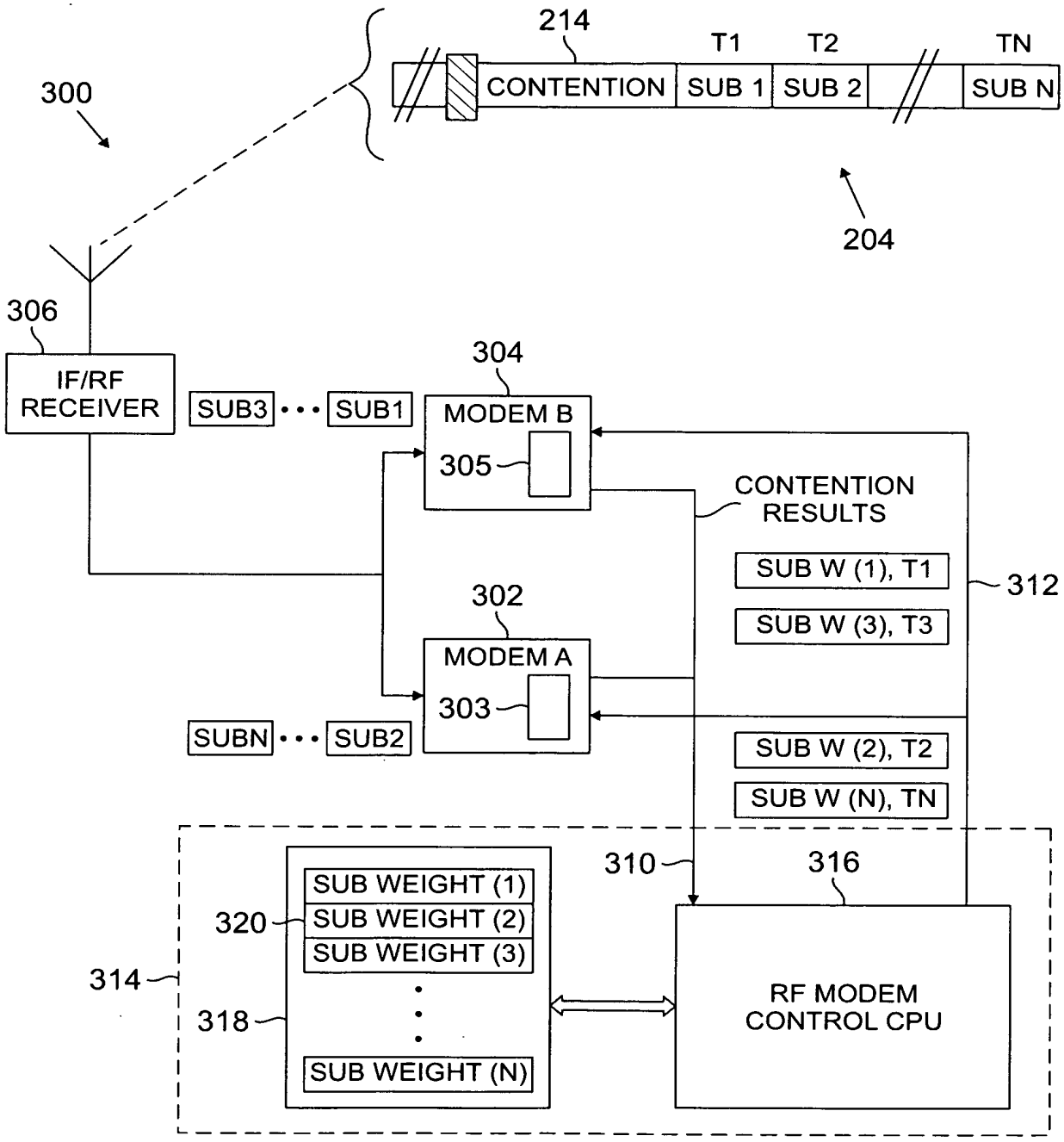

214
T1
T2
TN
CONTENTION
SUB 1
SUB 2
SUB N
300
204
306
304
IF/RF RECEIVER
SUB3
SUB1
MODEM B
305
CONTENTION RESULTS
SUB W (1), T1
SUB W (3), T3
312
302
MODEM A
303
SUBN
SUB2
SUB W (2), T2
SUB W (N), TN
310
316
320
SUB WEIGHT (1)
SUB WEIGHT (2)
SUB WEIGHT (3)
314
318
SUB WEIGHT (N)
RF MODEM CONTROL CPU

FIG. 3

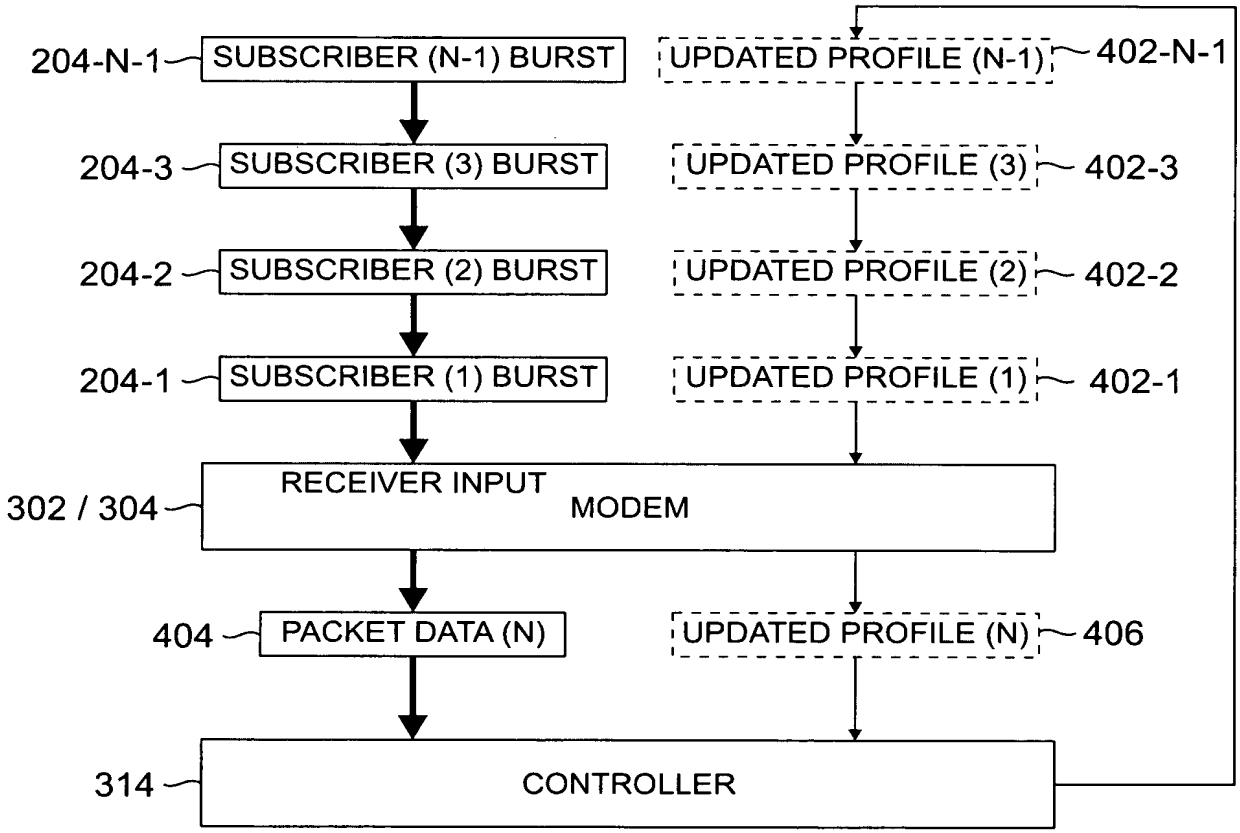

204-N-1
SUBSCRIBER (N-1) BURST
UPDATED PROFILE (N-1)
402-N-1
204-3
SUBSCRIBER (3) BURST
UPDATED PROFILE (3)
402-3
204-2
SUBSCRIBER (2) BURST
UPDATED PROFILE (2)
402-2
204-1
SUBSCRIBER (1) BURST
UPDATED PROFILE (1)
402-1
302 / 304
RECEIVER INPUT MODEM
404
PACKET DATA (N)
UPDATED PROFILE (N)
406
314
CONTROLLER

FIG. 4

DOCKET NO.: WEST14-00014 **PATENT**
CUSTOMER NO.: 23990

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	Paul F. Struhsaker, et al.
Patent No.	:	7,099,383
Issued	:	August 29, 2006
Application No.	:	09/839,726
Filed	:	April 20, 2001
For	:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
Art Unit	:	2611
Examiner	:	Erin M. File
Confirmation No.	:	1219

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

The undersigned attorney, on behalf of and including the attorneys/agents associated with Customer No. 23990, hereby withdraw as attorneys or agents in connection with the above-identified matter.

The reasons for withdrawal are that the Owner/Applicant (1) has effectively discharged the practitioners by failing to respond and communicate with practitioners to reasonable requests concerning representation and/or (2) has failed to pay one or more bills rendered by the practitioners for an unreasonable period of time and/or has knowingly and freely assented to termination of the employment.

Accordingly, the practitioners believe that no further action on the part of the practitioners is necessary for withdrawal. However, as a precautionary matter, the practitioners have taken reasonable steps to avoid any foreseeable prejudice to the rights of the Owner/Applicant, including having performed the following:

- Given due notice to the Owner/Applicant that the practitioners are withdrawing from representation in this matter and have filed, or will be filing, the necessary papers with the Patent & Trademark Office,
- Delivered to the Owner/Applicant all papers and property to which the Owner/Applicant is entitled, or requesting instructions from the Owner/Applicant regarding disposition of the Owner/Applicant's files; and
- Notified the Owner/Applicant of any responses that may be due and the time frame within which Owner/Applicant must respond.

Please address all future correspondence to:

Mr. Michael S. Hynek
17519 Muirfield Drive
Dallas, Texas 75287

Respectfully submitted,

MUNCK CARTER, P.C.

Date: 11 Dec. 2008

John T. Mockler
Reg. No. 39,775

Docket Clerk
P.O. Drawer 800889
Dallas, Texas 75380
Phone: (972) 628-3600
Fax: (972) 628-3616
Email: *jmockler@munckcarter.com*

Doc Code: PET.POA.WDRW
Document Description: Petition to withdraw attorney or agent (SB83)

PTO/SB/83 (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.

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	7,099,383
Issue Date	August 29, 2006
First Named Inventor	Paul F. Struhsaker
Art Unit	2611
Examiner Name	Erin M. File
Attorney Docket Number	WEST14-00014

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

Please withdraw me as attorney or agent for the above identified patent application, and

☐ all the practitioners of record;

☐ the practitioners (with registration numbers) of record listed on the attached paper(s); or

☑ the practitioners of record associated with Customer Number: 23990

NOTE: The immediately preceding box should only be marked when the practitioners were appointed using the listed Customer Number.

The reason(s) for this request are those described in 37 CFR :

☐ 10.40(b)(1)	☐ 10.40(b)(2)	☐ 10.40(b)(3)	☐ 10.40(b)(4)
☐ 10.40(c)(1)(i)	☐ 10.40(c)(1)(ii)	☐ 10.40(c)(1)(iii)	☐ 10.40(c)(1)(iv)
☐ 10.40(c)(1)(v)	☑ 10.40(c)(1)(vi)	☐ 10.40(c)(2)	☐ 10.40(c)(3)
☐ 10.40(c)(4)	☐ 10.40(c)(5)	☐ 10.40(c)(6) Please explain below:	

Certifications

Check each box below that is factually correct. WARNING: If a box is left unchecked, the request will likely not be approved.

1. ☑ I/We have given reasonable notice to the client, prior to the expiration of the response period, that the practitioner(s) intend to withdraw from employment.

2. ☑ I/We have delivered to the client or a duly authorized representative of the client all papers and property (including funds) to which the client is entitled.

3. ☑ I/We have notified the client of any responses that may be due and the time frame within which the client must respond.

Please provide an explanation, if necessary:

Please see attachment.

This collection of information is required by 37 CFR 1.36. 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 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.

PTO/SB/83 (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.

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

Complete the following section only when the correspondence address will change. *Changes of address will only be accepted to an inventor or an assignee that has properly made itself of record pursuant to 37 CFR 3.71.*

Change the correspondence address and direct all future correspondence to:

A. ☐ The address of the inventor or assignee associated with Customer Number: _____

OR

B. ☑ Inventor or Assignee name	Michael S. Hynek			
Address	17519 Muirfield Drive			
City Dallas	State Texas	Zip 75287	Country USA	
Telephone		Email		

I am authorized to sign on behalf of myself and all withdrawing practitioners.

Signature	John T. Mockler		
Name	John T. Mockler	Registration No.	39,775
Address	600 Banner Place, 12770 Coit Road		
City Dallas	State Texas	Zip 75251	Country USA
Date	11 Dec. 2008	Telephone No.	972-628-3600

NOTE: ***Withdrawal is effective when approved rather than when received.***

This collection of information is required by 37 CFR 1.36. 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 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.

Electronic Acknowledgement Receipt

EFS ID:	4441686
Application Number:	09839726
International Application Number:	
Confirmation Number:	1219
Title of Invention:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Correspondence Address:	DOCKET CLERK - PO DRAWER 800889 - DALLAS TX 75380 US 2149229221 -
Filer:	John Mockler/Keith Woods
Filer Authorized By:	John Mockler
Attorney Docket Number:	WEST14-00014
Receipt Date:	11-DEC-2008
Filing Date:	20-APR-2001
Time Stamp:	18:44:06
Application Type:	Utility under 35 USC 111(a)

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	Petition to withdraw attorney or agent (SB83)	WithdrawalAsAttorney.pdf	286947 c9b43e685be3c633e2e1efcca16f9d2260f1fe5f	no	4

Warnings:	
Information:	
Total Files Size (in bytes):	286947

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/81A (12-08)
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.

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	7,099,383
Issue Date	8/29/06
First Named Inventor	Struhsaker
Title	Apparatus and Associated Method for Operating Upon Data Signals...
Attorney Docket Number	9030101.125-US2

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 70763

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Inventor, having ownership of the patent.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Inventor or Patent Owner

Signature	Michael S. Hynek	Date	7-8-10
Name	Michael S. Hynek	Telephone	
Title and Company	Manager, Access Solutions, Ltd.		

NOTE: Signatures of all the inventors or patent owners 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 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.

PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Access Solutions, Ltd.

Application No./Patent No.: 7,099,383 Filed/Issue Date: 8/29/06

Titled: Apparatus and Associated Method for Operating Upon Data Signals Received at a Receiving Station of a Fixed Wireless Access Communication System

Access Solutions, Ltd. , a Texas limited partnership

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: P. Struhsaker, and R. McKown To: Raze Technologies, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 011729, Frame 0543, or for which a copy thereof is attached.

2. From: Raze Technologies, Inc. To: Access Solutions, Ltd.

The document was recorded in the United States Patent and Trademark Office at
Reel 012449, Frame 0730, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ 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 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.

Michael S. Hynek 7-8-10

Signature Date

Michael S. Hynek Manager

Printed or Typed Name Title

This collection of information is required by 37 CFR 3.73(b). 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 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.

Electronic Acknowledgement Receipt

EFS ID:	7990155
Application Number:	09839726
International Application Number:	
Confirmation Number:	1219
Title of Invention:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Correspondence Address:	DOCKET CLERK - PO DRAWER 800889 - DALLAS TX 75380 US 2149229221 -
Filer:	Matthew T. Byrne
Filer Authorized By:	
Attorney Docket Number:	WEST14-00014
Receipt Date:	11-JUL-2010
Filing Date:	20-APR-2001
Time Stamp:	13:17:17
Application Type:	Utility under 35 USC 111(a)

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	Power of Attorney	9030101_125_US2_POA.pdf	2075905 116eff0e9f4ec3e4aa55702a80583b85512db16e	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	2075905

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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.

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
09/839,726	04/20/2001	Paul F. Struhsaker	9030101.125-US2

CONFIRMATION NO. 1219

POA ACCEPTANCE LETTER

70763
Byrne Poh LLP
11 Broadway, Ste 865
New York, NY 10004

OC000000042658837

Date Mailed: 07/22/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/11/2010.

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.

/skiflemariam/

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
09/839,726	04/20/2001	Paul F. Struhsaker	WEST14-00014

CONFIRMATION NO. 1219

DOCKET CLERK
PO DRAWER 800889
DALLAS, TX 75380

POWER OF ATTORNEY NOTICE

OC00000042658777

Date Mailed: 07/22/2010

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/11/2010.

- 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).

/skiflemariam/

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

PTO/SB/80 (11-08)
Approved for use through 11/30/2020. 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: 164543

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: 164543

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

General Access Solutions, Ltd.
3400 Welborn St., #216
Dallas, TX 75219

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	/Michael S. Hynek/	Date	September 23, 2019
Name	Michael S. Hynek	Telephone	
Title	Manager of General Access, LLC which is GP of General Access I, Ltd., GP of Applicant		

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.

SCHEDULE A

Docket No.:	**000189-0006-101**	**Conf. No.:**	**1219**
Application No.:	**09/839,726**	**Patent No.:**	**7,099,383**

Total Assignments: 3

Application #: 09839726 Filing Dt: 04/20/2001 Patent #: 7099383 Issue Dt: 08/29/2006

PCT #: NONE Intl Reg #: Publication #: US20020097793 Pub Dt: 07/25/2002

Inventors: Paul F. Struhsaker, Russell C. McKown

Title: APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

Assignment: 1

Reel/Frame: 011729 / 0543 Received: 05/01/2001 Recorded: 04/20/2001 Mailed: 07/11/2001 Pages: 4

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors: STRUHSAKER, PAUL F. Exec Dt: 04/19/2001

MCKOWN, RUSSELL C. Exec Dt: 04/19/2001

Assignee: RAZE TECHNOLOGIES, INC.
2540 EAST PLANO PARKWAY, SUITE 188
PLANO, TEXAS 75074

Assignment: 2

Reel/Frame: 012449 / 0730 Received: 01/15/2002 Recorded: 01/10/2002 Mailed: 03/06/2002 Pages: 8

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: RAZE TECHNOLOGIES, INC. Exec Dt: 12/20/2001

Assignee: ACCESS SOLUTIONS, LTD.
17519 MUIRFIELD
DALLAS, TEXAS 75287

Assignment:

Reel/Frame: 050326 / 0971 **Received:** 09/10/2019 **Recorded:** 09/10/2019 **Mailed:** 09/11/2019 **Pages:** 8

Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

Assignor: ACCESS SOLUTIONS, LTD. **Exec Dt:** 08/15/2011

Assignee: GENERAL ACCESS SOLUTIONS, LTD.
3400 WELBORN ST., #216
DALLAS, TEXAS 75219

PTO/SB/96 (07-09)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: GENERAL ACCESS SOLUTIONS, LTD.

Application No./Patent No.: See Schedule A Filed/Issue Date: See Schedule A

Titled: See Schedule A

GENERAL ACCESS SOLUTIONS, LTD. (Name of Assignee) , Corporation (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. [x] the assignee of the entire right, title, and interest in;

2. [ ] an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. [ ] an assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above by virtue of either:

A. [ ] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. [x] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

2. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

3. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet(s).

[x] 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 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.

/Michael S. Hynek/	September 23, 2019
Signature	Date
Michael S. Hynek	Manager of General Access, LLC which is GP of General Access I, Ltd., GP of Applicant
Printed or Typed Name	Title or Registration No.

SCHEDULE A

Docket No.:	**000189-0006-101**	**Conf. No.:**	**1219**
Application No.:	**09/839,726**	**Patent No.:**	**7,099,383**

Total Assignments: 3

Application #: 09839726 Filing Dt: 04/20/2001 Patent #: 7099383 Issue Dt: 08/29/2006

PCT #: NONE Intl Reg #: Publication #: US20020097793 Pub Dt: 07/25/2002

Inventors: Paul F. Struhsaker, Russell C. McKown

Title: APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

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Assignee: RAZE TECHNOLOGIES, INC.
2540 EAST PLANO PARKWAY, SUITE 188
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Reel/Frame: 012449 / 0730 Received: 01/15/2002 Recorded: 01/10/2002 Mailed: 03/06/2002 Pages: 8

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Assignee: ACCESS SOLUTIONS, LTD.
17519 MUIRFIELD
DALLAS, TEXAS 75287

Assignment:

Reel/Frame: 050326 / 0971 **Received:** 09/10/2019 **Recorded:** 09/10/2019 **Mailed:** 09/11/2019 **Pages:** 8

Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

Assignor: ACCESS SOLUTIONS, LTD. **Exec Dt:** 08/15/2011

Assignee: GENERAL ACCESS SOLUTIONS, LTD.
3400 WELBORN ST., #216
DALLAS, TEXAS 75219

Electronic Acknowledgement Receipt

EFS ID:	37261370
Application Number:	09839726
International Application Number:	
Confirmation Number:	1219
Title of Invention:	APPARATUS AND ASSOCIATED METHOD FOR OPERATING UPON DATA SIGNALS RECEIVED AT A RECEIVING STATION OF A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Kevin Augustine Rieffel/Tracy Chu
Filer Authorized By:	Kevin Augustine Rieffel
Attorney Docket Number:	9030101.125-US2
Receipt Date:	25-SEP-2019
Filing Date:	20-APR-2001
Time Stamp:	11:04:35
Application Type:	Utility under 35 USC 111(a)

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	Power of Attorney	000189-0006-101_POA.pdf	1932597 654460af615daf4417e4c3726edcbb3857801b04	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	000189-0006-101_Stmt_373b.pdf	877119 ee31a1b7cdc48873e76189f54ce6cd3a07dc81b0	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2809716	

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.

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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
09/839,726	04/20/2001	Paul F. Struhsaker	000189-0006-101

CONFIRMATION NO. 1219

POA ACCEPTANCE LETTER

164543
Haley Guiliano LLP
75 Broad Street
Suite 1000
NEW YORK, NY 10004-3226

OC000000111687047

Date Mailed: 10/04/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/25/2019.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/deelliott/

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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
09/839,726	04/20/2001	Paul F. Struhsaker	9030101.125-US2

CONFIRMATION NO. 1219

POWER OF ATTORNEY NOTICE

70763
Byrne Poh LLP
11 Broadway, Ste 760
New York, NY 10004

OC000000111686988

Date Mailed: 10/04/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/25/2019.

- 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).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/deelliott/