

**MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION****RELATED APPLICATIONS**

**[0001]** This is a continuation of U.S. Application Ser. No. 09/401,584 filed on September 22, 1999, now U.S. Pat. No. \_\_\_\_\_ which is a continuation of U.S. Application Ser. No. 08/953962 filed on September October 20, 1997, now U.S. Pat. No. 6,026,277 which is a continuation of U.S. Application Ser. No. 08/687,722 filed Jul. 26, 1996, now U.S. Pat. No. 5,729,826 which is a National Phase Application of PCT/US95/07037, filed Jun. 2, 1995 which are all incorporated by reference in their entirety, herein.

**TECHNICAL FIELD**

**[0002]** The invention relates to cellular telephone systems in which a mobile unit communicates by wireless communication to a base station connected to the wire telephone network and more particularly to cellular telephone systems adapted for use with fast-moving mobile units.

**BACKGROUND**

**[0003]** In a typical cellular telephone system, an area is divided into a plurality of cells with each cell having a centrally located cell site. A mobile unit moving in such a cellular network communicates by radio with a nearest cell site. The cell sites are each connected by cable or point-to-point microwave to a telephone network interface. The network interface typically provides communication among cell sites and between the cell sites and the so-called wire line telephone network. The functions of a typical network interface are described in The Bell System Technical Journal, January 1979, Volume 58, No. 1. One of the functions to be performed by the telephone network interface is the so-called "handoff" function. As a mobile unit moves through a cellular network, it will move away from one cell site and toward another cell site. Each cell site monitors signal quality of the signal received from the mobile unit and passes

information to the telephone network interface and determines when a call in progress is to be transferred from one cell site to another. This procedure is known as "handoff". The handoff process involves several operations including selecting a cell site trunk between the MTSO and the new cell site, sending a message to the mobile unit transmitter/receiver to tune from its present voice channel to a voice channel in the new cell site corresponding to the newly selected trunk, setting up a talking path in the MTSO from the cell site trunk to the trunk of the telephone network presently in use in the call, and idling the talking path in the switching network in the MTSO between the old cell trunk and the telephone network trunk assigned to the call.

**[0004]** A problem with existing mobile telephone systems is the considerable time required in handoffs. This becomes a particular problem in urban areas which are highly congested. A basic principle of cellular telephone systems is the concept of frequency reuse. It can be shown that traffic capacity of a cellular system is increased by a factor  $N \cdot \sqrt{2}$  as the size of the cell, i.e., its diameter, is decreased by a factor of  $N$ . This is due to the fact that, at least in principle, all frequencies in the mobile telephone spectrum are available for use in each independent cell. Thus, as the number of cells is increased, the total number of calls that can concurrently exist in an area is increased. A drawback, however, to decreasing the size of the cells is that a mobile unit tends to cross cell boundaries more often, requiring a larger number of handoffs which will tend to overload the mobile telephone switching office (MTSO) to the point where existing calls may be interrupted or dropped.

**[0005]** Personal communication service (PCS) functions in substantially the same manner as the mobile cellular system. In PCS, the user may be in a building or walking in a street or riding a vehicle and using a handset which communicates with a base station in the same manner that the mobile unit communicates with the base station or cell site in the cellular network. It is envisioned that PCS, by implementing very small cells, could provide service to a very large number of users, for example in a densely populated urban area. The difficulty with PCS is the same as in the cellular system in that handoffs become the bottleneck.

**[0006]** Modern cellular systems use what is known as code division multiple access (CDMA) spread-spectrum communications. In direct-sequence coding CDMA (DS-CDMA), the energy of the user signal is distributed uniformly over the system bandwidth through the spreading process providing separation between users of the same frequency in adjacent cells. A requirement of DS-CDMA is that no interfering signal received may be significantly stronger than the desired signal since it would jam the weaker signal. This type of coding is used in what is sometimes referred to as hierarchal cell structures. The most commonly referenced hierarchal structure is a macro/umbrella cell overlaying a number of micro cells. A fast-moving mobile unit, for example, may be served by the macro cell to avoid an extreme number of handovers. Slow-moving users are allocated to micro cells to save capacity for the macro cells. Using the DS-CDMA concept, micro cells and macro cells share the same frequency. To avoid strong interference at a micro cell from mobile unit in communication with a macro base station, the output power of the mobile unit in the micro cell is increased to overpower the interfering signal. The use of hierarchal cell structure to provide high-quality speech, data communication at rates up to 2 megabits per second and video communication with mobile units traveling at rates in excess of 100 miles per hour and accommodating PCS are seen as needed to meet future mobile telecommunication demands.

**[0007]** In the hierarchal cell structure, the low tier, small cells, e.g., on the order of 100 feet in diameter, accommodate low speeds. The low speed is mostly pedestrian traffic and other traffic moving at speeds below 30 miles per hour. The advantages of small cells is low power, simple, inexpensive and light-weight terminals. What is desirable is an infra structure which allows use of such terminals in all applications, whether in the home or office as a cordless phone, on streets, in shopping malls, airports, etc., and in cars on expressways at highway speeds. Additionally, high-spectrum reuse is needed to provide low-cost, high-quality service which requires a large bandwidth for each subscriber.

**[0008]** To provide wire line toll, quality-voice service, a 32-kilobit per second bit rate is required with ADPCM coders. As wireless data services emerge, even more spectrum bandwidth will be required. In the future, it may be possible to utilize the spectrum in the 60 gigahertz range providing very large amounts of bandwidth.

However, the radio wave characteristics at that frequency dictate a very short range, line of site propagation, requiring very small cells. However, as noted, small cells and fast-moving mobile units are incompatible due to the time required for handoff.

### **SUMMARY**

**[0009]** These and other problems of the prior art are overcome in accordance with this invention by means of a moving base station which is interposed between a moving mobile telephone unit and a fixed base station. In accordance with this invention, a movable base station moves with the traffic at a rate of speed which is comparable to the speed of the traffic and communicates with a moving mobile telephone unit via standard mobile radio transmission. The movable base station further communicates by radio signals with a plurality of fixed antennas spaced along the path of travel of the mobile base station. The several fixed antennas are connected to a telephone wire line network via a telephone gateway office in a standard fashion. In accordance with this invention, the fixed radio ports are synchronized and the interface between the moving base station and the fixed radio ports is a time division multiplexed (TDM)--direct-sequence, spread-spectrum CDMA.

**[0010]** In one particular embodiment, a number of fixed base stations are provided in addition to moving base stations allowing slower moving traffic, such as pedestrian traffic or rush hour mobile traffic to communicate via the fixed base stations.

**[0011]** In a specific embodiment of the invention, the moving base stations are provided with highly directional antennas directed to moving traffic and highly directional antennas directed to the radio ports. Communications from the fixed radio ports to the movable base stations are at a relatively low power level and from the movable base stations to the mobile units are at a relatively higher power level. Due to the characteristics of the direct-sequence, spread-spectrum CDMA, the higher power level signal will overpower the lower level signal such that the mobile unit does not receive communications from the fixed radio port but only from the movable base station. In the reverse direction, a low level of signal is transmitted from the mobile units to the movable base station and a high-level signal is transmitted from the base station to the



fixed radio ports, thereby eliminating any direct communication from the mobile unit to the fixed radio port.

In one embodiment of the invention, the movable base stations are supported on a series of closed loops and ends of adjacent loops overlap to facilitate transfer of telephone calls between adjacent loops.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0012]** FIG. 1 is a block diagram representation of a roadway structure with fixed base stations, moving base stations, and fixed radio ports.

**[0013]** FIG. 2 is a block diagram representation of a fixed radio port of FIG. 1.

**[0014]** FIG. 3 is a block diagram representation of a fixed base station of FIG. 1.

**[0015]** FIG. 4 is a block diagram representation of a moving base station of FIG. 1.

**[0016]** FIG. 5 is a block diagram representation of a gateway telephone office shown in FIG. 1.

**[0017]** FIG. 6 is a tabular representation of channel allocation.

**[0018]** FIG. 7 is a representation of selected channels of FIG. 6.

**[0019]** FIG. 8 illustrates signal transmission among the various system entities.

**[0020]** FIG. 9 is a block diagram representation of moving base stations operating in separate loops.

### **DETAILED DESCRIPTION**

**[0021]** FIG. 1 is a diagrammatic representation of a mobile telecommunication system incorporating principles of the invention. FIG. 1 represents, for example, a divided highway with mobile units 20 traveling on a first roadway 10 in one direction and a plurality of mobile units 25 traveling along a second roadway 15, in the opposite direction. A plurality of moving base stations 30 are disposed along one side of the roadway 10. The base stations are spaced apart by a selected distance equivalent to

the diameter of the cell served by the moving base station. The moving base stations 30 may be moved by means of a rail 35, or other suitable conveying device which may include an automotive vehicle traveling on the roadway, in the same direction as the traffic flow on the roadway 10, as indicated by the arrow 12. In a similar fashion, a plurality of moving base stations 40 are disposed adjacent the roadway 15 moving in the direction of the traffic as indicated by the arrow 17. The moving base stations 40 are moved along a rail 45. The moving base stations 30, 40 may be supported on any suitable conveying device such as rails 35, 45. The conveying device may be at ground level or overhead, depending on the terrain and available space for the device. The moving base stations are preferably disposed for optimum radio communication with the mobile units on the roadways.

**[0022]** Disposed between the moving base stations moving along the rails 35, 45 are a plurality of fixed radio ports 50 which are connected by means of a fiber optic ring 55 or a similar signal transmitting device to a telephone office connected to the wire line telephone network and referred to as a gateway office. The gateway office 60 forms the interface between the mobile telecommunication system and the wire line telephone network. The gateway office is a well-known equipment. It is part of the telephone network and is responsible for call processing in conjunction with the base stations. As described further later herein, the gateway office will include certain processor hardware and software to detect a best signal quality indication and to selectively transmit information with a best signal quality indicator to the telephone network. A plurality of fixed base stations 70 are disposed in the vicinity of the roadway 10 and are connected to the gateway office 60 by means of a fiber optic ring 75 or similar signal transmission device.

**[0023]** In operation, the moving base stations 30 may move in the direction of the flow of the traffic at a rate of, for example, 60 miles per hour, which may be faster than some traffic and slower than other traffic. The moving base station preferably handles telecommunications with mobile units which travel at a rate of not more than 30 miles per hour faster or slower than the moving base station. For example, the moving base stations 30, 40 may be traveling at the rate of 60 miles per hour to accommodate traffic moving in the range of 30 to 90 miles per hour. In the arrangement of FIG. 1, fixed base

stations 70 would accommodate communications with mobile units traveling at a speed of less than 30 miles per hour including pedestrian traffic and stationary units. It will be readily apparent that instead of having fixed and moving base stations as depicted in FIG. 1, slowly moving and rapidly moving units may be used as well. A particular moving base station is effective when the mobile units are moving in the same direction as a base station. FIG. 1 shows two roadways traveling in opposite directions with the moving base stations disposed between moving in the direction of the traffic. The base stations may also be placed on opposite sides of the same roadway with two-way traffic with the moving base stations moving in opposite directions on the opposite sides of the roadway.

**[0024]** In the typical cellular telephone system, the base station, also referred to as a cell site, forms an interface between the mobile unit and the gateway office. As such, the base stations may perform a number of functions, including functions such as locating a particular mobile unit, as well as voice processing and functions associated with call setup, call supervision, and call termination. Additionally, the base stations perform the function of handing off and receiving an existing call involving a mobile unit which has moved into or out of the normal service area of a base station. All of these are well-known base station functions. In some proposed mobile telephone systems, the base stations are primarily only radio interface units and a base station controller, connected to a plurality of base stations performs call-handling functions for the plurality of base stations. The system in accordance with the invention differs from the prior art primarily in that the base stations 30, 40 are moving with the traffic and communicate with the gateway office 60 via fixed radio ports 50. Furthermore, the various call-handling functions, including handoff, are performed by the moving base station. Advantageously, because of movement of the base station in the same direction as the traveling mobile unit, the number of handoffs is greatly reduced.

**[0025]** Each of the moving base stations 30, 40 is provided with antennas 100, 101. The antennas 100, 101, preferably high gain, directional antennas for use in mobile communication, are well know and commercially available. The fixed base stations 70 are provided with four separate antennas 110 extending in four different directions. The antennas 100 on the base stations 30, 40 are used to communicate with the mobile

units 20, 25 whereas the antennas 101 on the moving base stations 30, 40 are used to communicate with the fixed radio ports 50. The fixed base stations 70 are preferably each provided with four antennas 102-105. Fewer than four antennas may also be used. In that case, at least one omni-directional antenna is used. In the configuration of FIG. 1, the antennas 102 are arranged to communicate with the mobile units 20 and the antennas 103-105 are arranged to communicate with other mobile telephone communications from slow moving traffic or stationary subscribers. The fixed radio ports 50, in the configuration of FIG. 1, are each provided with a pair of directional antennas 110, 111 of the same general type as the directional antennas 100-105. As the moving base stations 30, 40 move relative to the fixed radio ports 50, data representing voice signals and call related information is transmitted between the antennas 101 on the moving base stations 30, 40 and the antennas 110, 111 on the fixed radio ports 50.

**[0026]** FIG. 2 is a diagrammatic representation of the fixed radio ports 50. The unit includes a standard microprocessor 150 as well as a radio interface circuit 154 providing an interface between the radio signals received on the antennas 110, 111 and the processor 150. The circuits are of a type typically used in fixed base stations and are well known in the art. Additionally, each radio port 50 includes a processor 150 connected to an add/drop multiplexer (ADM) 152. The ADM 152 interfaces with the fiber optic cable 55 and is able to add data from the processor 150 to the data stream on the fiber optic cable 55. Additionally, the ADM 152 recognizes a data stream accompanied by an address identifying the processor 150 and transfers such data from the data stream of the fiber optic cable 55 to the processor 150. As will be described further later herein, the processor 150 computes a signal quality indicator for the information received from the radio interface circuits 154, based primarily on radio signal strength intensity, in a well-known fashion. Processor 150 controls the transfer information between the fiber optic cable 55 and the various moving base stations via the antennas 110, 111.

**[0027]** FIG. 3 is a block diagram representation of one of the fixed base stations 70. The fixed base stations 70 perform the functions of a standard prior art fixed base station. The base stations 70 are connected to the fiber optic ring 75 and include an

add/drop multiplexer (ADM) 162 which provides an interface between the processor 160 and the fiber optic ring 75.

**[0028]** As mentioned earlier, both the optical ring 55 and optical ring 75 are connected to the gateway office 60. The primary function of the gateway office is to provide the interface to a wired telephone network. It distributes the telecommunications traffic between the network and the moving base stations via the fixed radio ports. The fiber optic rings 55, 75 are preferably continuous rings with an add/drop multiplexer for each ring in the gateway office. Data transmission on the fiber optic rings 55, 75 is preferably in accordance with one of the well-known SONET or synchronous digital hierarchy (SDH) transmission protocols.

**[0029]** The directional antennas 100-105, 110, 111 may be of a sectorized architecture or may be phased array antennas with highly directional radio frequency beams. Such antennas are preferably used to decrease interference between the mobile base stations and the fixed radio ports, allowing greater spectrum reuse. Antenna diversity can be provided with two spatially separated radio beams separated in time with a predefined time-delay offset for easier separation at reception. Various techniques for obtaining high antenna diversity are well known in the art and antennas employing such techniques are commercially available.

**[0030]** FIG. 4 is a block diagram representation of the moving base station 30. The station 30 includes a processor 130 connected via radio interfaces 132, 134 to the antennas 100, 101, respectively. The processor 130 may be a standard microprocessor and the radio interface circuits 132 may be standard radio interface circuits. The microprocessor is preferably programmed to handle the call processing functions performed in a prior art system by a cell site or by a shared base station controller. In this manner, the moving base station has greater autonomy and requires less communications with a shared base station controller or the like. The circuits 132, like the radio interface circuits 154 in the fixed radio port 50 and the radio interface circuits 164 in the fixed base station 70, are well known and commercially available circuits.

**[0031]** The radio interface between the mobile units 20, 25 and the moving base stations 30, 40 and the fixed base station 70 is a standard radio interface, well known in

the art. The radio interface between the moving base stations 30, 40 and the fixed radio ports 50 is preferably a time division multiplexed, direct-sequence, spread-spectrum, code-division multiple-access interface (TDM/CDMA). Multiple channels between the base station and the fixed radio ports are time division multiplexed as time slots in a data stream. The data stream is spread with a pseudo-random code over the allocated spectrum. A pilot sequence is inserted in the transmitted signal for ease of synchronization in a well-known manner. The interface between the movable base station and the fixed radio port is preferably transparent to the overall system in spectrum use.

**[0032]** Frequency division or time division may be used for duplex communications. In the frequency division duplex (FDD) mode, data is simultaneously transmitted in both directions, each in a different spectrum band. In a typical system in the FDD mode, the TDM frame transmission duration will be approximately 500 microseconds making the interface substantially transparent to overall system delay.

**[0033]** The interface between the mobile unit and the movable base may be the standard IS-95-based PCS air interface standard. The channel capacity for the so-called "extended mode" (2.5 mhz) has been determined to be seven channels at 32 kilobits per second. The FCC allocated licensed spectrum for personal communications services (PCS) includes 10-mhz licenses and 30-mhz licenses. Each 10-mhz license provides two separated 5-mhz bands and each 30-mhz license provides two separated 15-mhz bands, for two-way communications. Two 5-mhz bands can support 14 duplex channels at 32 kilobits per second and two 15-mhz bands can support 42 duplex channels at 32 kilobits per second.

**[0034]** Voice signals between a mobile unit and the gateway office are encoded in a standard fashion using ADPCM voice encoding with a minimum bit rate of 32 kilobits per second in each channel. The interface between the moving base station and the fixed radio port is adapted to carry up to 19 channels of 32 kilobits per second each at 16 bits per time slot. The frame structure includes 16 bearer channels of 32 kilobits per second at 16 bits per time slot. The time division multiplexed frame rate between the movable base station and the fixed radio port is 608 kilobits per second. To achieve a

processing gain of 9 decibels, the frame rate is multiplied by a factor of 8, yielding 4,864 kilobits per second, which fit into a single 5-mhz band. FIG. 6 is a tabular representation of the channel allocation showing 16 bearer channels plus 3 channels for signaling, control, and error code. FIG. 7 is a representation of channels 18 and 19 of FIG. 6.

**[0035]** The moving base stations are addressed using predefined code sequences derived in a known manner by the use of Walsh functions. U.S. Pat. No. 5,103,459 entitled "System and Method for Generating Signal Wave Forms in CDMA Cellular Telephone System" describes the use of Walsh functions for code generation. U.S. Pat. No. 5,103,459 is incorporated by reference herein. As described in that patent, by choosing a Walsh function of order 8 provides 8 orthogonal codes in the present embodiment using spread spectrum CDMA uses the all 0 Walsh sequence as a pilot carrier with the other 7 sequences available for moving base station communications. The code sequences may be repeated as ABCDEFG; ABCDEFG; . . . Although fewer codes could be used, preferably no less than 3 are used. Because of differing propagation times for signals between a particular moving base station and two or more different fixed radio ports, it is not possible to satisfy the condition of time alignment required for Walsh function orthogonality for 2 or more fixed radio ports at one time. For this purpose, two outer pseudonoise codes are used to provide discrimination between signals arriving at the moving base station from different fixed radio ports. The pseudonoise code rate is preferably 4,864 kilobits per second. The sequence length for the transmitted carrier signal is preferably 32,768 chips, as described in U.S. Pat. No. 5,103,459. The outer pseudonoise codes modulate the signal in quadrature phase shift keying.

**[0036]** The pilot signal will be transmitted in both directions, from the moving base stations to the fixed radio ports and vice, versa. This is made possible by the line of site fading characterized as Rician.

**[0037]** The pilot sequence will be long enough that a number of different sequences can be generated by shifts in the basic sequence. The separation will be great enough to ensure that there is no interference between pilot signals. Each moving base stations will use a different offset from a neighboring moving base station to provide signal

separation. Similarly, each fixed radio port will use a different offset from a neighboring fixed radio port.

**[0038]** The FCC has allocated a 20 mhz of unlicensed spectrum, including a 10 mhz band for voice products and a 10-mhz band for data products. Thus, one continuous 10-megahertz channel is available and time division multiplex transmission is preferably used. The bit rate for both directions of transmission will be twice the frequency division duplex rate, introducing an overall delay of 500 microseconds and a processing gain of 9 decibels. In the time division duplex mode, the transmission times and direction, forward and reverse between the mobile unit and the moving base station and between the moving base station and the fixed radio ports, are aligned. In one half of the time division, duplex cycle signals are transmitted from the mobile unit to the moving base station and, from there, to the fixed radio port. In the other half-cycle, signals are transmitted from the fixed radio port to the moving base station and then to the mobile unit.

**[0039]** The two 15-mhz licensed spectrum bands (30 mhz) are preferably divided into three 5-megahertz channels in each direction, utilizing the same architecture as described earlier herein with respect to the 5-megahertz licensed spectrum. In the 15-mhz licensed spectrum, each of the 5-megahertz channels will support 14 traffic channels, for a total of 42 traffic channels in each 15-mhz band. The air interface between the moving base station and the fixed radio port, as well as the signal structure, can be modified and adapted to a variety of allocations of spectrum and air interface standards.

**[0040]** In the present embodiment, as described earlier herein, 7 orthogonal codes are available for communication between the fixed radio ports 50 and the moving base stations 30, 40. As described earlier herein and depicted in FIGS. 6 and 7, one 16 bit communication channel, channel 19, is set aside for control and identification bits. As depicted in FIG. 7, channel 19 may comprise 7 control bits and 9 identification bits. The 9 identification bits provide 512 unique identification numbers. Using 7 orthogonal codes and 512 identification numbers, 3,854 moving base stations can be uniquely identified. When the moving base stations are separated by a spacing of 200 feet, the total



distance of coverage using the 3,854 moving base stations is approximately 135 miles. FIG. 1 shows a portion of the system with moving base stations moving in opposite directions along oppositely directed roadways and fixed radio ports with dual antennas. Vehicular traffic moving in opposite directions on the same roadway are preferably served by moving base stations on opposite sides of the roadway. Where each roadway has only one-way traffic, the system is preferably disposed between the roadways. In one embodiment of the invention, depicted in FIG. 9, two separate loops 200, 205 are disposed between two separate roadways 206, 208 with the traffic on the roadways indicated by the arrows 207 and 209. The loops 200 and 205 comprise moving base stations 210 and 250, respectively. The base stations, in this embodiment, are moving in the direction indicated by the arrows 201 and 202. Since, as a practical matter, the loops 200, 205 are not of indefinite length, a plurality of loops may be required to cover a desired area. To avoid interruption in communications, the ends of the loops are preferably sufficiently close together, or overlapping, to provide an overlapping area of coverage for mobile units traveling in the area of the loop ends. This will allow one of the mobile stations nearing the end of the loop of which it is a part to hand off the call to a mobile station of the adjacent loop.

**[0041]** Each loop preferably has a single gateway for connection to the wire telephone network. One advantage of that arrangement is that it eliminates the need for registration of moving base stations, which is required where a moving base station moves between gateways. FIG. 9 shows a pair of gateways 215 associated with the loop 200 and a pair of gateways 255 associated with the loop 205. The two gateways of a loop are both connected to the fixed radio ports of the loop at all times and may be operated in a load sharing mode with each capable of handling the total telecommunication's traffic for the loop in the event of a failure in one of the gateways.

**[0042]** To avoid interrupting communications with a mobile unit traveling along the roadway in the area where two adjacent loops end, any existing calls are handed off from the moving base station near the terminating end of its loop to a moving base station of the next loop. The handoff process is essentially the same as a handoff between moving base stations on the same loop, except that the handed off call will be routed to the wire network to a different gateway. This procedure is equivalent to a

handoff between cell sites of different cells in the existing cellular network in a manner which is well known in the art. The loops 200 and 205 may physically overlap to assure proper overlap of communications between moving base stations of the two loops and to avoid loss of communication with a mobile unit handed off from one loop to another.

**[0043]** The timing and synchronization between the moving base station and a fixed radio port with which the moving base station communicates is phase-locked to the pilot signals received from the fixed radio port with which the moving base station communicates. For synchronization purposes, the moving base station will receive a Global Positioning Satellite (GPS) Coordinated Universal Time (UCT) timing signal once each second.

**[0044]** CDMA Technology is well-known for sensitivity to power control. Specifically, the more powerful signals tend to "mask out" less powerful signals at the receiver. Typically, elaborate power control schemes are implemented to ensure that all signals arrive at the receiver at the same level. In accordance with the system of this invention, however, the sensitivity to power level of CDMA is used to advantage. The principles of signal transmission employed in the system of the invention is illustrated in FIG. 8. Two power levels of radio transmission, high (H) and low (L), are defined. Referring to FIG. 1, high-power level signals are transmitted from the moving base station 30 to the mobile unit 20 and from the base station 30 to the fixed radio port 50. Low power level signals are transmitted from the fixed radio port 50 to the moving base station 30. Similarly, low power signals are transmitted from the mobile unit 20 to the moving base station 30. Since the moving base station receives a low power level signal from the fixed radio port and transmits a high level power signal toward terminals, the high power level received at the mobile unit 20 will mask out any signals of the low power signal transmitted from the fixed radio port to the moving base station. In a similar fashion, any low signal transmitted from the mobile unit 20 reaching the fixed radio port 50 will be masked by the high power level signal transmitted from the moving base station to the fixed radio port. As stated earlier, the antennas 100-105, 110, 111 are preferably highly directional antennas with very little feedback from the transmit signal to the receive signal. Feedback due to reflections and other extraneous sources can be readily eliminated at the moving base station using well-known noise cancellation techniques.

**[0045]** When a mobile unit set is first powered up or first enters a service area, the mobile unit must register in the manner described earlier, by transmitting its unique address in the new service area. The address will be received by the closest moving base station 30 and transmitted via a fixed radio port and the gateway switch 60 to the telephone network. This registration procedure is required so that an incoming call for the mobile unit can be appropriately directed.

**[0046]** The spacing of mobile based stations 20 and the fixed radio ports 50 of FIG. 1, together with the strength of the signal transmitted between the moving base stations and the fixed radio ports, determines the number of fixed radio ports with which a moving base station can communicate at any point in time. The spacing and signal strength is preferably such that each fixed radio port receives signals from three moving base stations. When a fixed radio port receives data, accompanied by the identification number of the moving base station, the processor 150 (FIG. 2) computes a signal quality indication on the received signal. The signal quality indication is a figure of merit preferably computed as a function of signal strength and signal-to-noise ratio. It is added to the received data and added to the fiber optic ring 55 via the ADM 152. The gateway 60 preferably receives the same data from several different ones of the fixed radio ports 50 and stores the data in an internal memory in the gateway 60 in association with the moving base station identification number and Walsh function spreading code. The address of the fixed radio port from which the data has been received is stored in the memory of processor 64 as well. Accordingly, multiple copies of the same data transmitted by a single moving base station are stored in the memory of the processor 64 in the gateway. The signal quality indications computed by the processors 150 in each of several fixed radio ports are compared to a predefined signal quality indication threshold, and the data corresponding to a signal quality indication below the threshold value is discarded. Otherwise, the data is retained. A cyclic redundancy code transmitted with the data is used to detect any TDM frame errors. The best data, i.e., associated with the best signal quality indication is transferred from the gateway 60 to the telephone network. Data received from the telephone network at the gateway 60 and intended for a registered mobile unit is stored in the memory of the processor 150 in a register particularly associated with the moving base station

currently serving the mobile unit. This data will be sent via the optical ring 55 to all fixed radio ports that are identified in the memory of the processor 65 as fixed radio ports with an acceptable signal quality indication. The received data will be transmitted from each of the fixed radio ports which received the data together with the identification code and Walsh function code of the moving base station to which the data is directed. The transmission of data from different fixed radio ports will be staggered, delayed by different amounts, so that they can be received and separated at the moving base stations. The delays can be precisely controlled by means of synchronous distribution via the optical ring 55, in the SONET or SDH format. The receiving moving base station, by means of its processor 130, compares the multiple copies of the received data signals, aligns them and combines them for the best reception.

**[0047]** Each of the moving base stations will have one of N assigned codes, where N may be any number, but preferably is at least 3 or more. Seven Walsh function codes are preferably used. The codes may be repeated in sequence, as for example, ABCDEFGABCDEFG. The codes are assigned in sequence to the various moving base stations so that two moving base stations having the same code will be physically separated by a sufficient distance to prevent interference in the communications between fixed radio ports and moving base stations having the same identity code. The operation of the fixed base stations 70 is essentially the same as that of a standard fixed base station. In congested traffic areas, a mobile unit which is stopped or slowly moving, e.g., less than 30 miles per hour, will preferably be serviced by one of the fixed base stations 70. As the speed of travel of the mobile unit 20 increases, a handoff will occur between the fixed base station and a moving base station. The procedures for determining whether a mobile unit is to be served by a fixed base station or a moving base station are the same procedures as described earlier herein in determining which moving base station is selected to serve a mobile unit, i.e., based on signal strength and error rate. Thus, when a call involving a mobile unit is initiated or when it is determined that a handoff should occur, the mobile unit may be handed from a moving station to a fixed station, or vice versa. Each mobile unit monitors pilot signals from fixed and moving base stations and synchronizes to the base station providing the best signal. The mobile unit may "connect" with three fixed or moving base stations while searching

for a fourth in what is known as the "soft" hand-off mode. As the speed of the vehicle increases, fixed or slow moving base stations will be dropped. In more congested areas where traffic speed will vary between 0 and 60 miles per hour, base stations speed may, for example, be set to move at 30 mph. The moving base station should then be able to accommodate all traffic in the 0-60 mph range.

**[0048]** It will be understood that the above-described arrangement is merely illustrative of the application of the principles of the invention and that other arrangements may be devised by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

**[0049]** What is claimed is:

## **CLAIMS**

1. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

2. A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

3. A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

4. A movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

5. A movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

6. A movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

7. A movable base station in accordance with claim 1, further comprising a controller configured to align and combine the received mobile device signals.

8. A movable base station in accordance with claim 1, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

9. A movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle.

10. A movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle.

11. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas; and

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

12. A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

13. A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

14. A movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

15. A movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

16. A movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

17. A movable base station in accordance with claim 11, further comprising a controller configured to align and combine the received radio frequency signals.

18. A movable base station in accordance with claim 11, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

19. A movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle.



20. A movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle.

**MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION****ABSTRACT**

A mobile communication system employs moving base stations moving in the direction of flow of traffic moving along a roadway. The moving base station communicates with fixed radio ports connected to a gateway office. A plurality of moving base stations are spaced apart on a closed loop and move with the flow of traffic along one roadway on one leg of the loop and with a flow of traffic on another roadway in another leg of the loop. The moving base stations communicate with a plurality of fixed radio ports connected by a signal transmission link to a gateway office which, in turn, is connected to the wire line network. The moving base stations are each provided with a pair of directional antennas with one antenna directed toward the flow of traffic and another antenna directed to the fixed radio ports.

DECLARATION FOR PATENT APPLICATION

As below-named inventor, I hereby declare that:

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

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION  
the specification of which is attached hereto unless the following box is checked:

☐ was filed on \_\_\_\_\_ as United States Application Number or PCT International Application Number \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that 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 information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

Priority Claimed

\_\_\_\_\_  
(Number) (Country) (Day/Month/Year Filed) ☐ Yes ☐ No

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 in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

PCT/US95/07037 June 2, 1995 pending  
(Application Serial No.) (Filing Date) (Status) (patented, pending or abandoned)

I hereby appoint the following attorneys and/or agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

John E. McGarry, Reg. No. 22,360; H. Lawrence Smith, Reg. No. 24,900; Peter Visserman, Reg. No. 25,185; Thomas L. Lockhart, Reg. No. 29,324; Timothy E. Eagle, Reg. No. 31,755; Joel E. Bair, Reg. No. 33,356; Richard J. McKenna, Reg. No. 35,610; and Alvin R. Wirthlin, Reg. No. 40,267. Address all telephone calls to VARNUM, RIDDERING, SCHMIDT & HOWLETT LLP at telephone number (616) 336-6000. Address all correspondence to Bridgewater Place, Post Office Box 352, Grand Rapids, Michigan 49501-0352.

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

Full name of sole or first inventor (given name, family name) Charles D. Gavrilovich

Inventor's signature Charles D. Gavrilovich Date 7-18-1996  
Residence 7 S 533 Plainfield Road, Naperville, Illinois 60540 Citizenship U.S.  
Post Office Address same as above

Full name of second joint inventor (given name, family name) \_\_\_\_\_

Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_

Full name of third joint inventor (given name, family name) \_\_\_\_\_

Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_

☐ Additional inventors are being named on separately numbered sheets attached hereto.

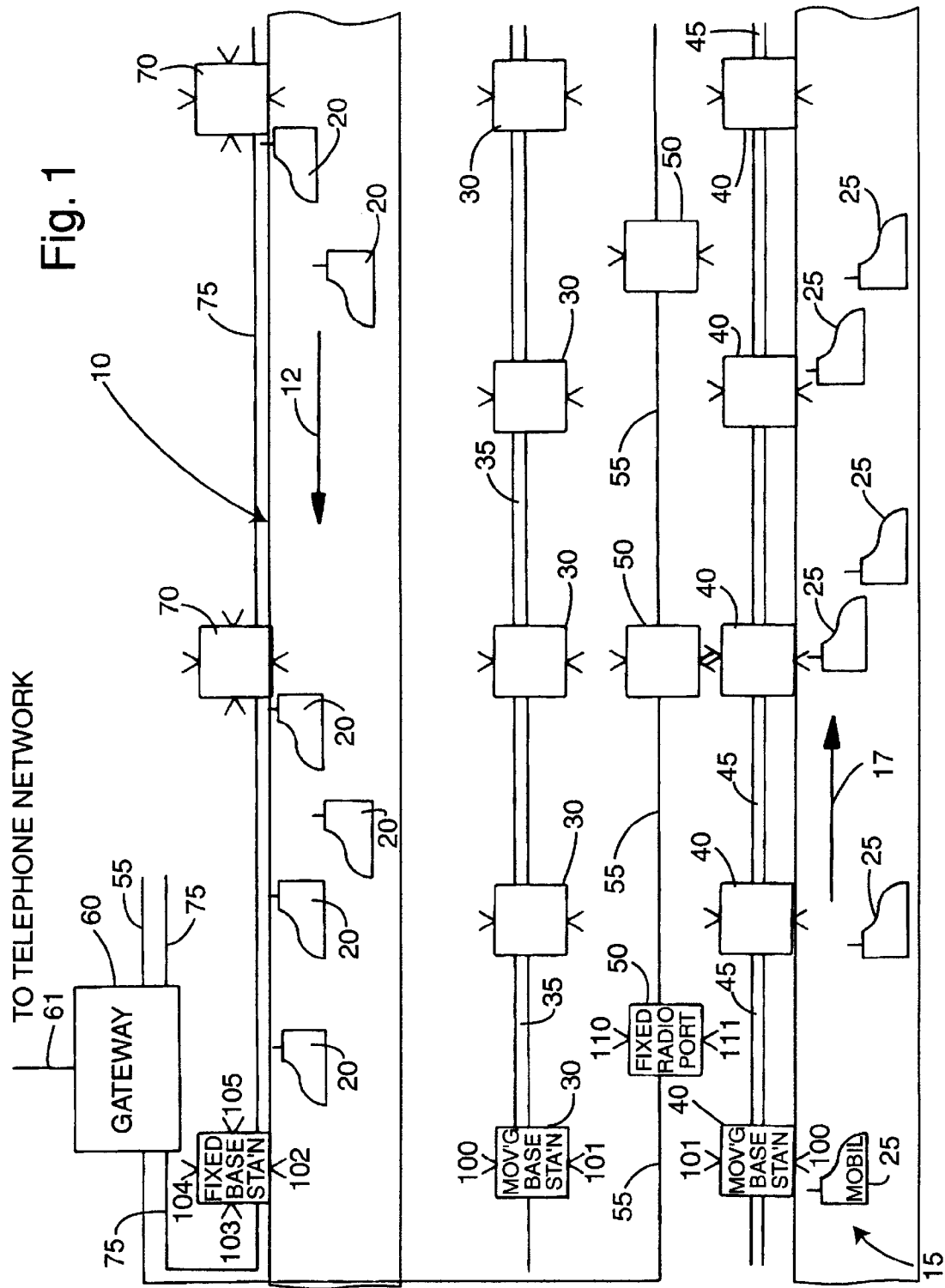
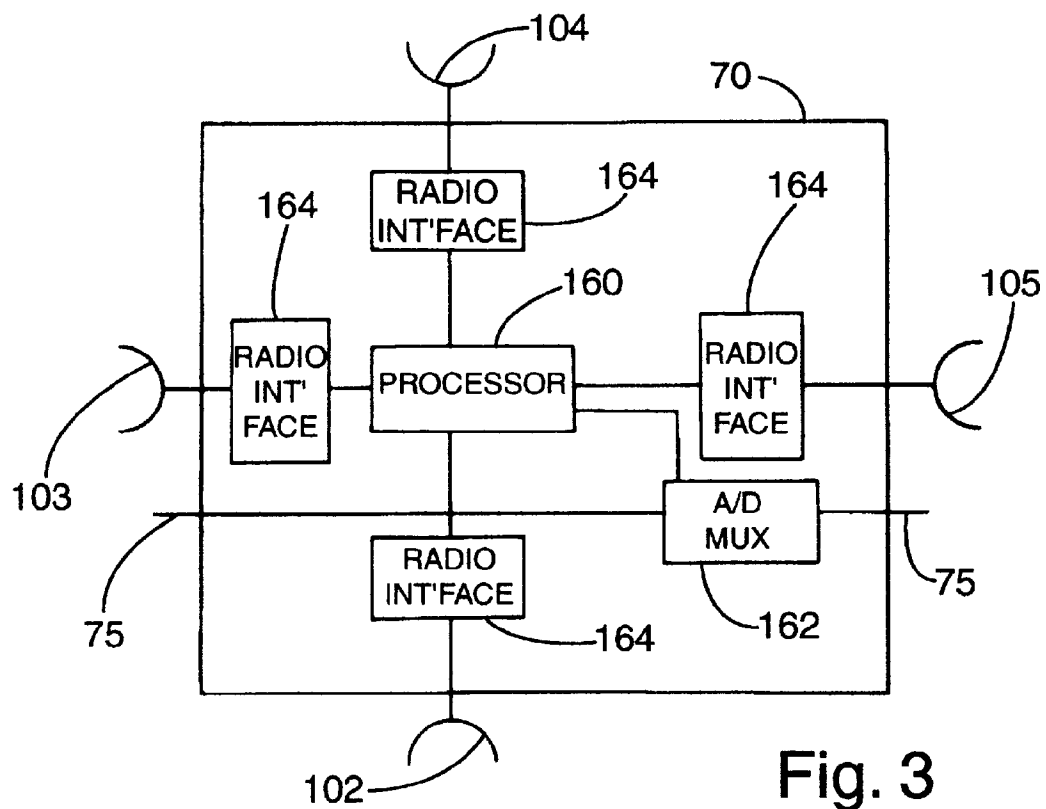
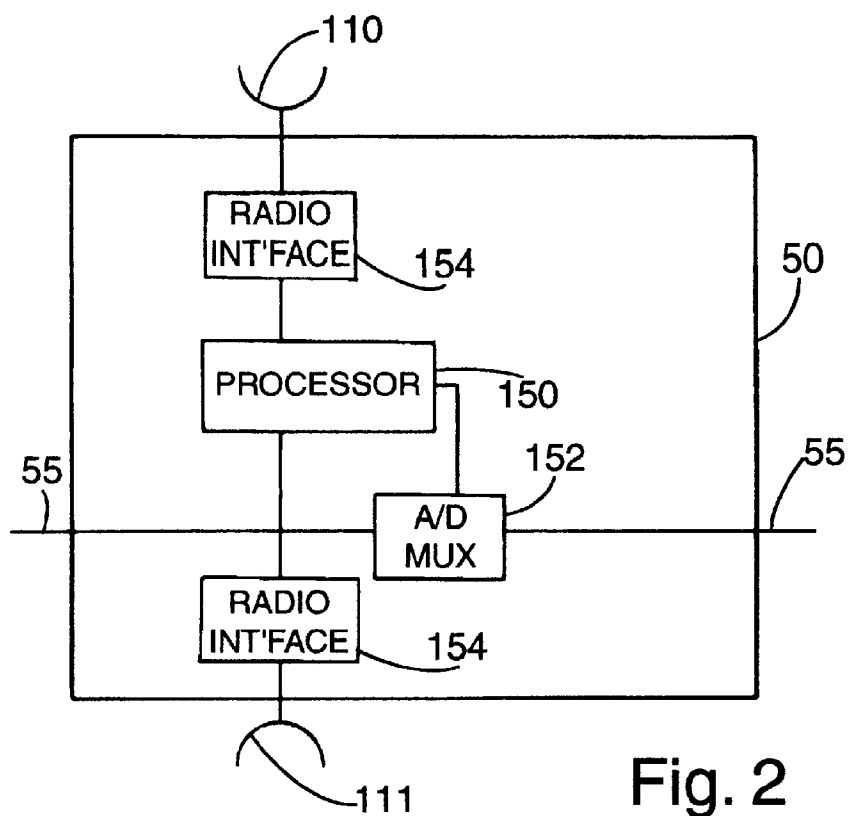


Fig. 1



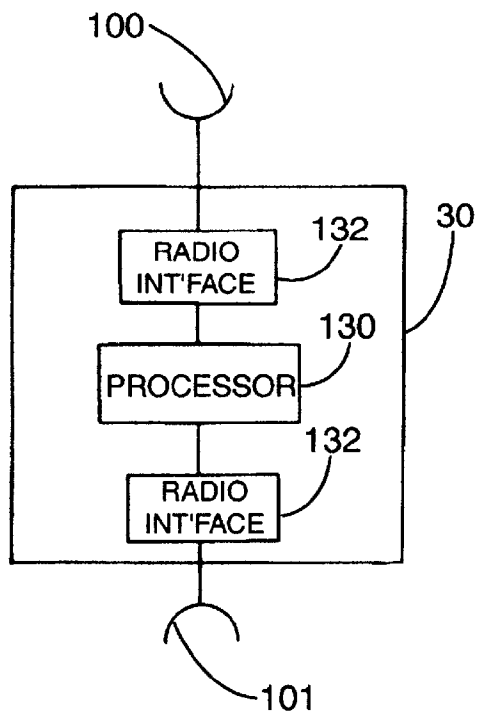


Fig. 4

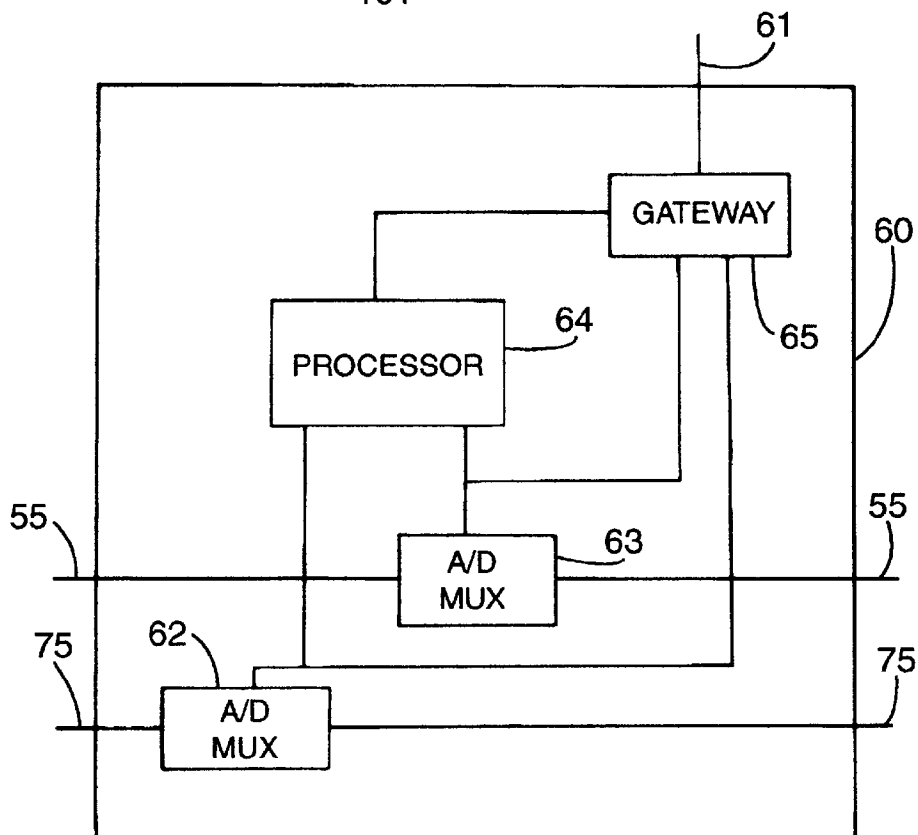


Fig. 5

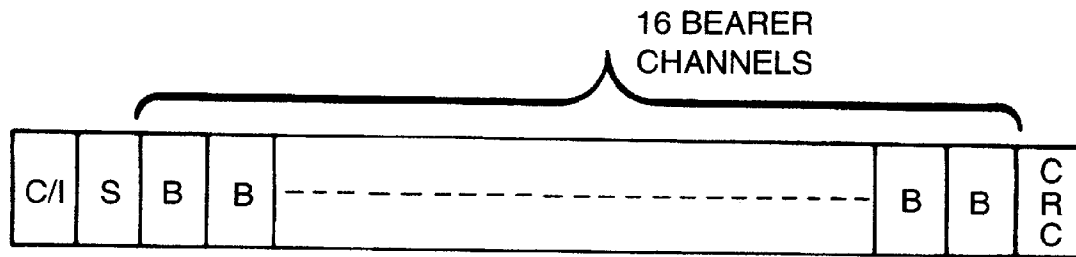


Fig. 6



Fig. 7

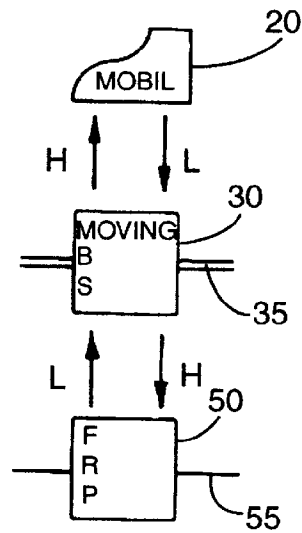


Fig. 8

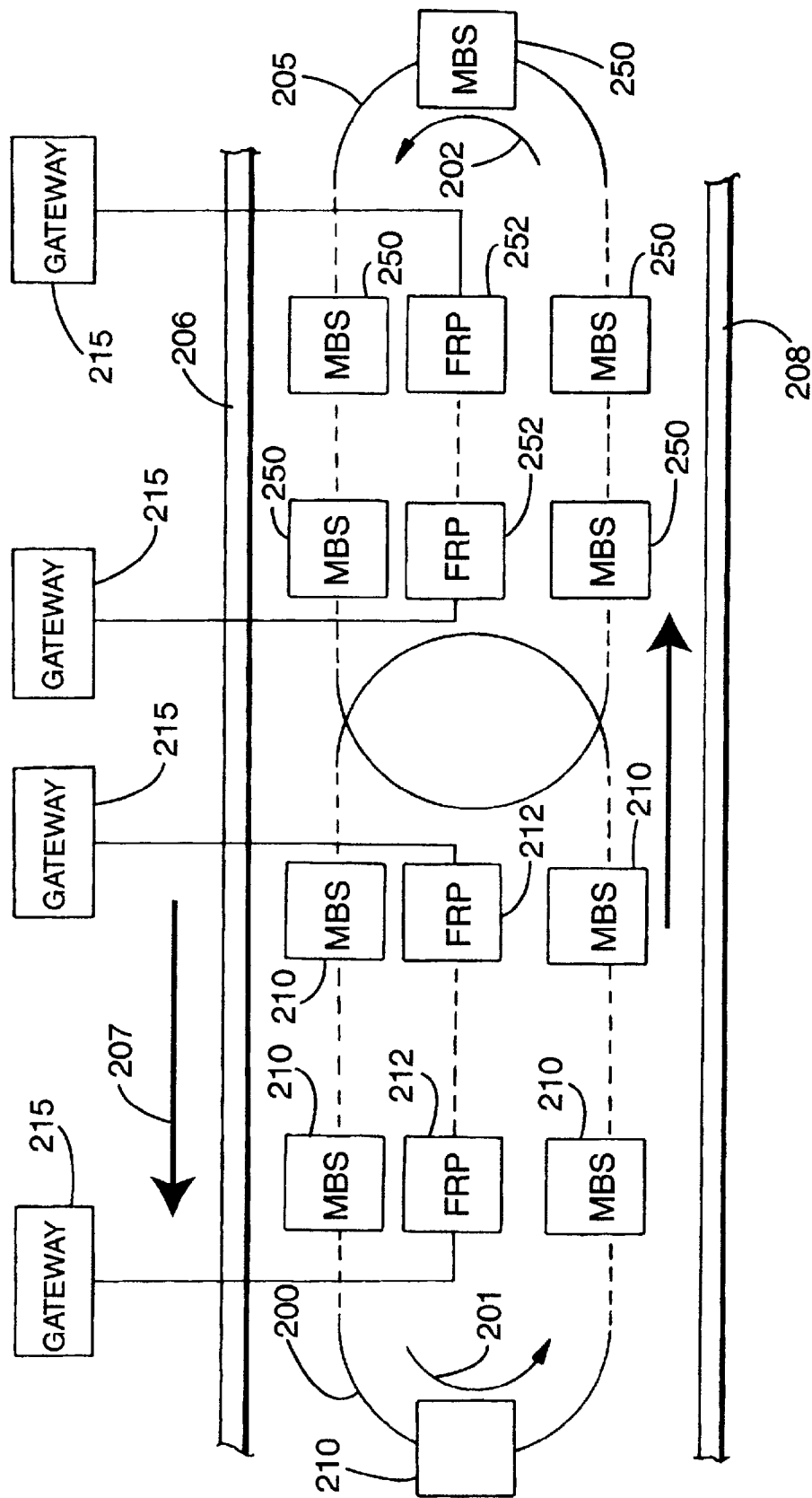


Fig. 9



## Electronic Patent Application Fee Transmittal

**Application Number:**

**Filing Date:**

**Title of Invention:**

Mobile Communication System With Moving Base Station

**First Named Inventor/Applicant Name:**

Charles Dan Gavrilovich

**Filer:**

Charles Dan Gavrilovich

**Attorney Docket Number:**

CAR100C3

Filed as Small Entity

### Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Basic Filing:</b>				
Utility filing Fee (Electronic filing)	4011	1	75	75
Utility Search Fee	2111	1	250	250
Utility Examination Fee	2311	1	100	100

**Pages:**

**Claims:**

**Miscellaneous-Filing:**

**Petition:**

**Patent-Appeals-and-Interference:**

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				425

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	1666500
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles Dan Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	09-APR-2007
<b>Filing Date:</b>	
<b>Time Stamp:</b>	18:11:28
<b>Application Type:</b>	Utility

### Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	\$425
RAM confirmation Number	985
Deposit Account	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
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1		CAR100C3.pdf	88437	yes	22
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	17	
	Claims		18	21	
	Abstract		22	22	
Warnings:					
Information:					
2	Oath or Declaration filed	CAR100C3Declaration.pdf	1412215	no	1
Warnings:					
Information:					
3	Drawings	FIGSCAR100C3.pdf	94869	no	5
Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	8352	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1603873		

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**

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4/9/07

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**PATENT APPLICATION FEE DETERMINATION RECORD**

Substitute for Form PTO-875

Application or Docket Number

**11/733,069****APPLICATION AS FILED – PART I**

(Column 1)

(Column 2)

FOR	NUMBER FILED	NUMBER EXTRA
BASIC FEE (37 CFR 1.16(a), (b), or (c))		
SEARCH FEE (37 CFR 1.16(k), (l), or (m))		
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		
TOTAL CLAIMS (37 CFR 1.16(i))	<b>20</b> minus 20 =	<b>0</b>
INDEPENDENT CLAIMS (37 CFR 1.16(h))	<b>2</b> minus 3 =	<b>0</b>
APPLICATION SIZE FEE (37 CFR 1.16(s))		
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))		

**SMALL ENTITY**

OR

**OTHER THAN SMALL ENTITY**

RATE (\$)	FEE (\$)
	<b>75</b>
	<b>250</b>
	<b>100</b>
X\$ 25	<b>0</b>
X\$100	<b>0</b>
180	
<b>TOTAL</b>	<b>425</b>

OR

RATE (\$)	FEE (\$)
X\$50	
X\$200	
360	
<b>TOTAL</b>	<b>0</b>

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

**APPLICATION AS AMENDED – PART II**

(Column 1)

(Column 2)

(Column 3)

AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	*		Minus	**	=
Independent (37 CFR 1.16(h))	*		Minus	***	=
Application Size Fee (37 CFR 1.16(s))					
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					

**SMALL ENTITY**

OR

**OTHER THAN SMALL ENTITY**

RATE (\$)	ADDITIONAL FEE (\$)
X =	
X =	
180	
<b>TOTAL</b>	
<b>ADD'T FEE</b>	

OR

RATE (\$)	ADDITIONAL FEE (\$)
X =	
X =	
360	
<b>TOTAL</b>	
<b>ADD'T FEE</b>	

(Column 1)

(Column 2)

(Column 3)

AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	*		Minus	**	=
Independent (37 CFR 1.16(h))	*		Minus	***	=
Application Size Fee (37 CFR 1.16(s))					
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					

RATE (\$)	ADDITIONAL FEE (\$)
X =	
X =	
N/A	
<b>TOTAL</b>	
<b>ADD'T FEE</b>	

OR

RATE (\$)	ADDITIONAL FEE (\$)
X =	
X =	
N/A	
<b>TOTAL</b>	
<b>ADD'T FEE</b>	

\* 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.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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4/9/2007



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/733,069	04/09/2007	2617	425	CAR100C3	20	2

**CONFIRMATION NO. 7533**

35083

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA91910-6729

**FILING RECEIPT**

Date Mailed: 04/23/2007

Receipt is acknowledged of this regular 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 mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. 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)**

Charles D. Gavrilovich, Naperville, IL;

**Power of Attorney:**

John McGarry--22360

H Smith--24900

Peter Visserman--25185

Tom Lockhart--29324

Timothy Eagle--31755

Joel Bair--33356

Richard McKenna--35610

Alvin Wirthlin--40267

**Domestic Priority data as claimed by applicant**

This application is a CON of 09/401,584 09/22/1999  
which is a CON of 08/953,962 10/20/1997 PAT 6,026,277  
which is a CON of 08/687,722 07/26/1996 PAT 5,729,826

**Foreign Applications**

**If Required, Foreign Filing License Granted: 04/20/2007**

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is  
**US11/733,069**

**Projected Publication Date: 08/02/2007**

**Non-Publication Request: No**

**Early Publication Request: No**



**\*\* SMALL ENTITY \*\***

**Title**

Mobile Communication System With Moving Base Station

**Preliminary Class**

455

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

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

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

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

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

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APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3

**CONFIRMATION NO. 7533**

35083

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA91910-6729

**Title:** Mobile Communication System With Moving Base Station

**Publication No.** US-2007-0178832-A1

**Publication Date:** 08/02/2007

### NOTICE OF PUBLICATION OF APPLICATION

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

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

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Pre-Grant Publication Division, 703-605-4283

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**REVOCATION OF POWER OF  
ATTORNEY WITH  
NEW POWER OF ATTORNEY  
AND  
CHANGE OF CORRESPONDENCE ADDRESS**

Application Number	11/733,069
Filing Date	April 09, 2007
First Named Inventor	Charles D. Gavrilovich
Art Unit	2617
Examiner Name	
Attorney Docket Number	CAR100C3

**I hereby revoke all previous powers of attorney given in the above-identified application.**

☐ A Power of Attorney is submitted herewith.

**OR**

☒ I hereby appoint the practitioners associated with the Customer Number: 35083

☐ Please change the correspondence address for the above-identified application to:

☒ The address associated with  
Customer Number:

35083

**OR**

☐ Firm or  
Individual Name

Address

City

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I am the:

☐ Applicant/Inventor.

☒ Assignee of record of the entire interest. See 37 CFR 3.71.  
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

**SIGNATURE of Applicant or Assignee of Record**

Signature

Name

Charles D. Gavrilovich

Date

8-11-2007

Telephone

847-308-6325

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below\*.

☐ \*Total of \_\_\_\_\_ forms are submitted.

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 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	2080941
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	14-AUG-2007
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	15:28:40
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73(b).	37CFR373.pdf	1084776 897944082226a90781154d199edf99c8c9bc6286	no	1

### Warnings:

<b>Information:</b>					
2	Power of Attorney	POA.pdf	1036264	no	1
			2368479a9ad8d727e51b366f4ad684228601d2aa		
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				2121040	
<p>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.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  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.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  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.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  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.</p>					

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: Carucel Investments, LPApplication No./Patent No.: 11/733,069 Filed/Issue Date: 04/09/2007Entitled: MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATIONCarucel Investments, a 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; or
2. ☐ an assignee of less than the entire right, title and interest  
(The extent (by percentage) of its ownership interest is \_\_\_\_\_ %)

in the patent application/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 013712, Frame 0275, or for which a copy thereof 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: \_\_\_\_\_ To: \_\_\_\_\_  
The document was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.
2. 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.
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.

☐ 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.

Charles D. Gavrilovich  
Signature

Carucel, LLC by Charles D. Gavrilovich, Member

Printed or Typed Name

General Partner

Title

8-11-2007  
Date

847-308-6325

Telephone Number

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.

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: <b>Charles D. Gavrilovich</b>	Group Art Unit: <b>to be assigned</b>
Application No.: <b>11/733,069</b>	Examiner: <b>to be assigned</b>
Filed: <b>April 09, 2007</b>	Confirmation No.: <b>7533</b>
Title: <b>MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION</b>	

**REQUEST FOR CORRECTED FILING RECEIPT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This Communication is submitted to request correction of the filing receipt in reference to the above-captioned application. The data requiring correction is indicated in pen and ink on the attached copy of the filing receipt and herein in **BOLD**.

**Foreign Priority data as claimed by applicant**

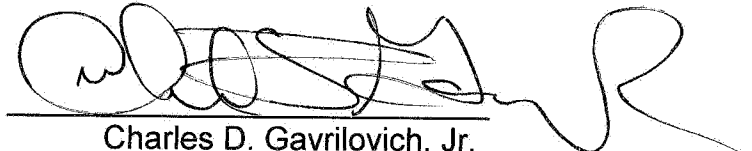
The priority data noted on the filing receipt is incorrect. Please add **--which is a National Application of PCT/US95/07037 filed June 02, 1995—**after “Foreign Applications”. Applicant(s) respectfully request the above correction be made of record.



No fee is believed to be due in connection with this request. However, should it be determined that a fee is in fact required for matters related to this submission, the Commissioner is hereby authorized to charge Deposit Account No. **502484**.

Respectfully Submitted,

Dated: August 14, 2007

A handwritten signature in black ink, appearing to read 'Charles D. Gavrilovich, Jr.', written over a horizontal line.

Charles D. Gavrilovich, Jr.  
Reg. No.: 41,031

Charles D. Gavrilovich, Jr.  
Gavrilovich, Dodd & Lindsey, LLP  
985 Paseo La Cresta, Suite B  
Chula Vista, CA 91910  
Phone: 619 271 0382  
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
11/733,069	04/09/2007	2617	425	CAR100C3	20	2

CONFIRMATION NO. 7533

35083

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA91910-6729

FILING RECEIPT

Date Mailed: 04/23/2007

Receipt is acknowledged of this regular 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 mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. 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)

Charles D. Gavrilovich, Naperville, IL;

Power of Attorney:

John McGarry--22360

H Smith--24900

Peter Visserman--25185

Tom Lockhart--29324

Timothy Eagle--31755

Joel Bair--33356

Richard McKenna--35610

Alvin Wirthlin--40267

Domestic Priority data as claimed by applicant

This application is a CON of 09/401,584 09/22/1999  
which is a CON of 08/953,962 10/20/1997 PAT 6,026,277  
which is a CON of 08/687,722 07/26/1996 PAT 5,729,826

Foreign Applications

which is a National Application of PCT/US95/07037 filed  
June 02, 1995

If Required, Foreign Filing License Granted: 04/20/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is  
**US11/733,069**

Projected Publication Date: 08/02/2007

Non-Publication Request: No

Early Publication Request: No

**\*\* SMALL ENTITY \*\***

**Title**

Mobile Communication System With Moving Base Station

**Preliminary Class**

455

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

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

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

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

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

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

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**LICENSE FOR FOREIGN FILING UNDER**

**Title 35, United States Code, Section 184**

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

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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

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

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	2081503
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	14-AUG-2007
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	16:08:59
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	CORFRCAR100C3.pdf	3814365 <small>6a951224825bdd44c4705e7c463dfa8c4ecf889a</small>	no	5

### Warnings:

<b>Information:</b>	
<b>Total Files Size (in bytes):</b>	3814365
<p>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.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  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.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  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.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  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.</p>	



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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3

CONFIRMATION NO. 7533

35083

CHARLES D. GAVRILOVICH, JR.,  
 GAVRILOVICH, DODD & LINDSEY, LLP  
 985 PASEO LA CRESTA, SUITE B  
 CHULA VISTA, CA 91910-6729

Date Mailed: 08/17/2007

### Notice Regarding Benefit/Priority Claim(s)

☐ **Improper Benefit Claim(s) to Prior-Filed Nonprovisional Application(s)**

The benefit claim(s) to prior-filed nonprovisional application(s) is improper because there is no specific reference for each prior-filed application that includes: (1) the identification of the prior-filed application by application number, or international application number and international filing date; and (2) a clear indication the relationship (i.e., continuation, divisional, or continuation-in-part) of the nonprovisional applications. For example, applicant should amend the specification to include a specific reference, such as "This application is a continuation of Application No. 10/---,--- filed ---." in the first sentence of the specification following the title.

Applicant should review each benefit claim submitted and, if appropriate, provide the proper reference to the prior-filed application(s) as required by 37 CFR 1.78. A proper relationship includes an identification of each nonprovisional application as a continuation, divisional or continuation-in-part application of the immediate prior-filed nonprovisional application for which a benefit is claimed under 37 CFR 1.78 in order to establish copendency throughout the entire chain of prior-filed applications. The specific reference must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for each benefit claim must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed. See 37 CFR 1.78(a).

☐ **Improper Benefit Claim(s) to Prior-Filed Provisional Application(s)**

The benefit claim(s) to prior-filed provisional application(s) is improper because the instant application was not filed within twelve (12) months from the filing date of the provisional application,

and there is no indication of an intermediate nonprovisional application that is directly claiming the benefit of the provisional application and filed within 12 months of the filing date of the provisional application. For example, applicant should amend the specification to include a specific reference, such as "This application is a continuation of Application No. 10/---,--- filed ---, which claims the benefit of U.S. Provisional Application No. 60/---,--- filed---." in the first sentence of the specification following the title.

Applicant should review each benefit claim submitted and, if appropriate, provide the proper reference to the prior-filed applications (including an indication of any intermediate nonprovisional application that is directly claiming the benefit of the provisional application and filed with 12 months of the filing date of the provisional application) as required by 37 CFR 1.78. The required reference must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for each benefit claim must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed during the pendency of the instant application.

#### ☐ **Improper Priority Claim(s) to Prior-Filed Foreign Application(s)**

The instant application was not filed within twelve (12) months from the filing date of the prior-filed foreign application, and there is no benefit claim to an intermediate nonprovisional application filed within 12 months of the filing date of the foreign application. Applicant should review each priority claim submitted and, if appropriate, provide the proper reference to any intermediate nonprovisional application filed within 12 months of the filing date of the foreign application in compliance with 37 CFR 1.78, or delete the priority claim. The required reference to an intermediate nonprovisional application must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for the benefit claim to an intermediate nonprovisional application must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed.

#### ☐ **Benefit Claims to More Than 400 Prior-Filed Applications**

The Office's automated system to record and capture benefit claims is only capable of recording benefit claims for 400 prior-filed applications. Therefore, the Office is unable to generate a filing receipt containing benefit claims for more than 400 prior-filed applications even though applicant is entitled to submit benefit claims for more than 400 prior-filed applications. Accordingly, applicant should not request a corrected filing receipt to include benefit claims for more than 400 prior-filed applications.



#### **Prior-Filed Nonprovisional Application has been Improperly Indicated as a National Stage (35**



**U.S.C. 371) Application**

Applicant submitted a benefit claim to a prior-filed nonprovisional application and improperly indicated that the prior-filed application is a national stage application under 35 U.S.C. 371. The Office's records show that the prior-filed application is an application filed under 35 U.S.C. 111(a). The Office has entered the benefit claim to the prior-filed application as a benefit claim to an application filed under 35 U.S.C. 111(a). Any request for a corrected filing receipt to include the indication that the prior-filed application is a national stage application will not be granted unless applicant supplies evidence that the prior application was in fact a national stage application. Accordingly, applicant should not submit such request without such evidence. Applicant should submit an amendment (or an application data sheet (ADS) if the benefit claim was submitted in an ADS) to delete the indication that the prior-filed application is a national stage application.

For more information and examples on benefit claims, please see Claiming the Benefit of a Prior-Filed Application under 35 U.S.C. 119(e), 120, 121, and 365(c), 1268 Off. Gaz. Pat. Office 89 (March 18, 2003), which is available on the USPTO website at <http://www.uspto.gov/web/offices/com/sol/og/2003/week11/pathbene.htm>, and the Manual of Patent Examining Procedure (MPEP) §§ 201.11 and 201.14.

PART 3 - OFFICE COPY



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www.uspto.gov

APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3

35083  
CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

**CONFIRMATION NO. 7533**




Date Mailed: 08/22/2007

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 08/14/2007.

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.

  
Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199  
OFFICE COPY



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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3

35083  
 CHARLES D. GAVRILOVICH, JR.,  
 GAVRILOVICH, DODD & LINDSEY, LLP  
 985 PASEO LA CRESTA, SUITE B  
 CHULA VISTA, CA 91910-6729

CONFIRMATION NO. 7533




\*OC000000025500064\*

Date Mailed: 08/22/2007

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/14/2007.

- 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).

  
 Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199  
 OFFICE COPY

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: <b>Charles D. Gavrilovich</b>	Group Art Unit: <b>to be assigned</b>
Application No.: <b>11/733,069</b>	Examiner: <b>to be assigned</b>
Filed: <b>April 09, 2007</b>	Confirmation No.: <b>7533</b>
Title: <b>MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION</b>	

**REQUEST FOR CORRECTED FILING RECEIPT AND RESPONSE TO NOTICE  
REGARDING BENEFIT/PRIORITY CLAIM(S)**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This Communication is submitted to request correction of the filing receipt in reference to the above-captioned application. The data requiring correction is indicated in pen and ink on the attached copy of the filing receipt and herein in **BOLD**. A previous Request was denied because of the request incorrectly listed a the

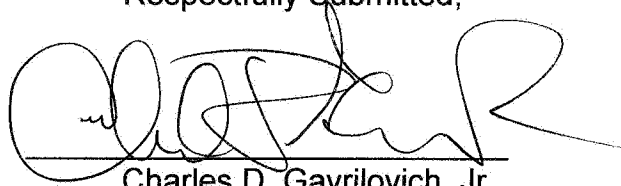
**Claim of Priority Data**

The priority data noted on the filing receipt is incorrect. Please add --**which is a CON of PCT/US95/07037 filed June 02, 1995**—after “which is a CON of 08/687,722 07/26/1996 PAT 5,729,826”. Applicant(s) respectfully request the above correction be made of record. A copy of the Notice of Benefit of Claim(s) has is also attached.

No fee is believed to be due in connection with this request. However, should it be determined that a fee is in fact required for matters related to this submission, the Commissioner is hereby authorized to charge Deposit Account No. **502484**.

Respectfully Submitted,

Dated: Oct 17, 2007

A handwritten signature in black ink, appearing to read "Charles D. Gavrilovich, Jr.", written over a horizontal line.

Charles D. Gavrilovich, Jr.  
Reg. No.: 41,031

Charles D. Gavrilovich, Jr.  
Gavrilovich, Dodd & Lindsey, LLP  
985 Paseo La Cresta, Suite B  
Chula Vista, CA 91910  
Phone: 619 271 0382  
Facsimile: 619 271 0383



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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3

CONFIRMATION NO. 7533

35083

CHARLES D. GAVRILOVICH, JR.,  
 GAVRILOVICH, DODD & LINDSEY, LLP  
 985 PASEO LA CRESTA, SUITE B  
 CHULA VISTA, CA 91910-6729

Date Mailed: 08/17/2007

### Notice Regarding Benefit/Priority Claim(s)

☐ **Improper Benefit Claim(s) to Prior-Filed Nonprovisional Application(s)**

The benefit claim(s) to prior-filed nonprovisional application(s) is improper because there is no specific reference for each prior-filed application that includes: (1) the identification of the prior-filed application by application number, or international application number and international filing date; and (2) a clear indication the relationship (i.e., continuation, divisional, or continuation-in-part) of the nonprovisional applications. For example, applicant should amend the specification to include a specific reference, such as "This application is a continuation of Application No. 10/---,--- filed ---," in the first sentence of the specification following the title.

Applicant should review each benefit claim submitted and, if appropriate, provide the proper reference to the prior-filed application(s) as required by 37 CFR 1.78. A proper relationship includes an identification of each nonprovisional application as a continuation, divisional or continuation-in-part application of the immediate prior-filed nonprovisional application for which a benefit is claimed under 37 CFR 1.78 in order to establish copendency throughout the entire chain of prior-filed applications. The specific reference must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for each benefit claim must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed. See 37 CFR 1.78(a).

☐ **Improper Benefit Claim(s) to Prior-Filed Provisional Application(s)**

The benefit claim(s) to prior-filed provisional application(s) is improper because the instant application was not filed within twelve (12) months from the filing date of the provisional application,

and there is no indication of an intermediate nonprovisional application that is directly claiming the benefit of the provisional application and filed within 12 months of the filing date of the provisional application. For example, applicant should amend the specification to include a specific reference, such as "This application is a continuation of Application No. 10/---,--- filed ---, which claims the benefit of U.S. Provisional Application No. 60/---,--- filed---." in the first sentence of the specification following the title.

Applicant should review each benefit claim submitted and, if appropriate, provide the proper reference to the prior-filed applications (including an indication of any intermediate nonprovisional application that is directly claiming the benefit of the provisional application and filed with 12 months of the filing date of the provisional application) as required by 37 CFR 1.78. The required reference must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for each benefit claim must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed during the pendency of the instant application.

☐ **Improper Priority Claim(s) to Prior-Filed Foreign Application(s)**

The instant application was not filed within twelve (12) months from the filing date of the prior-filed foreign application, and there is no benefit claim to an intermediate nonprovisional application filed within 12 months of the filing date of the foreign application. Applicant should review each priority claim submitted and, if appropriate, provide the proper reference to any intermediate nonprovisional application filed within 12 months of the filing date of the foreign application in compliance with 37 CFR 1.78, or delete the priority claim. The required reference to an intermediate nonprovisional application must be included in the domestic priority information section of an application data sheet (37 CFR 1.76), or the specification must contain, or be amended to contain, such reference in the first sentence following the title.

**Timeliness:** The required reference for the benefit claim to an intermediate nonprovisional application must be filed during the pendency of the instant application and within the later of: (1) four months from the actual filing date of the instant application, or the national stage commencement date if the instant application is a national stage application under 35 U.S.C. 371; or (2) sixteen months from the filing date of the prior-filed application. Failure to timely file the required reference is considered a waiver of any benefit claim, unless a grantable petition to accept an unintentionally delayed claim under 37 CFR 1.78(a), the surcharge set forth in 37 CFR 1.17(t), and the required reference are filed.

☐ **Benefit Claims to More Than 400 Prior-Filed Applications**

The Office's automated system to record and capture benefit claims is only capable of recording benefit claims for 400 prior-filed applications. Therefore, the Office is unable to generate a filing receipt containing benefit claims for more than 400 prior-filed applications even though applicant is entitled to submit benefit claims for more than 400 prior-filed applications. Accordingly, applicant should not request a corrected filing receipt to include benefit claims for more than 400 prior-filed applications.

☒ **Prior-Filed Nonprovisional Application has been Improperly Indicated as a National Stage (35**

**U.S.C. 371) Application**

Applicant submitted a benefit claim to a prior-filed nonprovisional application and improperly indicated that the prior-filed application is a national stage application under 35 U.S.C. 371. The Office's records show that the prior-filed application is an application filed under 35 U.S.C. 111(a). The Office has entered the benefit claim to the prior-filed application as a benefit claim to an application filed under 35 U.S.C. 111(a). Any request for a corrected filing receipt to include the indication that the prior-filed application is a national stage application will not be granted unless applicant supplies evidence that the prior application was in fact a national stage application. Accordingly, applicant should not submit such request without such evidence. Applicant should submit an amendment (or an application data sheet (ADS) if the benefit claim was submitted in an ADS) to delete the indication that the prior-filed application is a national stage application.

For more information and examples on benefit claims, please see Claiming the Benefit of a Prior-Filed Application under 35 U.S.C. 119(e), 120, 121, and 365(c), 1268 Off. Gaz. Pat. Office 89 (March 18, 2003), which is available on the USPTO website at <http://www.uspto.gov/web/offices/com/sol/og/2003/week11/patbene.htm>, and the Manual of Patent Examining Procedure (MPEP) §§ 201.11 and 201.14.

PART 2 - COPY TO BE RETURNED WITH RESPONSE



## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	2332237
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	17-OCT-2007
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	15:09:06
<b>Application Type:</b>	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	Request for Corrected Filing Receipt	CORFRCAR100C3OCT17.p df	4141605  5e3c88f57bbb3d862fb3f97cc0d8383d 3ff7185	no	5

### Warnings:

<b>Information:</b>	
<b>Total Files Size (in bytes):</b>	4141605
<p>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.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  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.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  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.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  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.</p>	



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
11/733,069	04/09/2007	2617	425	CAR100C3	20	2

**CONFIRMATION NO. 7533**

**CORRECTED FILING RECEIPT**

35083

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729



Date Mailed: 10/22/2007

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

## Applicant(s)

Charles D. Gavrilovich, Naperville, IL;

**Power of Attorney:** The patent practitioners associated with Customer Number 35083

## Domestic Priority data as claimed by applicant

This application is a CON of 09/401,584 09/22/1999 PAT 7,221,904  
which is a CON of 08/953,962 10/20/1997 PAT 6,026,277  
which is a CON of 08/687,722 07/26/1996 PAT 5,729,826  
which is a CON of PCT/US95/07037 06/02/1995

## Foreign Applications

**If Required, Foreign Filing License Granted:** 04/20/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/733,069**

**Projected Publication Date:** Not Applicable

**Non-Publication Request:** No

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

Mobile Communication System With Moving Base Station

**Preliminary Class**

455

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

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

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

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

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

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

**LICENSE FOR FOREIGN FILING UNDER****Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

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

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

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

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

## EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1780	455/562.1.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 17:24
L3	3573	(moving or movable) near10 "base station"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 17:24
L4	55	L3 and I2	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 17:39
L5	9	("5404570") or ("5058201") or ("4539706") or ("5729826") or ("5384824") or ("6026277") or ("5640443") or ("5282239") or ("5109390")).PN.	USPAT	OR	OFF	2008/01/06 17:40
S2	39	455/11.1.ccls. and @rlad<"19950602"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 00:36
S3	40	455/11.1.ccls. and @rlad<="19950602"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 00:36
S4	984	455/11.1.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 00:36
S5	17	(moving or movable) and S3	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 13:10
S6	3573	(moving or movable) near10 "base station"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 13:10
S7	13	array near10 S6	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2008/01/06 17:23



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733.069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

35083

7590

01/10/2008

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
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EXAMINER

CONTEE, JOY KIMBERLY

ART UNIT

PAPER NUMBER

2617

MAIL DATE

DELIVERY MODE

01/10/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

**Application No.**

11/733,069

**Applicant(s)**

GAVRILOVICH, CHARLES D.

**Examiner**

Joy K. Contee

**Art Unit**

2617

-- 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 09 April 2007.
- 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) 1,2,4-6,9-11,12,14-16,19 and 20 is/are rejected.
- 7) ☒ Claim(s) 3,7,8,13,17 and 18 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 09 April 2007 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:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ 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) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |



## DETAILED ACTION

### ***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 1,4-6,9-11,14-16 and 19-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Mears et al. (Mears), US Patent No. 4,539,706.

Regarding claim 1, Mears discloses a movable base station configured to move relative to Earth, the movable base station comprising: a plurality of spatially separated antennas (see Fig. 1 and col. 4, lines 40-57); a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas (see col. 4, lines 40-57); and a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station (see Fig. 1 and col. 4, lines 40-57).

Regarding claim 4, Mears discloses a movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas (reads on plural mobile vehicular repeaters), the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas (reads on plural mobile vehicular repeaters) (col. 4, lines 40-57).

Regarding claim 5, Mears discloses a movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to

Art Unit: 2617

transmit spatially separated radio frequency beams separated in time with a predefined time delay (col. 5,line 25-col. 6,line 49).

Regarding claim 6, Mears discloses a movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal (reads on in-range) (col. 3,lines 15-41).

Regarding claim 9, Mears discloses a movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle (col.4,lines 40-43).

Regarding claim 10, Mears discloses a movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle (col. 4,lines 58-64 and col. 1,lines 19-30).

Regarding claim 11, Mears discloses a movable base station configured to move relative to Earth, the movable base station comprising: a plurality of spatially separated antennas; and a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals (see col. 4,lines 40-57 and Fig. 1).

Regarding claim 14, Mears discloses a movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas(see col. 4,lines 40-57 and Fig. 1).

Regarding claim 15, Mears discloses a movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay(col. 5,line 25-col. 6,line 49).

Regarding claim 16,Mears discloses a movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal(reads on in-range) (col. 3,lines 15-41).

Regarding claim 19, Mears discloses a movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle(col. 4,lines 58-64 and col. 1,lines 19-30).

Regarding claim 20, Mears discloses a movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle(col. 4,lines 58-64 and col. 1,lines 19-30).

***Claim Rejections - 35 USC § 103***

3. 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 negated by the manner in which the invention was made.

4. Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mears, in view of Yokoi et al. (Yokoi), US, 5,282,239.

Regarding claim 2, Mears discloses a movable base station in accordance with claim 1, but fails to explicitly disclose wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

In a similar field of endeavor, Yokoi discloses wherein the plurality of spatially separated antennas is configured as directional antenna sectors (col. 5, lines 21-26).

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Mears to include a directional antenna for the purpose of providing directivity directly to the subject transceiver in the vehicle.

Regarding claim 12, Mears discloses a movable base station in accordance with claim 11, but fails to disclose wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

In a similar field of endeavor, Yokoi discloses wherein the plurality of spatially separated antennas is configured as directional antenna sectors (col. 5, lines 21-26).

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Mears to include a directional antenna for the purpose of providing directivity directly to the subject transceiver in the vehicle.

***Allowable Subject Matter***

5. Claims 3, 7, 8, 13, 18, 18 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***

Art Unit: 2617

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

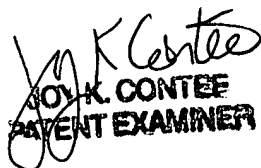
Alvesalo, US 5,384,824, discloses a method for carrying out a location updating from a mobile cellular radiophone system to another cellular radiophone system.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joy K. Contee whose telephone number is 571.272.7906. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Appiah can be reached on 571.272.7904. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JC

  
JOY K. CONTEE  
PATENT EXAMINER

**Notice of References Cited**

Application/Control No.

11/733,069

Applicant(s)/Patent Under

Reexamination

GAVRILOVICH, CHARLES D.

Examiner

Joy K. Contee

Art Unit

2617

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,282,239	01-1994	Yokoi et al.	455/465
*	B	US-4,539,706	09-1985	Mears et al.	455/11.1
*	C	US-5,384,824	01-1995	Alvesalo, Antero	455/456.2
	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					
	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.



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
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 Address: COMMISSIONER FOR PATENTS  
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## BIB DATA SHEET

CONFIRMATION NO. 7533

<b>SERIAL NUMBER</b> 11/733,069	<b>FILING or 371(c) DATE</b> 04/09/2007 <b>RULE</b>	<b>CLASS</b> 455	<b>GROUP ART UNIT</b> 2617	<b>ATTORNEY DOCKET NO.</b> CAR100C3		
<b>APPLICANTS</b> Charles D. Gavrilovich, Naperville, IL; <b>** CONTINUING DATA *****</b> This application is a CON of 09/401,584 09/22/1999 PAT 7,221,904 which is a CON of 08/953,962 10/20/1997 PAT 6,026,277 which is a CON of 08/687,722 07/26/1996 PAT 5,729,826 which is a CON of PCT/US95/07037 06/02/1995 <b>** FOREIGN APPLICATIONS *****</b> <b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY **</b> 04/20/2007						
Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Verified and /JOY KIMBERLY Acknowledged CONTEE/ Examiner's Signature	<input type="checkbox"/> Met after Allowance Initials	<b>STATE OR COUNTRY</b> IL	<b>SHEETS DRAWINGS</b> 5	<b>TOTAL CLAIMS</b> 20	<b>INDEPENDENT CLAIMS</b> 2	
<b>ADDRESS</b> CHARLES D. GAVRILOVICH, JR., GAVRILOVICH, DODD & LINDSEY, LLP 985 PASEO LA CRESTA, SUITE B CHULA VISTA, CA 91910-6729 UNITED STATES						
<b>TITLE</b> Mobile Communication System With Moving Base Station						
<b>FILING FEE RECEIVED</b> 425	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit			

# Index of Claims



Application/Control No.

11/733,069

Examiner

Joy K. Contee

Applicant(s)/Patent under  
Reexamination

GAVRILOVICH, CHARLES D.

Art Unit

2617

√	Rejected
=	Allowed

—	(Through numeral) Cancelled
+	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

Claim		Date									
Final	Original	1/5/08									
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**Search Notes**

Application/Control No.

11/733,069

Examiner

Joy K. Contee

Applicant(s)/Patent under  
Reexamination

GAVRILOVICH, CHARLES D.

Art Unit

2617

**SEARCHED**

Class	Subclass	Date	Examiner
455	11.1,562.1	1/05/08	JC
455	465	1/5/2008	JC

**INTERFERENCE SEARCHED**

Class	Subclass	Date	Examiner

**SEARCH NOTES  
(INCLUDING SEARCH STRATEGY)**

	DATE	EXMR
see search report used EAST	1/5/2008	JC

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Charles D. Gavrilovich

Serial No.: 11/733,069

Filed: April 09, 2007

For: **MOBILE COMMUNICATION  
SYSTEM WITH MOVING BASE  
STATION**

Group No.: 2617

Examiner: Joy Contee

Docket No. CAR100C3

Mail Stop Amendment Fee  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

## AMENDMENT AND RESPONSE TO OFFICE ACTION

Dear Commissioner:

Applicants respectfully submit the following Amendment and Remarks in response to the non-Final Office Action mailed January 10, 2008. Please enter the following amendment and remarks. This response submitted with a request for a two month extension of time with the appropriate fee for a small entity.

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks** begin on page 9.

**IN THE CLAIMS**

Please enter the following rewritten claims:

1. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:
  - a plurality of spatially separated antennas;
  - a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas;
  - a controller configured to align and combine the received mobile device signals; and
  - a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.
2. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.
3. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.
4. (Original) A movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.
5. (Original) A movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

6. (Original) A movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

7. (Cancelled)

8. (Original) A movable base station in accordance with claim 1, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

9. (Original) A movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle.

10. (Original) A movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle.

11. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas; and

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;

a controller configured to align and combine the received fixed port signals; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

12. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

13. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.
14. (Original) A movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.
15. (Original) A movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.
16. (Original) A movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.
17. (Cancelled).
18. (Original) A movable base station in accordance with claim 11, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.
19. (Original) A movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle.
20. (Original) A movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle.

21. (New) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station, the radio frequency signals transmitted within time slots of time-division multiplex channels.

22. (New) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

23. (New) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

24. (New) A movable base station in accordance with claim 21, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

25. (New) A movable base station in accordance with claim 21, wherein the movable base station is conveyed by a vehicle.

26. (New) A movable base station in accordance with claim 25, wherein the vehicle is an automotive vehicle.

27. (New) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured to provide directional radio frequency beams.

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

28. (New) A movable base station in accordance with claim 27, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

29. (New) A movable base station in accordance with claim 28, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

30. (New) A movable base station in accordance with claim 27, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

31. (New) A movable base station in accordance with claim 27, wherein the movable base station is conveyed by a vehicle.

32. (New) A movable base station in accordance with claim 31, wherein the vehicle is an automotive vehicle.

33. (New) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas; and

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals, the radio frequency signals transmitted within time slots of time-division multiplex channels.

34. (New) A movable base station in accordance with claim 33, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

35. (New) A movable base station in accordance with claim 33, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

36. (New) A movable base station in accordance with claim 33, wherein the movable base station is conveyed by a vehicle.

37. (New) A movable base station in accordance with claim 36, wherein the vehicle is an automotive vehicle.

38. (New) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured to provide directional radio frequency beams;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.



39. (New) A movable base station in accordance with claim 38, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

40. (New) A movable base station in accordance with claim 39, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

41. (New) A movable base station in accordance with claim 38, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

42. (New) A movable base station in accordance with claim 38, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

43. (New) A movable base station in accordance with claim 38, wherein the movable base station is conveyed by a vehicle.

44. (New) A movable base station in accordance with claim 43, wherein the vehicle is an automotive vehicle.

**REMARKS**

Before this amendment, claims 1-20 were pending in the present application. Applicant has cancelled claims 7 and 17, amended claims 1 and 11, and has added new claims 21-44. Accordingly, claims 1-6, 8-16, and 18-44 are now pending.

In the Non-Final Office Action mailed January 10, 2008, the Examiner indicated that claims 3, 7, 8, 13, 17 and 18 would be allowable if rewritten in independent form. Applicant has amended claims 1 and 11 to include the limitations of claims 7 and 17 respectively. New claims 21 and 33 are independent versions of claims 8 and 18, respectively. New claims 27 and 38 are independent versions of claims 3 and 13, respectively. All other claims are dependent claims depending from one of the independent claims. Accordingly, applicant respectfully submits that the pending claims 1-6, 8-16, and 18-44 are allowable.

**CONCLUSION**

For all the foregoing reasons, allowance of claims 1-6, 8-16, and 18-44 pending in the present application is respectfully requested. This amendment is submitted with a 2 month extension of time with the appropriate fee. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 502484.

Respectfully submitted,  
CHARLES D. GAVRILOVICH

Date:

May 25, 2008

By:



Charles D. Gavrilovich, Jr.  
Reg. No. 41,031

Charles D. Gavrilovich, Jr.  
Gavrilovich, Dodd & Lindsey, LLP  
985 Paseo La Cresta, Suite B  
Chula Vista, CA 91910  
Phone: 619 271 0382  
FAX: 619 271 0383

**REMARKS**

Before this amendment, claims 1-20 were pending in the present application. Applicant has cancelled claims 7 and 17, amended claims 1 and 11, and has added new claims 21-44. Accordingly, claims 1-6, 8-16, and 18-44 are now pending.

In the Non-Final Office Action mailed January 10, 2008, the Examiner indicated that claims 3, 7, 8, 13, 17 and 18 would be allowable if rewritten in independent form. Applicant has amended claims 1 and 11 to include the limitations of claims 7 and 17 respectively. New claims 21 and 33 are independent versions of claims 8 and 18, respectively. New claims 27 and 38 are independent versions of claims 3 and 13, respectively. All other claims are dependent claims depending from one of the independent claims. Accordingly, applicant respectfully submits that the pending claims 1-6, 8-16, and 18-44 are allowable.

**CONCLUSION**

For all the foregoing reasons, allowance of claims 1-6, 8-16, and 18-44 pending in the present application is respectfully requested. This amendment is submitted with a 2 month extension of time with the appropriate fee. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 502484.

Respectfully submitted,  
CHARLES D. GAVRILOVICH

Date:

May 25, 2008

By:



Charles D. Gavrilovich, Jr.  
Reg. No. 41,031

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Chula Vista, CA 91910  
Phone: 619 271 0382  
FAX: 619 271 0383

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	11733069			
<b>Filing Date:</b>	09-Apr-2007			
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station			
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich			
<b>Filer:</b>	Charles Dan Gavrilovich			
<b>Attorney Docket Number:</b>	CAR100C3			
Filed as Small Entity				
<b>Utility Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
Claims in excess of 20	2202	22	25	550
Independent claims in excess of 3	2201	3	105	315
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Extension - 2 months with \$0 paid	2252	1	230	230
Miscellaneous:				
Total in USD (\$)				1095

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	3355045
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	25-MAY-2008
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	14:04:36
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1095
RAM confirmation Number	4851
Deposit Account	502484
Authorized User	GAVRILOVICH,CHARLES D

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment - After Non-Final Rejection	RESP_CAR100C3_05_25_08_2.pdf	738985 6de709422d3589c079c63c0ca15463a7581594de	no	9
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8422 3f5e1bcd6125792fa119a40560cc7e3243e84672	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			747407		
<p>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.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  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.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  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.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  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.</p>					

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<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875					Application or Docket Number <b>11/733,069</b>		Filing Date <b>04/09/2007</b>		<input type="checkbox"/> To be Mailed			
<b>APPLICATION AS FILED – PART I</b>												
(Column 1)			(Column 2)		SMALL ENTITY <input checked="" type="checkbox"/>		OR		OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)		
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		N/A		N/A		N/A			
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A		N/A		N/A		N/A			
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		N/A		N/A		N/A			
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	X \$	=	X \$	=	X \$	=	X \$	=		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	X \$	=	X \$	=	X \$	=	X \$	=		
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).											
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))												
* If the difference in column 1 is less than zero, enter "0" in column 2.												
<b>APPLICATION AS AMENDED – PART II</b>												
(Column 1)			(Column 2)		(Column 3)		SMALL ENTITY		OR		OTHER THAN SMALL ENTITY	
AMENDMENT	05/25/2008	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	
Total (37 CFR 1.16(i))	*	42	Minus	** 20	=	X \$	=	OR	X \$	=	=	
Independent (37 CFR 1.16(h))	*	6	Minus	*** 3	=	X \$	=	OR	X \$	=	=	
<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))												
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE			
(Column 1)			(Column 2)		(Column 3)		SMALL ENTITY		OR		OTHER THAN SMALL ENTITY	
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	
Total (37 CFR 1.16(i))	*		Minus	**	=	X \$	=	OR	X \$	=	=	
Independent (37 CFR 1.16(h))	*		Minus	***	=	X \$	=	OR	X \$	=	=	
<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))												
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** 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.												

Legal Instrument Examiner:  
/PEGGY s. YARBOROUGH/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.





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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

35083

7590

08/22/2008

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

CONTEE, JOY KIMBERLY

ART UNIT

PAPER NUMBER

2617

MAIL DATE

DELIVERY MODE

08/22/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 11/733,069	<b>Applicant(s)</b> GAVRILOVICH, CHARLES D.	
	<b>Examiner</b> JOY K. CONTEE	<b>Art Unit</b> 2617	

-- 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 25 May 2008.
- 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) 1,2,4-12 and 14-44 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1,2,4-26 and 33-37 is/are allowed.
- 6) ☒ Claim(s) 27-29,31,32,38-41,43 and 44 is/are rejected.
- 7) ☒ Claim(s) 30 and 42 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 \_\_\_\_\_ 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) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Applicant states that new claims 27 and 38 encompass that of cancelled claims 3 and 13 but the limitations are not completely found in claims 27 and 38 and after reconsideration. Rejections based on merit follows.

### ***Claim Rejections - 35 USC § 103***

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
3. Claims 27-29,31,32 and 38-41,43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mears et al. (Mears), US Patent No. 4,539,706, , in view of Yokoi et al. (Yokoi), US, 5,282,239.

Regarding claims 27 and 38, Mears discloses a movable base station configured to move relative to Earth, the movable base station comprising: a plurality of spatially separated antennas (see Fig. 1 and col. 4,lines 40-57); a receiver configured to receive mobile device signals through the plurality of spatially separated antennas(and from a fixed port) (see col. 4,lines 40-57); and a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station (or fixed port signals) (see Fig. 1 and col. 4,lines 40-57).

Mears fails to explicitly disclose wherein the plurality of spatially separated antennas configured to provide directional radio beams.

In a similar field of endeavor, Yokoi discloses wherein the plurality of spatially separated antennas is configured as directional antenna beams (col. 5,lines 21-26).

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Mears to include a directional antenna for the purpose of providing directivity directly to the subject transceiver in the vehicle.

Regarding claims 28 and 39, Mears and Yokio discloses a movable base station in accordance with claims 27 and 38, further comprising another plurality of spatially separated antennas (reads on plural mobile vehicular repeaters), the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas (reads on plural mobile vehicular repeaters) (col. 4, lines 40-57).

Regarding claims 29, and 40, Mears and Yokio discloses a movable base station in accordance with claims 28 and 39, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay (col. 5, line 25-col. 6, line 49).

Regarding claims 31 and 43, Mears and Yokio discloses a movable base station in accordance with claims 27 and 38, wherein the movable base station is conveyed by a vehicle (see Mears, col. 4, lines 40-43).

Regarding claims 32 and 44, Mears and Yokio discloses a movable base station in accordance with claims 31 and 43, wherein the vehicle is an automotive vehicle (see Mears, col. 4, lines 58-64 and col. 1, lines 19-30).

***Allowable Subject Matter***

4. Claims 1,2,4-12 and 14-29 are allowed.
5. Claims 30 and 42 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***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joy K. Contee whose telephone number is 571.272.7906. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m.

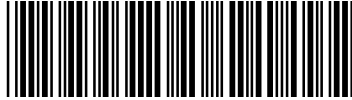
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Appiah can be reached on 571.272.7904. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JC


/Joy K Contee/

Patent Examiner(PSA), Art Unit 2617

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  JOY K CONTEE	<b>Art Unit</b>  2617

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>


<input type="checkbox"/> Claims renumbered in the same order as presented by applicant			<input type="checkbox"/> CPA			<input type="checkbox"/> T.D.			<input type="checkbox"/> R.1.47		
CLAIM		DATE									
Final	Original	08/18/2008									
	1	=									
	2	=									
	3	=									
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	23	=									
	24	=									
	25	=									
	26	=									
	27	✓									
	28	✓									
	29	✓									
	30	✓									
	31	✓									
	32	✓									
	33	=									
	34	=									
	35	=									
	36	=									

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  JOY K CONTEE	<b>Art Unit</b>  2617

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47										
CLAIM		DATE								
Final	Original	08/18/2008								
	37	=								
	38	✓								
	39	✓								
	40	✓								
	41	✓								
	42	✓								
	43	✓								
	44	✓								



<b>Search Notes</b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  JOY K CONTEE	<b>Art Unit</b>  2617

<b>SEARCHED</b>			
<b>Class</b>	<b>Subclass</b>	<b>Date</b>	<b>Examiner</b>
	updated subs	8/18/08	JC

<b>SEARCH NOTES</b>		
<b>Search Notes</b>	<b>Date</b>	<b>Examiner</b>

<b>INTERFERENCE SEARCH</b>			
<b>Class</b>	<b>Subclass</b>	<b>Date</b>	<b>Examiner</b>

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:	)	
	)	
Charles D. Gavrilovich	)	Group No.: 2617
	)	
Serial No.: 11/733,069	)	Examiner: Joy Contee
	)	
Filed: April 09, 2007	)	Docket No. CAR100C3
	)	
For: <b>MOBILE COMMUNICATION</b>	)	
<b>SYSTEM WITH MOVING BASE</b>	)	
<b>STATION</b>	)	

Mail Stop Amendment  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

**AMENDMENT AND RESPONSE TO OFFICE ACTION**

Dear Commissioner:

Applicants respectfully submit the following Amendment and Remarks in response to the non-Final Office Action mailed August 22, 2008. Please enter the following amendment and remarks. This response submitted with a request for a two month extension of time with the appropriate fee for a small entity.

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks** begin on page 9.

**IN THE CLAIMS**

Please enter the following rewritten claims:

1. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas;

a controller configured to align and combine the received mobile device signals; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

2. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

3. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

4. (Original) A movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

5. (Original) A movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

6. (Original) A movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

7. (Cancelled)

8. (Original) A movable base station in accordance with claim 1, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

9. (Original) A movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle.

10. (Original) A movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle.

11. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas; ~~and~~

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;

a controller configured to align and combine the received fixed port signals; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

12. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

13. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.
14. (Original) A movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.
15. (Original) A movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.
16. (Original) A movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.
17. (Cancelled).
18. (Original) A movable base station in accordance with claim 11, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.
19. (Original) A movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle.
20. (Original) A movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle.

21. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station, the radio frequency signals transmitted within time slots of time-division multiplex channels.

22. (Previously Presented) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

23. (Previously Presented) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

24. (Previously Presented) A movable base station in accordance with claim 21, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

25. (Previously Presented) A movable base station in accordance with claim 21, wherein the movable base station is conveyed by a vehicle.

26. (Previously Presented) A movable base station in accordance with claim 25, wherein the vehicle is an automotive vehicle.

27. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

28. (Previously Presented) A movable base station in accordance with claim 27, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

29. (Previously Presented) A movable base station in accordance with claim 28, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

30. (Previously Presented) A movable base station in accordance with claim 27, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

31. (Previously Presented) A movable base station in accordance with claim 27, wherein the movable base station is conveyed by a vehicle.

32. (Previously Presented) A movable base station in accordance with claim 31, wherein the vehicle is an automotive vehicle.

33. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas; ~~and~~

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals, the radio frequency signals transmitted within time slots of time-division multiplex channels.

34. (Previously Presented) A movable base station in accordance with claim 33, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

35. (Previously Presented) A movable base station in accordance with claim 33, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

36. (Previously Presented) A movable base station in accordance with claim 33, wherein the movable base station is conveyed by a vehicle.

37. (Previously Presented) A movable base station in accordance with claim 36, wherein the vehicle is an automotive vehicle.

38. (Currently Amended) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and



a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

39. (Previously Presented) A movable base station in accordance with claim 38, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

40. (Previously Presented) A movable base station in accordance with claim 39, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

41. (Previously Presented) A movable base station in accordance with claim 38, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

42. (Previously Presented) A movable base station in accordance with claim 38, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

43. (Previously Presented) A movable base station in accordance with claim 38, wherein the movable base station is conveyed by a vehicle.

44. (Previously Presented) A movable base station in accordance with claim 43, wherein the vehicle is an automotive vehicle.

**REMARKS**

Before this amendment, claims 1-6, 8-16, and 18-44 were pending in the present application. Applicant has amended claims 11, 27, 33 and 38. No claims are added or cancelled in this response. Accordingly, claims 1-6, 8-16, and 18-44 are still pending. The Office Action dated August 22, 2008 indicated that claims 1, 2, 4-12 and 14-44 are pending. During a telephone interview with Examiner Joy Contee on August 29, 2008, the Examiner agreed that this indication was in error and that claims 1-6, 8-16, and 18-44 are pending in the application.

Claims 27-29, 31, 32, 38-41, 43, and 44 were rejected under 35 USC 103(a) as being unpatentable over Mears in view of Yokoi. Applicants have amended independent claims 27 and 38 to recite "a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams." Applicants respectfully submit that this feature is not taught or suggested in the Mears or Yokoi and that claims 27 and 38 are allowable. Claims 28-29, 32, 32, 39-41 and 43 depend from one of claims 27 and 38. These claims, therefore, are allowable at least for the reason that they depend from an allowable base claims. The Examiner indicated that claims 1, 2, 4,-26 and 33-37 are allowed and that claims 30 and 42 were objected to but allowable if rewritten in independent form. Accordingly, applicant respectfully submits that the pending claims 1-6, 8-16, and 18-44 are allowable.

**CONCLUSION**

For all the foregoing reasons, allowance of claims 1-6, 8-16, and 18-44 pending in the present application is respectfully requested. No fee is due with this response. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 502484.

Respectfully submitted,  
CHARLES D. GAVRILOVICH

Date: September 01, 2008

By: /Charles D. Gavrilovich, Jr./

Charles D. Gavrilovich, Jr.  
Reg. No. 41,031

Charles D. Gavrilovich, Jr.  
Gavrilovich, Dodd & Lindsey, LLP  
985 Paseo La Cresta, Suite B  
Chula Vista, CA 91910  
Phone: 619 271 0382  
FAX: 619 271 0383

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	3869439
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	01-SEP-2008
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	15:00:43
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment - After Non-Final Rejection	RESP-CAR100C3-09-01-08.pdf	34717 a50158223d7e235927c02c2de106bc5fd6739ee7	no	10

### Warnings:

<b>Information:</b>	0112
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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.

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.

<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875					Application or Docket Number <b>11/733,069</b>		Filing Date <b>04/09/2007</b>		<input type="checkbox"/> To be Mailed	
<b>APPLICATION AS FILED – PART I</b>										
(Column 1)			(Column 2)		SMALL ENTITY <input checked="" type="checkbox"/>		OR		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)				
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		N/A					
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A		N/A					
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL				
<b>APPLICATION AS AMENDED – PART II</b>										
(Column 1)			(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
<b>AMENDMENT</b>	<b>09/01/2008</b>	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	* 42	Minus	** 42	= 0	X \$25 =	0	OR	X \$	=
	Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X \$105 =	0	OR	X \$	=
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))									
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	
<b>AMENDMENT</b>	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$	=	OR	X \$	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$	=	OR	X \$	=
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))									
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>										

Legal Instrument Examiner:  
/CATHERINE d. SMITH/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

35083

7590

03/04/2009

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

MAIL DATE

DELIVERY MODE

03/04/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 11/733,069	<b>Applicant(s)</b> GAVRILOVICH, CHARLES D.	
	<b>Examiner</b> TUAN A. TRAN	<b>Art Unit</b> 2618	

-- 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 01 September 2008.
- 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) 1-6,8-16 and 18-44 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) 1-6,8-16 and 18-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ 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 \_\_\_\_\_ 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) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |



## DETAILED ACTION

### ***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 negated by the manner in which the invention was made.

1. Claims 1-6, 8-16, 18-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charas et al. (5,404,570) in view of Gardner et al. (5,260,968).

Regarding claims 1-6, 8-16 and 18-20, Charas discloses a movable base station 116 configured to move relative to Earth wherein the movable base station 116 is conveyed by an automotive vehicle 114 (i.e. train) (See fig. 1), the movable base station 116 comprising: antennas 118, 120; a receiver configured to receive mobile device signals from a mobile device 102 through the antenna 120 and to receive fixed port signals from a fixed port 108, 208 through the antenna 118; and a transmitter configured to transmit RF signals corresponding to the received mobile device signals to a base station 106 through the antenna 118 and to transmit RF signals corresponding to the received fixed port signals to the mobile device 102, wherein the transmitter further configured to transmit RF signals within time slots of time-division multiplex channels (TDMA communication) (See figs. 1-3 and col. 4 line 1 to col. 5 line 44). However, Charas does not explicitly mention that each of the antenna 118, 120 used by the movable base station is a plurality of spatially separated antennas as specified in claims

Art Unit: 2618

and the movable base station further comprises a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal. Gardner teaches a base station comprising: spatially separated antennas used for RF signals reception/transmission by respective receiver and transmitter of the base station, wherein the spatially separated antennas being configured a plurality of phased array antennas with directional RF beams allocating in sectors and wherein the RF beams are transmitted separated in time with a predetermined time delay (temporal) (See figs. 6-8 and col. 14 line 25 to col. 15 line 41); and a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal (See figs. 8, 13 and col. 5 line 60 to col. 6 line 26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Gardner in modifying the movable base station, as disclosed by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality.

Claims 21-44 are rejected for the same reasons as set forth in claims 1-6, 8-16 and 18-20.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- USPAT (5,603,080)

***Response to Arguments***

Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUAN A. TRAN whose telephone number is (571)272-7858. The examiner can normally be reached on Mon-Fri, 10:00AM-6:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Anderson can be reached on (571) 272-4177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

Application/Control Number: 11/733,069  
Art Unit: 2618

Page 5

<b>Notice of References Cited</b>	Application/Control No. 11/733,069		Applicant(s)/Patent Under Reexamination GAVRILOVICH, CHARLES D.	
	Examiner TUAN A. TRAN		Art Unit 2618	Page 1 of 1

#### U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,404,570	04-1995	Charas et al.	455/22
*	B	US-5,603,080	02-1997	Kallander et al.	455/14
*	C	US-5,260,968	11-1993	Gardner et al.	375/347
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

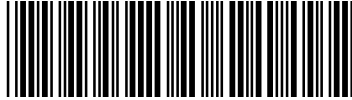
#### FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	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.

<b><i>Index of Claims</i></b> 	<b>Application/Control No.</b> 11733069	<b>Applicant(s)/Patent Under Reexamination</b> GAVRILOVICH, CHARLES D.
	<b>Examiner</b> TUAN A. TRAN	<b>Art Unit</b> 2618


✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant					<input type="checkbox"/> CPA					<input type="checkbox"/> T.D.					<input type="checkbox"/> R.1.47				
CLAIM		DATE																	
Final	Original	08/18/2008	12/08/2008	02/27/2009															
	1	=	✓	✓															
	2	=	✓	✓															
	3	=	✓	✓															
	4	=	✓	✓															
	5	=	✓	✓															
	6	=	✓	✓															
	7	=	-	-															
	8	=	✓	✓															
	9	=	✓	✓															
	10	=	✓	✓															
	11	=	✓	✓															
	12	=	✓	✓															
	13	=	✓	✓															
	14	=	✓	✓															
	15	=	✓	✓															
	16	=	✓	✓															
	17	=	-	-															
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	29	✓	✓	✓															
	30	✓	✓	✓															
	31	✓	✓	✓															
	32	✓	✓	✓															
	33	=	✓	✓															
	34	=	✓	✓															
	35	=	✓	✓															
	36	=	✓	✓															

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47										
CLAIM		DATE								
Final	Original	08/18/2008	12/08/2008	02/27/2009						
	37	=	✓	✓						
	38	✓	✓	✓						
	39	✓	✓	✓						
	40	✓	✓	✓						
	41	✓	✓	✓						
	42	✓	✓	✓						
	43	✓	✓	✓						
	44	✓	✓	✓						

<b>Search Notes</b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

SEARCHED			
Class	Subclass	Date	Examiner
455	11.1, 13.1, 25, 561, 562.1, 91, 101	2/26/09	TT
375	346, 347, 295, 299	2/26/09	TT

SEARCH NOTES		
Search Notes	Date	Examiner
EAST (USPAT, USPGPUB, USOCR, FPRS, JPO, EPO, DERWENT) updating search	2/26/09	TT

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:	)	
	)	
Charles D. Gavrilovich	)	Group No.: 2618
	)	
Serial No.: 11/733,069	)	Examiner: TRAN, Tuan A.
	)	
Filed: April 09, 2007	)	Docket No. CAR100C3
	)	
For: <b>MOBILE COMMUNICATION</b>	)	
<b>SYSTEM WITH MOVING BASE</b>	)	
<b>STATION</b>	)	

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**RESPONSE TO OFFICE ACTION**

Dear Commissioner:

Applicant respectfully submits the following Remarks in response to the Non-Final Office Action mailed March 04, 2009. This response submitted with a request for a one-month extension of time with the appropriate fee for a small entity.

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks** begin on page 9.

**IN THE CLAIMS**

Please enter the following rewritten claims:

1. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas;

a controller configured to align and combine the received mobile device signals;

and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

2. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

3. (Original) A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

4. (Original) A movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

5. (Original) A movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

6. (Original) A movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

7. (Cancelled)

8. (Original) A movable base station in accordance with claim 1, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

9. (Original) A movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle.

10. (Original) A movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle.

11. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;

a controller configured to align and combine the received fixed port signals; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

12. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

13. (Original) A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

14. (Original) A movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

15. (Original) A movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

16. (Original) A movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

17. (Cancelled)

18. (Original) A movable base station in accordance with claim 11, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

19. (Original) A movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle.

20. (Original) A movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle.

21. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station, the radio frequency signals transmitted within time slots of time-division multiplex channels.

22. (Previously Presented) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

23. (Previously Presented) A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

24. (Previously Presented) A movable base station in accordance with claim 21, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

25. (Previously Presented) A movable base station in accordance with claim 21, wherein the movable base station is conveyed by a vehicle.

26. (Previously Presented) A movable base station in accordance with claim 25, wherein the vehicle is an automotive vehicle.

27. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

28. (Previously Presented) A movable base station in accordance with claim 27, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

29. (Previously Presented) A movable base station in accordance with claim 28, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

30. (Previously Presented) A movable base station in accordance with claim 27, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

31. (Previously Presented) A movable base station in accordance with claim 27, wherein the movable base station is conveyed by a vehicle.

32. (Previously Presented) A movable base station in accordance with claim 31, wherein the vehicle is an automotive vehicle.

33. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals, the radio frequency signals transmitted within time slots of time-division multiplex channels.

34. (Previously Presented) A movable base station in accordance with claim 33, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

35. (Previously Presented) A movable base station in accordance with claim 33, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

36. (Previously Presented) A movable base station in accordance with claim 33, wherein the movable base station is conveyed by a vehicle.

37. (Previously Presented) A movable base station in accordance with claim 36, wherein the vehicle is an automotive vehicle.

38. (Previously Presented) A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

39. (Previously Presented) A movable base station in accordance with claim 38, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

40. (Previously Presented) A movable base station in accordance with claim 39, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

41. (Previously Presented) A movable base station in accordance with claim 38, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

42. (Previously Presented) A movable base station in accordance with claim 38, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

43. (Previously Presented) A movable base station in accordance with claim 38, wherein the movable base station is conveyed by a vehicle.

44. (Previously Presented) A movable base station in accordance with claim 43, wherein the vehicle is an automotive vehicle.



### **REMARKS**

Before this amendment, claims 1-6, 8-16, and 18-44 were pending in the present application. No claims are amended, added, or cancelled in this response. Accordingly, claims 1-6, 8-16, and 18-44 are still pending.

Claims 1-6, 8-16, and 18-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charas et al. (5,404,570) in view of Gardner et al. (5,260,968). Applicant respectfully submits that not all of the limitations of any one of the claims are taught or suggested by the cited references and that the combination of references is improper.

### **I. COMBINATION OF CHARAS AND GARDNER IS IMPROPER**

#### **A. Combination Of Charas And Gardner Is Not A Combination Of Familiar Elements According To Known Methods That Yields Predictable Results**

Applicant respectfully submits that the combination is an improper application of 35 U.S.C. § 103 and that the Examiner has not presented any evidence that the Examiner's combination of Charas and Gardner is a combination of familiar elements according to known methods that yields predictable results.

The Supreme Court stated that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007). In a precedential BPAI opinion, the Board explained that "the operative question in this 'functional approach' is, therefore, 'whether the improvement is more than the predictable use of prior art elements according to their established functions.'" *Ex Parte Smith (BPAI, June 25, 2005, per curiam)*, Page 13. (citing *KSR*, Page 1740). Applicant respectfully submits that the Examiner's combination of Charas and Gardner is not a combination of familiar elements according to known methods that yields predictable results. The Examiner proposes to significantly alter the teachings of Gardner by modifying the single frequency multi-element antenna system of Gardner to operate in a dual frequency single antenna system of Charas. Gardner explicitly states that the same frequency **MUST** be used for transmission and reception. (Gardner, Column 5, Lines 39-41). On the other hand, Charas teaches to use different frequencies for transmission and reception. (See Charas, Column 4, Lines 8-11). For the multi-element antenna system of Gardner to operate, spatial filtering adaptation is performed during transmission from the mobile unit to the base station and transmission from the base station to the mobile unit **MUST** use a spatial filter developed during the spatial filtering adaptation. (Gardner, Column 5, Lines 34-37). Such adaptation cannot occur

in Charas since different frequencies are used for transmission and reception between the mobile unit and repeater. The multi-element antenna in Gardner is not a “familiar element.” On the contrary, it was the subject of the Gardner patent application. Charas uses a single antenna and different frequencies for transmission and reception for communication between the mobile unit and the repeater. Accordingly, the case at hand is not a situation where one with ordinary skill in the art would replace a dual frequency single antenna with any other type antenna that uses a single frequency in both directions. The substitution of the multi-element spatial filtering antenna system of Gardner in a frequency division duplex system of Charas is not a “predictable use of prior art elements according to their established functions.”

In addition, using the Gardner TDD system as taught by Gardner would require that the mobile units in Charas operate in accordance with TDD not in FDD. This would require modification of GSM mobile units which operate in the FDD mode to be converted to operate in the TDD and thus be incompatible with cellular systems. As a result, this obviates the intended invention of Charas by modifying the mobile units in such a way that they could no longer communicate with the GSM base stations outside of the tunnel and there would be no need for a repeater system as described by Charas.

#### **B. Combination Is Applied Using Improper Hindsight**

The Supreme Court warned that “[a] fact finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, at 1742. Applicant respectfully submits that the cited prior art is only combined in retrospect, in light of the present invention. That is, the obviousness rejection is based upon characterization of Charas and Gardner in view of the Applicant’s own invention description. Applicant respectfully submits that the Examiner has combined the references by observing that Charas does not teach or suggest using a plurality of antennas and that Gardner includes a discussion of a multi-element antenna system. Applicant submits that the Examiner is constructing the claimed invention by using Applicant’s teaching of a moving base station with a plurality of antennas to form a combination within Charas that significantly alters the operation of Charas to the point that the Charas mechanism will not perform its intended function of frequency division duplex.

#### **C. Improper Motivation For Combining The References**

Further, the evidence of record does not support the proposition by the Examiner that “[i]t would be obvious to one of ordinary skill in the art at the time of the invention was made to

apply the teaching of Gardner in modifying the moveable base station, as described by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality. (Office Action dated March 4, 2009, Page 3, Lines 10-13, emphasis added). On the contrary, the evidence clearly indicates that the combination will not function or, will operate at a reduced data rate, at best. The data rate will be reduced if the communication link between the repeater to the mobile unit in Charas is changed to a time division duplex interface. As a result, there would be no “advantage of enhancing the communication” as the Examiner alleges.

Accordingly, Applicant respectfully submits that the combination is improper and the rejection should be withdrawn.

## **II. ALL LIMITATIONS OF ANY ONE OF CLAIMS 1-6, 8-16, and 18-44 ARE NOT TAUGHT OR SUGGESTED BY THE REFERENCES**

Applicant respectfully submits that all of the limitations of any one of claims 1-6, 8-16, and 18-44 are not taught or suggested by Charas, Gardner, or a combination of the two.

The failure of the cited art to teach or suggest each and every feature of a claim is fatal to an obviousness rejection under 35 U.S.C. § 103. For example, section 2143.03 of the MPEP requires the “consideration” of every claim feature in an obviousness determination. For a proper rejection, this “consideration” requires that the Examiner find that Gardner and Charas teach or suggest each and every claim feature. See *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) (emphasis added) (to establish *prima facie* obviousness of a claimed invention, all the claim features must be taught or suggested by the prior art). As the Board of Patent Appeal and Interferences has recently confirmed, a proper obviousness determination requires that an Examiner make “a searching comparison of the claimed invention—including all its limitations—with the teaching of the prior art.” See *In re Wada and Murphy*, Appeal 2007-3733, citing *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995) (emphasis in original). Further, the necessary presence of all claim features is axiomatic, since the Supreme Court has long held that obviousness is a question of law based on underlying factual inquiries, including . . . ascertaining the differences between the claimed invention and the prior art. *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966) (emphasis added).

Applicant submits that this is why Section 904 of the MPEP instructs Examiners to conduct an art search that covers “the invention as described and claimed.” (Emphasis added). Further, Applicant respectfully directs attention to MPEP § 2143, the instructions of which buttress the conclusion that obviousness requires at least a suggestion of all of the features of a claim, since the Supreme Court in *KSR Int’l v. Teleflex Inc.* stated that “there must be some

articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int’l v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Accordingly, it remains well-settled law that an obviousness rejection requires at least a suggestion of all of the features in a claim. See *In re Wada and Murphy*, citing *CFMT, Inc. v. Yieldup Intern. Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) and *In re Royka*, 490 F.2d 981, 985 (CCPA 1974).

### **Claims 1, 21, and 27**

Claims 1, 21, and 27 recite a movable base station comprising “a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas.” Charas does not suggest this feature. Gardner does not disclose a movable base station with a plurality of antennas. The combination of Gardner and Charas results in a device that **cannot** receive signals from a mobile device. For example, simply replacing the single antenna of Charas with a multi-element antenna results in a system that cannot receive signals. Charas does not teach how to process an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This deficiency is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, the mobile unit will transmit signals during times when the Gardner multi-element system is in the transmit mode and cannot receive signals. Accordingly, the mobile unit signals will not be received. The Examiner has provided no evidence that the combination results in a receiver that is configured to receive signals through a plurality of antennas. Accordingly, Applicant respectfully submits that the Examiner has not presented a prima facie case for obviousness since all of the elements of claim 1 are not taught or suggested by the references.

### **Claims 11, 33, and 38**

Claim 11, 33, and 38 recite a movable base station comprising “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Applicant respectfully submits that neither Charas, nor Gardner, nor a combination of the two, teaches or suggest this feature. Charas does not mention a plurality of antennas. Gardner does not mention a moveable base station. Further, Gardner does not teach to receive signals from a fixed port through a plurality of spatially separated antennas. Gardner explicitly states that the plurality of antennas is used to receive signals from mobile units.

It appears that the Examiner is alleging that the single antenna (118) receiving signals from the amplifiers (208) connected to the cable transmission means (110) of Charas can be replaced with the multi-element antenna of Gardner to result in “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Applicant respectfully submits that such a combination does not result in a receiver that can receive signals from a fixed port. Simply replacing the Charas antenna (118) with the multi-element antenna array of Gardner results in a device that cannot receive signals. Charas does not teach how to process an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This problem is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, amplifiers 208 transmit GSM signals that are linearly converted to a lower frequency. The signals, therefore, have the same timing as GSM signals. As a result, the amplifiers transmit signals during times when the Gardner multi-element system is in the transmit mode and not receiving. Accordingly, the signals from the amplifiers will not be received. Accordingly, Applicant respectfully submits that the Examiner has not presented a prima facie case for obviousness since all of the elements of claim 1 are not taught or suggested by the references.

**Claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44**

Regarding claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44, these claims depend from one of independent claims 1, 11, 21, 27, 33, or 38 which Applicant submits are allowable. Accordingly, claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44 are at least allowable for the reason that they depend from an allowable base claim.

**Claims 4, 14, 28, and 39**

Further regarding claims 4, 14, 28, and 39, these claims recite “another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.” Applicant respectfully submits that neither, Charas, nor Gardner, nor a combination of the two, teaches or suggests this feature. Charas does not discuss spatially separated antennas. Gardner discusses only a single multi-element antenna.

**Claims 10, 20, 26, 32, 37, and 44**

Further regarding claims 10, 20, 26, 32, 37, and 44, these claims recite that the movable base station is conveyed by a vehicle "wherein the vehicle is an automotive vehicle." Applicant respectfully submits that neither, Charas nor Gardner, nor a combination of the two, teaches or suggests this feature. Gardner does not disclose moveable base stations. Charas discusses a repeater on a train and does not suggest automobiles.

**CONCLUSION**

For all the foregoing reasons, allowance of claims 1-6, 8-16, and 18-44 pending in the present application is respectfully requested. A fee for a one-month extension of time is submitted with this response. The Commissioner is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 502484.

Respectfully submitted,  
CHARLES D. GAVRILOVICH

Date: July 1, 2009

By: /Charles D. Gavrilovich, Jr./

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## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	11733069			
<b>Filing Date:</b>	09-Apr-2007			
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station			
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich			
<b>Filer:</b>	Charles Dan Gavrilovich			
<b>Attorney Docket Number:</b>	CAR100C3			
Filed as Small Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				
Extension - 1 month with \$0 paid	0139 2251	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				65



## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	5623947
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	01-JUL-2009
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	12:18:46
<b>Application Type:</b>	Utility under 35 USC 111(a)

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RAM confirmation Number	10027
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Amendment/Req. Reconsideration-After Non-Final Reject	CAR100C3ROA070109.pdf	69314 13aebdddb705b5b033b65b88c34c1437fd8f 7d66c	no	14
<b>Warnings:</b>					
<b>Information:</b>					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30128 70ddc52d37ba23f7cef1b4bbc9434c253d8 9937f	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			99442		
<p><b>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.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>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.</b></p>					

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<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875					Application or Docket Number <b>11/733,069</b>		Filing Date <b>04/09/2007</b>		<input type="checkbox"/> To be Mailed	
<b>APPLICATION AS FILED – PART I</b>										
(Column 1)			(Column 2)			SMALL ENTITY <input checked="" type="checkbox"/> OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A				
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
			TOTAL			TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
<b>APPLICATION AS AMENDED – PART II</b>										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
<b>AMENDMENT</b>	<b>07/01/2009</b>	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 42	Minus	** 42	= 0	X \$26 =	0	OR	X \$ =	
	Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X \$110 =	0	OR	X \$ =	
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))									
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
<b>AMENDMENT</b>	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		X \$ =		
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		X \$ =		
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))									
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>										

Legal Instrument Examiner:  
/SANDRA L. TUCKER SMITH/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

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35083

7590

10/29/2009

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EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

MAIL DATE

DELIVERY MODE

10/29/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 11/733,069	<b>Applicant(s)</b> GAVRILOVICH, CHARLES D.	
	<b>Examiner</b> TUAN A. TRAN	<b>Art Unit</b> 2618	

-- 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 01 July 2009.
- 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) 1-6,8-16 and 18-44 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) 1-6,8-16 and 18-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ 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 \_\_\_\_\_ 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) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***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 negated by the manner in which the invention was made.

1. Claims 1-6, 8-16, 18-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charas et al. (5,404,570) in view of Gardner et al. (5,260,968).

Regarding claims 1-6, 8-16 and 18-20, Charas discloses a movable base station 116 configured to move relative to Earth wherein the movable base station 116 is conveyed by an automotive vehicle 114 (i.e. train) (See fig. 1), the movable base station 116 comprising: antennas 118, 120; a receiver configured to receive mobile device signals from a mobile device 102 through the antenna 120 and to receive fixed port signals from a fixed port 108, 208 through the antenna 118; and a transmitter configured to transmit RF signals corresponding to the received mobile device signals to a base station 106 through the antenna 118 and to transmit RF signals corresponding to the received fixed port signals to the mobile device 102, wherein the transmitter further configured to transmit RF signals within time slots of time-division multiplex channels (TDMA communication) (See figs. 1-3 and col. 4 line 1 to col. 5 line 44). However, Charas does not explicitly mention that each of the antenna 118, 120 used by the movable base station is a plurality of spatially separated antennas as specified in claims

Art Unit: 2618

and the movable base station further comprises a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal. Gardner teaches a base station comprising: spatially separated antennas used for RF signals reception/transmission by respective receiver and transmitter of the base station, wherein the spatially separated antennas being configured a plurality of phased array antennas with directional RF beams allocating in sectors and wherein the RF beams are transmitted separated in time with a predetermined time delay (temporal) (See figs. 6-8 and col. 14 line 25 to col. 15 line 41); and a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal (See figs. 8, 13 and col. 5 line 60 to col. 6 line 26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Gardner in modifying the movable base station, as disclosed by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality.

Claims 21-44 are rejected for the same reasons as set forth in claims 1-6, 8-16 and 18-20.

### ***Response to Arguments***

Applicant's arguments filed 07/01/2009 have been fully considered but they are not persuasive.

In response to applicant's argument (See Remark, page 10) that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction

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based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

The applicant also argued that limitations recited in claims are not taught or suggested by the cited references (See Remark, page 11-13). The examiner respectfully disagrees with the applicant's argument. In this instant case, the difference between Charas and the claimed invention is the use of a plurality of spatially separated antennas (i.e. directional or diversity antennas) to receive and transmit a best signal. Since Gardner does teach a base station comprising: spatially separated antennas used for RF signals reception/transmission by respective receiver and transmitter of the base station, wherein the spatially separated antennas being configured a plurality of phased array antennas with directional RF beams allocating in sectors and wherein the RF beams are transmitted separated in time with a predetermined time delay (temporal) (See figs. 6-8 and col. 14 line 25 to col. 15 line 41); and a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal (See figs. 8, 13 and col. 5 line 60 to col. 6 line 26), and both communication systems of Charas & Gardner are capable of utilizing TDMA communication protocol; therefore, Charas and Gardner are combinable, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Gardner in modifying the movable base station, as disclosed by



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Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality (See above rejections for details). For those reasons, the rejection(s) are proper and maintained.

### ***Conclusion***

**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.

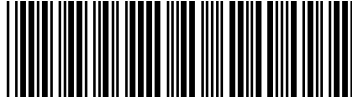
Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUAN A. TRAN whose telephone number is (571)272-7858. The examiner can normally be reached on Mon-Fri, 10:00AM-6:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Anderson can be reached on (571) 272-4177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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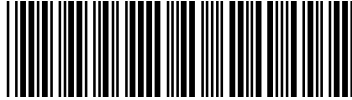
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618


✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant						<input type="checkbox"/> CPA		<input type="checkbox"/> T.D.		<input type="checkbox"/> R.1.47	
CLAIM		DATE									
Final	Original	08/18/2008	12/08/2008	02/27/2009	10/26/2009						
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	2	=	✓	✓	✓						
	3	=	✓	✓	✓						
	4	=	✓	✓	✓						
	5	=	✓	✓	✓						
	6	=	✓	✓	✓						
	7	=	-	-	-						
	8	=	✓	✓	✓						
	9	=	✓	✓	✓						
	10	=	✓	✓	✓						
	11	=	✓	✓	✓						
	12	=	✓	✓	✓						
	13	=	✓	✓	✓						
	14	=	✓	✓	✓						
	15	=	✓	✓	✓						
	16	=	✓	✓	✓						
	17	=	-	-	-						
	18	=	✓	✓	✓						
	19	=	✓	✓	✓						
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	32	✓	✓	✓	✓						
	33	=	✓	✓	✓						
	34	=	✓	✓	✓						
	35	=	✓	✓	✓						
	36	=	✓	✓	✓						

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant		<input type="checkbox"/> CPA		<input type="checkbox"/> T.D.		<input type="checkbox"/> R.1.47			
CLAIM		DATE							
Final	Original	08/18/2008	12/08/2008	02/27/2009	10/26/2009				
	37	=	✓	✓	✓				
	38	✓	✓	✓	✓				
	39	✓	✓	✓	✓				
	40	✓	✓	✓	✓				
	41	✓	✓	✓	✓				
	42	✓	✓	✓	✓				
	43	✓	✓	✓	✓				
	44	✓	✓	✓	✓				

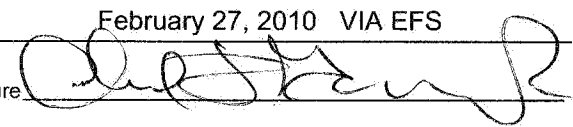

<b>Search Notes</b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

SEARCHED			
Class	Subclass	Date	Examiner
455	11.1, 13.1, 25, 561, 562.1, 91, 101	10/24/09	TT
375	346, 347, 295, 299	10/24/09	TT

SEARCH NOTES		
Search Notes	Date	Examiner
EAST (USPAT, USPGPUB, USOCR, FPRS, JPO, EPO, DERWENT) updating search	10/24/09	TT

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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<b>PRE-APPEAL BRIEF REQUEST FOR REVIEW</b>		Docket Number (Optional)  CAR100C3					
<p>I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)]</p> <p>on <u>February 27, 2010</u> VIA EFS</p> <p>Signature </p> <p>Typed or printed name <u>Charles D. Gavrilovich, Jr.</u></p>	<table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; padding: 5px;">Application Number  11/733,069</td><td style="width: 50%; padding: 5px;">Filed  April 09, 2007</td></tr><tr><td colspan="2" style="padding: 5px;">First Named Inventor  Charles D. Gavrilovich</td></tr><tr><td style="padding: 5px;">Art Unit  2618</td><td style="padding: 5px;">Examiner  TRAN, Tuan A</td></tr></table>	Application Number  11/733,069	Filed  April 09, 2007	First Named Inventor  Charles D. Gavrilovich		Art Unit  2618	Examiner  TRAN, Tuan A
Application Number  11/733,069	Filed  April 09, 2007						
First Named Inventor  Charles D. Gavrilovich							
Art Unit  2618	Examiner  TRAN, Tuan A						
<p>Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.</p> <p>This request is being filed with a notice of appeal.</p> <p>The review is requested for the reason(s) stated on the attached sheet(s). Note: No more than five (5) pages may be provided.</p> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 20px;"><div style="width: 45%;"><p>I am the</p><p><input type="checkbox"/> applicant/inventor.</p><p><input type="checkbox"/> assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)</p><p><input checked="" type="checkbox"/> attorney or agent of record. Registration number <u>41,031</u></p><p><input type="checkbox"/> attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____</p></div><div style="width: 50%; text-align: center;"> Signature <u>Charles D. Gavrilovich, Jr.</u> Typed or printed name <u>619 271 0382</u> Telephone number <u>February 27, 2010</u> Date</div></div> <p>NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.</p>							
<p><input type="checkbox"/> *Total of _____ forms are submitted.</p>							

This collection of information is required by 35 U.S.C. 132. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:	)	
	)	
Charles D. Gavrilovich	)	Group No.: 2618
	)	
Serial No.: 11/733,069	)	Examiner: TRAN, Tuan A.
	)	
Filed: April 09, 2007	)	Docket No. CAR100C3
	)	
For: <b>MOBILE COMMUNICATION</b>	)	
<b>SYSTEM WITH MOVING BASE</b>	)	
<b>STATION</b>	)	

Mail Stop AF  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

**PRE-APPEAL BRIEF REQUEST FOR REVIEW**

Dear Commissioner:

In response to the Final Office Action dated October 29, 2009, Applicant respectfully submits that pending claims 1-6, 8-16, and 18-44 are allowable over the combination of Charas and Gardner. Claims 1-6, 8-16, and 18-44 are pending in the present application. Applicant submits this Pre-Appeal Brief Request for Review as the Applicant believes the Examiner has committed a clear error in finding the claimed limitations are disclosed by Charas et al. (5,404,570) in view of Gardner et al. (5,260,968) and in finding that the combination of references is proper. Arguments are provided on the following 5 pages. This Request is filed with a Notice of Appeal, a Request for one month extension of time and the appropriate fees.

## **ARGUMENT**

### **I. COMBINATION OF CHARAS AND GARDNER IS IMPROPER**

#### **A. Combination Of Charas And Gardner Is Not A Combination Of Familiar Elements According To Known Methods That Yields Predictable Results**

Applicant respectfully submits that the combination is an improper application of 35 U.S.C. § 103 and that the Examiner has not presented any evidence that the Examiner's combination of Charas and Gardner is a combination of familiar elements according to known methods that yields predictable results.

The Supreme Court stated that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007). In a precedential BPAI opinion, the Board explained that "the operative question in this 'functional approach' is, therefore, 'whether the improvement is more than the predictable use of prior art elements according to their established functions.'" *Ex Parte Smith (BPAI, June 25, 2995, per curium)*, Page 13. (citing *KSR*, Page 1740). Applicant respectfully submits that the Examiner's combination of Charas and Gardner is not a combination of familiar elements according to known methods that yields predictable results. The Examiner proposes to significantly alter the teachings of Gardner by modifying the single frequency multi-element antenna system of Gardner to operate in a dual frequency single antenna system of Charas. Gardner explicitly states that the same frequency **MUST** be used for transmission and reception. (Gardner, Column 5, Lines 39-41). On the other hand, Charas teaches to use different frequencies for transmission and reception. (See Charas, Column 4, Lines 8-11). For the multi-element antenna system of Gardner to operate, spatial filtering adaptation is performed during transmission from the mobile unit to the base station and transmission from the base station to the mobile unit **MUST** use a spatial filter developed during the spatial filtering adaptation. (Gardner, Column 5, Lines 34-37). Such adaptation cannot occur in Charas since different frequencies are used for transmission and reception between the mobile unit and repeater. The multi-element antenna in Gardner is not a "familiar element." On the contrary, it was the subject of the Gardner patent application. Charas uses a single antenna and different frequencies for transmission and reception for communication between the mobile unit and the repeater. Accordingly, the case at hand is not a situation where one with ordinary skill in the art would replace a dual frequency single antenna with any other type antenna that uses a single frequency in both directions. The substitution of the multi-element spatial filtering



antenna system of Gardner in a frequency division duplex system of Charas is not a “predictable use of prior art elements according to their established functions.”

In addition, using the Gardner TDD system as taught by Gardner would require that the mobile units in Charas operate in accordance with TDD not in FDD. This would require modification of GSM mobile units which operate in the FDD mode to be converted to operate in the TDD and thus be incompatible with cellular systems. As a result, this obviates the intended invention of Charas by modifying the mobile units in such a way that they could no longer communicate with the GSM base stations outside of the tunnel and there would be no need for a repeater system as described by Charas.

### **B. Combination Is Applied Using Improper Hindsight**

The Supreme Court warned that “[a] fact finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, at 1742. Applicant respectfully submits that the cited prior art is only combined in retrospect, in light of the present invention. That is, the obviousness rejection is based upon characterization of Charas and Gardner in view of the Applicant’s own invention description. Applicant respectfully submits that the Examiner has combined the references by observing that Charas does not teach or suggest using a plurality of antennas and that Gardner includes a discussion of a multi-element antenna system. Applicant submits that the Examiner is constructing the claimed invention by using Applicant’s teaching of a moving base station with a plurality of antennas to form a combination within Charas that significantly alters the operation of Charas to the point that the Charas mechanism will not perform its intended function of frequency division duplex. MPEP § 2142 states that “impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the **facts gleaned from the prior art**” (emphasis added). There is no evidence in the record other than Applicant’s specification that supports the reasoning behind combining the references.

### **C. Improper Motivation For Combining The References**

Further, the evidence of record does not support the proposition by the Examiner that “[i]t would be obvious to one of ordinary skill in the art at the time of the invention was made to apply the teaching of Gardner in modifying the moveable base station, as described by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality. (Office Action dated October 29, 2009, Page 3, Lines 11-14, emphasis added). On the contrary, the evidence clearly indicates that the combination will not function or, will

operate at a reduced data rate, at best. The data rate will be reduced if the communication link between the repeater to the mobile unit in Charas is changed to a time division duplex interface. As a result, there would be no “advantage of enhancing the communication” as the Examiner alleges.

Accordingly, Applicant respectfully submits that the combination is improper and the rejection should be withdrawn.

**II. ALL LIMITATIONS OF ANY ONE OF CLAIMS 1-6, 8-16, and 18-44 ARE NOT TAUGHT OR SUGGESTED BY THE REFERENCES**

Applicant respectfully submits that all of the limitations of any one of claims 1-6, 8-16, and 18-44 are not taught or suggested by Charas, Gardner, or a combination of the two. The failure of the cited art to teach or suggest each and every feature of a claim is fatal to an obviousness rejection under 35 U.S.C. § 103.

**Claims 1, 21, and 27**

Claims 1, 21, and 27 recite a movable base station comprising “a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas.” Charas does not suggest this feature. Gardner does not disclose a movable base station with a plurality of antennas. The combination of Gardner and Charas results in a device that **cannot** receive signals from a mobile device. For example, simply replacing the single antenna of Charas with a multi-element antenna results in a system that cannot receive signals. Charas does not teach how to process an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This deficiency is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, the mobile unit will transmit signals during times when the Gardner multi-element system is in the transmit mode and cannot receive signals. Accordingly, the mobile unit signals will not be received. The Examiner has provided no evidence that the combination results in a receiver that is configured to receive signals through a plurality of antennas. Accordingly, Applicant respectfully submits that the Examiner has not presented a prima facie case for obviousness since all of the elements of claim 1 are not taught or suggested by the references.

**Claims 11, 33, and 38**

Claim 11, 33, and 38 recite a movable base station comprising “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Applicant respectfully submits that neither Charas, nor Gardner, nor a combination of the two, teaches or suggest this feature. Charas does not mention a plurality of antennas. Gardner does not mention a moveable base station. Further, Gardner does not teach to receive signals from a fixed port through a plurality of spatially separated antennas. Gardner explicitly states that the plurality of antennas is used to receive signals from mobile units.

It appears that the Examiner is alleging that the single antenna (118) receiving signals from the amplifiers (208) connected to the cable transmission means (110) of Charas can be replaced with the multi-element antenna of Gardner to result in “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Applicant respectfully submits that such a combination does not result in a receiver that can receive signals from a fixed port. Simply replacing the Charas antenna (118) with the multi-element antenna array of Gardner results in a device that cannot receive signals. Charas does not teach how to processes an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This problem is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, amplifiers 208 transmit GSM signals that are linearly converted to a lower frequency. The signals, therefore, have the same timing as GSM signals. As a result, the amplifiers transmit signals during times when the Gardner multi-element system is in the transmit mode and not receiving. Accordingly, the signals from the amplifiers will not be received. Accordingly, Applicant respectfully submits that the Examiner has not presented a prima facie case for obviousness since all of the elements of claim 1 are not taught or suggested by the references.

**Claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44**

Regarding claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44, these claims depend from one of independent claims 1, 11, 21, 27, 33, or 38 which Applicant submits are allowable. Accordingly, claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44 are at least allowable for the reason that they depend from an allowable base claim.

**Claims 4, 14, 28, and 39**

Further regarding claims 4, 14, 28, and 39, these claims recite “another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.” Applicant respectfully submits that neither, Charas, nor Gardner, nor a combination of the two, teaches or suggests this feature. Charas does not discuss spatially separated antennas. Gardner discusses only a single multi-element antenna.

**Claims 10, 20, 26, 32, 37, and 44**

Further regarding claims 10, 20, 26, 32, 37, and 44, these claims recite that the movable base station is conveyed by a vehicle “wherein the vehicle is an automotive vehicle.” Applicant respectfully submits that neither, Charas nor Gardner, nor a combination of the two, teaches or suggests this feature. Gardner does not disclose moveable base stations. Charas discusses a repeater on a train and does not suggest automobiles.

**CONCLUSION**

For all the foregoing reasons, allowance of claims 1-6, 8-16, and 18-44 pending in the present application is respectfully requested. A fee for a one-month extension of time is submitted with this response. The Commissioner is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 502484.

Respectfully submitted,  
CHARLES D. GAVRILOVICH

Date: February 27, 2010

By: /Charles D. Gavrilovich, Jr./

Charles D. Gavrilovich, Jr.  
Reg. No. 41,031

Charles D. Gavrilovich, Jr.  
Gavrilovich, Dodd & Lindsey, LLP  
985 Paseo La Cresta, Suite B  
Chula Vista, CA 91910  
Phone: 619 271 0382  
FAX: 619 271 0383

# **NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Docket Number (Optional)

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] February 27, 2010 VIA EFS on \_\_\_\_\_

Signature

Typed or printed name Charles D. Gavrilovich, Jr.

In re Application of  
**Charles D. Gavrilovich**

Application Number  
**11/733,069**

Filed  
**April 09, 2007**

For Mobile Communication System With Moving Base Station

Art Unit  
**2618**

Examiner  
**TRAN, Tuan A**

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1))

\$ 540

☒ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is:

\$ 270

☐ A check in the amount of the fee is enclosed.

☒ Payment by credit card. Form PTO-2038 is attached. VIA EFS

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. \_\_\_\_\_

☐ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

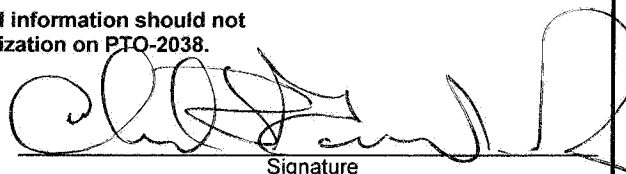
I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.  
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed.  
(Form PTO/SB/96)

☒ attorney or agent of record.  
Registration number 41,031

☐ attorney or agent acting under 37 CFR 1.34.  
Registration number if acting under 37 CFR 1.34. \_\_\_\_\_

  
Signature

Charles D. Gavrilovich, Jr.

Typed or printed name

619 271 0382

Telephone number

February 27, 2010

Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below\*.

☐ \*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 41.31. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: 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 Patent Application Fee Transmittal

<b>Application Number:</b>	11733069			
<b>Filing Date:</b>	09-Apr-2007			
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station			
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich			
<b>Filer:</b>	Charles Dan Gavrilovich			
<b>Attorney Docket Number:</b>	CAR100C3			
Filed as Small Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
Notice of appeal	2401	1	270	270
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>	0162			

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	2251	1	65	65
Miscellaneous:				
Total in USD (\$)				335

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	7104292
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	27-FEB-2010
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	19:54:52
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$335
RAM confirmation Number	7611
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
0104					



1	Pre-Brief Conference request	PABRFRCAR100C3022710.pdf	976458 aa31d499b2bdbcaeb9b923117cf29593b10 2a063	no	7
<b>Warnings:</b>					
<b>Information:</b>					
2	Notice of Appeal Filed	NoticeofAppeal.pdf	1054716 55536166952576dff74f74c4eb89ab9a5dbb 37496	no	1
<b>Warnings:</b>					
<b>Information:</b>					
3	Fee Worksheet (PTO-875)	fee-info.pdf	31897 b409247244ed0d8008c838ba498207e60ac c4d52	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			2063071		
<p><b>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.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>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.</b></p>					



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

35083

7590

03/29/2010

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

MAIL DATE

DELIVERY MODE

03/29/2010

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Notice of Panel Decision from Pre-Appeal Brief Review</b>	Application/Control No.	Applicant(s)/Patent under Reexamination	
	11/733,069	GAVRILOVICH, CHARLES D.	
	Tuan Tran	Art Unit	
		2618	

This is in response to the Pre-Appeal Brief Request for Review filed 27 February 2010.

1. ☐ **Improper Request** – The Request is improper and a conference will not be held for the following reason(s):

- ☐ The Notice of Appeal has not been filed concurrent with the Pre-Appeal Brief Request.
- ☐ The request does not include reasons why a review is appropriate.
- ☐ A proposed amendment is included with the Pre-Appeal Brief request.
- ☐ Other: .

The time period for filing a response continues to run from the receipt date of the Notice of Appeal or from the mail date of the last Office communication, if no Notice of Appeal has been received.

2. ☒ **Proceed to Board of Patent Appeals and Interferences** – A Pre-Appeal Brief conference has been held. The application remains under appeal because there is at least one actual issue for appeal. Applicant is required to submit an appeal brief in accordance with 37 CFR 41.37. The time period for filing an appeal brief will be reset to be one month from mailing this decision, or the balance of the two-month time period running from the receipt of the notice of appeal, whichever is greater. Further, the time period for filing of the appeal brief is extendible under 37 CFR 1.136 based upon the mail date of this decision or the receipt date of the notice of appeal, as applicable.

☐ The panel has determined the status of the claim(s) is as follows:

Claim(s) allowed: \_\_\_\_\_.

Claim(s) objected to: \_\_\_\_\_.

Claim(s) rejected: *1-6,8-16,18-44*.

Claim(s) withdrawn from consideration: \_\_\_\_\_.

3. ☐ **Allowable application** – A conference has been held. The rejection is withdrawn and a Notice of Allowance will be mailed. Prosecution on the merits remains closed. No further action is required by applicant at this time.

4. ☐ **Reopen Prosecution** – A conference has been held. The rejection is withdrawn and a new Office action will be mailed. No further action is required by applicant at this time.

All participants:

(1) MATTHEW D. ANDERSON.

(3) Edward Urban.

(2) Tuan Tran.

(4) \_\_\_\_\_.

/Matthew D. Anderson/  
Supervisory Patent Examiner, Art  
Unit 2618

/Edward Urban/  
Supervisory Patent Examiner, Art  
Unit 2618

**PETITION TO MAKE SPECIAL BASED ON AGE FOR ADVANCEMENT OF EXAMINATION  
UNDER 37 CFR 1.102(c)(1)**

**Application Information**

Application Number	11/733,069	Confirmation Number	7533	Filing Date	2007-04-09
Attorney Docket Number (optional)	CAR100C3	Art Unit	2618	Examiner	TRAN, Tuan A
First Named Inventor	Charles D. Gavrilovich				
Title of Invention	MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION				

**Attention: Office of Petitions**

An application may be made special for advancement of examination upon filing of a petition showing that the applicant is 65 years of age, or more. No fee is required with such a petition. See 37 CFR 1.102(c)(1) and MPEP 708.02 (IV).

APPLICANT HEREBY PETITIONS TO MAKE SPECIAL FOR ADVANCEMENT OF EXAMINATION IN THIS APPLICATION UNDER 37 CFR 1.102(c)(1) and MPEP 708.02 (IV) ON THE BASIS OF THE APPLICANT'S AGE.

A grantable petition requires one of the following items:

- (1) Statement by one named inventor in the application that he/she is 65 years of age, or more; or
- (2) Certification by a registered attorney/agent having evidence such as a birth certificate, passport, driver's license, etc. showing one named inventor in the application is 65 years of age, or more.

**Name of Inventor who is 65 years of age, or older**

Given Name	Middle Name	Family Name	Suffix
Charles	Dan	Gavrilovich	

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the format of the signature.

Select (1) or (2) :

- ☐ (1) I am an inventor in this application and I am 65 years of age, or more.
- ☒ (2) I am an attorney or agent registered to practice before the Patent and Trademark Office, and I certify that I am in possession of evidence, and will retain such in the application file record, showing that the inventor listed above is 65 years of age, or more.

Signature	/Charles D. Gavrilovich, Jr./	Date (YYYY-MM-DD)	2010-06-27
Name	Charles D. Gavrilovich, Jr.	Registration Number	41031

## Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



## UNITED STATES PATENT AND TRADEMARK OFFICE

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In re Application of  
Charles D. Gavrilovich

Application No. 11733069

Filed: April 9, 2007

Attorney Docket No. CAR100C3

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:DECISION ON PETITION TO MAKE SPECIAL  
:UNDER 37 CFR 1.102(c)(1)

This is a decision on the electronic petition under 37 CFR 1.102 (c)(1), filed 27-JUN-2010 to make the above-identified application special based on applicant's age as set forth in MPEP § 708.02, Section IV.

The petition is **GRANTED**.

A grantable petition to make an application special under 37 CFR 1.102(c)(1), MPEP § 708.02, Section IV: Applicant's Age must include a statement by applicant or a registered practitioner having evidence that applicant is at least 65 years of age. No fee is required.

Accordingly, the above-identified application has been accorded "special" status and will be taken up for action by the examiner upon the completion of all pre-examination processing.

Telephone inquiries concerning this electronic decision should be directed to the Electronic Business Center at 866-217-9197.

All other inquiries concerning either the examination or status of the application should be directed to the Technology Center.

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	7900298
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	27-JUN-2010
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	14:49:38
<b>Application Type:</b>	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 automatically granted by EFS	petitionage2.pdf	751855 091c75e31b3c5d885367c432170379e187a c164b	no	2

### Warnings:

<b>Information:</b>	0171
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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.



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s) : <b>GAVRILOVICH, Charles D.</b>	Group Art Unit: <b>2618</b>
App. No.: <b>11/733,069</b>	Examiner: <b>TRAN, Tuan A</b>
Filed: <b>April 09, 2007</b>	Conf.: <b>7533</b>
Title: <b>MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION</b>	

Mail Stop Appeal Briefs – Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**APPELLANTS' APPEAL BRIEF UNDER 37 CFR §41.37**

In accordance with the Notice of Appeal to the Board of Patent Appeals and Interferences dated February 27, 2010 in the above-identified U.S. Patent Application, Appellants hereby present the Appellants' Appeal Brief under 37 CFR §41.37. The APPELLANTS' APPEAL BRIEF is submitted with copies of each reference discussed and a copy of the Final Office Action as well as the appropriate fees required under 37 CFR §41.20(b)(2).

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**REAL PARTY IN INTEREST**

Carucel Investments Limited Partnership is the real party in interest as the assignee and 100 percent owner of the above-identified application.

**RELATED APPEALS AND INTERFERENCES**

Appellants are not aware of any prior or pending appeals, judicial proceedings, or interferences that may be related to, directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**STATUS OF CLAIMS**

Claims 1-6, 8-16, and 18-44 stand rejected. Claims 7 and 17 have been canceled. The claims on appeal include claims 1-6, 8-16, and 18-44.

**STATUS OF AMENDMENTS**

The Amendment submitted on September 01, 2008 has been entered. Appellants have not submitted any amendments since the September 01, 2008 response.

### **SUMMARY OF CLAIMED SUBJECT MATTER**

In accordance with 37 CFR § 41.37(v), Appellants provide a brief summary of each independent claim involved in the appeal, where each summary refers to the specification by page and line number and to the drawings by reference number. Appellants note that this "Summary of claimed subject matter" is provided only to assist the Board in identifying some portions of the specification related to the particular claims. In the interest of brevity, each claim summary does not necessarily include all references to all relevant portions of the specification and drawings. Accordingly, omission of any reference to the specification or to the drawings should not be construed in any way as an intent to relinquish claim scope, or as an implication or statement regarding the conformance with 35 U.S.C. § 112. Appellants respectfully submit that the claims should not be construed as being limited to the embodiments described or referenced in any claim summary, and further submit that other embodiments, as well as the Doctrine of Equivalents, may apply in determining claim scope.

#### **Claim 1**

The subject matter of independent claim 1 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 100), a receiver (Specification, paragraphs [0030]; Fig. 4, reference character 132), controller (Specification, paragraphs [0030]; Fig. 4, reference character 130), and a transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132). The receiver is configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas. (Specification, paragraphs [0025]). The controller is configured to align and combine the received mobile device signals (Specification, paragraphs [0046]) and the transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132) is configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

**Claim 4**

The subject matter of dependent claim 4 is directed to a movable base station that comprises another plurality of spatially separated antennas. The transmitter is configured to transmit the radio frequency signals through the another plurality of spatially separated antennas. (Specification, paragraphs [0025], [0029]; Fig, 4, reference character 101)

**Claim 10**

The subject matter of dependent claim 10 is directed to a movable base station, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9)

**Claim 11**

The subject matter of independent claim 11 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig, 4, reference character 101), a receiver (Specification, paragraphs [0030]; Fig, 4, reference character 132), controller (Specification, paragraphs [0030]; Fig, 4, reference character 130), and a transmitter (Specification, paragraphs [0030]; Fig, 4, reference character 132). The receiver is configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas. (Specification, paragraphs [0025]). The controller is configured to align and combine the received fixed port signals. (Specification, paragraphs [0046]). The transmitter is configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals. (Specification, paragraphs [0030]; Fig, 4, reference character 132)

**Claim 14**

The subject matter of dependent claim 14 is directed to a movable base station, where the movable base station comprises another plurality of spatially separated antennas. The transmitter is configured to transmit the radio frequency signals through the another plurality of spatially separated antennas. (Specification, paragraphs [0025], [0029]; Fig, 4, reference character 100).



**Claim 20**

The subject matter of dependent claim 20 is directed to a movable base station, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9)

**Claim 21**

The subject matter of independent claim 21 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 100), a receiver (Specification, paragraphs [0030]; Fig. 4, reference character 132), and a transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132). The receiver is configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas. The transmitter is configured to transmit radio frequency signals corresponding to the mobile device signals to a base station. (Specification, paragraphs [0030]; Fig. 4, reference character 132). The radio frequency signals are transmitted within time slots of time-division multiplex channels. (Specification, paragraphs [0031]).

**Claim 26**

The subject matter of dependent claim 26 is directed to a movable base station, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9)

**Claim 27**

The subject matter of independent claim 27 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 100), a receiver (Specification, paragraphs [0030]; Fig. 4, reference character 132), and a transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132). The spatially separated

antennas are configured as a plurality of phased array antennas to provide directional radio frequency beams. (Specification, paragraphs [0029]). The receiver is configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas. (Specification, paragraphs [0030]; Fig. 4, reference character 132). The transmitter is configured to transmit radio frequency signals corresponding to the mobile device signals to a base station. (Specification, paragraphs [0030]; Fig. 4, reference character 132).

### **Claim 28**

The subject matter of dependent claim 28 is directed to a movable base station that further comprises another plurality of spatially separated antennas. The transmitter is configured to transmit the radio frequency signals through the another plurality of spatially separated antennas. (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 101).

### **Claim 32**

The subject matter of dependent claim 32 is directed to a movable base station, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9).

### **Claim 33**

The subject matter of independent claim 33 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 101), a receiver (Specification, paragraphs [0030]; Fig. 4, reference character 132), and a transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132). The receiver is configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas. (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 101). The transmitter is configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals. (Specification, paragraph [0029]). The radio frequency signals are transmitted within time slots of time-division multiplex channels. (Specification, paragraphs [0031]).

**Claim 37**

The subject matter of dependent claim 37 is directed to a movable base station, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9).

**Claim 38**

The subject matter of independent claim 38 is directed to a movable base station configured to move relative to Earth. (Specification, paragraphs [0021], [0030]; Fig. 1, Fig. 4, reference character 30). The movable base station includes a plurality of spatially separated antennas (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 101), a receiver (Specification, paragraphs [0030]; Fig. 4, reference character 132), and a transmitter (Specification, paragraphs [0030]; Fig. 4, reference character 132). The plurality of spatially separated antennas is configured as a plurality of phased array antennas to provide directional radio frequency beams. The receiver is configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas. The transmitter is configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

**Claim 39**

The subject matter of dependent claim 39 is directed to a movable base station that further comprises another plurality of spatially separated antennas. The transmitter is configured to transmit the radio frequency signals through the another plurality of spatially separated antennas. (Specification, paragraphs [0025], [0029]; Fig. 4, reference character 101).

**Claim 44**

Claim 44 is a dependent claim directed at a movable base station in accordance with claim 38, where the movable base station is conveyed by an automotive vehicle. (Specification, paragraph [0021], line 9).

**GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

Appellants wish the Board of Patent Appeals and Interferences to review the following grounds of rejection on appeal:

1) Whether claims 1-6, 8-16 18-44 are unpatentable under 35 U.S.C. §103(a) over US Patent No. 5,404,570 to Charas, et al. (“Charas”) in view of U.S. Patent No. 5,260,968 to Gardner, et al. (“Gardner”).

## **ARGUMENT**

### **REJECTION OF CLAIMS 1-6, 8-16, AND 18-44 UNDER 35 U.S.C. §103(A) OVER CHARAS IN VIEW OF GARDNER IS IMPROPER**

The Examiner rejected claims 1-6, 8-16, and 18-44 under 35 U.S.C. 103(a) as being unpatentable over Charas in view of Gardner. Appellants respectfully submit that this rejection is improper because 1) the combination of references is improper, and 2) the references do not teach or suggest all of the limitations of any one of the claims,

#### **I. COMBINATION OF CHARAS AND GARDNER IS IMPROPER**

Appellant respectfully submits that the combination of references is an improper application of 35 U.S.C. § 103 because the Examiner has not presented any evidence that the Examiner's combination of Charas and Gardner is a combination of familiar elements according to known methods that yields predictable results, the combination was applied using impermissible hindsight, and the motivation to combine the references asserted by the Examiner is improper.

#### **A. Combination Of Charas And Gardner Is Not A Combination Of Familiar Elements According To Known Methods That Yields Predictable Results**

Appellant respectfully submits that the combination is an improper application of 35 U.S.C. § 103 and that the Examiner has not presented any evidence that the Examiner's combination of Charas and Gardner is a combination of familiar elements according to known methods that yields predictable results.

#### **Summary of the References**

##### **Charas**

Charas describes a repeater system for providing a communications link between a base station and a mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit. Such a condition occurs when the mobile unit is on a train traveling through a tunnel and the base station is outside of the tunnel. The repeater system has a first frequency converter

including a high frequency port for two-way coupling to the base station and a low frequency port for two-way coupling to a low frequency signal that is capable of distributing radio frequency power through the closed environment such as tunnel. The low frequency port is connected to a cable which propagates and receives low radio frequency power within the closed environment. Accordingly, low frequency signals are transmitted and received through the cable. A second frequency converter has first antenna for transmitting and receiving low frequency signals to and from the cable and has a second antenna for communicating with the mobile unit using high frequency signals. The repeater system includes a first antenna for low frequency wireless coupling to the cable and a second antenna for high frequency coupling to mobile units. A base station uses frequency duplex to transmit and receive signals in a high frequency band. Since the second converter extends the bases station cell, the second converter also uses frequency duplex to transmit and receive signals in the high frequency band to communicate with the mobile units. Therefore, transmission from the second antenna to mobile units is at frequencies different than frequencies of reception at the second antenna from the mobile units.

### **Gardner**

Gardner describes multiplexing communication signals and increasing spectral capacity by blind adaptive spatial filtering of spectrally overlapping signals. An antenna with a large number of elements is used for transmission to mobile units and for reception from the mobile units. Spatial filtering adaptation is performed during transmission from the mobile unit to the base station. Transmission from the base station to the mobile unit must use a spatial filter developed during the spatial filtering adaptation. (Gardner, Column 5, Lines 34-37). Gardner uses time division duplex (TDD) so that the spatial filtering adaptation can be performed during transmission from the mobile unit to the base station.

### **Combination of Charas and Gardner**

The Supreme Court stated that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007). In a precedential BPAI opinion, the Board explained that "the operative question in this 'functional approach' is, therefore, 'whether the improvement is more than the predictable use of prior art elements according to their established

functions.’” *Ex Parte Smith (BPAI, June 25, 2995, per curium)*, Page 13. (citing *KSR*, Page 1740). Appellant respectfully submits that the Examiner’s combination of Charas and Gardner is not a combination of familiar elements according to known methods that yields predictable results. The Examiner proposes to significantly alter the teachings of Gardner by modifying the single frequency multi-element antenna system of Gardner to operate in a dual frequency single antenna system of Charas. Gardner explicitly states that the same frequency **MUST** be used for transmission and reception. (Gardner, Column 5, Lines 39-41). On the other hand, Charas teaches to use different frequencies for transmission and reception. (See Charas, Column 4, Lines 8-11). For the multi-element antenna system of Gardner to operate, spatial filtering adaptation is performed during transmission from the mobile unit to the base station and transmission from the base station to the mobile unit **MUST** use a spatial filter developed during the spatial filtering adaptation. (Gardner, Column 5, Lines 34-37). Such adaptation cannot occur in Charas since different frequencies are used for transmission and reception between the mobile unit and repeater. The multi-element antenna in Gardner is not a “familiar element.” On the contrary, it was the subject of the Gardner patent application. Charas uses a single antenna and different frequencies for transmission and reception for communication between the mobile unit and the repeater. Accordingly, the case at hand is not a situation where one with ordinary skill in the art would replace a dual frequency single antenna with any other type antenna that uses a single frequency in both directions. The substitution of the multi-element spatial filtering antenna system of Gardner in a frequency division duplex system of Charas is not a “predictable use of prior art elements according to their established functions.”

In addition, using the Gardner TDD system as taught by Gardner would require that the mobile units in Charas operate in accordance with TDD not in accordance with FDD. This would require modification of GSM mobile units which operate in the FDD mode to be converted to operate in the TDD and thus be incompatible with cellular systems. As a result, this obviates the intended invention of Charas by modifying the mobile units in such a way that they could no longer communicate with the GSM base stations outside of the tunnel and there would be no need for a repeater system as described by Charas.

In the Final Office Action, the Examiner attempts to rebut one of Appellant’s arguments by stating that Charas and Gardner are capable of utilizing TDMA communication protocol and therefore, are combinable. (See Final Office Action, Page 4, lines 19-20). Appellant respectfully

submits that the capability of the references to use TDMA communications does not make the references combinable. TDMA (Time Division Multiple Access) provides a technique for allowing multiple mobile units to share a channel by designating particular times for each mobile unit to transmit signals. Accordingly, TDMA provides a way to share a channel between mobile units and is not related to whether the system uses time division duplex (TDD) or frequency division duplex (FDD) for managing signals transmitted between the base station and the mobile unit. As explained above, Gardner must use time division duplex (TDD) for the antenna to function. With TDD, the same frequency is used for transmission and reception and the channel must be shared by the mobile unit and the base station. The mobile can only transmit part of the time. The allegation that the mobile may use TDMA when transmitting does not mean that the mobile can be modified to use FDD where communications between the mobile and the base station are separated in frequency. The repeater in Charas is provided in order to connect the mobile unit to the GSM system which uses FDD (not TDD). Modification of the Charas system to a TDD system results in a system that no longer meets the intended purpose of providing a connection to a GSM system.

### **B. Combination Is Applied Using Improper Hindsight**

The Supreme Court warned that “[a] fact finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, at 1742. Appellant respectfully submits that the cited prior art is only combined in retrospect, in light of the present invention. That is, the obviousness rejection is based upon characterization of Charas and Gardner in view of the Appellant’s own invention description. Appellant respectfully submits that the Examiner has combined the references by observing that Charas does not teach or suggest using a plurality of antennas and that Gardner includes a discussion of a multi-element antenna system. Appellant submits that the Examiner is constructing the claimed invention by using Appellant’s teaching of a moving base station with a plurality of antennas to form a combination within Charas that significantly alters the operation of Charas to the point that the Charas mechanism will not perform its intended function of frequency division duplex. MPEP § 2142 states that “impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the **facts gleaned from the prior art**”



(emphasis added). The only reasoning provided by the Examiner for combining the references is for “the advantage of enhancing the communication signal quality”. (Office Action dated October 29, 2009, Page 3, Line 14) There is no evidence in the record other than Appellant’s specification that supports the reasoning behind combining the references. On the contrary, as discussed herein, the evidence of record indicates that the communication signal quality would decrease with the combination. Therefore, not only is the reasoning to combine the references found only in Appellant’s specification, but the evidence of record teaches away from combining the references. Appellant respectfully submits that the Examiner’s stated reason to combine is not found in the evidence of record and, as a result, the legal conclusion of obviousness is based on impermissible hindsight.

### **C. Improper Motivation For Combining The References**

Further, the evidence of record does not support the proposition by the Examiner that “[i]t would be obvious to one of ordinary skill in the art at the time of the invention was made to apply the teaching of Gardner in modifying the moveable base station, as described by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality. (Office Action dated October 29, 2009, Page 3, Lines 11-14, emphasis added). On the contrary, the evidence clearly indicates that the combination will not function or, will operate at a reduced data rate, at best. Since Gardner requires TDD, the use of the Gardner antenna with the teachings of Charas would require Charas to use TDD instead of FDD as Charas teaches. The data rate will be reduced if the communication link between the repeater and the mobile unit in Charas is changed to a time division duplex (TDD) interface since the channel must be shared for transmission. The data rate would be less for both transmissions since the mobile unit and the repeater could only transmit a portion of the time rather than continuously as in FDD. As a result, there would be no “advantage of enhancing the communication” as the Examiner alleges. Accordingly, Appellant respectfully submits that the combination is improper and the rejection should be withdrawn.

**II. ALL LIMITATIONS OF ANY ONE OF CLAIMS 1-6, 8-16, and 18-44 ARE NOT TAUGHT OR SUGGESTED BY THE REFERENCES**

Appellant respectfully submits that all of the limitations of any one of claims 1-6, 8-16, and 18-44 are not taught or suggested by Charas, Gardner, or a combination of the two. The failure of the cited art to teach or suggest each and every feature of a claim is fatal to an obviousness rejection under 35 U.S.C. § 103. For example, section 2143.03 of the MPEP requires the “consideration” of every claim feature in an obviousness determination. For a proper rejection, this “consideration” requires that the Examiner find that Gardner and Charas teach or suggest each and every claim feature. See *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) (emphasis added) (to establish *prima facie* obviousness of a claimed invention, all the claim features must be taught or suggested by the prior art). As the Board of Patent Appeal and Interferences has recently confirmed, a proper obviousness determination requires that an Examiner make “a searching comparison of the claimed invention—including all its limitations—with the teaching of the prior art.” See *In re Wada and Murphy*, Appeal 2007-3733, citing *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995) (emphasis in original). Further, the necessary presence of all claim features is axiomatic, since the Supreme Court has long held that obviousness is a question of law based on underlying factual inquiries, including . . . ascertaining the differences between the claimed invention and the prior art. *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966) (emphasis added).

Appellant submits that this is why Section 904 of the MPEP instructs Examiners to conduct an art search that covers “the invention as described and claimed.” (Emphasis added). Further, Appellant respectfully directs attention to MPEP § 2143, the instructions of which buttress the conclusion that obviousness requires at least a suggestion of all of the features of a claim, since the Supreme Court in *KSR Int’l v. Teleflex Inc.* stated that “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int’l v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Accordingly, it remains well-settled law that an obviousness rejection requires at least a suggestion of all of the features in a claim. See *In re Wada and Murphy*, citing *CFMT, Inc. v. Yieldup Intern. Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) and *In re Royka*, 490 F.2d 981, 985 (CCPA 1974).

**Claims 1, 21, and 27**

Claims 1, 21, and 27 recite a movable base station comprising “a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas.” Charas does not suggest this feature. Gardner does not disclose a movable base station with a plurality of antennas. The combination of Gardner and Charas results in a device that **cannot** receive signals from a mobile device. For example, simply replacing the single antenna of Charas with a multi-element antenna results in a system that cannot receive signals. Charas does not teach how to process an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This deficiency is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, the mobile unit will transmit signals during times when the Gardner multi-element system is in the transmit mode and cannot receive signals. For the Gardner antenna to operate, TDD must be used. (Gardner, Column 5, Lines 34-37). Since the mobile transmits continuously in Charas, there will be times when the Gardner antenna is not receiving mobile signals when combined with Charas. Accordingly, the mobile unit signals will not be received. The Examiner has provided no evidence that the combination results in a receiver that is configured to receive signals through a plurality of antennas as claimed. Accordingly, Appellant respectfully submits that the Examiner has not presented a *prima facie* case for obviousness since all of the elements of any one of claims 1, 21, or 27 are not taught or suggested by the references.

**Claims 11, 33, and 38**

Claim 11, 33, and 38 recite a movable base station comprising “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Appellant respectfully submits that neither Charas, nor Gardner, nor a combination of the two, teaches or suggest this feature. Charas does not mention a plurality of antennas. Gardner does not mention a moveable base station. Further, Gardner does not teach to receive signals from a fixed port through a plurality of spatially separated antennas. Gardner explicitly states that the plurality of antennas is used to receive signals from mobile units.

It appears that the Examiner is alleging that the single antenna (118) receiving signals from the amplifiers (208) connected to the cable transmission means (110) of Charas can be replaced with the multi-element antenna of Gardner to result in “a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas.” Appellant respectfully submits that such a combination does not result in a receiver that can receive signals from a fixed port. Simply replacing the Charas antenna (118) with the multi-element antenna array of Gardner results in a device that cannot receive signals. Charas does not teach how to process an output of a multi-element antenna. Accordingly, signals reaching a multi-element antenna in Charas will not be received. This problem is not solved by applying the antenna processing teachings of Gardner to a multi-element antenna incorporated into Charas. For example, the antenna processing techniques of Gardner require time division duplex switching. (See Gardner, Column 15, Lines 9-13). In the GSM system of Charas, amplifiers 208 transmit GSM signals that are linearly converted to a lower frequency. The signals, therefore, have the same timing as GSM signals. As a result, the amplifiers transmit signals during times when the Gardner multi-element system is in the transmit mode and not receiving. Accordingly, the signals from the amplifiers will not be received. Accordingly, Appellant respectfully submits that the Examiner has not presented a *prima facie* case for obviousness since all of the elements of claim 1 are not taught or suggested by the references.

**Claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44**

Regarding claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44, these claims depend from one of independent claims 1, 11, 21, 27, 33, or 38 which Appellant submits are allowable. Accordingly, claims 2-6, 8-10, 12-16, 18-19, 22, 26, 28-32, 34-37, and 39-44 are at least allowable for the reason that they depend from an allowable base claim.

**Claims 4, 14, 28, and 39**

Further regarding claims 4, 14, 28, and 39, these claims recite “another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.” Appellant respectfully submits that neither, Charas, nor Gardner, nor a combination of the two, teaches or suggests this feature. Charas does not discuss spatially separated antennas. Gardner discusses only a single multi-

element antenna. The Examiner has provided no support for the allegation that the limitation is shown.

**Claims 10, 20, 26, 32, 37, and 44**

Further regarding claims 10, 20, 26, 32, 37, and 44, these claims recite that the movable base station is conveyed by a vehicle “wherein the vehicle is an automotive vehicle.” Appellant respectfully submits that neither, Charas nor Gardner, nor a combination of the two, teaches or suggests this feature. Gardner does not disclose moveable base stations. Charas discusses a repeater on a train and does not suggest automobiles.

**CONCLUSION**

Appellants respectfully submit that the pending claims are allowable and that the rejections should be reversed.

Respectfully Submitted,

Dated: June 27, 2010

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**APPENDIX****Claims**

1. A movable base station configured to move relative to Earth, the movable base station comprising:
  - a plurality of spatially separated antennas;
  - a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas;
  - a controller configured to align and combine the received mobile device signals;
  - and
  - a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.
2. A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.
3. A movable base station in accordance with claim 1, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.
4. A movable base station in accordance with claim 1, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.
5. A movable base station in accordance with claim 4, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

6. A movable base station in accordance with claim 1, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

7. (Cancelled)

8. A movable base station in accordance with claim 1, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

9. A movable base station in accordance with claim 1, wherein the movable base station is conveyed by a vehicle.

10. A movable base station in accordance with claim 9, wherein the vehicle is an automotive vehicle.

11. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;

a controller configured to align and combine the received fixed port signals; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

12. A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

13. A movable base station in accordance with claim 11, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

14. A movable base station in accordance with claim 11, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

15. A movable base station in accordance with claim 14, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

16. A movable base station in accordance with claim 11, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

17. (Cancelled)

18. A movable base station in accordance with claim 11, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

19. A movable base station in accordance with claim 11, wherein the movable base station is conveyed by a vehicle.



20. A movable base station in accordance with claim 19, wherein the vehicle is an automotive vehicle.

21. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station, the radio frequency signals transmitted within time slots of time-division multiplex channels.

22. A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

23. A movable base station in accordance with claim 21, wherein the plurality of spatially separated antennas is configured as a plurality of phased array antennas with directional radio frequency beams.

24. A movable base station in accordance with claim 21, further comprising a controller configured to compare the received mobile device signals received through the spatially separated antennas and to select a best signal.

25. A movable base station in accordance with claim 21, wherein the movable base station is conveyed by a vehicle.

26. A movable base station in accordance with claim 25, wherein the vehicle is an automotive vehicle.

27. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive mobile device signals from a mobile device through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals corresponding to the mobile device signals to a base station.

28. A movable base station in accordance with claim 27, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

29. A movable base station in accordance with claim 28, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

30. A movable base station in accordance with claim 27, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

31. A movable base station in accordance with claim 27, wherein the movable base station is conveyed by a vehicle.

32. A movable base station in accordance with claim 31, wherein the vehicle is an automotive vehicle.

33. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals, the radio frequency signals transmitted within time slots of time-division multiplex channels.

34. A movable base station in accordance with claim 33, wherein the plurality of spatially separated antennas is configured as directional antenna sectors.

35. A movable base station in accordance with claim 33, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

36. A movable base station in accordance with claim 33, wherein the movable base station is conveyed by a vehicle.

37. A movable base station in accordance with claim 36, wherein the vehicle is an automotive vehicle.

38. A movable base station configured to move relative to Earth, the movable base station comprising:

a plurality of spatially separated antennas configured as a plurality of phased array antennas to provide directional radio frequency beams;

a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and

a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

39. A movable base station in accordance with claim 38, further comprising another plurality of spatially separated antennas, the transmitter configured to transmit the radio frequency signals through the another plurality of spatially separated antennas.

40. A movable base station in accordance with claim 39, wherein the another plurality of spatially separated antennas is configured to transmit spatially separated radio frequency beams separated in time with a predefined time delay.

41. A movable base station in accordance with claim 38, further comprising a controller configured to compare the received fixed port signals received through the spatially separated antennas and to select a best signal.

42. A movable base station in accordance with claim 38, the transmitter further configured to transmit the radio frequency signals within time slots of time-division multiplex channels.

43. A movable base station in accordance with claim 38, wherein the movable base station is conveyed by a vehicle.

44. A movable base station in accordance with claim 43, wherein the vehicle is an automotive vehicle.

## **APPENDIX**

### **Evidence**

- 1) U.S. Patent No. 5,404,570 to Charas et al. (“Charas”)
- 2) U.S. Patent No. 5,260,968 to Gardener et al. (“Gardener”)
- 3) Final Office Action dated October 29, 2009



US005404570A

**United States Patent** [19]

Charas et al.

[11] Patent Number: **5,404,570**[45] Date of Patent: **Apr. 4, 1995**[54] **RADIO COVERAGE IN CLOSED ENVIRONMENTS**[75] Inventors: **Philippe Charas**, Upplands Väsby;  
**Stefan Källander**, Lidingö, both of Sweden[73] Assignee: **Telefonaktiebolaget L M Ericsson**, Stockholm, Sweden[21] Appl. No.: **979,909**[22] Filed: **Nov. 23, 1992**[51] Int. Cl.<sup>6</sup> ..... **H04Q 7/02; H04B 7/26; H04B 7/15**[52] U.S. Cl. .... **455/22; 455/33.3; 455/33.4; 455/56.1; 455/70; 379/59**[58] Field of Search ..... **455/14-16, 455/41, 66, 20, 22, 31.1, 1.1, 33.2, 54.1, 33.4, 33.3, 70; 379/59, 60**[56] **References Cited****U.S. PATENT DOCUMENTS**

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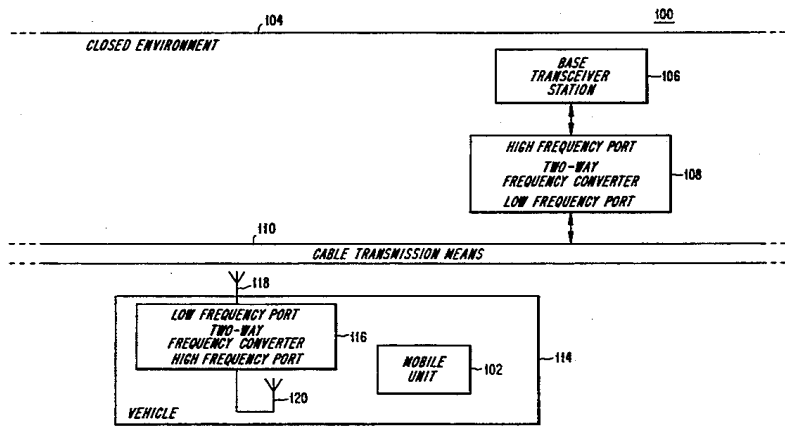
*Primary Examiner*—Edward F. Urban

*Assistant Examiner*—Mark D. Wisler

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[57] **ABSTRACT**

A repeater system in a communication system including a base station and a mobile unit provides a communications link between the base station and the mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit. The repeater system has a first linear two-way frequency converter including a high frequency port for two-way coupling to the base station and a low frequency port for two-way coupling to a low frequency signal that is capable of distributing radio frequency power through the closed environment. The low frequency port is connected to a cable which propagates and receives low radio frequency power within the closed environment. The repeater system also includes a first antenna for wireless coupling to the cable, and a second linear two-way frequency converter having a low frequency port connected to the first antenna for two-way coupling to a low frequency signal and a high frequency port for two-way coupling to a signal that is compatible with the high radio frequency signal used by the communications system. A second antenna is connected to the high frequency port of the second linear two-way frequency converter for wireless coupling of the second linear two-way frequency converter to a nearby mobile unit.

**19 Claims, 3 Drawing Sheets**

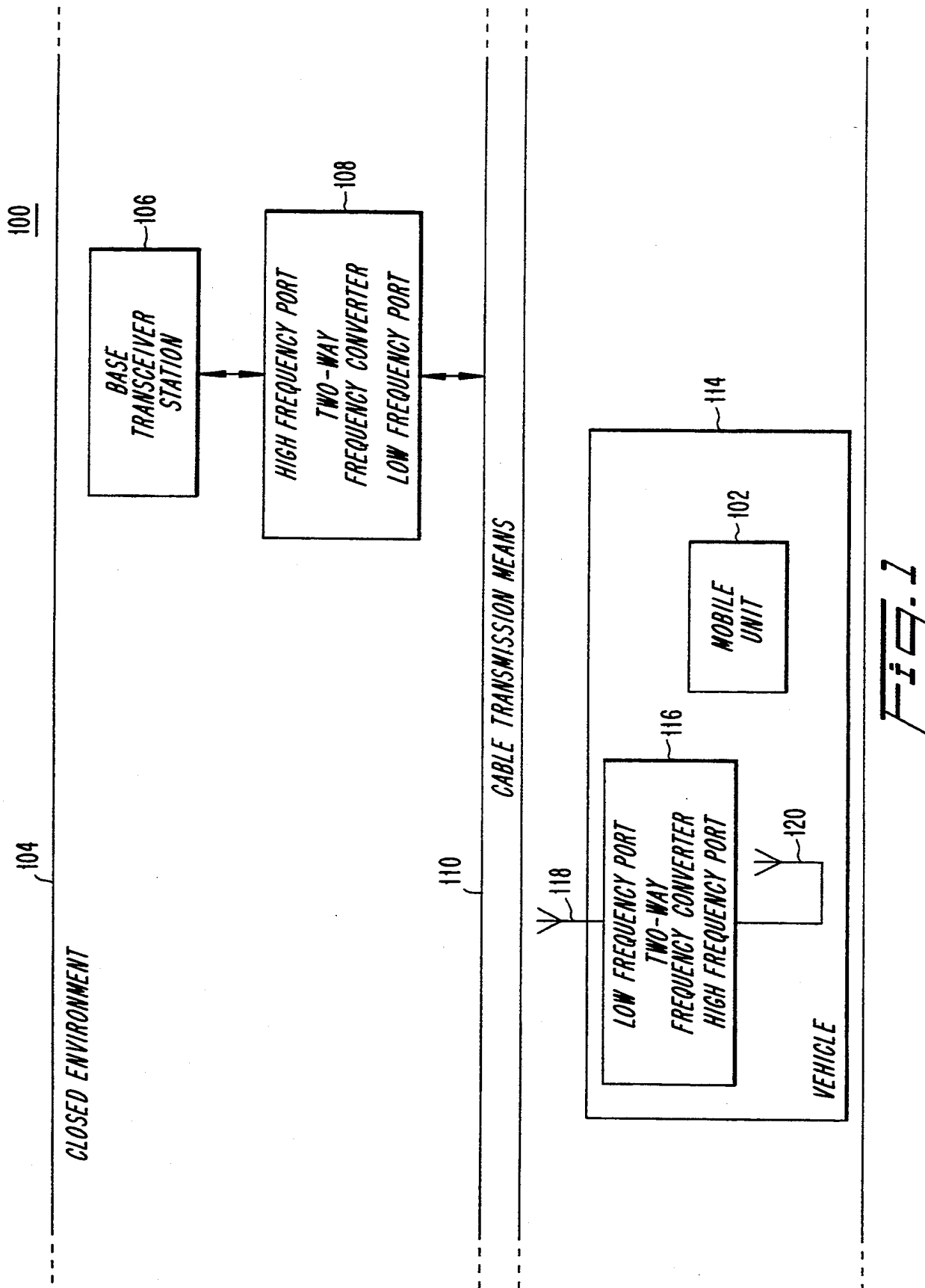
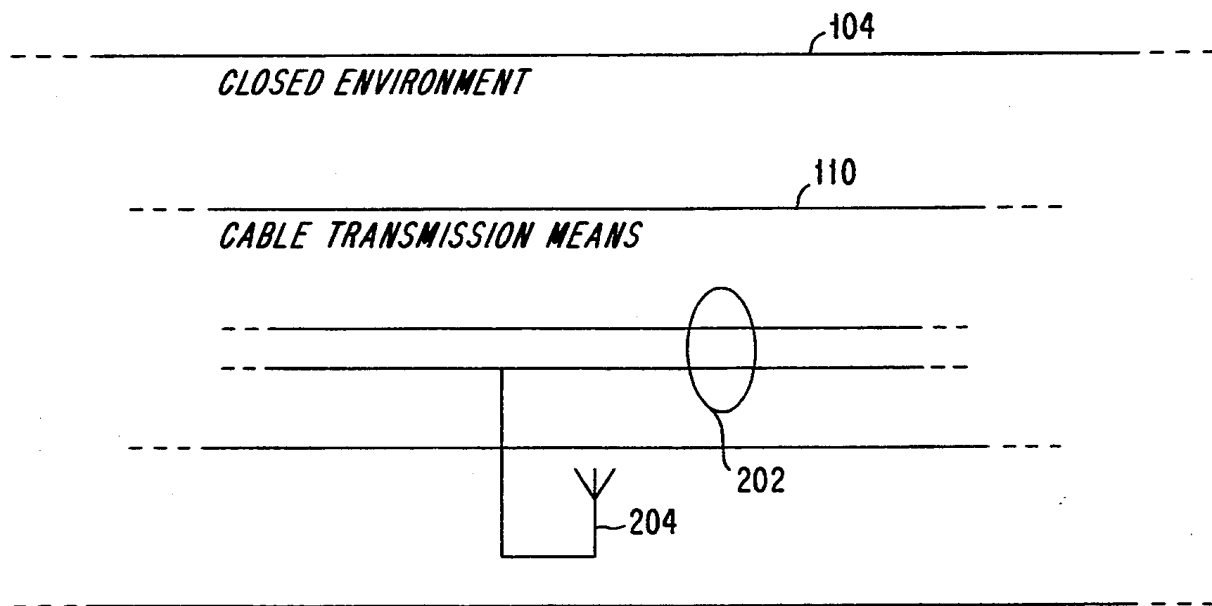
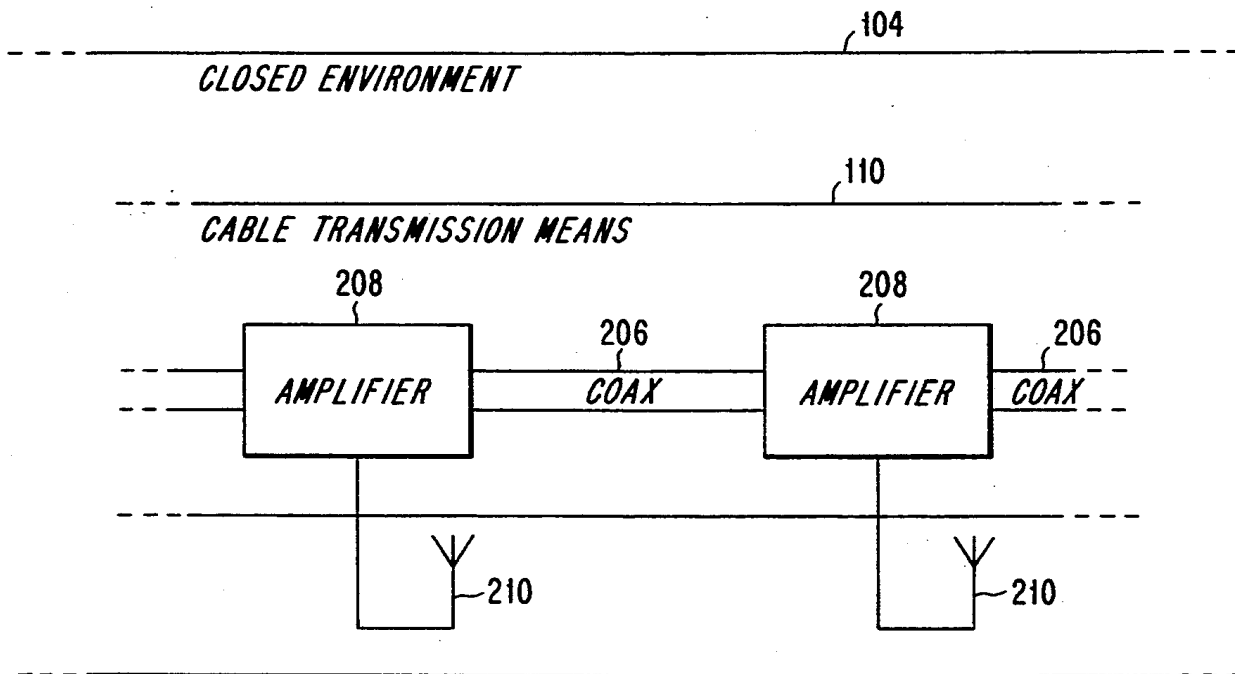


Fig. 1

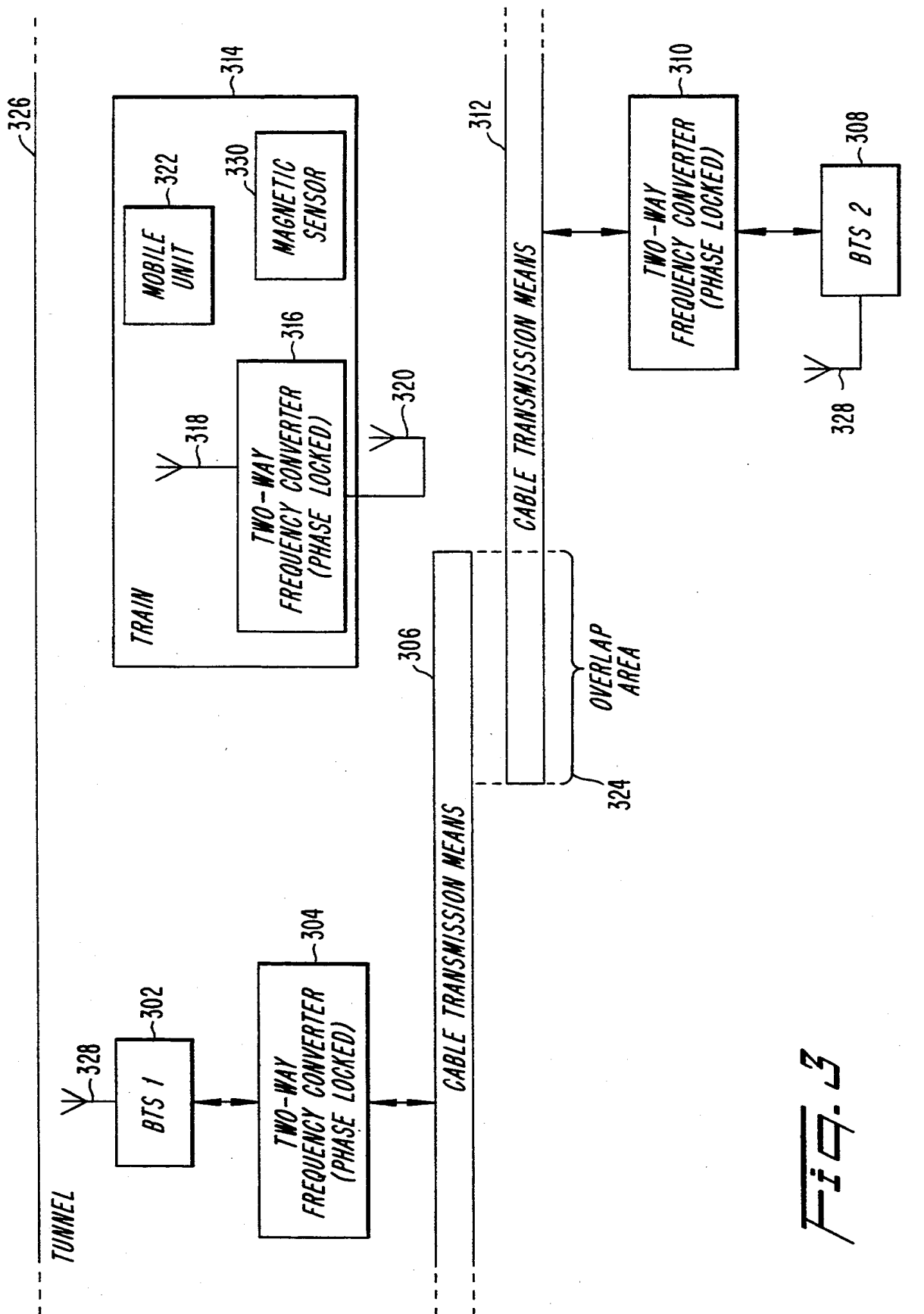




*FIG. 2a*



*FIG. 2b*



## RADIO COVERAGE IN CLOSED ENVIRONMENTS

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to radio coverage in environments that are otherwise closed off to such coverage, and more particularly to cellular radio communications coverage in such closed off environments by means of repeaters, and even more particularly to a repeater system which converts communications system high radio frequency signals into low radio frequency signals for propagation in the closed off environment, and then back into high radio frequency signals.

#### 2. Related Art

In a cellular telephone system, each portable telephone, referred to here as a mobile unit, is able to function only to the extent that it is able to send and receive radio signals to and from a base station associated with the system. However, in the real world environment there are impediments to normal radio communication. For example, at frequencies of approximately 1 GHz or higher, obstructions such as tunnels can attenuate the radio signal 50 dB/km up to total cut-off. The amount of attenuation will depend on circumstances such as the shape of the tunnel, and the presence of obstructions like trains. This attenuation makes the radio propagation environment erratic and unreliable.

Prior attempts to radiate radio frequency (RF) power into problematic isolated structures, referred to here as closed environments, include the use of leaky coaxial cable in the structure, and also the brute force approach of directing a large RF power level into the structure. However, such approaches have proven to be both expensive and prohibitively complicated.

### SUMMARY OF THE INVENTION

It is therefore one object of the present invention to provide a simple and cost effective approach to providing radio coverage in closed environments.

Another object of the invention is to extend a cellular telephone architecture into a closed environment so that the closed environment is subdivided into several cells, and to provide for the hand off of frequencies between them as a mobile unit moves from one cell to another.

A further object of the invention is to offer a simple and cost effective solution which can be implemented as an "add-on kit" to present radio hardware without substantial change or extra cost to this hardware.

According to the present invention, the foregoing and other objects are attained in a repeater system for use in a communication system that includes a base station and a mobile unit, both operating at a high radio frequency. The repeater system provides a communications link between the base station and the mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit. The repeater system comprises a first linear two-way frequency converter including a high frequency port for two-way coupling to the base station, and a low frequency port for two-way coupling to a low frequency signal that is capable of distributing frequency power through the closed environment. The repeater system also includes cable transmission means con-

nected to the low frequency port of the first linear two-way frequency converter. The cable transmission means is located within the closed environment for radiating the low frequency converted signals within the closed environment. The repeater system also includes a first antenna for wireless coupling to the cable transmission means, and a second linear two-way frequency converter including a low frequency port connected to the first antenna for two-way coupling to a low frequency signal, and a high frequency port for two-way coupling to a signal that is compatible with the high radio frequency signal used by the communications system. The repeater system also has a second antenna connected to the high frequency port of the second linear two-way frequency converter.

With the above-described structure, a mobile unit in the vicinity of the second antenna can communicate with the base station in a normal fashion. The conversion of the high frequency signal into a low frequency signal and then back again into a high frequency signal is completely transparent to both the mobile unit and the base station.

In another embodiment of the above-described repeater system, the first antenna, second linear two-way frequency converter, and second antenna are located within a vehicle, and the cable transmission means is distributed along an anticipated path of the vehicle through the closed environment. As used throughout this specification, the term "vehicle" is used to represent a conveyance within which a mobile unit is to be able to operate. For example, the vehicle may be a train car travelling through a tunnel as part of a subway system. In this example, a passenger on the train is able to use a mobile unit to communicate with the base station by means of the repeater system. This is because a train car so equipped becomes a mobile base station that services a moving cell that is defined by the confines of the train itself. A passenger on the train may use a mobile unit the same as he or she would outside of the subway system.

Besides providing normal communications service to a mobile unit located on a vehicle that is travelling within a closed environment, a further advantage of the described mobile base station is that the high radio frequency power level need only be strong enough to propagate through the train car (i.e., the moving cell). This keeps the total radiated power in the closed environment at a low level compared to the high level of output power that would be required to propagate the high radio frequency signal throughout the tunnel for direct reception by a mobile unit on a train. Other environmental benefits are achieved by not having to subject passengers and other equipment to high levels of radio wave energy. Instead, passengers are only subjected to the lower power signal transmitted by the second antenna on board the train.

Another feature of the repeater system is useful, for example, when a communication system has a base station located in each of adjacent subway stations. Here, the cable transmission means is associated with a first base station, and a terminal portion of the cable transmission means overlaps a corresponding terminal portion of a cable transmission means that is associated with a second base station. The region of overlap should be sufficient to permit the vehicle, in this case a train car, to simultaneously pass by the terminal portions of both cable transmission means for at least several sec-

onds when the vehicle is travelling at a typical speed away from the first base station and toward the second base station. This avoids the problem of having all mobile units on board the train, travelling away from the first base station and toward the second base station, handed off from the first base station to the second base station at the same time.

Also, in the example of a mobile unit located on a moving vehicle, the above-described repeater system may further include a sensor coupled to the second linear two-way frequency converter for alternatively turning the second linear two-way frequency converter on and off in response to respectively sensing the vehicle entering and exiting the closed environment.

In another embodiment of the repeater system, the high radio frequency is in a range of 900 to 2000 megahertz, and the low frequency is in a range of 30 to 300 megahertz.

In yet another embodiment of the repeater system, the cable transmission means is a bifilar cable.

In still another embodiment of the repeater system, the cable transmission means comprises a coaxial cable connected to the first linear two-way frequency converter, an amplifier having an input connected to the coaxial cable, and a third antenna connected to an output of the amplifier.

In another embodiment of the repeater system, the first and second linear two-way frequency converters are phase locked to a system clock. This avoids interference problems if two or more vehicles are close to each other and are receiving signals from the same base station.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of one embodiment of the system in accordance with the present invention.

FIGS. 2a and 2b are more detailed block diagrams showing two preferred embodiments of the cable transmission means for use in the present invention.

FIG. 3 is a block diagram showing another embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides radio coverage to closed environments by recognizing that the radio frequency environment consists of two parts: a first environment in which the radio signal is propagated up to, but not within, the closed environment; and a second environment consisting of the area located within the closed environment. Methods for propagating a radio signal in the first environment, which does not present the above-described signal obstruction problems, are well known to those of ordinary skill in the art, and need not be described here. Cellular telephone systems functioning in this first environment typically radiate RF power in the 900-2000 megahertz (MHz) range. Both the mobile units and the base stations of such a system are adapted to transmit and receive in this frequency range.

Propagation of the signal within the second, closed environment can be accomplished by propagating a low radio frequency signal, preferably in the range 30-300 MHz, through either a coaxial or a bifilar conductor located within the closed environment. However, it should be readily apparent that a typical mobile unit is not capable of operating in this frequency range, and cannot directly take advantage of such a signal.

Referring to FIG. 1, a preferred embodiment of a system 100 for enabling a mobile unit 102 to continue to operate within a closed environment 104 is shown. The system 100 includes a multi-channel Base Transceiver Station (BTS) 106 associated with a cellular telephone system (not shown). The BTS 106 operates on a frequency that is compatible with the cellular telephone system. For the purposes of this description, it will be presumed that the BTS 106 transmits and receives RF power in the 1500 MHz band with a 45 MHz duplex distance between uplink and downlink frequencies.

The closed environment 104 may be a tunnel that is part of a subway system. In such a case, a BTS 106 is preferably placed in each underground station, with BTS's 106 located at adjacent underground stations operating at different frequencies in accordance with frequency allocation requirements for ordinary cell planning.

In order to communicate with the mobile unit 102 located in the closed environment 104, the BTS 106 is connected to the high-frequency port of a first linear two-way frequency converter 108. The low frequency port of the first frequency converter 108 is connected to cable transmission means 110. The function of the first frequency converter 108 is to convert the 1500 MHz signal that is output by the BTS 106 into a low frequency RF signal which can be propagated into the closed environment 104 by means of the cable transmission means 110 which is distributed throughout the closed environment 104, preferably along an anticipated path of the vehicle 114 containing a mobile unit 102. For purposes of discussion, it will be assumed that this low frequency RF signal is 200 MHz.

The first frequency converter 108 also converts low frequency RF signals, which may be received from another source and propagated by the cable transmission means 110, into high frequency signals for reception by the BTS 106. Thus, in the illustrative example, a 200 MHz signal propagated by the cable transmission means 110 would be converted to a 1500 MHz signal for use by the BTS 106.

It has been mentioned that the function of the cable transmission means 110 is to propagate a low frequency RF signal throughout the closed environment 104. FIGS. 2a and 2b illustrate two different embodiments for accomplishing this. FIG. 2a shows the cable transmission means 110 implemented as a simple bifilar cable 202 connected to simple radiators 204, such as dipole antennas, that are located throughout the closed environment 104. Power from the low frequency RF signal is then radiated into the closed environment 104 through the simple radiators 204 as well as through the bifilar cable 202 itself. The same bifilar cable 202 may be used to propagate a low frequency RF signal that is received, as described below, within the closed environment 104, for reception by the low frequency port of the first frequency converter 108.

An alternative embodiment of the cable transmission means 110 is shown in FIG. 2b. Here, an inexpensive coaxial cable 206 distributes the low frequency RF signal to a series of simple low cost amplifiers 208, each connected to an antenna 210. The amplifier 208/antenna 210 combinations can be placed at every 100 m along the closed environment. Output power can be maintained at a very low level that is amplified by each successive amplifier 208. Each amplifier 208 should be capable of amplifying signals travelling in two directions, that is, into and out of the first frequency con-

verter 108. The purpose of this two way signal propagation is to permit bidirectional communication between a mobile unit 102 and the BTS 106. This is described in greater detail below.

Another alternative embodiment of the cable transmission means 110 is to use two cables in parallel, each dedicated to propagating a signal in only one direction. For example, the cable transmission means 110 may be embodied by two bifilar cable 202/radiator 204 combinations which are both distributed along the same path in the closed environment 104. In this case, each bifilar cable 202 is dedicated to propagation of a low frequency RF signal in only one direction, either into or out of the first frequency converter 108.

Referring back to FIG. 1, the mobile unit 102 is located inside a vehicle 114, which may be a train car. Associated with the vehicle 114 is a second linear two-way frequency converter 116. The second frequency converter 116 is connected at its low frequency port to a first antenna 118. The first antenna 118 is located on the outside of the vehicle 118 as close as possible to the radiating cable transmission means 110, to enable it to receive and transmit the low frequency RF signal.

The second frequency converter 116 is connected at its high frequency port to a second antenna 220, which transmits and receives the high RF signal inside the vehicle 118.

The first and second frequency converters 108, 116 are phase locked to the system clock so that their output frequencies will be synchronized with one another. This is necessary in order to avoid interference problems if two or more vehicles 114 (only one shown) are close to each other and are receiving signals from the same BTS 106.

With the configuration described above, each vehicle 114 is treated as an extended BTS cell, allowing handheld cellular telephones to be used in the ordinary way.

The above-described system 100, involving the use of frequency conversion, is preferably part of a digital communications system that utilizes a Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), or Code Division Multiple Access (CDMA) method of transmission. However, it could also be used in an analog communications system.

Referring now to FIG. 3, an example is shown in which the vehicle 114 is one car in a train 314 in a subway system. A first BTS 302 is located at a first subway station, and a second BTS 308 is located at a second subway station that is adjacent the first. The first BTS 302 communicates with a mobile unit 322 located on the train 314 by propagating its low RF frequency signal along the first cable transmission means 306, which may preferably be either of the embodiments described above with respect to FIGS. 2a and 2b. As the train 314 moves away from the first station toward the second station, it will be necessary for the first BTS 302 to hand off the call to the second BTS 308. In order to prevent all mobile units 322 from making hand offs at the same time, terminal portions of the first and second cable transmission means 306, 312 should overlap one another. The amount of overlap 324 should be designed to permit the second antenna 320, mounted on the vehicle, to be near both the first and second cable transmission means 306, 312 for several seconds when the train 314 is travelling at a typical speed. For example, the system may be designed to permit the second antenna 320 to be near both the first and second cable transmission means 306 for about 5 seconds when the train 314 is travelling

at a speed of 20 meters per second by allowing terminal portions of the first and second cable transmission means 306, 312 to overlap one another for a length of about 100 meters. This will allow the second antenna 320 to experience a gradual decrease in received power as it leaves the coverage area of the first BTS 302 while at the same time experiencing a gradual increase in received power as it approaches the coverage area of the second BTS 308.

In another feature of the present invention, the two-way frequency converter 316 located inside the train 314 is switched off when the train 314 leaves the tunnel 326 and comes under the coverage of another BTS cell that does not provide service to the closed environment (not shown). Similarly, the frequency converter 316 located inside the train 314 is switched on when the train 314 enters a tunnel 326. The switching on and off of the frequency converter 316 is activated by a magnetic sensor 330, or the like, in the train that senses the emerging entrance into and exit from the tunnel 326, and sends appropriate signals to the frequency converter 316.

It is important to note that when the train 314 leaves the tunnel 326, causing the two-way frequency converter 316 to be switched off, a mobile unit 322 in use at the time must quickly be handed off to an outside BTS cell that does not provide service to the closed environment (not shown). Thus, the outside BTS cell should provide good coverage to the area just outside the tunnel. To achieve this, an outside BTS cell may preferably be placed at the exit of the tunnel 326.

In another feature of the present invention, each BTS 302, 308 has a third antenna 328 which enables it to directly serve any mobile unit being operated at the subway station. Thus, a passenger who is utilizing a mobile unit 322 at a subway station may continue to be serviced by the same BTS 302, 308 as he or she moves from the station platform to the train 322. The same is true when a passenger who is using a mobile unit 322 leaves the train 322 and steps onto a station platform.

The invention has been described with reference to particular embodiment. However, it will be readily apparent to those skilled in the art that it is possible to embody the invention in specific forms other than those of the preferred embodiment described above. This may be done without departing from the spirit of the invention. For example, if only one-way communication is required, then the two linear frequency converters need only be capable of converting signals in one direction. The preferred embodiment is merely illustrative and should not be considered restrictive in any way. The scope of the invention is given by the appended claims, rather than the preceding description, and all variations and equivalents which fall within the range of the claims are intended to be embraced therein.

What is claimed is:

1. In a communications system including a base station and a mobile unit, both operating at a high radio frequency, a repeater system for providing a communications link between the base station and the mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit, the repeater system comprising:

a first linear two-way frequency converter including:  
a high frequency port for two-way coupling to the base station; and

- a low frequency port for two-way coupling to a low frequency signal having a frequency that is capable of radiating radio frequency power through the closed environment, the low frequency signal being in a frequency band that is lower than a frequency band of the high frequency port;
- cable transmission means connected to the low frequency port of the first linear two-way frequency converter, and located within the closed environment for radiating and receiving the low frequency signal within the closed environment;
- a first antenna for wireless coupling to the cable transmission means;
- a second linear two-way frequency converter including:
- a low frequency port connected to the first antenna for two-way coupling to the low frequency signal; and
  - a high frequency port for two-way coupling to a high radio frequency signal having a frequency that is compatible with the high radio frequency used by the communications system; and
  - a second antenna connected to the high frequency port of the second linear two-way frequency converter.
2. The repeater system of claim 1 wherein the first antenna, second linear two-way frequency converter, and second antenna are disposed on a vehicle, and the cable transmission means is distributed along an anticipated path of the vehicle through the closed environment.
3. The repeater system of claim 2 wherein the cable transmission means is associated with a first base station, and a terminal portion of the cable transmission means overlaps, for a predetermined length, a corresponding terminal portion of a cable transmission means associated with a second base station, the predetermined length being sufficient to permit the vehicle to simultaneously pass by the terminal portions of both cable transmission means for at least several seconds when the vehicle is travelling at a predetermined speed away from the first base station and toward the second base station.
4. The repeater system of claim 2 wherein the vehicle further includes a sensor coupled to the second linear two-way frequency converter for alternatively turning the second linear two-way frequency converter on and off in response to respectively sensing the vehicle entering and exiting the closed environment.
5. The repeater system of claim 2 wherein the high radio frequency is in a range of 900 to 2000 megahertz, and the low frequency is in a range of 30 to 300 megahertz.
6. The repeater system of claim 2 wherein the cable transmission means is a bifilar cable.
7. The repeater system of claim 2 wherein the cable transmission means comprises:
- a coaxial cable, connected to the first linear two-way frequency converter;
  - an amplifier having an input connected to the coaxial cable; and
  - a third antenna connected to an output of the amplifier.
8. The repeater system of claim 2 wherein the first and second linear two-way frequency converters are phase locked to a system clock.
9. The repeater system of claim 2

- wherein the base station is located at a passenger station situated along an anticipated path of the vehicle, the base station is coupled to the high frequency port of the first linear two-way frequency converter, and wherein the base station includes a fourth antenna for wireless, high radio frequency coupling to a mobile unit.
10. The repeater system of claim 1 wherein the high radio frequency is in a range of 900 to 2000 megahertz, and the low frequency is in a range of 30 to 300 megahertz.
11. The repeater system of claim 1 wherein the cable transmission means is a bifilar cable.
12. The repeater system of claim 1 wherein the cable transmission means comprises:
- a coaxial cable, connected to the first linear two-way frequency converter;
  - an amplifier having an input connected to the coaxial cable; and
  - a third antenna connected to an output of the amplifier.
13. The repeater system of claim 1 wherein the first and second linear two-way frequency converters are phase locked to a system clock.
14. In a communications system including a base station and a mobile unit, both operating at a high radio frequency, a method for communicating between the base station and the mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit, comprising the steps of:
- linearly converting a base station high radio frequency signal into a low frequency signal that is capable of radiating radio frequency power into the closed environment, the low frequency signal being in a frequency band that is lower than a frequency band of the high radio frequency signal;
  - using cable transmission means to distribute the low frequency signal within the closed environment;
  - receiving the distributed low frequency signal in a first antenna;
  - linearly converting the received low frequency signal into a reconverted high radio frequency signal; and
  - using a second antenna to transmit the reconverted high radio frequency signal to the mobile unit.
15. The method of claim 14 wherein the steps of receiving, linearly converting the received low frequency signal, and using a second antenna to transmit are performed on a vehicle.
16. In a communications system including a base station and a mobile unit, both operating at a high radio frequency, a method for communicating between the base station and the mobile unit when the mobile unit is located in an environment that is substantially closed off to high radio frequency communication between the base station and the mobile unit, comprising the steps of:
- using a second antenna to receive a high radio frequency signal from the mobile unit;
  - linearly converting the received high radio frequency signal into a low frequency signal that is capable of radiating radio frequency power into the closed environment, the low frequency signal being in a frequency band that is lower than a frequency band of the high radio frequency signal;
  - radiating the low frequency signal from a first antenna;
  - using cable transmission means to receive the low frequency signal within the closed environment;

linearly converting the received low frequency signal into a base station high radio frequency signal; and outputting the base station high radio frequency signal to the base station.

17. The method of claim 16 wherein the steps of using a second antenna to receive, linearly converting the received high radio frequency signal, and radiating are performed on a vehicle.

18. In a communications system including at least one stationary base station and a mobile unit, both operating at a high radio frequency, a mobile base station for providing communication system service to the mobile unit when the mobile unit is located in a vehicle that is travelling in an environment that is substantially closed off to high radio frequency communication between the stationary base station and the mobile unit, the mobile base station comprising:

first means, disposed on the vehicle, for wireless coupling to a cable transmission means, coupled to a stationary base station, for two-way, low fre-

quency signal propagation within the closed environment;

a linear two-way frequency converter, disposed on the vehicle, including:

a low frequency port connected to the first wireless coupling means for two-way coupling to a low frequency signal; and

a high frequency port for two-way coupling to a high radio frequency signal that is compatible with the high radio frequency used by the communications system, the high radio frequency signal being in a frequency band that is higher than a frequency band of the low frequency signal; and

second means, disposed on the vehicle and connected to the high frequency port of the linear two-way frequency converter, for wireless high radio frequency coupling to the mobile unit located in the vehicle.

19. The mobile base station of claim 18 wherein the first wireless coupling means and second wireless coupling means are, respectively, first and second antennas.

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**United States Patent** [19]

Gardner et al.

[11] **Patent Number:** 5,260,968[45] **Date of Patent:** Nov. 9, 1993

[54] **METHOD AND APPARATUS FOR  
MULTIPLEXING COMMUNICATIONS  
SIGNALS THROUGH BLIND ADAPTIVE  
SPATIAL FILTERING**

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[51] Int. Cl.<sup>5</sup> ..... **H04K 1/00**

[52] U.S. Cl. .... **375/1**

[58] Field of Search ..... **375/1**

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*Primary Examiner*—David C. Cain

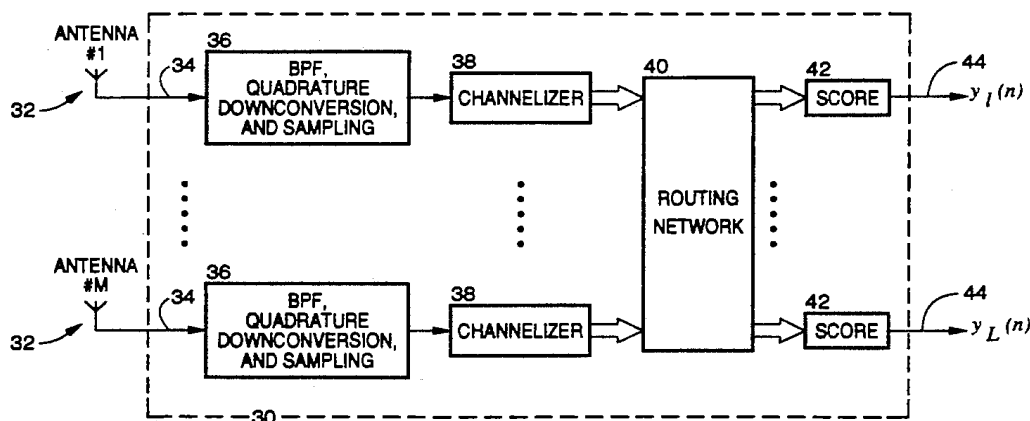
*Attorney, Agent, or Firm*—John P. O'Banion

[57]

**ABSTRACT**

A method and apparatus for spatial multiplexing of spectrally overlapping communications signals which does not require use of a training signal, computationally intensive direction-finding methods, or antenna calibration is presented. An adaptive antenna array at a base station is used in conjunction with signal processing through self coherence restoral to separate the temporally and spectrally overlapping signals of users that arrive from different specific locations within the locale and to mitigate multipath fading and shadowing at the base station and, by reciprocity, to transmit directly to minimize interfering signals arriving at the mobile (or portable or stationary) units and to mitigate multipath fading and shadowing at the mobile units. The radiation pattern of transmitted signal is matched to the adapted reception pattern of the signal received at the base station.

**21 Claims, 10 Drawing Sheets**





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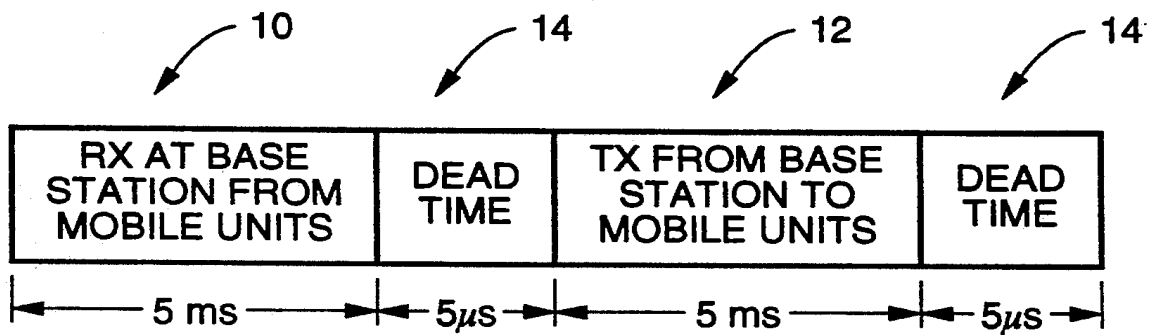


FIG.-1

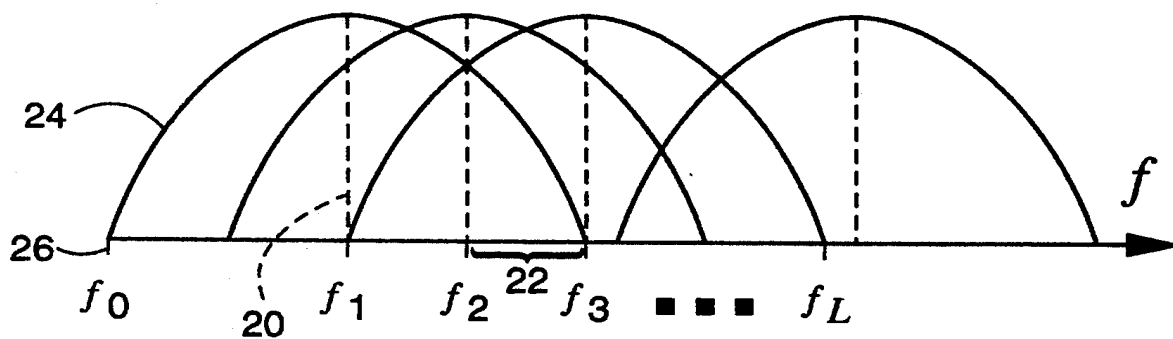


FIG.-2

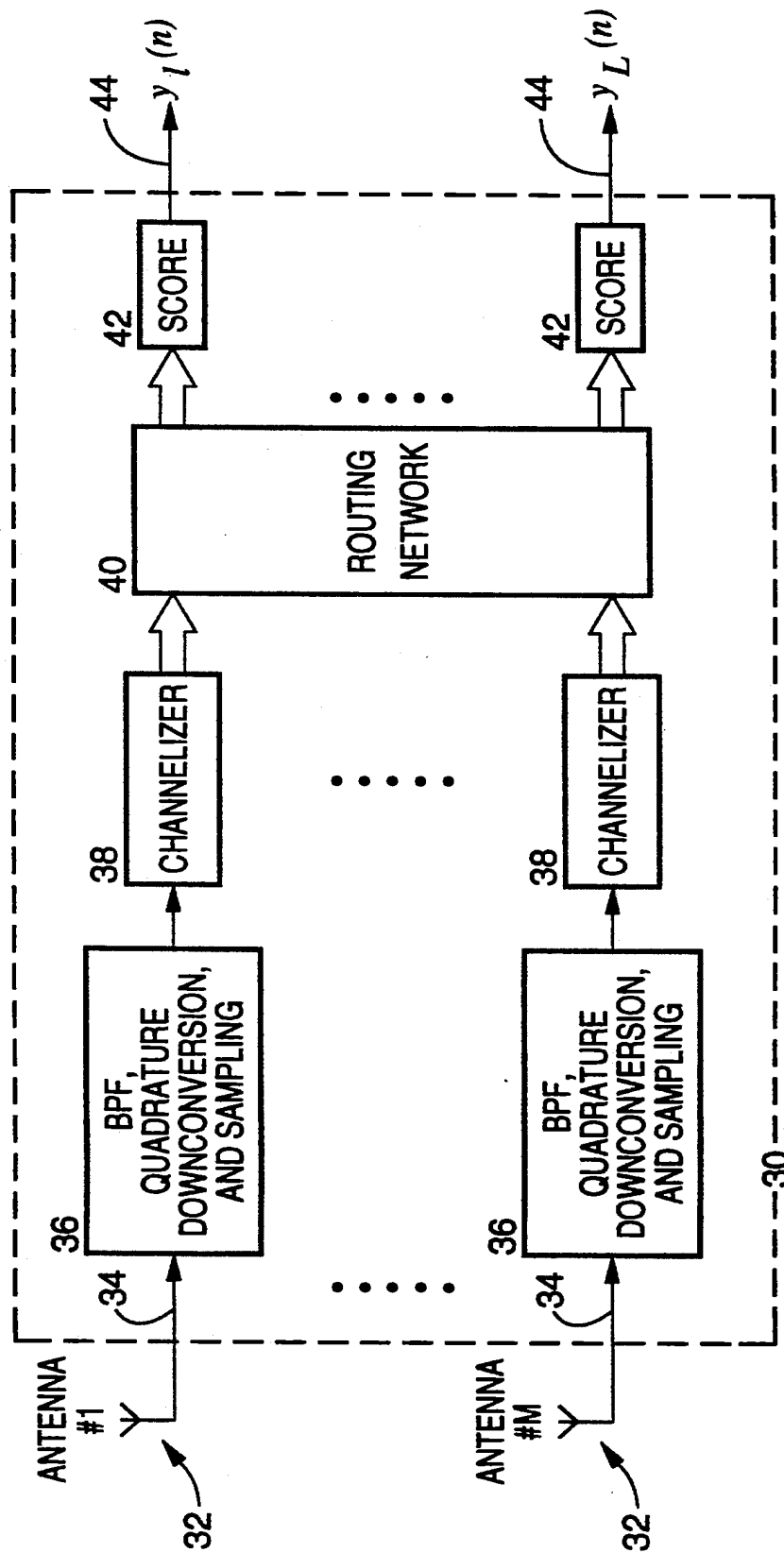


FIG.-3

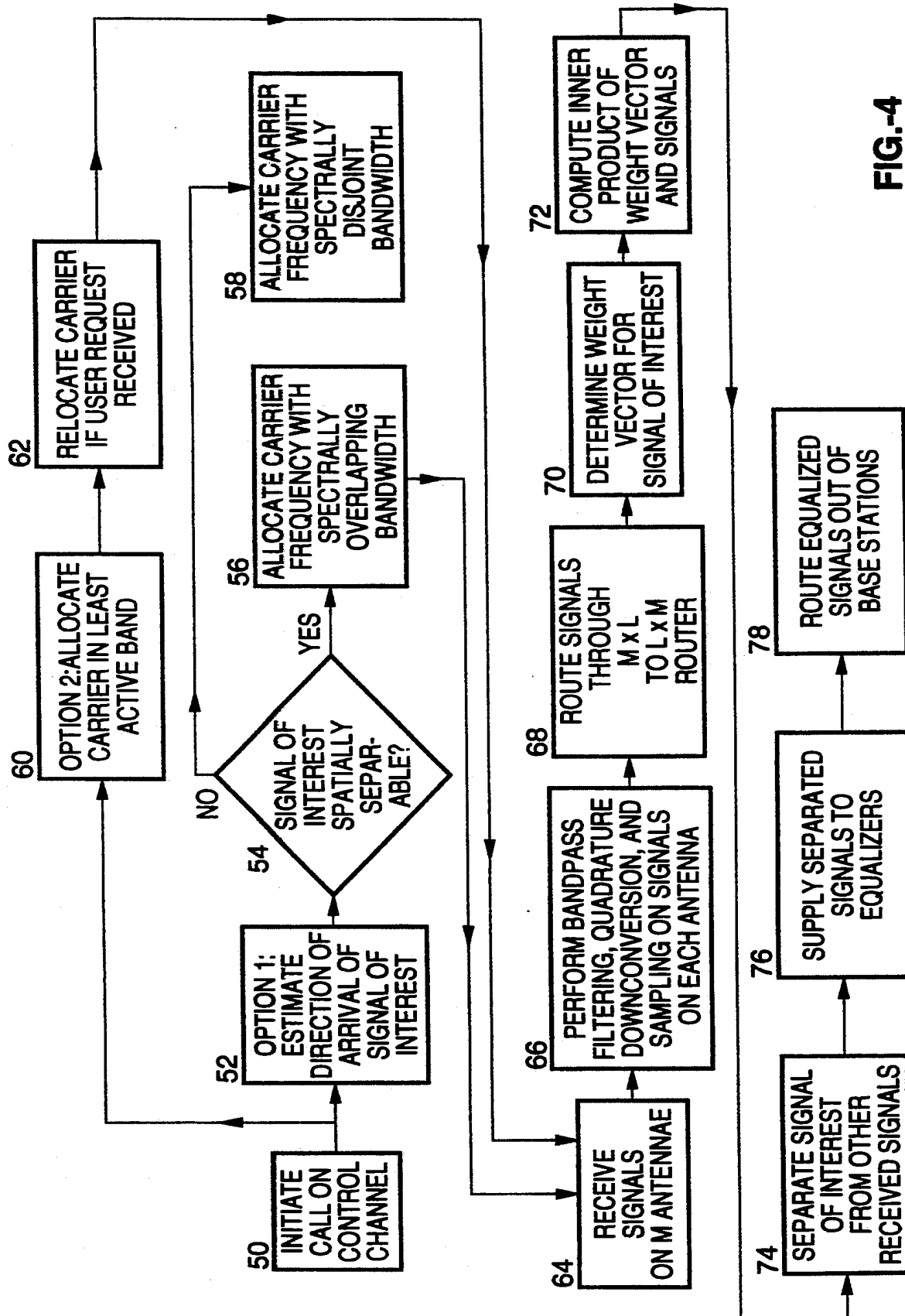


FIG.-4

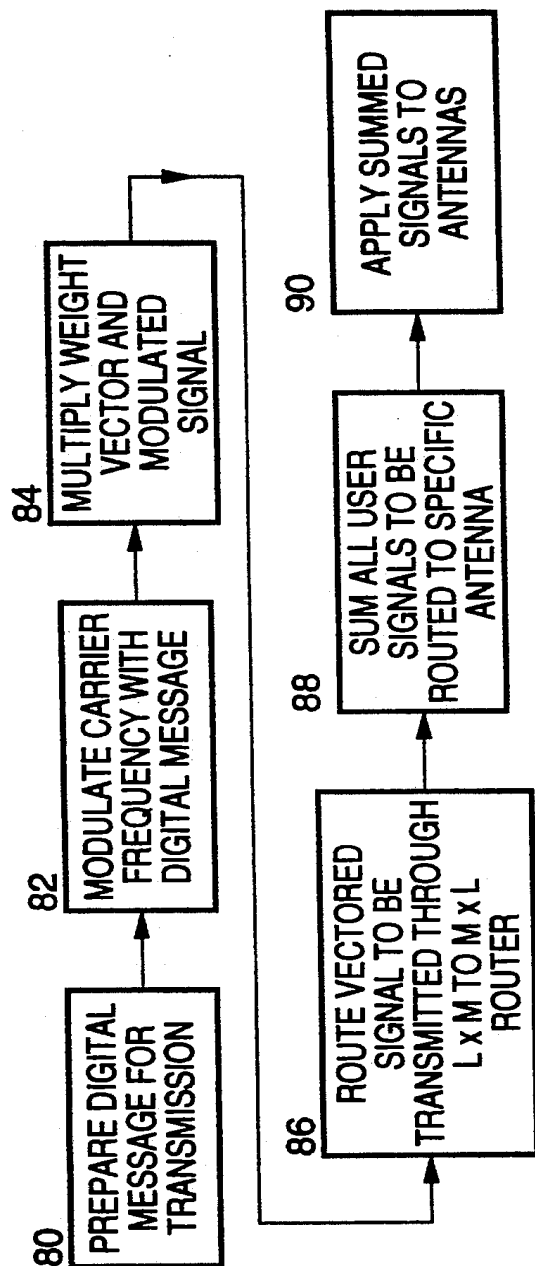


FIG.-5

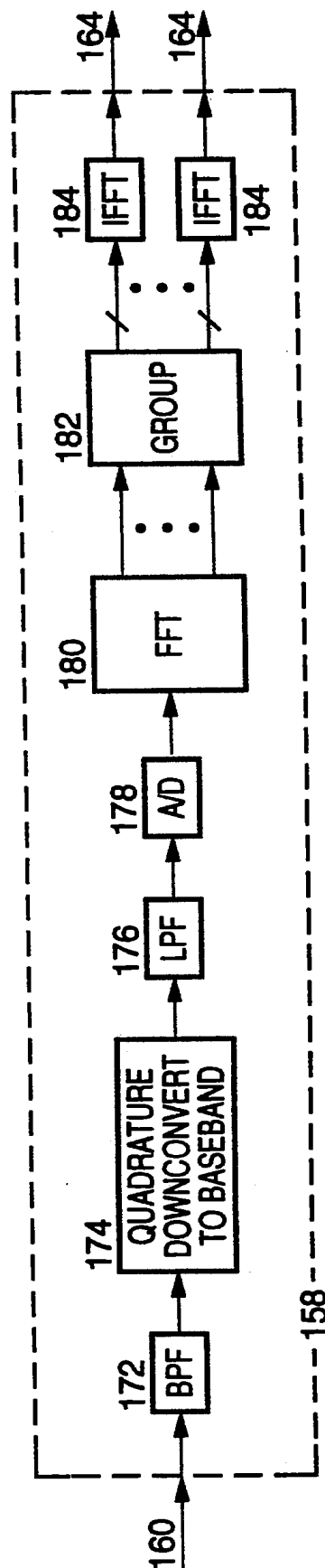


FIG.-9

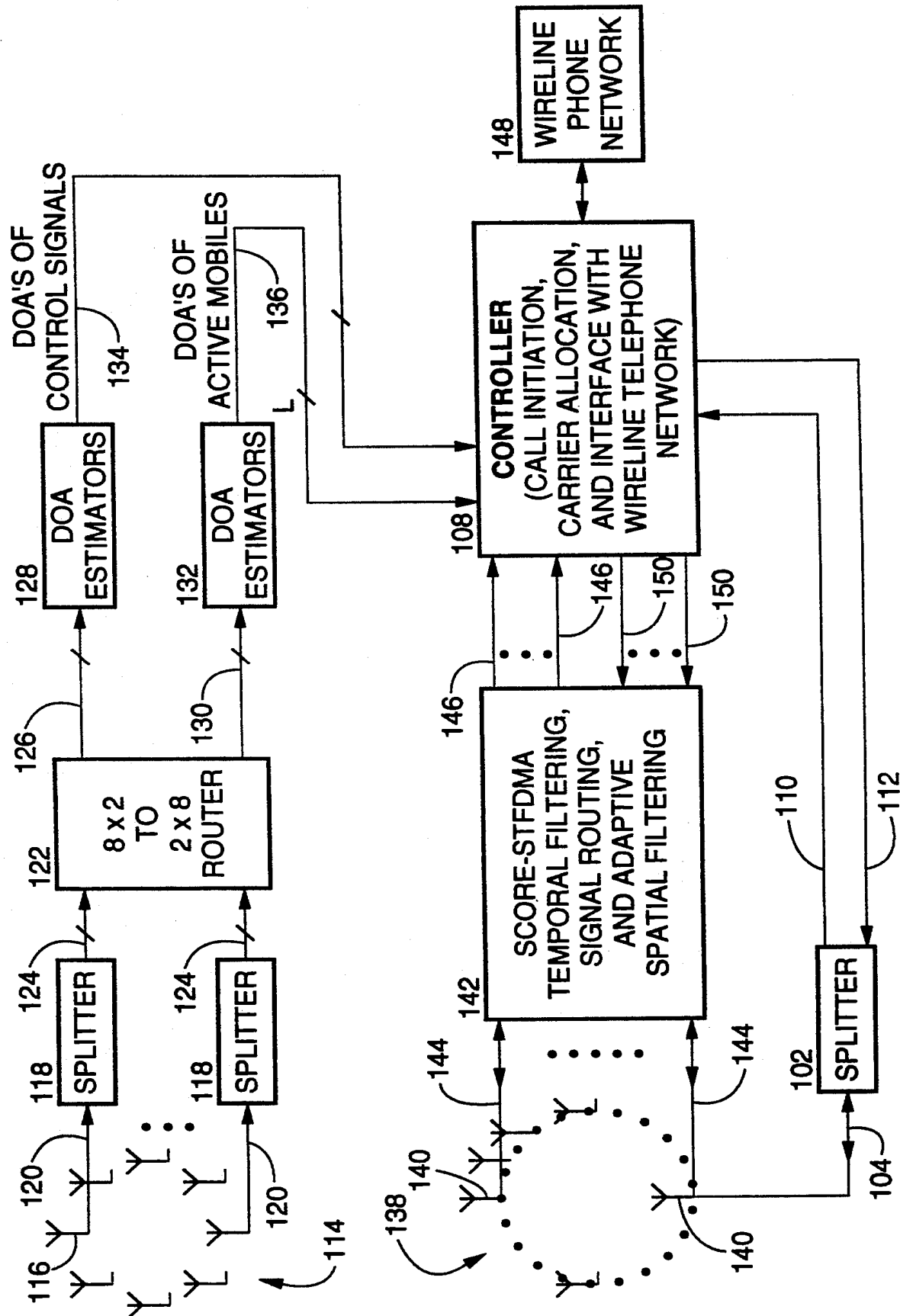
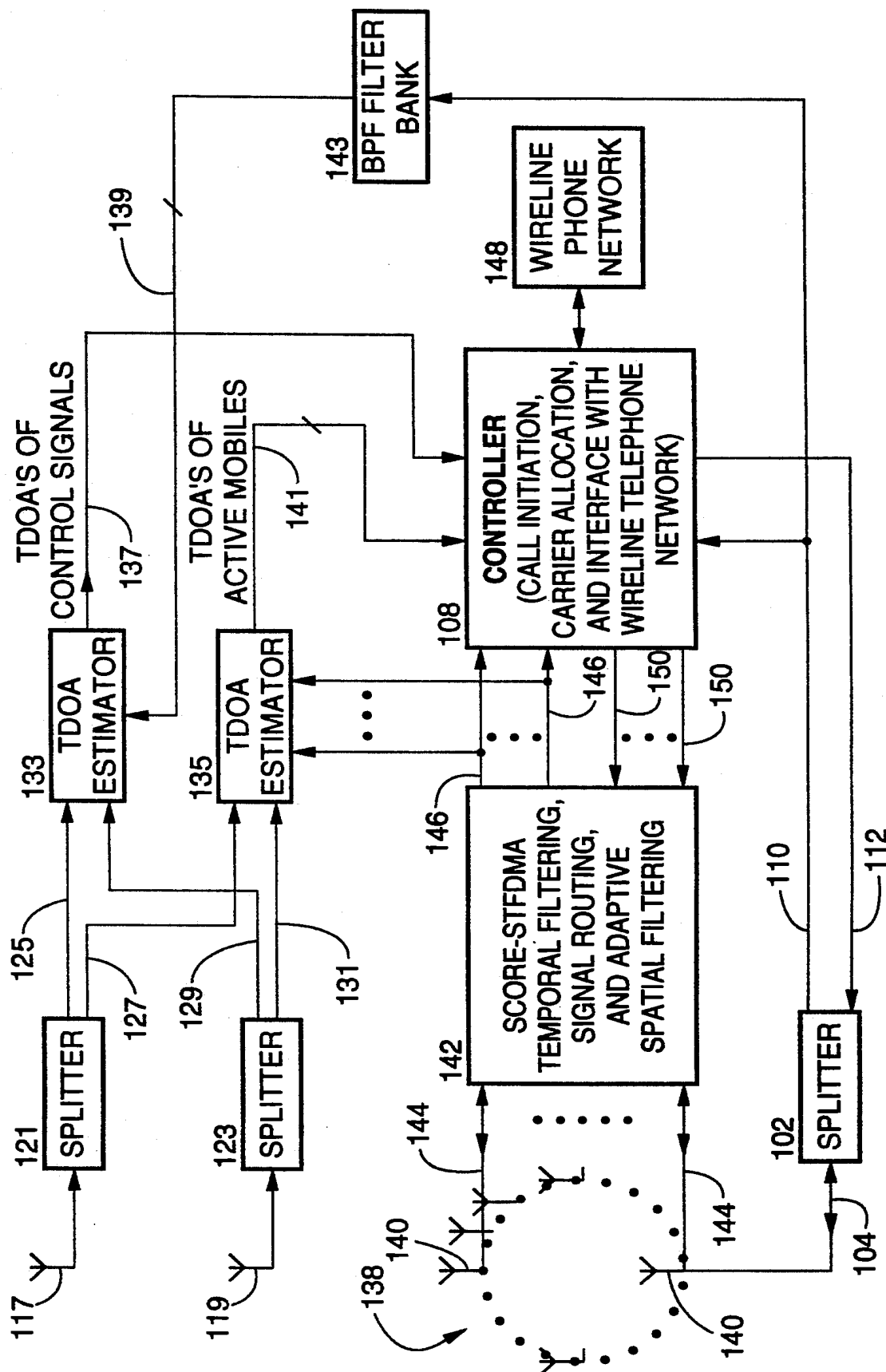


FIG.-6



**FIG.-7**

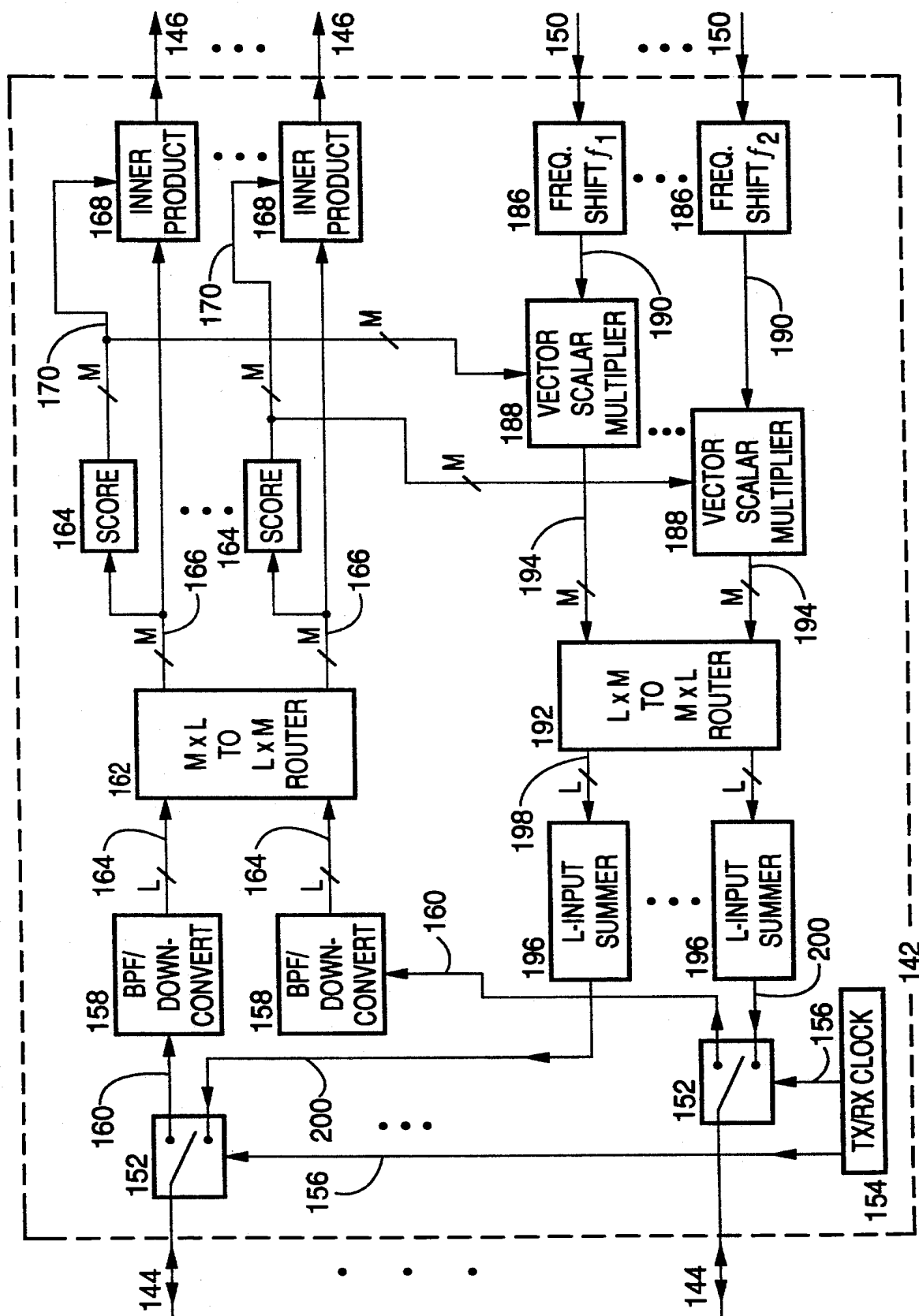


FIG.-8



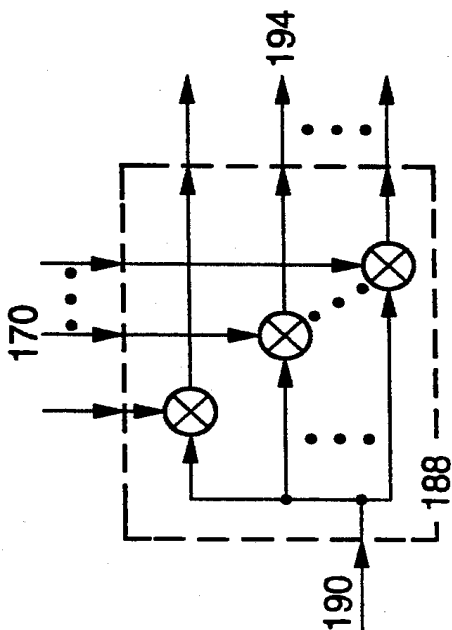


FIG.-10

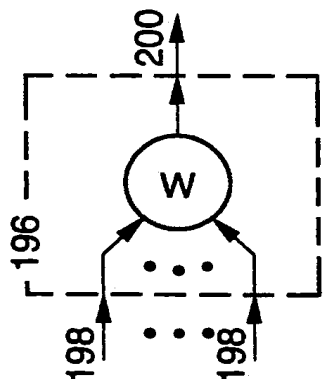


FIG.-11

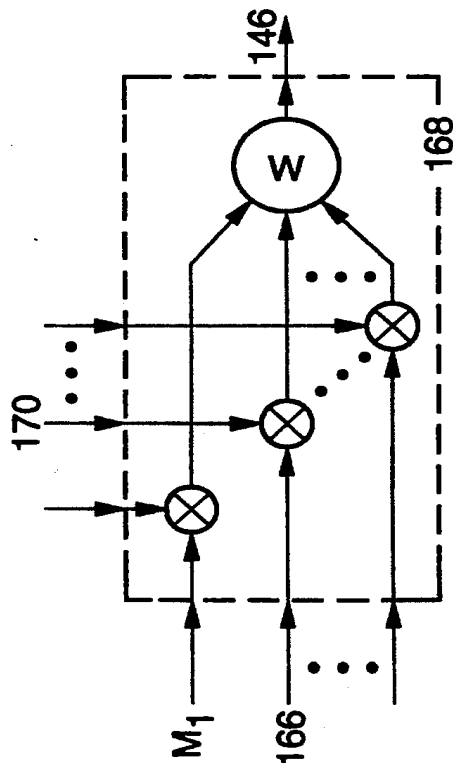


FIG.-12

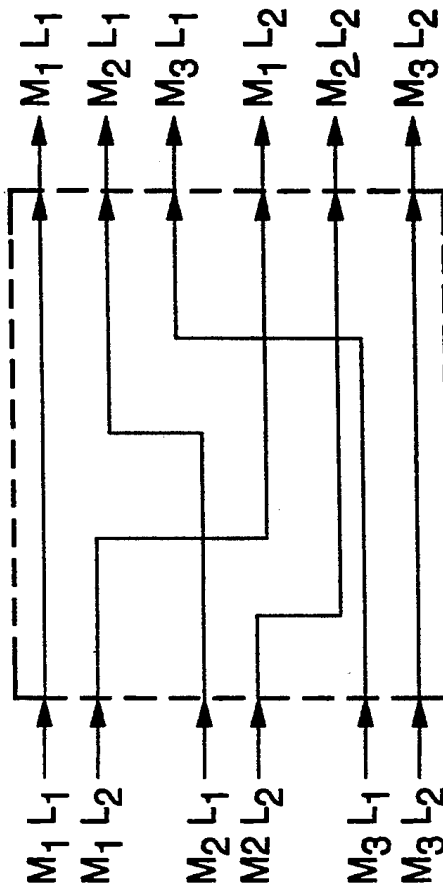


FIG.-13

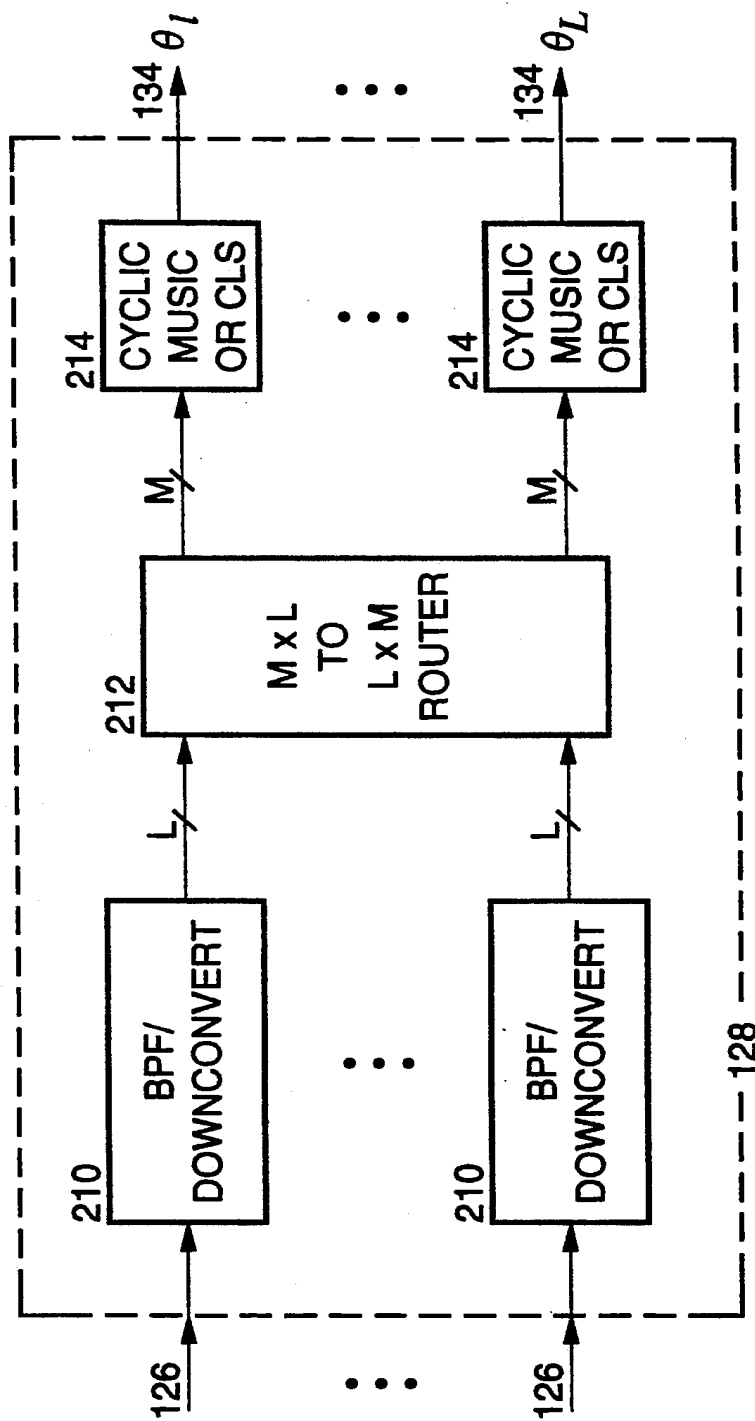
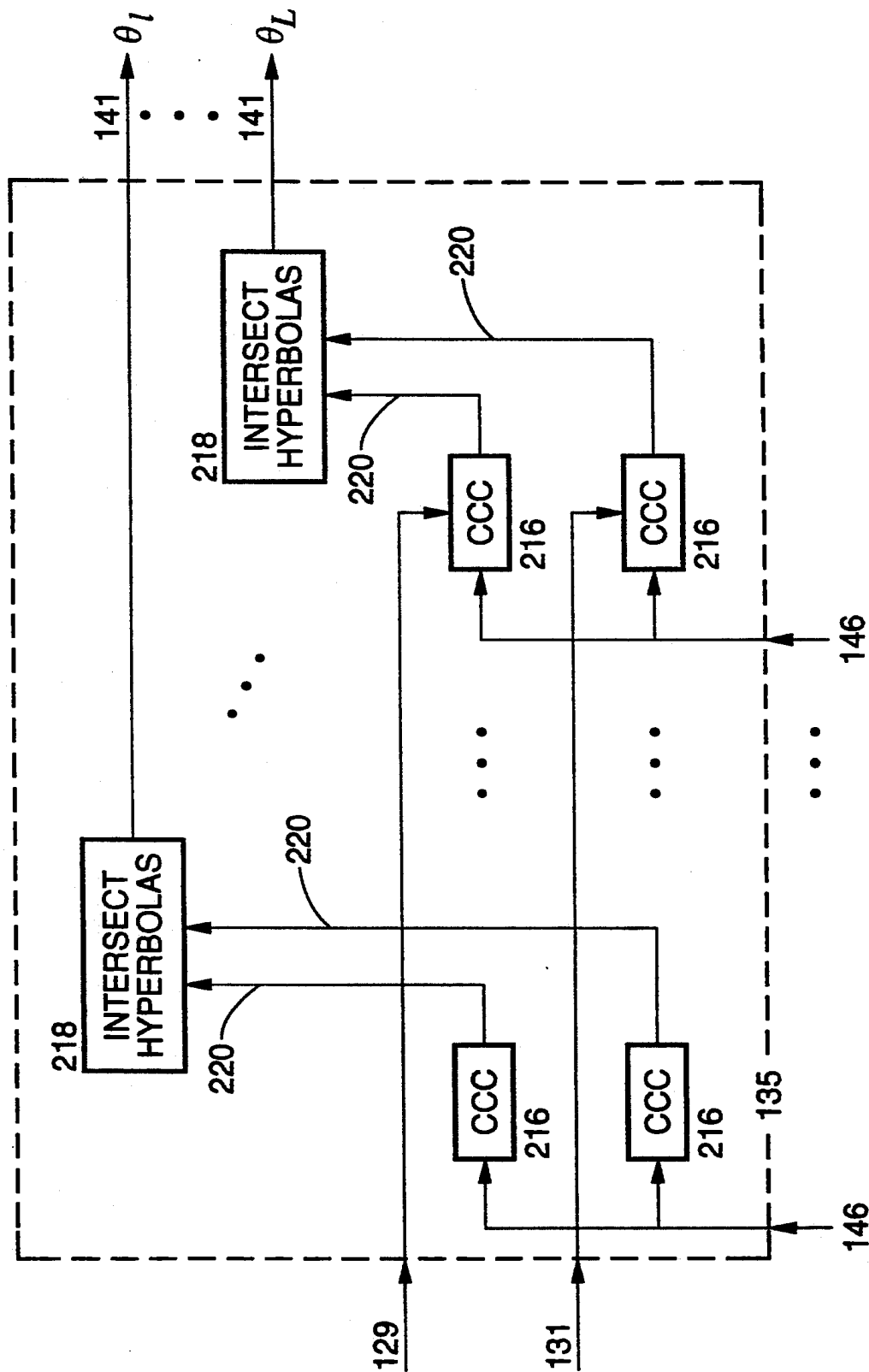


FIG.-15



**FIG.-16**

# METHOD AND APPARATUS FOR MULTIPLEXING COMMUNICATIONS SIGNALS THROUGH BLIND ADAPTIVE SPATIAL FILTERING

## BACKGROUND OF THE INVENTION

The Government has rights in this invention pursuant to Grant No. MIP-88-12902 awarded by the National Science Foundation.

## FIELD OF THE INVENTION

This invention pertains generally to multiplexing radio communications signals, and more particularly to increasing spectral capacity by blind adaptive spatial filtering of spectrally overlapping signals.

## DESCRIPTION OF THE BACKGROUND ART

Demand for mobile, portable and stationary personal communication continues to increase as these communication modes become easier to use and more widely available, as they offer a greater variety of services, and as their benefits become more visible. As a result of the increasing demand for a limited number of radio spectrum allocations, new multiplexing techniques that will increase spectral efficiency over conventional multiplexing techniques have been widely sought.

Conventional multiplexing techniques rely solely on frequency, time, or code division to allow multiple users in the same locale to communicate simultaneously with the base station in that locale. These techniques include frequency division multiplexing (FDM)—also called frequency division multiple access (FDMA); time division multiplexing (TDM)—also called time division multiple access (TDMA); and code division multiplexing (CDM)—also called code division multiple access (CDMA).

For FDM, each user's signals occupy separate frequency bands (one for transmit and one for receive) and no other user is assigned to those bands. FDM alone offers very restricted opportunities for increasing spectral efficiency, namely different spectrally efficient modulation schemes, but the potential of such schemes is limited by the severity of the radio communications environment and, even in the most benign environment, the maximum capacity is relatively low.

For TDM, all users occupy the same frequency band, and each is allocated a time slot within which transmission and reception can occur. The frequency bandwidth of each user's signal can be much greater than that in FDM, but a synchronized access scheme is needed to prevent multiple users' signals from being active simultaneously. TDM alone offers no increase in spectral efficiency and requires a complicated access protocol. The inactivity time in typical speech is already exploited in many speech compression methods, so this redundancy has already been used up.

For CDM (using direct-sequence spread spectrum signals), all users' signals occupy the same band and can be active simultaneously. Each user is assigned a unique spreading code which is used at the receiver to separate a desired user's signal from the rest. CDM offers some limited increases in spectral efficiency but requires power control methods that can be difficult to implement in severe fading environments. There can also be some burden in managing the distinct codes that are assigned to the users.

As a result, space division multiplexing (SDM)—also called space division multiple access (SDMA)—was developed to employ spatial filtering to separate spectrally overlapping signals from different users. For SDM, a system can separate a desired user's signal from the rest if its spatial characteristics (e.g., direction of arrival) are sufficiently different from those of the other users. SDM can multiply spectral efficiency by a factor equal to the number of spatially separable channels sharing a spectral band. Since this number can be roughly equal to the number of elements in the antenna array (which can practically be on the order of 100 depending on physical and/or cost limitations at the base station), potentially large increases in spectral efficiency are possible. Transmission power can be reduced, thereby reducing the interference level for other users and increasing mobile (or portable) battery life. Also, reduction or elimination of multipath fading can improve the received signal quality. However, except for variations of these techniques that use fixed multibeam or multisector antennas to further increase capacity, none of them fully exploits the multiplicity of spatial channels that arises because each user occupies a unique spatial location. SDM techniques adapt the antenna array either by estimating the directions of arrival of the spectrally overlapping signals and then using these estimates to compute appropriate weights for the spatial filter, or by minimizing the time-averaged squared error between a known training signal and the output of the spatial filter.

Several methods for adaptively adjusting spatial filters based on antenna arrays have been heretofore developed.

For example, in the "known reference signal" approach, a reference signal is transmitted in addition to the message signal. As a result, channel capacity for the message is reduced, especially as the severity of the environment increases the need for adaptation and as the number of elements in the antenna array is increased. When TDM of reference and message signal is used, receiver complexity is increased, some start-up overhead is incurred in assigning training codes, and signal bandwidth must be increased to compensate for reduced message capacity.

With the "time redundancy" approach, each user has a unique message block length (which is an extra complication), and a given block is transmitted twice (which reduces effective capacity by 50 percent).

With the "frequency redundancy" approach, the message is transmitted at two different carrier frequencies, which reduces effective capacity by 50 percent.

With the "DF-based beamforming" approach, for moderately to widely separated multipath reflections, and for a large number of sources in a frequency band (which is desirable for increased spectral efficiency), direction-finding (DF) based methods are impractical or unusable and incur prohibitive computational expense. Array calibration problems also arise.

It can be seen therefore, that SDM versions based on direction estimation have numerous disadvantages, including computationally intensive algorithms, poor performance in the presence of multipath signals arriving from different directions, the need to measure, store, and update array calibration data, and considerable sensitivity to errors in the array calibration data. Versions that require a training signal have different disadvantages, including the need to use spectral capacity to periodically transmit the training signal, the need to

synchronize the received and locally generated copies of the training signal, and the need to adaptively increase or decrease the duration of the training signal to accommodate varying levels of interference.

Therefore, there is a need for a spatial filtering method of multiplexing communications signals which overcomes the foregoing deficiencies. The present invention fulfills that need.

### SUMMARY OF THE INVENTION

The present invention pertains generally to spatial filtering techniques, and more specifically to adaptive space, time and frequency multiplexing. This multiplexing method is neither dependent on direction of arrival estimation nor on use of a reference or training signal.

By way of example and not of limitation, an adaptive antenna array at a base station separates temporally and spectrally overlapping received signals of different users and transmits directly to each user, exploiting multipath when present. The invention uses the technique of restoring the spectral coherence of a received signal of interest impinging on an array of antennas in order to adapt the spatial filter for reception at the base station and determine the optimum reception pattern for the signal, which filter can be reused for transmission with a radiation pattern equal to that of the adapted reception pattern. Unlike schemes that rely solely on frequency, time, or code division multiplexing and thus use only one spatial channel, the present invention exploits space as well as partial time and frequency division multiplexing (STFDMA) and thus uses multiple spatial, temporal, and spectral channels. Users whose signals arriving at the base station are spatially separable are assigned to spectral bands that overlap, and users whose signals arriving at the base station are spatially inseparable are assigned to disjoint spectral bands. Also, signals coming from the individual users can be assigned to time intervals that are interleaved with those assigned to signals coming from the base station. Under the assumption that users are sufficiently well distributed throughout a geographical area, all available spatial and spectral channels can be used effectively. Since the number of multiple spatial channels that can be separated from each other by the antenna array is approximately equal to the number of antenna elements in the array (which can be quite large), overall capacity can be much greater than schemes using a single spatial channel. Also, unlike adaptive array schemes that require direction estimation processors or known training signals, the present invention uses a property restoral method to exploit some property, such as the spectral redundancy (cyclostationarity or spectral correlation or spectral coherence), that is already present in essentially all digital communication signals and thus does not require array calibration data or computationally intensive multidimensional searches for direction finding (DF). Nor does it waste channel capacity by transmitting a training signal.

An object of the invention is to increase the communications capacity of limited spectral allocations.

Another object of the invention is to provide for overlapping spectral channels without unacceptable interference between users.

Another object of the invention is to spatially filter communications signals without the need for a training signal.

Another object of the invention is to spatially filter communications signals without the need to determine direction of arrival.

Another object of the invention is to blindly adapt an antenna array.

Another object of the invention is to mitigate multipath fading and shadowing of received signals.

Another object of the invention is to directionally transmit signals to users from a base station without employing direction finding techniques.

Further objects and advantages of the invention will be brought out in the following portions of the specification, wherein the detailed description is for the purpose of fully disclosing preferred embodiments of the invention without placing limitations thereon.

### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood by reference to the following drawings which are for illustrative purposes only:

FIG. 1 diagrammatically shows the typical time multiplexing windows employed in the present invention.

FIG. 2 diagrammatically shows the partial frequency division multiplexing employed in the present invention.

FIG. 3 is a functional block diagram showing a generalized receiver employing the present invention.

FIG. 4 is a flow diagram showing the general reception steps of the present invention.

FIG. 5 is a flow diagram showing the general transmission steps of the present invention.

FIG. 6 is a functional block diagram of one embodiment of an overall communications system employing the present invention.

FIG. 7 is a functional block diagram of an alternative embodiment of an overall communications system employing the present invention.

FIG. 8 is a schematic block diagram of one embodiment of the temporal filtering, signal routing and adaptive spatial filtering element shown in FIG. 6 and FIG. 7.

FIG. 9 is a schematic block diagram of one embodiment of a bandpass filtering and downconversion element shown in FIG. 8.

FIG. 10 is a schematic block diagram of one embodiment of a splitter element shown in FIG. 6 and FIG. 7.

FIG. 11 is a schematic block diagram of one embodiment of an input summer element shown in FIG. 8.

FIG. 12 is a schematic block diagram of one embodiment of a vector scalar multiplier element shown in FIG. 8.

FIG. 13 is a schematic block diagram of one embodiment of an inner product element shown in FIG. 8.

FIG. 14 is a partial schematic diagram showing the typical configuration of a signal router element shown in FIG. 8.

FIG. 15 is a schematic block diagram of one embodiment of a direction of arrival estimator element shown in FIG. 6.

FIG. 16 is a schematic block diagram of one embodiment of a time difference of arrival estimator elements shown in FIG. 7.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more specifically to the drawings, for illustrative purposes the present invention is embodied in the drawings of FIG. 1 through FIG. 16. It will be appreciated that the method of the present invention

may vary as to specific steps and their order of implementation, and that the apparatus of the present invention may vary as to configuration and as to details of the parts without departing from the basic concepts as disclosed herein.

The conventional transmit/receive configuration for multiuser cellular communication consists of a base station through which all users in a given cell communicate. The base station then communicates with other base stations and with a central switching office to provide cell-to-cell communication and cell-to-wire-line communication, respectively, for the individual users. Communication among base stations is not, in the usual sense, multiuser communication and, therefore, is not presented herein.

Communication between individual users in a cell and the base station in that cell can, in principle, exploit SDMA by performing adaptive spatial filtering at either each user's location or the base station or both. However, adaptive arrays at the mobile unit (or the portable or stationary personal unit) are prohibitively expensive and subject to neglect or abuse by the users. Also, adaptive spatial filtering at the mobile unit is unlikely to be effective since the signals from the base station and the other interferers can arrive from a nearly uniform angular spread over 360 degrees (due to scattering, for example, from buildings, other cars, and the ground in the mobile communication environment). Therefore, in the present invention the existing single omnidirectional antenna at the mobile unit is retained, but a multi-element antenna array is used at the base station.

Spatial filtering as disclosed herein requires the use of a multi-element antenna array with a large number of elements. Therefore spatial adaptation occurs only during the transmission from the mobile unit to the base station; transmission from the base station to the mobile unit must use a spatial filter that is developed during said adaptation. In addition, the spatial filtering method of the present invention is frequency dependent and, therefore, both directions of transmission must use the same carrier frequency. In order to use the same frequency for duplex communications, the present invention also employs time division multiplexing of the signals from the base station and the users. That is, reception at the base station from all mobile units is temporally separated from transmission from the base station to all mobile units. The base station transmits to the user unit for some time period  $T$ , the user then transmits to the base station for time period  $T$ , and the cycle repeats.

Therefore, spatial filtering at the base station separates spectrally and temporally overlapping signals of multiple users during transmission from and reception at the base station. The lack of direct spatial filtering at the mobile unit does not imply, however, that mobile units must be prevented from interfering with each other, because the TDM scheme employed by the present invention insures that all mobile units transmit at the same time during one time period, and that they all receive at the same time in another time period.

During the time period that the signals are received by the base station, the base station blindly adapts its antenna array using the spectral coherence restoral (SCORE) method of the present invention. With SCORE, spectral redundancy already present in the signal is exploited and the weights of spatial filters are computed while the received data is saved.

To understand use of the SCORE method for blindly adapting an antenna array, let the vector  $x(n)$  denote the

sampled complex envelopes of the output signals of  $M$  antennas having an arbitrary geometric arrangement and arbitrary directional characteristics (but preferably omnidirectional). To maximize spatial resolution while preventing grating lobes (ambiguities), the antennas are typically separated by approximately one half of the wavelength corresponding to the highest frequency in the reception band. It should be noted that this geometry is fundamentally different from that used in most space diversity systems, in which antennas are spaced many wavelengths apart so as to decorrelate multipath propagation parameters at the different antennas. Also, let  $y(n) \triangleq w^H x(n)$  be the output of the spatial filter, where  $w$  is referred to as the weight vector representing a set of weights that realize the reception pattern of the signal of interest as it impinges on the array of antennas and which are used to extract the signal of interest. By choosing  $w$  appropriately, an adaptive receiver can enhance (steer beams in the direction of) desired signals, attenuate (steer nulls in the direction of) undesired signals, and minimize the contribution of additive noise (through coherent processing gain and by minimizing the height of sidelobes in the antenna pattern). In general, the sum of the number of beams and the number of nulls that can be controlled is equal to one less than the number  $M$  of antenna elements.

Instead of choosing  $w$  to maximize the degree of correlation between  $y(n)$  and a known training signal as is typically done in conventional schemes, the SCORE method chooses  $w$  and an auxiliary spatial filter  $c$  to maximize the degree of correlation (correlation coefficient) between  $y(n)$  and an auxiliary output signal  $u(n) \triangleq c^H x(n - \tau) * e^{j\pi\alpha n}$ .

$$\max_{w, c} \frac{|R_{yu}|^2}{R_{yy}R_{uu}} \rightarrow \max_{w, c} \frac{|w^H R_{xx}^{\alpha}(\tau) c|^2}{[w^H R_{xx} w] [c^H R_{xx}^* c]} \quad (1)$$

Since  $R_{yu}$  is the cyclic cross-correlation between the spatial filter output  $w^H x(n) = y(n)$  and the conjugated auxiliary spatial filter output  $c^H x^*(n - \tau)$ , then the quantity being maximized in equation (1) is a measure of the degree of conjugate spectral coherence between these two spatial-filter outputs. Since the presence of interfering signals and noise that corrupt the signal of interest in  $x(n)$  decreases the degree of conjugate spectral coherence by increasing the denominator in equation (1) relative to the degree exhibited by the uncorrupted signal of interest, then spatial filtering with  $w$  and  $c$  to maximize the correlation coefficient as in equation (1) can be interpreted as restoring conjugate spectral coherence. Thus, the criterion in equation (1) is referred to as spectral coherence restoral (SCORE). Also, since  $R_{yu}$  can be interpreted as the Fourier coefficient for the regenerated sine wave at frequency  $\alpha$  in the product waveform  $[w^H x(n)][c^H x^*(n - \tau)]$ , then the SCORE method can be seen to maximize the average power of this sine wave relative to the average powers of the waveforms  $w^H x(n)$  and  $c^H x^*(n - \tau)$ . Under the assumption that  $L_{\alpha}$  signals have cycle frequency  $\alpha$ , it can be shown that the solutions to the equation in (1) are given by the  $L_{\alpha}$  most dominant eigenvectors  $w_1$ , for  $l = 1, \dots, L_{\alpha}$  that satisfy

$$R_{xx}^{\alpha}(\tau) R_{xx}^* x_{\alpha} - l R_{xx}^{\alpha}(\tau) w_1 = \lambda_1 R_{xx} w_1 \quad (2)$$

and similarly for  $c$ .

It should be noted that only the most dominant eigenvector of equation (2) is needed when only one signal

exhibits cyclic conjugate correlation at the chosen value of  $\alpha$ , in which case the matrix product on the left-hand side of equation (2) has rank equal to one, and thus this eigenvector can be found using a simple iteration based on the power method of computation. In the present invention, this is true in the absence of multipath reflections of the desired signal. In the presence of  $K$  spatially separable multipath reflections of the desired signal, each of the  $K+1$  most dominant eigenvectors extracts a linear combination of the multipath reflections; thus, the most dominant eigenvector can still be used to extract the desired signal, although an adaptive equalizer might be required to mitigate the smearing of the signal in time if the delay spread of the multipath is too great.

Alternatively, note that the desired signals (those having cycle frequency  $\alpha$ ) are the only ones common to both  $x(n)$  and  $x(n-\tau)^* e^{j2\pi\alpha n}$  in the sense that the correlation between these two data sets is asymptotically equal to the correlation between the components due to the desired signals and their frequency-shifted and conjugated versions. From this point of view, estimating the desired signals is equivalent to estimating the common factors of the two data sets  $x(n)$  and  $x(n-\tau)^* e^{j2\pi\alpha n}$ . Common factor analysis (also called canonical correlation analysis) is a well-known technique in multivariate analysis. Formulating the problem in this way leads to exactly the same solution of equation (2). The SCORE method can also estimate the desired signals that are common to both  $x(n)$  and  $x(n-\tau)e^{j2\pi\alpha n}$ , in which case the conjugation symbols  $*$  are dropped from equation (2), although this variation is not required in the present invention.

It should be noted that the SCORE method is based upon the cyclostationarity exhibited by a signal. A vector-valued complex envelope  $x(n)$  exhibits cyclostationarity if it is correlated with either a frequency-shifted version of itself (i.e., if it exhibits spectral coherence) for any nonzero frequency shift  $\alpha$  or a conjugated and frequency-shifted version of itself for any frequency shift  $\alpha$ . Mathematically, this correlation (or spectral coherence) is expressed in terms of the cyclic autocorrelation matrix

$$R_{xx}^{\alpha}(\tau) \quad (3)$$

or the cyclic conjugate correlation matrix

$$R_{xx}^{*\alpha}(\tau) \quad (4)$$

respectively, where

$$R_{xx}^{\alpha}(\tau) \triangleq [x(n)x(n-\tau)^H e^{-j2\pi\alpha n}]_{\infty} \quad (5)$$

$$R_{xx}^{*\alpha}(\tau) \triangleq [x(n)x(n-\tau)^T e^{-j2\pi\alpha n}]_{\infty} \quad (6)$$

with

$$\langle f(n) \rangle_N = \frac{1}{N} \sum_{n=0}^{N-1} f(n) \quad (7)$$

and where  $(\cdot)^T$  and  $(\cdot)^H$  denote the matrix transposition and matrix conjugate transposition operators, respectively. The values of  $\alpha$  for which either of these correlation matrices are nonzero are the cycle frequencies of the signals comprising  $x(n)$ . Since equations (3) and (4) can be reinterpreted as the Fourier coefficients for the matrices of conjugate and nonconjugate lag-product waveforms  $x(n)x(n-\tau)^H$  and  $x(n)x(n-\tau)^T$ , then it can be seen that  $x(n)$  exhibits cyclostationarity (or spectral

coherence) if and only if the lag-product waveforms contain finite-strength additive sine-wave components with frequency equal to the cycle frequency  $\alpha$ . That is, cyclostationarity means that sine waves can be generated by multiplying the signal by a delayed and possibly conjugated version of itself. Most digital communication signals exhibit cyclostationarity as a result of the periodic sampling, gating, keying, and mixing operations in the modulator. For example, the cycle frequencies of binary phase shift keying (BPSK) are equal to the doubled carrier frequency offset, harmonics of the baud rate, and sums and differences of these. More specifically, if  $x(n)$  contains a BPSK signal having carrier offset  $f_c$  (relative to the frequency of the downconverter) and baud rate  $f_b$ , then  $R_{xx}^{\alpha}(\tau)$  is not identically zero for  $\alpha = kf_b$  for integers  $k$ , and  $R_{xx}^{\alpha}(\tau)$  is not identically zero for  $\alpha = 2f_c + kf_b$  for integers  $k$ . The useful values of  $\tau$  in the correlation matrices are typically between 0 and  $\frac{1}{2}f_b$ . The only case of particular interest in the present invention is the fact that for a scalar BPSK signal having carrier frequency offset  $f_c$ , the magnitude of the cyclic conjugate correlation  $R_{xx}^{*2f_c}(\tau)$  is maximized at  $\tau=0$  regardless of the pulse shape. Measurements of these two types of cyclic correlations are useful because they select contributions from only the signal components that exhibit the specified cyclostationarity property and discriminate against all others. This is analogous to the property that measurements of the correlation between a desired signal corrupted by additive interference and noise and an uncorrupted version of the desired signal (e.g., the training signal) select only the contributions from the desired signal and discriminate against all others. The utility of exploiting cyclostationarity to gain signal-selectivity has been demonstrated for many applications, including adaptation of antenna arrays, estimation of directions of arrival, estimation of time difference of arrival, detection, and the like.

Referring to FIG. 1, during the receiving and adaptation phase 10, the weights of the spatial filters are computed. At the end of that phase, the weights are applied to the received data to separate the signals sent by the mobile units. During the transmission phase 12, the weights computed in the receiving phase 10 are used to direct the transmission of each outgoing signal to the appropriate mobile unit. The duration of the phases is limited here primarily by the reciprocal of the fast fading rate (the maximum rate is approximately 100 fades/second, so the duration of each phase can be about half the reciprocal, or 5 milliseconds) because the propagation conditions must remain relatively constant over this time for the spatial filtering to be effective. A "dead time" 14 during which neither reception nor transmission occurs is inserted between each phase to allow the trailing edges of the signal from or to the farthest mobile unit to arrive at their destination and to allow the microwave hardware at the base station and the mobile unit to switch between transmission and reception modes (since the same spectral band is used for both). This dead time is negligible (approximately 5 microseconds in a cell having radius of 1 mile) compared to the reception and transmission times (approximately 5 milliseconds). The cycle summarized in FIG. 1 is then repeated.

To avoid the waste of channel capacity and additional synchronization difficulties that occur when a training signal is used to adapt the array, the SCORE method of blind adaption is used to separate signals

based on their differing carrier frequencies. Thus, the SCORE method represented by equation (2) is implemented for each active user in the cell. Although it is conceivable that differing baud rates could also be used to separate signals, the additional complexity of accommodating a unique baud rate for each user is prohibitive.

Consequently, as can be seen in FIG. 2, each mobile unit is assigned a unique carrier frequency (accomplished during call initiation and hookup) according to the relationship

$$f_l = f_0 + (l) f_{sep} \text{ for } l = 1, \dots, L \quad (8)$$

where  $f_l$  is the carrier frequency 20 of the user numbered 1,  $f_0$  is the lowest frequency 26 in the reception band,  $f_{sep}$  is the separation 22 between adjacent carrier frequencies, and  $L$  is the maximum number of users that can be accommodated in the cell. The choice of  $f_{sep}$  is determined by the maximum Doppler shift (about 100 Hertz in the land mobile cellular radio environment), and by some convergence-time considerations in the SCORE method, namely the time required for an estimate of a cyclic conjugate correlation to adequately reject contributions from signals having adjacent carrier frequencies (at least 100 Hertz separation is required for adequate rejection in the 5 milliseconds during which adaptation occurs; this follows because the cycle resolution of the measurement of the cyclic conjugate correlation matrix, and thus the minimum separation of the doubled carriers, is equal to the reciprocal of the averaging time). The value of  $f_{sep}$  is also limited by the maximum number of spectrally overlapping signals 24 that can be separated by the antenna array. Because transmission from the base station to each mobile unit is highly directional, a smaller frequency reuse distance, such as three, can be tolerated in the present invention than in the conventional analog frequency modulation (FM) scheme in which it is seven. The success of the SCORE-STFDMA method depends on the ability to use spatial filters to spatially separate spectrally overlapping signals and the ability to use conventional spectral filters to separate spatially inseparable signals. This frequency allocation method coupled with the use of the SCORE method accomplishes this under the assumption that spatially inseparable users can be assigned to disjoint spectral bands. One approach to accomplish this is to obtain and use knowledge of the directions of arrival of the signals from the mobile units. This in turn can be accomplished either by using a location sensing device (e.g., global positioning system) in each mobile unit, which could be prohibitively expensive, or by using the signal-selective Cyclic MUSIC or Cyclic Least Squares (CLS) direction estimation methods at the base station, or by using the signal-selective Cyclic Cross Correlation (CCC) time-difference-of-arrival (TDOA) estimation algorithm at the base station and one or two auxiliary reception sites within the cell.

In the Cyclic MUSIC approach, we measure

$$R_{xx}^{\alpha}(\tau) = \langle x(n)x(n-\tau)^T e^{-j2\pi\alpha n} \rangle_N$$

where  $\alpha$  equals twice the carrier frequency of the desired user. We then compute the singular value decomposition

$$R_{xx}^{\alpha}(\tau) = U \Sigma V^H$$

of  $R_{xx}^{\alpha}(\tau)$  where  $U$  and  $V$  are  $M \times M$  unitary matrices and  $\Sigma$  is diagonal with elements  $\sigma_1, \dots, \sigma_M$  arranged in

descending order  $\sigma_1 \geq \dots \geq \sigma_M \geq 0$ . Then, we search for the highest peak in the function

$$P(\theta) = |U_1^H a(\theta)|$$

where the corresponding value of  $\theta$  is the estimated direction of arrival of the desired user,  $U_1$  is the first column of  $U$ , and  $a(\theta)$  is the array response vector for angle  $\theta$  and is typically known for many values of  $\theta$  equally spaced from 0 degrees to 360 degrees.

In the CLS method, we measure

$$R_{xx}^{\alpha}(\tau) = \langle x(n)x(n-\tau)^T e^{-j2\pi\alpha n} \rangle_N$$

where  $\alpha$  equals twice the carrier frequency of the desired user. We also measure  $R_{x^*x^*}(\tau) = \langle x(n)^*x(n)^T \rangle_N$  and compute

$$R = R_{xx}^{\alpha}(\tau) R_{x^*x^*}^{-1} R_{xx}^{\alpha}(\tau)^H$$

and search for the highest peak in the function  $P(\theta) = a(\theta)^H R a(\theta)$ . The corresponding value of  $\theta$  is the estimated direction of arrival of the desired user.

The Cyclic MUSIC and CLS approaches, however, require the use of a calibrated array, but this array can be much smaller (e.g., only 4 elements) than the one used for spatial filtering because a unique carrier frequency is assigned to each mobile unit and these methods are signal selective.

In the CCC method of TDOA estimation, we compute a cross conjugate cyclic spectrum estimate  $S_{yz}^{\alpha}(f)$  and then minimize the weighted inverse Discrete Fourier Transform (DFT)

$$\sum_f S_{yz}^{\alpha}(f) |P(f)|^2 e^{j2\pi f d}$$

with respect to the TDOA estimate  $d$ , where  $P(f)$  is the raised-cosine pulse-transform used in the BPSK signal. Multipath propagation will result in multiple peaks. One of several possible methods for estimating the cross conjugate cyclic spectrum is to frequency smooth the cross conjugate cyclic periodogram

$$\sum_f W(f) Y(\alpha/2 + f) Z(\alpha/2 - f)$$

Where  $Y$  and  $Z$  are the DFT's of the signals received at main and auxiliary stations and  $W(f)$  is a smoothing window.

To actually locate a user would require intersection of the two location-hyperbolas determined by two such TDOA estimates obtained from two pairs of reception stations, each pair of which includes the same base station and a unique auxiliary reception site. However, a single TDOA estimate for a set of estimates corresponding to multipath propagation from a single pair of reception stations could be adequate for determining spatial separability.

Also, it is possible to forego the task of locating mobile units and to assign frequencies in the least active bands (or at random) and make reassignments whenever co-channel interference is detected after the spatial filter has converged. This detection can possibly be accomplished using the SCORE method or, alternatively, can be readily detected by the user at the mobile unit and reported (by the push of a button) to the base station.



Although there is some flexibility in the choice of a modulation type, the type chosen for the present invention for several reasons is BPSK using Nyquist-shaped pulses having 100% excess bandwidth. The strength of the cyclic conjugate correlation  $R_{xx} \propto 2/c$  for a BPSK signal having carrier offset  $f_c$  is the same as the strength of the signal itself, which speeds convergence of the SCORE adaptation method. Although BPSK having 100% excess bandwidth is not as spectrally efficient as modulation types using less excess bandwidth and/or higher-order alphabets, it is less susceptible to noise, easier to synchronize to, and its 200% spectral redundancy (100% due to double sideband and 100% due to excess bandwidth) can be effectively exploited for equalization and reduction of residual co-channel interference. Since the cyclic conjugate correlation characteristics of differential phase shift keying (DPSK) are identical to those of BPSK, DPSK can be used for transmission from the base station so as to simplify the receiver in the mobile unit. The actual baud rate and thus the bandwidth of the BPSK signal depend on the rate of the vocoder used. In the present invention, a vocoder rate of 8 kilobaud/second is used. Since transmission and reception are multiplexed in time, the actual rate that must be supported by the channel is 16 kilobaud/second, which yields a BPSK bandwidth of 32 Khz. In general, for a total system-bandwidth  $B_t$ , single-user channel-bandwidth  $B_c$ , and frequency-reuse factor  $r$ , the maximum number  $L$  of users that can be accommodated by the frequency allocation scheme in equation (8) is  $L = (B_t/r - B_c)/f_{sep} + 1$ . The number  $M$  of antenna elements required to separate these signals is bounded from below by the number  $K$  of users whose signals are spectrally overlapping with any given user's signal, where  $M > K = 2(B_c/f_{sep} - 1)$ . Using  $B_c = 32$  Khz and  $f_{sep} = 1$  Khz, at least 63 antenna elements (which can be omnidirectional) are needed to separate the signals of all users, assuming that the energy from each user arrives at the base station from a single direction, and assuming that the users are approximately uniformly distributed throughout the cell. In practice, more antenna elements might be required to achieve adequate performance at full capacity in the presence of spatially separable multipath, although fewer antenna elements can suffice if a lower capacity is opted for and appropriate channel allocation is done. Also, adaptive equalization should follow the spatial filtering to mitigate the time-smearing effects of multipath.

A block diagram of a generalized receiver 30 at the base station is shown in FIG. 3. The output signals 34 of the  $M$  antenna elements 32 are processed by individual preprocessing systems 36 that perform bandpass filtering, quadrature downconversion, sampling, and channelization on each output signal at each antenna. Channelizers 38 transform the resultant scalar input signal to a  $L \times 1$  vector of signals, each of which is obtained by bandpass filtering (centered on a particular user's carrier frequency and having bandwidth equal to that of this user's signal) the input signal and downconverting it to baseband, where  $L$  is the maximum number of users that the system can accommodate. The outputs of the  $M$  channelizers 38 then pass through a routing network 40 that routes the  $M$  channelizer outputs corresponding to each user to a SCORE processor 42. That is, the  $M$  vector inputs each having dimension  $L$  and corresponding to a particular antenna element are rearranged to yield  $L$  vector outputs each having dimension  $M$  and corresponding to a particular user's carrier frequency.

An example of a  $3 \times 2$  to  $2 \times 3$  router can be seen in FIG. 14. Each  $M \times 1$  vector is then processed by a corresponding SCORE processor device 42 to extract the signal of the user that is assigned the corresponding carrier frequency and separate that signal into a usable output signal 44.

Referring now to FIG. 4, a typical implementation of the invention would begin with call initiation on the control channel at step 50. Here a call can be initiated either by the base station or by the user. Call initiation is preferably performed on separate control channels so that communication channels are not wasted. These control channels would typically occupy distinct, non-overlapping spectral bands. If the user initiates the call then the reception cycle can proceed. On the other hand, if the base station initiates the call the user must first respond on the control channel before the reception cycle can proceed.

If direction of arrival information is to be used for frequency allocation, then the reception cycle proceeds with step 52 where an estimation of the direction of arrival of the signal from the user (signal of interest) is made. This option is useful because the signals from users who are not sufficiently separated geographically may not be spatially separable and, therefore, should be allocated disjoint carrier frequencies. At step 54 the determination of spatial separation is made. If the signal of interest is spatially separable from the other users' signals, then at step 56 that user is assigned a carrier frequency which, when modulated, results in a signal having a bandwidth which spectrally overlaps with that of other users, but whose carrier frequency is sufficiently separated from the carrier frequencies of the other users that signal-selective spatial filtering can be performed. If the signal of interest is not spatially separable, then at step 58 the user is assigned a carrier frequency which is sufficiently removed from those of the other users that the signals will not overlap. It should be clarified that the direction of arrival estimation system will not necessarily locate each mobile unit; rather it will determine possible multiple apparent locations for each unit that result from multipath propagation due to reflections and shadowing. But, it is these apparent locations—not the actual location—that are relevant in assessing spatial separability.

Steps 52 through 58 are optional and can be omitted. If carrier frequencies assigned without an initial determination of spatial separability, then the reception cycle would proceed from step 50 to step 60. At step 60, carrier frequencies are allocated in the least active band. If interference between users results, then a reassignment of carrier frequencies can be made at step 62 if requested by the user. As can be seen, therefore, direction of arrival information is neither required nor it is a necessary element of the SCORE-STFDMA method of signal processing.

Once the user is assigned a carrier frequency which may or may not result in spectral overlap of the modulated signal with those of others, communications begins. At step 64, the signal of interest together with interfering signals is received on each antenna in an array of  $M$  antennas. At step 66, bandpass filtering, quadrature downconversion, and sampling of the signal of interest and interference occurs for each antenna in the array. Since a particular user's signal will be separated from signals of other users by processing the  $M$  output signals of the  $M$  bandpass filters that are centered on the particular user's signal, each group of  $M$

corresponding bandpass filter outputs is routed to a different SCORE processor at step 68.

Once the signals of interest and interference are routed, at step 70 the SCORE method of adaption based on restoring spectral coherence is applied to determine the weight vector  $w$ . Then, at step 72, the inner product of the weight vector  $w$  and the signal of interest and interference is determined. This inner product will be separate and distinct for the signals of all users and, therefore, the signal of interest is separated from those of other users at step 74.

It is important to note that the foregoing steps result in an implicit determination of an optimum reception pattern for the signal of interest as it impinged on the antennas in the array. This reception pattern can have single or multiple beams and multiple nulls determined by multipath reflections from buildings and by locations of interfering users. The present invention uses that reception pattern, as represented by the SCORE weight vector, as the foundation of spatial multiplexing.

Once the signal of interest is separated from those of other users, the signal is equalized at step 76 and routed out of the base station at step 78 where it interfaces directly with the wireline phone network or is passed to another base station for interconnection with the wireline phone network.

Referring now to FIG. 5, a responsive message from the wireline phone network (which may be routed through the base station directly or through multiple base stations) is digitized for transmission at step 80. The carrier frequency is then modulated with the digital message at step 82. At step 84, the modulated signal is then multiplied by the weight vector  $w$  developed in step 70. At step 86, the vectored signal is passed through a  $L \times M$  to  $M \times L$  router for routing to a corresponding antenna. At step 88, the signals from all users to be routed to specified antennas are summed. The summed signals are applied to the antennas at step 90.

The overall effect of this process is that the radiation pattern of the signal transmitted by the base station to the user will match the reception pattern of the user's signal as seen by the antenna array at the base station. Therefore, the output signals and phasing of those signals may vary from antenna to antenna in the array.

FIG. 6 shows a block diagram of one embodiment of an overall system which implements the steps described above. One of the antennas 140 in the antenna array 138 is coupled to a splitter/combiner 102 through interconnection 104 and is used to transmit and receive on the control channel. Splitter 102, which can be seen in more detail in FIG. 10, includes a pair of bandpass filters 106, the outputs of which are coupled to controller 108 through interconnections 110 and 112, respectively. Splitter 102 is used to separate the spectrally disjoint control signals received from the mobile user and the control signals transmitted to the mobile user, and to separate the control channel from the band occupied by active users. The control channel is used for call initiation and coordination between the user and the base station as previously described.

A calibrated antenna array 114 contains a plurality of antennas 116 (more than 4) which are separately coupled to a plurality of splitters 118 through interconnections 120. Splitters 118 are similar in configuration to splitter 102 previously described and, where eight antennas are used, the outputs of splitters 118 are coupled to an  $8 \times 2$  to  $2 \times 8$  router 122 as shown through interconnections 124. Referring also to FIG. 14, a typical

router configured for  $3 \times 2$  to  $2 \times 3$  can be seen. As previously described, the function of a router is that the  $M$  vector inputs each having dimension  $L$  and corresponding to a particular antenna element are rearranged to yield  $L$  vector outputs each having dimension  $M$  and corresponding to a particular user's carrier frequency.

Router 122 permits separation of a set of signals from the eight antennas in antenna array 114, one set representing control signals and the other representing user signals. Control output 126 is coupled to control direction of arrival (DOA) estimator 128, and user output 130 is coupled to user DOA estimator 132. The DOA data corresponding to the control signals is coupled to controller 108 through interconnections 134, while similar data corresponding to users is coupled to controller 108 through bus 136. Controller 108, which can be a microcomputer or the like, performs the functions of call initiation, carrier allocation, and interfacing with the telephone network 148.

Optionally, elements 114 through 136 which comprise the apparatus needed to estimate directions of arrival can be omitted or replaced by other elements appropriate to the implementation of a TDOA estimator such as CCC.

FIG. 7 shows an alternative embodiment of an overall communications system employing the present invention. Elements 102, 104, 108, 110, 112, 138, 140, 142, 144, 146, 148, and 150 in FIG. 7 are identical to the corresponding elements in FIG. 6. The embodiment shown in FIG. 7 differs from that shown in FIG. 6 in the details of how the directions of arrival of the active mobile units and control signals are determined. Elements 117, 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141, and 143 shown in FIG. 7 comprise alternate means for estimating the directions of arrival. Two auxiliary antennas 117, 119 are located in different areas of the cell and should be as far as possible from the base station. Splitters 121, 123 are similar in configuration to splitters 102 previously described and separate the signals received at antennas 117 and 119 into control signals and signals from active mobile units. The outputs of splitters 121, 123 are separately coupled to two TDOA estimators 133, 135 through interconnections 125, 127, 139, and 131 as shown. TDOA estimators 133, 135 can be seen in more detail in FIG. 16. The TDOA estimators measure the DOA's using methods that differ from the methods used in the DOA estimators 128, 132 shown in FIG. 6. The received control signals are routed from splitter 102 through interconnection 110 to a bank of bandpass filters 143 that splits their inputs into a plurality of control signals occupying disjoint spectral bands and routes them through interconnection 139 to TDOA estimator 133. The resulting DOA's of the control signals are coupled through interconnection 137 to the controller 108. The received and spatially filtered signals of the active mobile users are routed through interconnections 146 to TDOA estimator 135. The resulting DOA's of the active mobile users are coupled through interconnections 141 to the controller 108.

For normal communications, the users' signals are preferably received and transmitted using an antenna array 138 (for example, a circular array) which contains  $M$  antennas 140 (for example, omnidirectional antennas). Antennas 140 are coupled to SCORE-STFDMA module 142 through interconnections 144, there being one input (output) for each antenna  $M$ . SCORE-STFDMA module 142 performs the temporal filtering, signal routing, and adaptive spatial filtering functions of

the system. SCORE-STFDMA module 142 has a plurality of output lines 146 to route communications from the users to the wireline phone network 148, and a plurality of input lines 150 to receive communications from the wireline phone network 148 for transmission to the users. Controller 108 provides the interface to the wireline phone network 148.

Referring now to FIG. 8, SCORE-STFDMA module 142 includes a transmit/receive switch 152 for each of its connections to an antenna 140. Transmit/receive switches 152 are coupled to a clock 154 which controls the time division multiplexing windows of the transmitted and received signals through interconnections 156. Signals received from a particular antenna 140 are subjected to bandpass filtering, quadrature downconversion and sampling by a processing module 158 through interconnections 160. The output of each processing module 158 contains information for each of the L users of the system received on a particular antenna. Since there are M antennas in the base station antenna array 138, it is necessary to select each of M received signals for a particular user and route them for processing. This is performed by router 162 which is coupled to processing module 164 through interconnections 164.

The output of router 162 contains, for each user, the signals from each of the M antennas. For each user therefore, there are M signal components which must be processed by a SCORE processor 164 which is coupled to router 162 through interconnections 166. SCORE processor 164, which has M outputs and inputs, determines the weight vector  $w$  for each user's signals as previously described. The outputs of a SCORE processor 164 are then applied to that user's received signals in an inner product multiplier 168 which is coupled to the SCORE processor 164 through interconnections 170. There, the signals are also summed and the composite signal is output to controller 108 on an interconnection 146.

FIG. 13 schematically shows an inner product multiplier 168. The output signals on interconnections 146 are represented by  $w^H x(n)$  for the particular user.

Referring now to FIG. 9, processing module 158 includes a bandpass filter 172 which is coupled to a quadrature downconverter 174 for conversion to base-band for preconditioning and anti-aliasing. The resultant signal is filtered by low pass filter 176 and converted into digital data by analog to digital converter 178. Transformation module 180 performs a 1024-point Fast Fourier Transform to split the band into 1024 bands which are 1 KHz wide. Grouping module 182 groups the bands into 64 KHz subbands prior to a 64-point inverse Fast Fourier Transform by inverse transformation modules 184. Therefore, the function of processing module 158 is typically to split a spectral band having a width of 1024 KHz into several overlapping bands having a width of 64 KHz whose centers are separated by 1 KHz.

Referring again to FIG. 8, digital information which is to be transmitted to the user is input to SCORE-STFDMA module 142 through interconnections 150. Modulators 186 place that data on the carrier signal, assigned to the user. Modulators 186 are coupled to vector scalar multipliers 188 through interconnections 190, where the weight vector  $w$  is applied to the transmitted signal. In other words, the weight vector  $w$  developed from that user's received signal by the SCORE processors 164 is used to condition the transmitted signal and separate it into components which

will be separately routed to the M antennas in antenna array 138. FIG. 12 schematically shows a typical vector scalar multiplier used herein.

Vector scalar multipliers 188 are coupled to an  $L \times M$  to  $M \times L$  router 192 through interconnections 194. Router 192 takes the M signal components for each user and reorganizes that information so that each antenna 140 will have the its corresponding information for all users. L-input summers 196, which are coupled to router 192 through interconnections 198, sum the signal information for all users for a given antenna so that the composite signal can be transmitted through transmit/receive switches 152 through interconnections 200 and on to antennas 140.

FIG. 11 shows a schematic of a typical L-input summer used with the present invention. FIG. 14 shows an example of a  $3 \times 2$  to  $2 \times 3$  router configuration which can be expanded to any number of users and antennas.

Once all of the signals are applied to the antennas in antenna array 138, the radiation pattern of the signal transmitted to the user will match the reception pattern of the signal received from the user as that signal impinged on the antenna array 138.

Referring to FIG. 15, one embodiment of a DOA estimator 128 is shown (which is the same as for DOA estimator 132). Bandpass filtering and downconversion is performed by filter/converter module 210 and signals are routed through an  $M \times L$  to  $L \times M$  router 212. The directions of arrival  $\theta$  are determined by DOA processors 214 using, for example, the Cyclic MUSIC or CLS methods previously described.

Referring to FIG. 16, one embodiment of TDOA estimator 135 is shown (which is the same for TDOA estimator 133). Each CCC processor 216 (which implements in a straightforward manner the CCC method previously described) measures the TDOA between a signal on interconnections 129, 131 from an auxiliary antenna and a signal on interconnections 146 from the SCORE-STFDMA processor 142. The two TDOA estimates from a pair of CCC processors interconnected to a particular signal line in interconnections 146 are routed via interconnections 220 to a hyperbola intersect processor 218 that combines the two TDOA estimates to form a DOA estimate as previously described in conjunction with the description of the CCC method. The resulting DOA estimates from the plurality of hyperbola intersect processors 218 are routed out of TDOA estimator 135 on interconnections 141.

For the purpose of comparing the potential increase in capacity due to the SCORE-STFDMA method of the present invention relative to the analog FM-FDMA, TDMA, and CDMA schemes previously described, consider a total system-bandwidth of  $B_T = 1.25$  Mhz. In the following comparison, the number of channels needed by each user in the analog FM-FDMA, TDMA, and CDMA schemes is two (one for transmission and one for reception), and one channel is needed by each user in the present invention because transmission and reception are multiplexed in time. With FM-FDMA, using a channel bandwidth of 30 KHz, 2 channels per user, and a cell reuse factor of 7 yields 3 users per cell. With TDMA, using a channel bandwidth of 30 KHz with three time slots for TDMA, 2 channels per user, and a cell reuse factor of 4 yields 15 users per cell. With CDMA, using 2 channels per user, a frequency reuse factor of 1, sectorization of 3, and voice activity factor of  $\frac{1}{3}$  yields 120 channels per cell or 60 users per cell. With the SCORE-STFDMA method of the pres-

ent invention, using a channel bandwidth of 32 KHz, 1 channel per user, a cell reuse factor of 3, and a carrier separation of 1 KHz yields up to 385 users per cell. Decreasing the carrier separation to 500 Hz allows up to 770 users per cell at the expense of doubling the number of antennas. By decreasing the frequency reuse factor from three to one, the user capacity would triple.

Accordingly, it will be seen that this invention provides for significant increases in user capacity of radio communications systems by space, time and frequency multiplexing of communications signals. The spatial filtering method of the present invention blindly adapts an array of antennas in accordance with the reception pattern of a signal received from a mobile or portable unit by restoring its spectral coherence. To accomplish this, the signal is correlated with a time and frequency shifted version of itself. The resultant weighting factors that realize the reception pattern of the signal are also applied to the signal to be transmitted to the mobile or portable unit, whereby the reception pattern of the user's signal is reproduced in the radiation pattern of the signal transmitted to the user. This results in radiation of maximum power to the user and minimum power to unintended users, by combining directivity with multipath radiation.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Thus the scope of this invention should be determined by the appended claims and their legal equivalents.

I claim:

1. A method of spatially filtering spectrally overlapping communications signals, comprising the
  - (a) receiving a plurality of radio frequency signals on an array of antennas;
  - (b) determining an optimum reception pattern for a signal of interest in said received signals as said received signals impinge on said array of antennas by restoring the spectral self-coherence of said signal of interest, said signal of interest corresponding to communications from a specified user; and
  - (c) transmitting a signal to said user, said transmitted signal having a radiation pattern from said array of antennas substantially identical to said reception pattern of said signal of interest.
2. The method recited in claim 1, further comprising the step of time division multiplexing steps (a) through (c).
3. The method recited in claim 1, further comprising the step of modulating said transmitted signal with digital data.
4. The method recited in claim 3, wherein said transmitted signal is modulated with binary phase shift keying.
5. The method recited in claim 1, further comprising the step of concurrently performing steps (a) through (c) for a plurality of users.
6. The method recited in claim 1, wherein said step of determining the optimum reception pattern for a signal of interest in said received signals as said received signals impinge on said array of antennas by restoring the spectral self-coherence of said signal of interest includes the step of computing a weight vector  $w$  representing a set of weights that realize said reception pattern for said signal of interest where  $w$  is the solution to

$$R_{xx}^{*a}(\tau)R_{xx}^{*x} - {}^{-1}R_{xx}^{*aH}(\tau)w_1 = \lambda_1 R_{xx}w_1$$

where  $\alpha$  is the cycle frequency,  $R_{xx}^{*a}(\tau)$  is the conjugate cyclic autocorrelation matrix at lag  $\tau$  for the vector  $x(t)$  of said received signals,  $R_{xx}^{*aH}(\tau)$  is its Hermetian transpose,  $R_{xx}$  is the autocorrelation matrix for  $x(t)$  at lag zero,  $R_{xx}^{*x} - {}^{-1}$  is the inverse of the autocorrelation matrix for the conjugated vector  $x^*(t)$  of said received signals, and  $w_1$  is the solution to this eigenequation corresponding to the largest eigenvalue  $\lambda_1$ .

7. The method recited in claim 6, further comprising the steps of:

- (a) computing the inner product of said signal of interest and said weight vector  $w$ ; and
- (b) extracting communications data from said user from said inner product.

8. The method recited in claim 7, further comprising the step of computing the scalar vector product of said weight vector  $w$  and said transmitted signal.

9. A method for multiplexing communications signals having overlapping spectral bands, comprising the steps of:

- (a) receiving a plurality of digital radio communications signals on an array of antennas, each of said communications signals having a distinct carrier frequency corresponding to a specified user;
- (b) identifying a signal of interest from said plurality of communications signals using the carrier frequency of said signal of interest, said signal of interest corresponding to communications from a specified user;
- (c) determining a weight factor for each antenna in said array of antennas through spectral coherence restoral for said signal of interest to realize an optimum reception pattern for said signal of interest and the remainder of interfering signals in said plurality of signals; and
- (d) transmitting a signal to said user over said array of antennas, said transmitted signal adjusted at each of said antennas by the corresponding weight factor, whereby the radiation pattern of said transmitted signal from said array of antennas is substantially identical to said reception pattern for said received signal of interest.

10. The method recited in claim 9, further comprising the steps of:

- (a) determining discrete weight factors for each of said communications signals received at each of said antennas through spectral coherence restoral of said communications signals; and
- (b) transmitting a plurality of communications signals over said array of antennas, each of said transmitted signals having a radiation pattern substantially identical to said reception pattern of the corresponding signal received at said array of antennas.

11. The method recited in claim 9, further comprising the step of temporally separating said received signals from said transmitted signals.

12. The method recited in claim 9, wherein the step of determining a weight factor for each antenna in said array of antennas through spectral coherence restoral of said signal of interest comprises the step of computing a weight vector  $w$  representing a set of weights corresponding to the optimum reception pattern of said signal of interest where  $w$  is the solution to

$$R_{xx}^{*a}(\tau)R_{xx}^{*x} - {}^{-1}R_{xx}^{*aH}(\tau)w_1 = \lambda_1 R_{xx}w_1$$

where  $\alpha$  is the cycle frequency,  $R_{xx}^{\alpha}(\tau)$  is the conjugate cyclic autocorrelation matrix at lag  $\tau$  for the vector  $x(t)$  of said received signals,  $R_{xx}^{\alpha H}(\tau)$  is its Hermetian transpose,  $R_{xx}$  is the autocorrelation matrix for  $x(t)$  at lag zero,  $R_{xx}^{\alpha \alpha -1}$  is the inverse of the autocorrelation matrix for the conjugated vector  $x^*(t)$  of said received signals, and  $w_1$  is the solution to this eigenequation corresponding to the largest eigenvalue  $\lambda_1$ .

13. A method of reducing co-channel interference between radio communications signals, comprising the steps of:

- (a) initiating radio communications between a user and a base station coupled to an array of antennas;
- (b) determining if radio communications signals transmitted from said user to said base station are spatially separable from signals transmitted by other users to said base station;
- (c) allocating to a user with a spatially separable signal a distinct communications channel which spectrally overlaps that of another user;
- (d) allocating to a user with a spatially non-separable signal a distinct communications channel which is spectrally disjoint with those of other users;
- (e) receiving communications signals from a plurality of users on said array of antennas;
- (f) determining the optimum reception patterns of each of said received signals at said array of antennas; and
- (g) transmitting signals from said base station to said users wherein the radiation pattern of the signal transmitted to a user corresponds to the optimum reception pattern of the signal received from that user at said base station.

14. The method recited in claim 13, further comprising the step of restoring the spectral coherence of said received signals to adapt said array of antennas.

15. The method recited in claim 14, wherein the step of restoring the spectral coherence of said received signals to adapt said array of antennas comprises the step of computing a weight vector  $w$  representing a set of weights corresponding to the optimum reception pattern of said signal of interest where  $w$  is the solution to

$$R_{xx}^{\alpha}(\tau)R_{xx}^{\alpha \alpha -1}R_{xx}^{\alpha H}(\tau)w_1 = \lambda_1 R_{xx}w_1$$

where  $\alpha$  is the cycle frequency,  $R_{xx}^{\alpha}(\tau)$  is the conjugate cyclic autocorrelation matrix at lag  $\tau$  for the vector  $x(t)$  of said received signals,  $R_{xx}^{\alpha H}(\tau)$  is its Hermetian transpose,  $R_{xx}$  is the autocorrelation matrix for  $x(t)$  at lag zero,  $R_{xx}^{\alpha \alpha -1}$  is the inverse of the autocorrelation matrix for the conjugated vector  $x^*(t)$  of said received signals, and  $w_1$  is the solution to this eigenequation corresponding to the largest eigenvalue  $\lambda_1$ .

16. An apparatus for spatial multiplexing of communications signals, comprising:

- (a) a plurality of antennas arranged in an array;

- (b) receiving means for receiving radio frequency signals, said receiving means coupled to said array of antennas;
- (c) spectral coherence processor means for restoring spectral coherence of signals received by said array of antennas and generating weight factors for each of said antennas, said processor means coupled to said receiving means;
- (d) transmitting means for transmitting radio frequency signals, said transmitting means coupled to said array of antennas; and
- (e) means for adapting radio frequency signals transmitted from said transmitting means by said weight factors, whereby the radio frequency radiation pattern of a signal transmitted to a user corresponds to the optimum reception pattern for the signal transmitted by said user measured at said array of antennas.

17. The apparatus recited in claim 16, further comprising means for time division multiplexing said received signals and said transmitted signals.

18. The apparatus recited in claim 17, further comprising means for allocation of spectrally overlapping communications channels to users having spatially separable signals.

19. The apparatus recited in claim 18, further comprising means for allocation of spectrally disjoint communications channels to users having spatially non-separable signals.

20. The apparatus recited in claim 19, further comprising signal conditioning means for bandpass filtering and quadrature downconversion of said received signals, said signal conditioning means coupled to said array of antennas.

21. A space, time and frequency multiplexed communications system, comprising:

- (a) a base station, said base station including an array of antennas;
- (b) call initiation and control means for establishing a radio frequency link between said base station and a plurality of users;
- (c) direction of arrival estimating means for estimating the direction of arrivals of radio frequency signals transmitted from said users to said base station and the multipath reflections of said signals;
- (d) channel allocation means for allocating spectrally overlapping communications channels to users having spatially separable signals and allocating spectrally disjoint communications channels to users having spatially non-separable signals; and
- (e) adapting means for adapting said array of antennas using spectral coherence properties of said received signals; and
- (f) transmission means for transmitting signals to said users, said signals emanating from said array of antennas, the radiation pattern of a signal intended for a given user being substantially identical to the optimum reception pattern for the signal received from said user at said array of antennas.

\* \* \* \* \*



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

35083

7590

10/29/2009

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

MAIL DATE

DELIVERY MODE

10/29/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 11/733,069	<b>Applicant(s)</b> GAVRILOVICH, CHARLES D.	
	<b>Examiner</b> TUAN A. TRAN	<b>Art Unit</b> 2618	

-- 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 01 July 2009.
- 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) 1-6,8-16 and 18-44 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) 1-6,8-16 and 18-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ 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 \_\_\_\_\_ 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) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***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 negated by the manner in which the invention was made.

1. Claims 1-6, 8-16, 18-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charas et al. (5,404,570) in view of Gardner et al. (5,260,968).

Regarding claims 1-6, 8-16 and 18-20, Charas discloses a movable base station 116 configured to move relative to Earth wherein the movable base station 116 is conveyed by an automotive vehicle 114 (i.e. train) (See fig. 1), the movable base station 116 comprising: antennas 118, 120; a receiver configured to receive mobile device signals from a mobile device 102 through the antenna 120 and to receive fixed port signals from a fixed port 108, 208 through the antenna 118; and a transmitter configured to transmit RF signals corresponding to the received mobile device signals to a base station 106 through the antenna 118 and to transmit RF signals corresponding to the received fixed port signals to the mobile device 102, wherein the transmitter further configured to transmit RF signals within time slots of time-division multiplex channels (TDMA communication) (See figs. 1-3 and col. 4 line 1 to col. 5 line 44). However, Charas does not explicitly mention that each of the antenna 118, 120 used by the movable base station is a plurality of spatially separated antennas as specified in claims



Art Unit: 2618

and the movable base station further comprises a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal. Gardner teaches a base station comprising: spatially separated antennas used for RF signals reception/transmission by respective receiver and transmitter of the base station, wherein the spatially separated antennas being configured a plurality of phased array antennas with directional RF beams allocating in sectors and wherein the RF beams are transmitted separated in time with a predetermined time delay (temporal) (See figs. 6-8 and col. 14 line 25 to col. 15 line 41); and a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal (See figs. 8, 13 and col. 5 line 60 to col. 6 line 26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Gardner in modifying the movable base station, as disclosed by Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality.

Claims 21-44 are rejected for the same reasons as set forth in claims 1-6, 8-16 and 18-20.

### ***Response to Arguments***

Applicant's arguments filed 07/01/2009 have been fully considered but they are not persuasive.

In response to applicant's argument (See Remark, page 10) that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction

Art Unit: 2618

based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

The applicant also argued that limitations recited in claims are not taught or suggested by the cited references (See Remark, page 11-13). The examiner respectfully disagrees with the applicant's argument. In this instant case, the difference between Charas and the claimed invention is the use of a plurality of spatially separated antennas (i.e. directional or diversity antennas) to receive and transmit a best signal. Since Gardner does teach a base station comprising: spatially separated antennas used for RF signals reception/transmission by respective receiver and transmitter of the base station, wherein the spatially separated antennas being configured a plurality of phased array antennas with directional RF beams allocating in sectors and wherein the RF beams are transmitted separated in time with a predetermined time delay (temporal) (See figs. 6-8 and col. 14 line 25 to col. 15 line 41); and a controller configured to align, combine and compare received signals through the spatially separated antennas and to select a best signal (See figs. 8, 13 and col. 5 line 60 to col. 6 line 26), and both communication systems of Charas & Gardner are capable of utilizing TDMA communication protocol; therefore, Charas and Gardner are combinable, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Gardner in modifying the movable base station, as disclosed by

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Charas, with the spatially separated antenna system for the advantage of enhancing the communication signal quality (See above rejections for details). For those reasons, the rejection(s) are proper and maintained.

### ***Conclusion***

**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 TUAN A. TRAN whose telephone number is (571)272-7858. The examiner can normally be reached on Mon-Fri, 10:00AM-6:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Anderson can be reached on (571) 272-4177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2618

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

**APPENDIX**

**Related Proceedings**

**None**

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	11733069			
<b>Filing Date:</b>	09-Apr-2007			
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station			
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich			
<b>Filer:</b>	Charles Dan Gavrilovich			
<b>Attorney Docket Number:</b>	CAR100C3			
Filed as Small Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
Filing a brief in support of an appeal	2402	1	270	270
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>	0242			

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 2 months with \$0 paid	2252	1	245	245
Miscellaneous:				
Total in USD (\$)				515

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	7900301
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	Mobile Communication System With Moving Base Station
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	27-JUN-2010
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	14:56:46
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$515
RAM confirmation Number	6725
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
02					



1	Appeal Brief Filed	CAR100C3AppealBrief062710.pdf	1357693 75bc4389335f493d32cde0b49b2373762947d9c5	no	69
<b>Warnings:</b>					
<b>Information:</b>					
2	Fee Worksheet (PTO-875)	fee-info.pdf	31831 d76d947966187dd3c2703ceed8f2b0e42ddc9d8b2	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			1389524		
<p><b>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.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>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.</b></p>					



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## NOTICE OF ALLOWANCE AND FEE(S) DUE

35083 7590 09/17/2010

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

DATE MAILED: 09/17/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

11/733,069

04/09/2007

Charles D. Gavrilovich

CAR100C3

7533

TITLE OF INVENTION: MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	12/17/2010

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### 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, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). 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. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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**

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Commissioner for Patents  
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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)

35083 7590 09/17/2010

**CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729**

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.
-----------------	-------------	----------------------	---------------------	------------------

11/733,069 04/09/2007 Charles D. Gavrilovich CAR100C3 7533

TITLE OF INVENTION: MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional YES \$755 \$300 \$0 \$1055 12/17/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
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TRAN, TUAN A 2618 455-011100

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, 1 \_\_\_\_\_
- (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. 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 submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, 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).

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3	7533
35083	7590	09/17/2010	EXAMINER	
CHARLES D. GAVRILOVICH, JR., GAVRILOVICH, DODD & LINDSEY, LLP 985 PASEO LA CRESTA, SUITE B CHULA VISTA, CA 91910-6729			TRAN, TUAN A	
			ART UNIT	PAPER NUMBER
			2618	
DATE MAILED: 09/17/2010				

## 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 0 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 0 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.

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	11/733,069	GAVRILOVICH, CHARLES D.	
	<b>Examiner</b>	<b>Art Unit</b>	
	TUAN A. TRAN	2618	

**-- 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 06/27/2010.
2. ☒ The allowed claim(s) is/are 1-6, 8-16 and 18-44 renumbered 1-42.
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)**

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. <input type="checkbox"/> Notice of References Cited (PTO-892)</li> <li>2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</li> <li>3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br/>Paper No./Mail Date _____</li> <li>4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br/>of Biological Material</li> </ol> | <ol style="list-style-type: none"> <li>5. <input type="checkbox"/> Notice of Informal Patent Application</li> <li>6. <input type="checkbox"/> Interview Summary (PTO-413),<br/>Paper No./Mail Date _____.</li> <li>7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment</li> <li>8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance</li> <li>9. <input type="checkbox"/> Other _____.</li> </ol> |
|---|---|

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

## **DETAILED ACTION**

### **EXAMINER'S AMENDMENT**

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.

The application has been amended as follows:

#### **IN THE SPECIFICATION:**

Page 1, first paragraph: please fill U.S. Pat. No. **7,221,904** into the blank.

#### ***Allowable Subject Matter***

1. Claims 1-6, 8-16 and 18-44 are allowed.

The following is an examiner's statement of reasons for allowance:

The applicant's response (See Appeal Brief, Argument section, page 15) clearly states the inventive steps of the instant application.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

#### ***Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUAN A. TRAN whose telephone number is (571)272-7858. The examiner can normally be reached on Mon-Fri, 10:00AM-6:30PM.

Art Unit: 2618

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Anderson can be reached on (571) 272-4177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

<b>Search Notes</b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

SEARCHED			
Class	Subclass	Date	Examiner
455	11.1, 13.1, 25, 561, 562.1, 91, 101	9/7/10	TT
375	346, 347, 295, 299	9/7/10	TT

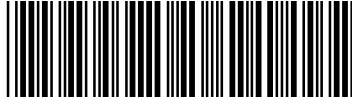
SEARCH NOTES		
Search Notes	Date	Examiner
EAST (USPAT, USPGPUB, USOCR, FPRS, JPO, EPO, DERWENT) updating search	9/7/10	TT

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	Interference text search	9/7/10	TT

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<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b>		<input type="checkbox"/> <b>CPA</b>		<input type="checkbox"/> <b>T.D.</b>		<input type="checkbox"/> <b>R.1.47</b>			
CLAIM		DATE							
Final	Original	08/18/2008	12/08/2008	02/27/2009	10/26/2009	09/13/2010			
1	1	=	✓	✓	✓	=			
2	2	=	✓	✓	✓	=			
3	3	=	✓	✓	✓	=			
4	4	=	✓	✓	✓	=			
5	5	=	✓	✓	✓	=			
6	6	=	✓	✓	✓	=			
	7	=	-	-	-	-			
7	8	=	✓	✓	✓	=			
8	9	=	✓	✓	✓	=			
9	10	=	✓	✓	✓	=			
10	11	=	✓	✓	✓	=			
11	12	=	✓	✓	✓	=			
12	13	=	✓	✓	✓	=			
13	14	=	✓	✓	✓	=			
14	15	=	✓	✓	✓	=			
15	16	=	✓	✓	✓	=			
	17	=	-	-	-	-			
16	18	=	✓	✓	✓	=			
17	19	=	✓	✓	✓	=			
18	20	=	✓	✓	✓	=			
19	21	=	✓	✓	✓	=			
20	22	=	✓	✓	✓	=			
21	23	=	✓	✓	✓	=			
22	24	=	✓	✓	✓	=			
23	25	=	✓	✓	✓	=			
24	26	=	✓	✓	✓	=			
25	27	✓	✓	✓	✓	=			
26	28	✓	✓	✓	✓	=			
27	29	✓	✓	✓	✓	=			
28	30	✓	✓	✓	✓	=			
29	31	✓	✓	✓	✓	=			
30	32	✓	✓	✓	✓	=			
31	33	=	✓	✓	✓	=			
32	34	=	✓	✓	✓	=			
33	35	=	✓	✓	✓	=			
34	36	=	✓	✓	✓	=			

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  11733069	<b>Applicant(s)/Patent Under Reexamination</b>  GAVRILOVICH, CHARLES D.
	<b>Examiner</b>  TUAN A. TRAN	<b>Art Unit</b>  2618

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b>		<input type="checkbox"/> <b>CPA</b>		<input type="checkbox"/> <b>T.D.</b>		<input type="checkbox"/> <b>R.1.47</b>			
CLAIM		DATE							
Final	Original	08/18/2008	12/08/2008	02/27/2009	10/26/2009	09/13/2010			
35	37	=	✓	✓	✓	=			
36	38	✓	✓	✓	✓	=			
37	39	✓	✓	✓	✓	=			
38	40	✓	✓	✓	✓	=			
39	41	✓	✓	✓	✓	=			
40	42	✓	✓	✓	✓	=			
41	43	✓	✓	✓	✓	=			
42	44	✓	✓	✓	✓	=			

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)

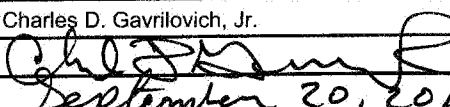
Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

35083 7590 09/17/2010

CHARLES D. GAVRILOVICH, JR.,  
 GAVRILOVICH, DODD & LINDSEY, LLP  
 985 PASEO LA CRESTA, SUITE B  
 CHULA VISTA, CA 91910-6729

**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.

Charles D. Gavrilovich, Jr.	(Depositor's name)
	(Signature)
September 20, 2010	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/733,069	04/09/2007	Charles D. Gavrilovich	CAR100C3	7533

TITLE OF INVENTION: MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	12/17/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, TUAN A	2618	455-011100

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 Gavrilovich, Dodd &amp; Lindsey, LLP

2 Charles D. Gavrilovich, Jr.

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)

Carucel Investments L.P.

Park Ridge, IL

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 submitted:

- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☒ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, 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).

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

Charles D. Gavrilovich, Jr.

Registration No. 41,031

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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## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	11733069			
<b>Filing Date:</b>	09-Apr-2007			
<b>Title of Invention:</b>	MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION			
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich			
<b>Filer:</b>	Charles Dan Gavrilovich			
<b>Attorney Docket Number:</b>	CAR100C3			
Filed as Small Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
Utility Appl issue fee	2501	1	755	755
Publ. Fee- early, voluntary, or normal	0257 1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1055

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	8458713
<b>Application Number:</b>	11733069
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	7533
<b>Title of Invention:</b>	MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION
<b>First Named Inventor/Applicant Name:</b>	Charles D. Gavrilovich
<b>Customer Number:</b>	35083
<b>Filer:</b>	Charles Dan Gavrilovich
<b>Filer Authorized By:</b>	
<b>Attorney Docket Number:</b>	CAR100C3
<b>Receipt Date:</b>	20-SEP-2010
<b>Filing Date:</b>	09-APR-2007
<b>Time Stamp:</b>	22:24:15
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1055
RAM confirmation Number	6801
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
0200					

1	Issue Fee Payment (PTO-85B)	PartBsigned.pdf	1496541 a8c14d4512b5938268f693405393cbad1f1 ac318	no	1
<b>Warnings:</b>					
<b>Information:</b>					
2	Fee Worksheet (PTO-875)	fee-info.pdf	31803 cc11629e56181f5f39c72d3868bb9dbf2dfe 3b8f	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			1528344		
<p><b>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.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>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.</b></p>					





# UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office  
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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11/733,069

04/09/2007

Charles D. Gavrilovich

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10/28/2010

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

EXAMINER

TRAN, TUAN A

ART UNIT

PAPER NUMBER

2618

MAIL DATE

DELIVERY MODE

10/28/2010

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Supplemental  
Notice of Allowability**

**Application No.**

11/733,069

**Examiner**

TUAN A. TRAN

**Applicant(s)**

GAVRILOVICH, CHARLES D.

**Art Unit**

2618

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  - a) ☐ All    b) ☐ Some\*    c) ☐ None    of the:
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    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
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**Attachment(s)**

- |  |  |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Notice of Informal Patent Application                      |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____    | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                    |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material | 8. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance              |
|  | 9. <input type="checkbox"/> Other _____.   |

/Tuan A Tran/  
Primary Examiner, Art Unit 2618

**DETAILED ACTION**

**EXAMINER'S AMENDMENT**

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.

The application has been amended as follows:

**IN THE SPECIFICATION:**

**Page 1, first paragraph:** the phrase "which is a National Phase Application" has been changed to "which is a continuation"

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUAN A. TRAN whose telephone number is (571)272-7858. The examiner can normally be reached on Mon-Fri, 10:00AM-6:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Anderson can be reached on (571) 272-4177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2618

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan A Tran/  
Primary Examiner, Art Unit 2618



# 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](http://www.uspto.gov)

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/733,069	12/07/2010	7848701	CAR100C3	7533

35083 7590 11/17/2010

CHARLES D. GAVRILOVICH, JR.,  
GAVRILOVICH, DODD & LINDSEY, LLP  
985 PASEO LA CRESTA, SUITE B  
CHULA VISTA, CA 91910-6729

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Charles D. Gavrilovich, Naperville, IL;

AO 120 (Rev. 08/10)

<b>TO:</b> <b>Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of Florida on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 14-cv-60363-RSR	DATE FILED 2/13/2014	U.S. DISTRICT COURT Southern District of Florida
PLAINTIFF Carucel Investments, L.P.		DEFENDANT Gogo, Inc. et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,221,904 B1	5/22/2007	
2 7,848,701 B2	12/7/2010	
3 7,979,023 B2	7/12/2011	
4 8,463,177 B2	6/11/2013	
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK Steven M. Larimore	(BY) DEPUTY CLERK Valerie Kemp	DATE 2/14/2014
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

AO 120 (Rev. 08/10)

<b>TO:</b> <b>Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of Florida (Fort Lauderdale) on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 15-cv-61116-BB	DATE FILED 5/27/2015	U.S. DISTRICT COURT Southern District of Florida (Fort Lauderdale)
PLAINTIFF Carucel Investments, L.P.		DEFENDANT Novatel Wireless, Inc. AT&T Mobility LLC Verizon Communications, Inc. et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,221,904	5/22/2007	
2 7,848,701	12/7/2010	
3 7,979,023	7/12/2011	
4 8,463,177	6/11/2013	
5 8,718,543	5/6/2014	

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1 8,849,191	9/30/2014		
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK Steven M. Larimore	(BY) DEPUTY CLERK S. Reid	DATE
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

AO 120 (Rev. 08/10)

<b>TO: Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of Florida (Fort Lauderdale) on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 15-cv-61116-BB	DATE FILED 5/27/2015	U.S. DISTRICT COURT Southern District of Florida (Fort Lauderdale)
PLAINTIFF Carucel Investments, L.P.		DEFENDANT Novatel Wireless, Inc. AT&T Mobility LLC Verizon Communications, Inc. et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,221,904	5/22/2007	
2 7,848,701	12/7/2010	
3 7,979,023	7/12/2011	
4 8,463,177	6/11/2013	
5 8,718,543	5/6/2014	

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,849,191	9/30/2014	
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT	Case transferred to the Southern District of California
--------------------	---

CLERK Steven M. Larimore	(BY) DEPUTY CLERK S. Reid	DATE 5/27/2015
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

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To:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of California on the following:   X   Patents or      Trademarks:

<b>DOCKET NO.</b>	<b>DATE FILED</b>	<b>US District Court Southern District of California</b>
3:16-cv-00118-LAB-BLM	1/19/16	San Diego, CA
PLAINTIFF		DEFENDANT
Carucel Investments, L.P.		Novatel Wireless Inc, et al.
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1. 7,221,904	6.	11.
2. 7,848,701	7.	12.
3. 7,979,023	8.	13.
4. 8,463,177	9.	14.
5. 8,718,543	10.	15.

In the above-entitled case, the following patents(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY	
	<u>    </u> Amendment <u>    </u> Answer <u>    </u> Cross Bill <u>    </u> Other Pleading	
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1.	6.	11.
2.	7.	12.
3.	8.	13.
4.	9.	14.
5.	10.	15.

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT
-------------------

CLERK	(BY) DEPUTY CLERK	DATE
John Morrill		

To:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of California on the following:   X   Patents or        Trademarks:

<b>DOCKET NO.</b>	<b>DATE FILED</b>	<b>US District Court Southern District of California</b>
3:16-cv-00118-H-KSC	1/19/16	San Diego, CA
<b>PLAINTIFF</b>		<b>DEFENDANT</b>
Carucel Investments, L.P.		Novatel Wireless Inc. et al.
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1. 7,221,904	6.	11.
2. 7,848,701	7.	12.
3. 7,979,023	8.	13.
4. 8,463,177	9.	14.
5. 8,718,543	10.	15.

In the above-entitled case, the following patents(s)/ trademark(s) have been included:

<b>DATE INCLUDED</b>	<b>INCLUDED BY</b>	
	Amendment <u>      </u> Answer <u>      </u> Cross Bill <u>      </u> Other Pleading <u>      </u>	
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1.	6.	11.
2.	7.	12.
3.	8.	13.
4.	9.	14.
5.	10.	15.

In the above-entitled case, the following decision has been rendered or judgment issued:

<b>DECISION/JUDGMENT</b>
Judgment - Pursuant to jury verdict, Court enters judgment in favor of Defendants and against Plaintiff.

<b>CLERK</b>	<b>(BY) DEPUTY CLERK</b>	<b>DATE</b>
John Morrill	s/ J. Diaz	4/28/2017