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Published: with international search report

(54) Title: UNIVERSAL SYNCHRONIZED PACKET RADIO TELEMETRY DATA COMMUNICATIONS

(57) Abstract: A wireless telemetry data supervisory control and acquisition data (SCADA) telemetry system utilizing host network elements that are found in cellular radio telephone systems, personal communications systems (PCS), 3G multi-format wireless telephony standards, big Leo mobile (147), Little Leo, geo synchronous, publicly switched telephone networks signaling system seven (SS7) (115), Local Multi-point Distribution Service (LMDS) (242), Teledesic satellites, global positioning systems (GPS) (103) satellite navigation system, ISM spread spectrum 2.3-2.4GHz technology, 200 KHz EDGE high-speed data technology, high speed EGPRS packet technology and the like.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
UNIVERSAL SYNCHRONIZED PACKET RADIO
TELEMETRY DATA COMMUNICATIONS

This application claims the benefit of pending U.S. provisional patent application no.
60/117,276, filed January 26, 1999.

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to wireless telemetry data supervisory control and
acquisition data (SCADA) telemetry systems, E-911 systems and the like. The invention
also utilizes host network elements that are found in cellular radio telephone systems,
personal communications systems (PCS), 3G multi-format wireless telephony standards,
big Leo mobile, Little Leo, geo synchronous, publicly switched telephone networks
signaling system seven (SS7), Local Multi-point Distribution Service (LMDS), Teledesic
satellites, global positioning systems (GPS) satellite navigation system, ISM spread
spectrum 2-3-2.4GHz technology, 200 kHz EDGE high-speed data technology, high speed
EGPRS packet technology and the like.

Description of Related Art

The birth of digital packet data communications technology in the late 60’s and
70’s occurred when the first successful transmission of digital information was made over
ARPA-Net: the birthplace of the internet world wide web (WW) between two mainframe
computers. The next important event occurred when a data packet was transmitted
between two computers via a wireless radio channel at the University of Hawaii. This
event marked the birth of the Aloha Net, the first wireless packet data network. Since the
Early 70’s wireless packet data has exponentially grown, and simultaneously evolved into
an endless array of wireless data communications platforms. Today there are many types
of wireless data packet formats, and just as many wireless and wireline data
communications pathways to transport packet data. There is much talk in the Wireless Press and mass market media about wireless internet services, such as wireless e-mail, text messaging and the like. Proportionately little is said about one of the most important areas of wireless data communications: Telemetry data and supervisory control and data acquisition (SCADA) management systems.

Wireless telemetry data is the dirty workhorse of wireless telecommunications technology. Wireless telemetry is little black boxes with antennas sticking out of them. Stuck off in factories while keeping track of a plurality of application systems: set inside commercial security systems, traffic control systems; wireless telemetry terminals are little robotic brains that keep it all together. Today with few exceptions wireless telemetry data systems tends to mimic the protocols, processes that reflect a technical adaptation of conventional wireless terrestrial trunked radio systems such as: cellular, personal communications systems (PCS), trunked mobile radio, specialized mobile radio (SMR) and packet radio networks. Also included are space segment and ground segment satellite networks with all its myriad of wireless data communication modulation schemes and packet data formations.

The invention is based upon a synthesis of key theoretical elements drawn from a multiplicity of disparate resources. One resource drawn upon here occurred as a culminating event in 1948. Dr. Claude Shannon a Bell Labs theorist and engineer published a paper based upon a concept called “Information Theory.” Like Maxwell’s Theorem that essentially defined electromagnetism and thus made radio and telephone communications possible, Shannon’s Information Theorem enabled all electronic data communications. From the internet and digital television to wireless telemetry data: all is made possible because of Shannon’s work. One of the tenets of Information Theory is that the content of the information is irrelevant. Information Theory converts all electronic based information into quantifiable elements called binary data. Zeros and Ones are the discrete units that define what most observe in the technological reductionist universe that dominates current communication system design thinking.

As Shannon said: “These semantic aspects of communication are irrelevant to the engineering problem: The significant aspect is that the actual message is one selected from
a set of possible messages. The system must be designed to operate for each possible selection, not just the one which will actually be chosen, since this is unknown at the time of design.” This concept is a cornerstone that makes possible the inventions linear wireless telemetry data packet communication “join-in-mechanism,” in the same channel space and the fuzzy logic based route “bucket brigade” relay spread spectrum wireless telemetry data packet protocol technology that transpires in a singular telemetry data communications event. The invention extends the fundamental concepts of Information Theory for beyond what has come before in wireless telemetry data. The invention creates an electromagnetic-wireless-data-telemetry-organism that operates in inter-dimensional fractals of data in a telemetry metaverse that behaves in a predicted yet randomly applied protocol that acts dynamically in a malleable per event basis without impacting the conventional purpose of the selected host wireless or wireline telecommunications network.

There have been many attempts throughout the history of wireless telemetry data to create efficient and low-cost wireless telemetry data communication systems. However most contemporary wireless telemetry data communication systems are but adaptations of conventional wireless and wireline telecommunications platforms that were originally designed to support voice communication services. These conventional wireless and wireline based telecommunications platforms have evolved into mature, robust and reliable systems that are at the same time costly mechanisms for wireless telemetry data. How can wireless and wireline networks that were originally designed to support heavy voice traffic handle lower tier telemetry data efficiently and remain cost effective? The invention provides the solution with its pioneering means and methods.

The invention provides the means, the method and the apparatus to enable efficient telemetry data communications within the network elements of a plurality of host network platforms. These networks include but are not limited to analog and digital: trunked mobile radio systems, cellular radio telephone, personal communication systems (PCS), EDACS Trunked Mobile Radio, Motorola iDEN Trunked Radio, specialized mobile radio (SMR), enhanced specialized mobile radio (ESMR), trunked paging systems, narrow band two way paging systems, Motorola Flex paging and cable television/broadcom networks. The invention provides the means to specifically serve the needs of telemetry data
applications in innovative and improved means and methods provided by its unique protocols and telemetry data system management.

The invention’s unique forward and reverse telemetry data channel protocols, operate seamlessly with its novel Universal Synchronized Packet Radio-Telemetry Data Management Hub means and methods. The system can be easily implemented and made operational without significant changes to host network infrastructure, and the conventional voice and data traffic it currently supports. Further, the inventions means and methods will operate within all private access, public access, and commercial access trunked radio systems, SMR dispatch, ESMR (Nextell). These systems include specialized roamer trunked radio networks, two-way paging networks, narrow band PCS based two-way paging, Motorola Flex Paging Protocol two paging networks, and specialized roamer paging networks.

The invention also enables a completely innovative approach to providing USPR telemetry data protocols for analog cellular networks, and digital cellular networks, digital personal communications systems (PCS), Global System for Mobile (GSM), Local Multipoint Distribution Service (LMDS), and mobile telemetry geo-synchronous satellite networks. Other satellite systems that can use the inventions USPR telemetry data protocols include geo synchronous (GEO), low earth orbit, (LEO) medium earth orbit (MEO), high earth orbit (HEO) and ellipsoidal orbit (EO), maritime satellite networks, aircraft control wireless communications networks, space segment data communication networks, public transportation system management networks, motor vehicle traffic management networks, wireless space craft system management networks, undersea submarine data communications networks and VSAT/USAT satellite networks can also the invention’s USPR network CDTMA protocols and act as the enabling wireless and wireline mediums between the inventions novel USPR hub, and the inventions unique wireless telemetry data communications and management terminals.

The inventions specialized CDTMA telemetry data management protocols for it’s dynamic FTMC forward channel scheme, and RTMC reverse dynamic channel use scheme truly enable a revolutionary approach for robotically controlled automatic telemetry application specific data devices. These application specific telemetry data
devices are used for SCADA based synchronized terrestrial and space segment radio system applications that the invention USPR telemetry data network model enables. The invention is unique in the wireless data telemetry, and data communications world. The invention provides immediate technical adaptation and public benefit to mobile trunked radio systems such as utility communication systems, public safety communication systems, law enforcement and other such public service trunked radio communication systems. The invention’s CDTMA telemetry data system manage protocols will operate efficiently, and without interfering with conventional voice and data traffic.

Traditionally, trunked radio systems are those which share a small number of radio channels among larger numbers of users. The physical channels are allocated as needed to the users who are assigned reverse radio channels. The users only hear units on the same logical channels. This uses the available resources more efficiently since most users do not need the channel 100% of the time. The term “trunking” has its origins in the Telephone Industry. For over 100 years, the lines between telephone exchanges have been shared between customers. In early telephone exchanges, operators would call an adjacent exchange and patch through a call when a customer was located there. The operator just selected the next circuit that was idle and not in use. Now the allocation is automatic but the result is the same. For example, overhead control channels in analog and digital cellular and PCS essentially operate in this same fundamental way.

Physical radio channels and their assigned frequencies have been shared mediums since the early days of radio. In the early days of radio operators would have to listen to a particular frequency to determine if it was in use. Early mobile telephone systems similarly required a customer to find an inactive channel manually. These systems were upgraded by hardware and software that could find a vacant mobile-telephone channel automatically, and by two-way radios with sub-audible (CTSS) tone equipment. This equipment was available in the 1950’s. In the 1980’s, microcomputers brought a revolution in this access control procedure to both trunked mobile radio and cellular mobile telephone. A real computer could be put inside a mobile two-way radio and a cellular communications terminal. Today digital cellular and PCS handsets have more sophisticated circuitry, firmware and software inside, but the technical mission is the same as shared radio. Both trunked mobile radio and cellular systems have a central-computer
that manages the system. Like cellular mobile switching centers (MSC) and its network management medium called the SS7 network, and radio-cellular control channels, the trunked mobile radio control center communicates with the mobile radios via an overhead data signal. Like cellular, trunked mobile radio supports telephony interconnections from conventional PSTN originated calls to trunked mobile radio repeaters that relay the calls to and from mobile radio communications terminals. Trunked mobile radio networks support DID, DOD, DTMF, MF, MF1, MFC, dial pulse and dial click and other in-band and out-of-band signaling. Most of these analog and digital trunked mobile radio networks support T1, E1, ISDN and frame relay interconnections and connectionless voice and data messaging, and efficient call routing. Therefore, these networks are perfect enabling host wireless network platforms for the inventions revolutionary means, methods and apparatus.

When a trunked mobile radio user wishes to talk with someone on the same reverse channel, the user simply presses the microphone (PTT) or handset talk button. The trunked mobile radio then sends a data signal to the controller located at the mobile radio control center requesting the assignment of a specific reverse voice/traffic channel. The controller located in the control center (CC) responds with a physical reverse channel number. In digital TDMA or CDMA trunked radio and an assignment of time slot or coded slot in the frame slot of a logical trunked radio traffic channel occurs. The requesting mobile radio switches back to receive long enough to “hear” this information. At the same time, all the other mobile radios see the same data. Those with the same logical channel selected, follow to that physical channel. They use that channel just like any other two-way radio would. Trunked mobile radio control centers (CC) are similar to cellular network mobile switching center (MSC) in that both manage all inbound and outbound user traffic.

These mobile radio systems use repeater-base stations, because they repeat the same set of allocated channel bands in a typical operational footprint area. In a cellular network environment, each base site reuses frequencies that are assigned to that network. However these cellular frequencies are not repeated in adjacent base site cells. For example in a 400 hundred base site cellular system physical channel frequencies are repeated a total of approximately seven times. The plot plan of each cellular network is designed to spread out base sites with the same frequency assignment. Therefore, when a
cellular base site is assigned a set of channel frequencies by the FCC the cell operating adjacent to its footprint is using yet another set of assigned frequencies in order to avoid cross-talk and other obvious radio propagation frequency collision phenomenon.

In a typical trunked mobile radio scenario the base station transmits from a base station that is located on a tall tower, a mountain top or tall building in an urban environment, over the base frequency or channel. The mobile radio units listen on that frequency but transmit on another frequency paired with it. This scenario is quite similar to cellular network operations. When a cellular radio user requests service by dialing a directory number and presses the send button. What results after authentication and other procedures are completed, is a full duplex voice channel assignment. Once the control channel assignment and activity is complete, and voice channels are assigned, they are routed from the serving base site to the associated mobile switching center (MSC) and then routed to the called party or calling party. In a trunked mobile radio environment the mobile radio listens to the base station frequency or channel, it transmits on the mobile frequency and repeats the audio tone onto the base station frequency paired with it. Thus any mobile radio unit that can hear or detect the base station can detect all other mobile radio which the base station detects. These repeaters extend the mobile-to-mobile coverage. The repeater base station infrastructure will enable the inventions capabilities without having to change repeater configuration in order to enable the inventions protocol means and methods. The same is true for the cellular, PCS and mobile satellite version of the inventions USPR telemetry data management network means and methods.

Trunked mobile radio utilizes several frequency ranges that have standard separation between the base station and mobile frequency pairs. In the 851-869MHz range, the mobile radio units transmit exactly 45 MHz lower that the base station utilizes 806-824 frequency ranges. The 900 MHz band uses a 39 MHz separation for example, base stations transmit in the 935-940 MHz band and the mobile radio units transmit on the 896-901 MHz band. On the 450 MHz band, the mobiles transmit 5 MHz higher, base stations at 450-455 or 460-465 MHz and the mobiles at 455-460 or 465-470 MHz. Because the relatively slow data throughput rate demands of the invention telemetry data protocol, and the ample channel separation of host mobile radio channels, intersymbol interference on adjacent channel cross talk will not be a problem when using these mobile
radio frequency bands. In conventional two way paging networks intersymbol interference creates many problems for installed AMR applications where nodal density high. For this reason, Trunked mobile radio, analog and digital cellular, specialized mobile radio (SMR), enhanced specialized mobile radio (ESMR) and telephony base satellite networks are better suited for supporting wireless data telemetry than the Motorola’s two way Flex paging, Flexen, and other such silly attempts at providing networks for wireless telemetry data. However the inventions means and methods can dramatically improve these two way paging networks when configured for supporting USPR wireless telemetry data CDTMA protocols.

Like cellular networks and PCS, Motorola trunked radio systems utilize a channel assigned as the forward control channel. The control center (CC) controller sends data over this channel at 3600 baud to 9,600bps. However these channels will support significantly higher data throughput rates, if managed properly. Like cellular forward overhead control channels (FOCC) some transmit continuously. The trunked mobile radio control channel has a raspy sound with some detectable variations. The inventions forward telemetry message channel (FTMC) has similar control features. However it all transmits data payload, command and control, authentication, network time coding, radio DSP synchronization, radio communication telemetry terminal (RCTT Unit) identifiers, application codes, RCTT Unit reverse or mobile radio channel access assignments, RCTT Unit programming codes, checksum, and other pertinent application specific control information. Also the inventions forward telemetry management channel (FTMC) does not have to transmit continuously, and can be dynamically transmitted upon the need the application point of use (APU) and the application specific wireless telemetry data group devices that must be managed. Because all access is essentially robotically controlled, the FTMC can transmit at key time-of-use period in a dynamic fashion in order not to interfere with conventional voice and data traffic and the management of this traffic. This dynamic-use scenario is also used for the cellular, PCS, LMDS and mobile satellite versions of the USPR telemetry data management networks means and methods.

In trunked mobile radio networks there are up to 19 more channels used for voice. One or more of these voice channels is used dynamically by the inventions reverse message telemetry channel (RTMC) data protocols. Channel usage and allocation is
completely dynamic for it is controlled from the USPR networks telemetry data management hub. The USPR hub is interconnected via public or private trunks or satellite VSAT back haul to mobile radio control centers. The conventional control center uses a computer based controller that assigns physical channels of the actual repeaters on demand, and sends out a control word that tells the mobile radio unit which specific channel is assigned to which repeater. The information is transmitted continuously during a conversation so when a mobile radio is turned-on or automatically initialized it can join in. The invention uses and exploits this venerable mobile trunked radio “join-in” feature. Unlike cellular and PCS, there is no need to differentiate user conversations like a wireless and wireline telephone networks need to do. Conversely the invention adapts this join-in feature in a revolutionary way for any telephony based cellular, PCS, narrow band PCS, mobile satellite, Geo satellite, LMDS networks and cable television/broadcom networks.

Local Multipoint Distribution Service (LMDS) for example is a broadband radio-frequency service. Application service providers (ASP) typically transmit and receive signals that might be voice, video or conventional data traffic such via internet access. The LMDS signal is transmitted over terrestrial antennas that have a range of about 5 kilometers. Users receive the LMDS signals on parabolic antennas that measure about 12 inches in diameter. LMDS is an interactive service. It can handle telephony and video programming, as well as data services such as internet access using a modem with speeds up to 550,000 bps, which is 19 times faster than conventional dialup modem, which manages data speeds at a typical 28,800 bps. Existing ASPs could use LMDS for a number of possible applications: distance learning, telecommuting, telemedicine, video conferencing, cable television, metropolitan area local area network (LAN) interconnection and many other undiscovered areas. One undiscovered area is wireless data telemetry. The invention integrates its USPR telemetry data CDTMA protocols with the LMDS operational scheme. LMDS operates in the 28GHz and 31GHz band. The invention occupies only a small bit of bandwidth for the transmission of its CDTMA: FMTC and RTMC protocols. Therefore LMDS can be used to communicate with the inventions RCTT Units and RCTT Unit mini-hubs in the same means and methods as envisioned for other host wireless communications networks that are detailed in the body of this disclosure.
The F.C.C. as allocated two LMDS licenses per metropolitan and rural service area called Block A and Block B. This bandwidth allocation scheme is essentially the same as the cellular model, whereby the service is broken up for market competitive areas. Block A is allocated 1150MHz of bandwidth: 27,500-28,350 MHz, 29,100-29,250 MHz, and 31,075-31,225 MHz. Block B is allocated 150Mhz of bandwidth: 31,000-31,075 and 31,225-31,300 MHz. When the invention’s CDTMA FMTC and RTMC telemetry data protocols are implemented and deployed in host wireless networks such cellular, PCS, Satellite, LMDS and trunked mobile radio networks for example, the FMTC channel manages each of then inventions RCTT Units in the following way. In a trunked mobile radio network the invention utilizes the conventional join in feature by essentially broadcasting forward access instruction sets and other pertinent authorization coding on the FMTC channel. The FMTC therefore sends join in or access instructions to RCTT Units that have been instructed to passively “listen” to the currently assigned FTMC channel. The inventions data listening feature is actually not listening at all in the traditional sense that is commonly understood by most trunked radio technicians. The RCTT Unit is designed to operate in three general capacities. A master mode (MM) whereby an RCTT is first called, by broadcasting its I.D. and address/user data over the FTMC of the trunked radio network. When the RCTT unit responds to master mode (MM) instruction sets or invoke parameters, it first transmits its own telemetry status packets.

Once the RCTT unit that is set in master mode (MM) and its telemetry data transmission is complete, it then transmits unique signaling data communications RTMC sub set protocols in an intermittent burst transmission scheme based upon the instruction sets contained in the FTMC program, time code orders and RTMC transmission schemes. The RCTT Unit in master mode (MM) transmits SAT tone or other in-band control signaling to the currently serving base station in order to maintain integrity in the assigned channel until other RCTT Units are ordered to transmit their SAT tone signaling and data packets in the same assigned channel space. The serving base station relays the information to the USPR telemetry data management hub host via the mobile radio control center. Then, the other RCTT units that have been listening to the FTMC on the same frequency channel are ordered to join-in upon receiving a specifically coded and designated “join in” order, by bursting their status packets ordered by the FTMC in a carefully synchronized and time coded sequential burst fashion. The result? One RCTT
Unit at a time sequentially joins-in as ordered by the USPR hub, which controls the FTMC transmission of data dynamically in real time. This same process and procedure operates in cellular, PCS and mobile satellite networks with some variation in the telemetry data event set up and tear down protocol procedure.

Along with the master mode (MM) another important set-of-modes is the inventions RCTT Unit’s passive sniff mode (PSM) the active access mode (AAM). Both modes are set by instructions contained in the FTMC address/user data that is uniquely assigned to each RCTT Unit. What is important here is that each mode enables full synchronizing, and time code alignment instruction set recognition by each RCTT unit that is being broadcast to on the FMTC. When an instruction set or access order is received by an RCTT unit via the FTMC the unit also receives a specific host wireless network radio channel frequency designation for voice/traffic access and service. A designated RCTT Unit is also given a command or instruction data bit increment that is associated and follows to its unique 10-64 character identification code respectively. This I.D. code precedes the reverse channel assignment order, and all other RCTT Unit orders and program instruction sets.

The channel assignment order also contains a host DSP route instruction that actually causes the RCTT Unit to copy the code and enter it into the firmware and software of its micro controller. The RTMC packet will therefore be pointed to a specific DSP host address when it is contained in a telemetry status response or heartbeat message. Each host DSP address is located at the inventions specialized USPR hub, and this depends upon its data processing traffic handling capacity. This unique hub facility is connected to any host wireless network that supports the inventions USPR-CDTMA protocol based telemetry services by a preferred host wireline interconnection enabled by a public or private provider. Access provided by the preferred wireline carrier can be configured in a permanently assigned multiple access (PAMA) scheme, or demand assigned multiple access (DAMA) scheme and this depends upon actual or projected packet loads.

The inventions multi party data information join-in feature is like any other party line conversation where multiple parties participate in a group conversation. To maintain
order each person has to know when the other person is finished talking, before he or she joins in. If all people talked at once the conversation would produce chaos. The same model applies with the inventions telemetry data packet management protocols and procedures. The inventions novel processes and protocol procedures guarantee that only one RCTT Unit will transmit its application specific status data packet burst at a time over the same assigned RTMC channel space that other RCTT Units will share during a multi RCTT Unit telemetry data communications event. Each RCTT Unit RTMC status response data packet will have a data payload capacity of 250 bytes, 500 bytes and 2 Kilobytes. For example using a data throughput rate of 9,600 Bps and using DSP sub-modem protocols, a 2 kilobyte single packet or concatenated packet stream can be transmitted from the RCTT Unit to the inventions data management DSP based host under three seconds of total event duration. All USPR network access and control is enabled remotely from the USPR hub facility. No manual user access is allowed this feature alone enables an incredibly efficient means of managing host network resources with the least amount of negative impact due to fraud or other unauthorized access attempts.

Today some trunked mobile radio systems have reported to more than 20 channels in operation through a given base station-repeater network. There are normally only four frequencies known to a conventional HF/VHF/UHF trunked portable communications mobile radio unit. There are typically four channels used for control channel operations. When a mobile radio is turned on, it searches those four frequencies for the available control channel data stream. Once that is found, the mobile radio then scans for a control word containing the reverse traffic channel it is tuned to, or to be assigned to. Since the control center (CC) controller can tell the mobile radio communicator to go to any reverse channel in the band. Adding or changing channels at the base station or repeater site can be done at the control center (CC) controller without re-programming all the mobile radios. This process is similar to how cellular manages its traffic channel assignment processes. Adding reverse channel designations is done by dynamically reprogramming each mobile radio needing the new channel. The invention fully exploits these features.

In fact the inventions USPR hub and its network management subsystems and the like provide protocols that are used to cause the inventions modified trunked mobile radio based RCTT Unit to respond to frequency change commands via the FTMC concatenated
data packet stream. The FTMC packet stream acts in conjunction with commands sent to the trunked mobile radio control center (CC) via specialized out-of-band or in-band signaling based instruction sets. The Inventions RCTT Units modified mobile radio firmware and software is designed to enable automatic channel frequency changes originating from the USPR Hub once initial access and traffic channels are assigned. In fact the invention is the first to utilize control channel application specific protocols data (CCAD) over the four or more analog or digital control channels of trunked mobile radio such as Ericsson’s EDACS and any of the aforementioned Motorola analog or digital trunked mobile radio control channels. These channels are used for system management at the trunked mobile radio control center (CC) and at all selected trunked mobile radio repeater base stations.

The inventions RTMC telemetry status response data packet is designed to carry all current trunked mobile radio repeater frequencies. When the trunked mobile RCTT Unit is in passive sniff mode (PSM), scans all known frequency ranges assigned to the host trunked mobile radio network and listens detects which channels are occupied at what time and relays the channel information to the USPR hub via currently used wireline network. With this busy or idle trunked mobile radio channel assignment information, the inventions USPR hub can know what channels are currently available for FTMC and RTMC telemetry data traffic. In fact many RCTT Units can continue to communicate application specific telemetry status data packets in an interleaved time division multiple access scheme, as in an on going data conversation during a PSM data listen event. An interleaved telemetry data packet based conversation is also controlled by the USPR hub’s DSP host. The DSP host system manages both FTMC and RTMC data payload packets that are bi-directionally routed by a specialized programmable telephony switch and further interacts with a special telemetry based message storage stack (MSS) that is controlled by the host system.

The invention also utilizes public and private wireline and wireless networks owned and operated by public agencies and private corporations. For example, Pacific Gas & Electric (PG&E), a utility operating in Northern California owns and manages approximately 13,000 fiber-miles, over 400 physical route-miles in that State. In addition, PG&E owns and operates 5,700 route-miles of 315 microwave links, operating over three
hundred and sixty four sites in Northern California for the support of the delivery of
electricity and gas to its customers. Furthermore, this 400 route-mile of fiber and 5,700-
route miles of microwave links are installed over Northern California interconnecting
other electric and gas utilities in Southern California, Oregon, Nevada and Arizona. In
addition to the microwave radio and fiber optic systems, PG&E has licensed from the
Federal Communications Commission (F.C.C.) mobile and portable full duplex voice
capable radio frequencies. These radio bands include 37 48MHz band licenses, 321
150MHz licenses, 260 220MHz licenses, 258 450MHz licenses, 414 800MHz licenses,
219 900MHz licenses throughout the State of California.

The invention utilizes all of these trunked mobile radio, and SMR channel
frequencies for its novel Code Division Timed Multiple Access (CDTMA) synchronized
digital telemetry data packet radio protocols that are designed especially for wireless data
telemetry. Typically, these utility based conventional mobile and trunked mobile radio
channel frequency are frequency modulated (FM) and utilize a frequency shift keyed
(FSK) analog channel modulation scheme like analog AMPS, TACS and NMT cellular
radio channel frequencies. Furthermore each specific trunked mobile radio frequency uses
full duplex upper and lower side band channels that can be used optionally to extend the
inventions means and methodology.

In two-way trunked, non-trunked mobile radio systems, and analog cellular
systems the use of FM has a number advantages. First of all FM mobile radio and cellular
almost always supports robust voice-audio communications. Like analog cellular channels,
these mobile radio FM channels will support V.35, and V.36 data modem protocols. These
data protocols are ideal for low band VHF, hi-band VHF and UHF frequency bands.
Conventional mobile radio bands typically support 1200bbs, 2400bps, 4800bps and
9600bps data throughput rates. Analog cellular represented by the American Mobile
Phone System (AMPS), Nordic Mobile Telephone (NMT) and Total Access System
(TACS) use FM as a modulation scheme and FSK for analog bandwidth and data
management. Like trunked mobile radio, cellular provides wideband channel deviation
from 5KHz to 30KHz. However the limitation of analog cellular is that its wireless
terminal transmit power levels are limited from 0.6 watts to 3 watts. However, this limited
power level limitation is offset because a cellular base station supports up to 55 full duplex voice channels and three duplex data or control channels, one per cell.

Like trunked mobile radio version of the inventions USPR telemetry data network, the cellular versions dynamically assigned FTMC channel assigns each cellular based RCTT Unit and RCTT Unit mini-hub its own reverse channel RTMC designation. This action is dependent upon whether or not the terminal has been ordered to report its application specific status by the USPR hub. The RCTT Unit is therefore ordered to “join in” on the USPR telemetry data party line in a burst transmission scheme. The inventions approach creates a revolution that provides a unique cellular, paging network, PCS, LMDS, trunked mobile radio, SMR, ESMR and satellite based virtual telemetry data management network. Today in cellular there are many organizations attempting to cash in on telemetry data services. These heretofore disclosed technical approaches at present are nothing more than patch work attempt to deliver effective and low cost telemetry data. Solutions such as circuit switched cellular, limited control channel data solutions, cellular digital packet data (CDPD) and the like, fall short of what is severely needed in the world today. The invention delivers the solution. The cellular, PCS and trunked mobile radio versions of the USPR telemetry data network means and methods offer the same data packet payloads for delivery of data to and from the cellular and PCS versions of the RCTT Units, and 250byte, 500byte and 2kilobyte data packet payloads on the reverse and forward cellular or PCS channel that will support the inventions RTMC protocols.

The invention also provides a digital version of the USPR CDTMA FMTC and RTMC protocols that will operate in the GSM TDMA, Interim Standard (IS) 54, IS-136 and wideband W-TDMA, W-CDMA, CDMA 2000, GSM-CDMA-3G convergence hybrid, and universal-3G wireless operational standards. The efficient nature of the cellular or PCS versions of the USPR telemetry data virtual network will use relatively small amounts of host network element resources. Also the inventions means and methods will in no way interfere with conventional cellular, PCS, 3G voice and data traffic. The invention creates an incredibly flexible and robust wireless data telemetry data protocol that will revolutionize cellular, PCS, 3G and trunked mobile radio utility, and network flexibility without having to change any of the infrastructure. Depending on how many cellular or PCS RCTT Units are deployed in a given base station footprint, any RCTT Unit
can be the lead or master mode (MM) terminal that in fact leads the other RCTT Units in that base station area. Each RCTT Unit is remotely programmable to operate in the trailblazing Master Mode (MM). The invention also uses the electrical power infrastructure as host network messaging medium. There are technologies that enable internet access, internodal communications using building wiring and the like. Instead of cellular and PCS, the inventions RCTT Unit, and RCTT Unit mini-hub can back haul FTMC and RTMC packet streams to the USPR Hub using one way and bi-directional electrical power infrastructure. Such companies as Nortel switch manufacturers and the like produce a technology that enables bi-directional messaging via electrical power lines and commercial and residential building wiring. The invention completely exploits this technology.

This novel approach will support hundreds of cellular and PCS based RCTT Units that are attached to and integrated with stationary or fixed application specific devices such as electrical power meters and residential and commercial security systems. This approach saves precious host cellular or PCS or trunked mobile radio network resources by eliminating time consuming call set ups and tear down procedures that are required for each conventional circuit switch telemetry data communications terminal operating in the world today. The cellular or PCS version of the inventions USPR telemetry data messaging network creates a new standard in wireless data telemetry.

Trunked mobile radio handsets, typically transmits in power increments from 5 to 50 plus watts and have other advantages over cellular and PCS networks, especially for rural telemetry data applications where cellular and PCS do not have broad and effective coverage. Also effective irradiated power (ERP) levels for cellular voice and data terminals range from 0.6 watts to 3 watts for handheld and motor vehicle mounted terminals. While utility mobile radio infrastructure supports fewer physical channels at each base station in comparison to cellular, the inventions novel CDTMA concatenate synchronized data packet protocol uses selected host trunked mobile radio telecommunications networks with maximum efficiency and radio bandwidth management in mind. The invention’s USPR telemetry data messaging network is completely managed and controlled from its unique USPR Hub. In fact, the air-interface standard supported by the host wireless network is transparent to the inventions USPR hub. Therefore it makes
no difference if the RCTT Unit is trunked mobile radio, cellular, PCS or satellite based. The invention mainly utilizes concatenated telemetry data packets for its FTMC and RTMC protocols. Base station radios have been tested, and the findings have revealed that cellular, PCS, trunked mobile radio networks, LEO satellite networks, RAM Mobile Data, and Ardis network radio channels perform better if they transport multiple-concatenated smaller data packets during a data event cycle. Optimum packet sizes that range from 100 to 500Bytes, instead of one larger 2Kilobyte packet for the same application specific event cycle. Also host radio networks tend to handle concatenated smaller packets better than larger packets because of marginal power levels of terrestrial base stations and satellites. Its one thing for a radio signal to operate in theory, it is still another matter when a radio signal operates in a real propagation environment. By using smaller data packets that are concatenated in strings, USPR telemetry data communications events will have a much better margin of successful completions.

Furthermore, the invention converts these trunked mobile radio, cellular and PCS channels, into forward and reverse channel telemetry mediums without having to modify or upgrade conventional base station radios, control centers (CC), mobile switching centers (MSC) and other infrastructure related network elements on per event basis. The key-enabling component of this architecture is the usage of an RCTT Unit in master mode (MM). These trunked mobile radio channels can be permanently allocated for the inventions means and methods. Or they can be dynamically converted for one telemetry data packet event cycle at a time, and returned to the former conventional state upon completion of the respective USPR telemetry data event cycle as is the case for cellular and PCS host network protocol operations. The invention creates a new mobile radio band data packet technology that will operate elegantly on all mobile radio, cellular and PCS channel frequencies. These radio channels are designated as Forward Telemetry Management Channels (FTMC) that support telemetry data traffic, and Reverse Telemetry Management Channel (RTMC) that support telemetry data traffic. This duplex telemetry data traffic is also transported, routed and managed from and to the mobile radio base stations, cellular base stations, and PCS base transceiver station using the PSTN telecom switching, utility based telecom switching, fiber optic and microwave line-of-line repeater infrastructure.
Another distinct advantage that the invention efficiently exploits is based on the fact that electrical power utilities nationwide own and leases nearly all the mountaintops where most radio towers exist today. Also, what is interesting is that cellular, PCS and SMR carriers have to obtain access rights from the utilities in order to place their base sites and other wireless nodes. Television broadcast stations, and other radio networks also use the utility-owned land on the mountain tops. Furthermore, if need be the utilities can add mobile radio channels at these trunked mobile radio base station repeater sites if increased telemetry data traffic demand rises significantly. All the inventions RCTT Units invoke USRP telemetry data network access in a predictable and automated fashion.

USPR telemetry data management network access is completely controlled and managed from the inventions USPR hub that constantly, or periodically transmits the forward concatenated synchronized data packet protocol that govern all telemetry data traffic activity. Therefore, the invention creates a robotic like control approach to all its RCTT Units and the integrated application devices that are controlled and communicated with by the USPR network. No manual user can randomly access the USPR network. All RCTT Unit-access is managed with complete automated control. The inventions USRP telemetry network is the first data telemetry communications network that has the potential to be deployed on a nationwide footprint using completely inter linked trunked mobile radio, cellular, PCS and mobile satellite telecommunications networks that are all ready in place and operating.

Cellular base sites typically transmit at a 100 watts which is more than sufficient. However the cellular terminal transmit power level creates serious limitations for wireless telemetry units operating in rural areas. Cellular radiotelephone is based on a frequency reuse scheme that the inventions means and methods exploit in urban areas where cellular and PCS are readily deployed. Typically an analog AMPS cellular base site will have up to 55 duplex voice channels allocated and up to three duplex control channels. Because these channels are used primarily for commercial voice and data services, low level wireless telemetry communications are simply not practical and cost effective for use in these networks when control channel data or circuit switch is used to support wireless telemetry. One reason is that the low-level price structure cannot effectively compete with cellular voice, circuit switched data, and other related services. Also there are serious limitations on forward overhead control channel (FOCC) capacity and data variability.
The USPR telemetry data management network approach makes more sense because it designed specifically for wireless data telemetry. The inventions USPR network does utilize conventional voice communication services but also does not interfere with mobile radio, cellular or PCS voice communications in any way. Therefore the capacity advantages of cellular radiotelephone networks is truly not an advantage for conventional wireless data telemetry services. The inventions trunked mobile radio USPR network for public utilities uses privately owned infrastructure operated by organizations that have vested interest in using the inventions technological advantages. Public utilities will use the USPR network for the purpose of monitoring and controlling commercial, residential, and rural electrical power meters, gas meters, propane tank meters and water meters. While channel allocation is much less for utility mobile radio, in comparison it to analog cellular, the invention maximizes its capacity with its unique CDTMA concatenated synchronized telemetry packet radio protocol, that in fact is used for all cellular and PCS networks.

For trunked mobile radio the invention transmits and receives its low-level synchronized concatenated packet protocol via multiple trunked mobile radio FM channels and side-band channels simultaneously with conventional utility personnel voice traffic that is transpiring on adjacent channels. Because conventional utility personnel traffic is so low, these utility telecommunications networks are ideal platforms for the transport and bidirectional delivery of the invention’s data protocols, systems and services. The invention’s telemetry data traffic will not interfere with conventional usage.

Since most of the USPR network telemetry applications are stationary and will always be placed in a fixed predictable radio propagation environment, telemetry data communications should remain consistently robust throughout the USPR virtual network footprint. This fixed application specific approach is also advantages for cellular, PCS, and mobile satellite applications. USPR also supports robust management of stationary application specific embedded systems. An embedded device includes vending systems, utility meters, home appliances, factory assembly equipment, point-of-sales, copiers, fax machines, and gambling units and the like. The inventions RCTT Unit mini-hub can also be used to control home appliances, factory systems, copiers and the like. In these
environments, the backend of the RCTT Unit mini-hub can be used for access to IBM’s Global Services network that controls embedded systems via the internet. The front end of the RCTT Unit mini-hub will communicate with and control the inventions ISM 2.4GHz nodes, and the inventions ISM 2.4GHz operating in ISM master-mode while being controlled and communicated with the internet via TCP/IP protocols or other such internet based communications protocols. The invention’s USPR telemetry data management network will also support application specific mobile-telemetry-services (MTS). Such mobile applications as GPS tracking, automobile anti-theft and recovery, automotive system diagnostics, road side assistance, car door unlock, flashing lights for location in a Parking lot, emergency 911 response, and other such mobile telemetry data services. The invention even enables effective and secure wireless gaming and gambling terminals designed for casino gambling, river boat gambling and other such activities.

Private and public utilities typically own vast private telecommunications networks that are typically underutilized. These utility networks can be used to control stationary application specific embedded systems. PG&E for example, a large public utility operating in Northern California has a voice telephone network. The network currently consists of 10 tandem switches, six combined tandem private branch or business exchanges (PBX) and 121 standalone PBXs that will support the inventions synchronized packet protocol on the backend and support robust transport to each control station and utility radio base site on the front end. PG&E Gas Transmission Company, a subsidiary of PG&E also owns similar telecommunications systems in Oregon, Washington and in Canada where PG&E is interconnected for the delivery of gas. Furthermore, almost all electric, gas and water utilities in the U.S., Canada and Europe operate similar networks that the invention combines to create its regional and national footprint USPR network. The public utility network is coupled with commercial cellular and PCS USPR based telemetry data management networks via the inventions unique telemetry data management facility. Because of deregulation, these systems can be used and combined together to support the invention’s Universal Synchronized Packet Radio network (USPR). Furthermore, the invention combines these utility networks with cellular, PCS, and mobile satellite analog and digital control channel, authentication channel, and digital traffic channel telemetry data technology that creates an incredibly omnipresent, low cost fiber optic, wireline, and wireless data telemetry network providing incredible diversity and flexibility.
The RCTT Unit provides synchronized half duplex, time division duplex (TDD) and full duplex packet radio protocols that communicate directly with the heretofore mentioned utility trunked and non-trunked mobile radio base station/repeater transmission towers. The RCTT Unit trunked mobile radio, cellular and PCS unit is essentially a specially modified off-the-self radio-card or core. These universal, trunked mobile radio HF/VHF/UHF and cellular and PCS radio cards have digital signal processor (DSP) capabilities. The inventions CDTMA protocols will also operate seamlessly within TDMA based GMSK, and CDMA based OQPSK/BPSK digital traffic channel modulation schemes and there are radio cards available that will support the invention’s CDTMA digital compatible protocols. The invention’s protocols and procedures can be configured to support the invention’s synchronized telemetry data packet radio protocol with little or no modification to the conventional trunked mobile radio, cellular and PCS radio card firmware and software. Motorola, Marantz, Ericsson, Nokia, Johnson, G.E., Uniden, Kenwood and others manufacture these radio cards and at a low cost and are well developed and flexible in their configurable software.

Therefore the invention provides these unique synchronized telemetry data packet protocols and telemetry communication services without having to provide a completely new radio set that has to adhere to FCC type approval and other costly processes and procedures. These existing trunked mobile radio HF/VHF/UHF/FM transceivers are designed with many useful, modifiable, and manipulatable features. The invention exploits these features is such as way as to create a new paradigm in terms of providing the optimum wireless telemetry data performance from these conventional trunked mobile radio terminals. Such terminal/transceivers the ICOM IC-W32A Dual Band FM transceiver, and the Kenwood TH-G71A FM Dual Band Transceiver have numerous features that the invention innovatively manipulates and uses. These transceiver/terminals have selectable frequency step; 5, 10, 12.5, 15, 20 and 25kHz, in that FM channel bandwidth in conjunction with selectable bands HF/VHF/UHF, enable flexible data throughput rates. These frequency step settings and selectable band capabilities can be automatically control via the USPR hub and the inventions CDTMA-FTMC-RTMC concatenated data packet and exception report data stream protocols.
There terminals also have DTMF telephony dial-up, DID, DOD and other capabilities that can be used to route CDTMA packet streams to and from the RCTT Unit/mini-hub when it is designed around the radio and firmware and software management system embodied in these conventional trunked mobile radio transceiver. The essentially takes these heretofore disclosed off-the-shelf conventional trunked mobile radio transceivers, modifies the firmware, software and DSP system to operate as RCTT Unit and RCTT Unit mini-hubs. Other features the invention uses are band scan, program scan, memory scan, call scan; time-operated and carrier-operated scan stop modes in order to facilitate efficient time-of-use telemetry data packet transmissions and the like.

The RCTT Unit mini-hub receives and transmits unique telemetry data packet protocols without interfering with conventional based voice and data traffic that is currently operating on the conventional cellular, PCS, mobile satellite and trunked mobile radio frequencies from its backend portion. This backend is managed by the integrated RCTT Unit mini-hub internal digital radio computer based controller. This same controller manages multiple wireless telemetry nodes, up to 72 from on RCTT Unit mini-hub that communicates in a hoped frequency scheme via unlicensed FCC PART 15-802.11 compliant devices in the ISM bands and other spread spectrum bands and protocols on its front end. The invention uses multiple spread spectrum enabling standards. One that it utilizes is the industrial open standard 80CS1 spread spectrum protocol. However the invention modifies it radically and uniquely to maximize allocated frequencies and ISM nodal data capacity and operational flexibility, thus extending the current limit of eight ISM slaves nodes in one group, to 72 nodes or more controlled by eight ISM mini hubs, in groups of eight. In turn the spread spectrum 2.3-2.45GHz node operating in master-mode are controlled by the inventions RCTT Unit mini-hub that utilizes up to eight ISM spread spectrum transceivers. The invention is the first technological wireless data platform that is designed specifically for telemetry and SCADA while using existing wireless and wireline infrastructure, without modifying said infrastructure.

This ISM-spread spectrum based protocol was originally designed to enable inside building telemetry and SCADA control of, local area networks, wireless computer peripherals, wireless home devices, automotive applications, SCADA applications, cordless telephone communications, and other embedded system control. The invention
extends the ISM PART 15-802.11 compliant spread spectrum means and methods into its wireless RCTT Unit mini-hub protocol scheme. This protocol in fact creates a microcosmic mini-cellular system that operates within a larger or macrocosmic-cellular telephone system, PCS, trunked mobile radio, LMDS, in-building LANS, satellite, mobile dispatch, SMR, ESMR, GSM-CDMA-3G hybrid, narrow band two way paging systems and the like. The inventions wireless RCTT Unit mini-hub can be used to route real time high speed video and voice information for conferencing, and managing and routing surveillance CCTV video camera, and back-ending the video information to a common collection point via the internet world wide web (WWW). The inventions RCTT Unit min-hub can utilize any chip based controller systems such as Bluetooth™ chipsets, Siliconian™ chip sets, and PRISM™ chip sets in conjunction with key firmware modifications in the inventions RCTT Unit mini-hub architecture. In fact the invention can utilize its own application specific integrated circuit (ASIC) chipset that can be Java based or any other serial data pump application specific technology such as Aptola Jcan and the like.

Like a conventional telecommunications switching platform, the RCTT Unit mini-hub behaves like a microcosmic intelligent-hot-programmable wireless switch. Today in the Telephony Art switch classes of service (COS), translation and call/data packet routing tables have to be updated off line. The invention’s RCTT Unit mini-hub as switch is programmable while the switch is “hot” and fully operational. Like all telephony switches, packet routers and the like the inventions mini switch is synchronized by a master primary resource signal (PRS). PRS is based upon Universal Coordinated Time (UTC) that is synchronized with GPS satellite timing. This PRS signal is embedded in the backend base band signal being sent from the USPR network hub. The PRS is further transported via the preferred host wireline carrier T1/T3 network that supports DSO/DS1 PSTN protocols.

The PRS is relayed and transported through the host wireless networks forward voice or traffic channel via the CDTMA time code (TC) data bit fields embedded in the inventions FTMC concatenated telemetry data packet streams that operates within the modulation scheme of the dynamically assigned host wireless voice/traffic channel. The invention adds telemetry data management capabilities to these host networks without having to upgrade or add to any the conventional infrastructures. Each ISM spread
spectrum 2.4GHz node is controlled via data protocols that are transmitted from the RCTT Unit mini-hubs front end-baseband system. This front-end system also delivers command and instruction sets, synchronization, and operation programs to the attached application specific devices over these spread spectrum 2.4GHz ISM bands via the inventions ISM snap shot-mirrored 2.4GHz spread spectrum frequency hopped forward and reverse ISM channel concatenated data packet protocols.

The RCTT Unit mini-hub can control all of the 2.4GHz ISM application telemetry data nodes via the inventions embedded autonomous algorithms that maintain the application specific systems without having to be constantly instructed from the inventions USPR telemetry data management hub and FTMC channels. However, the baseband backend is controlled by continued or dynamically event driven periodic commands and instructions, synchronization and program updates that are originated from the USPR hub. Conversely, the spread spectrum 2.4GHz ISM nodes, and ISM 2.4GHz operating in mini-hub master mode (MM), route relay (RR) mode, and end node mode, report to the RCTT Unit min-hub via the reverse channel or return path of the 2.4GHz ISM frequency that is dynamically assigned by the RCTT mini-hubs CPU micro-controller on a per event basis. The RCTT Unit can decide to act autonomously based upon previously received USPR network hub instruction sets and operation programs, and pole the host wireless networks dynamically assigned FTMC channel for RTMC access instruction setting and status periodically. Then upon USPR network access approval, the report status from one or more of the selected spread spectrum 2.4GHz ISM application specific telemetry data nodes to the USPR network hub transpires via its host network elements in a single USPR telemetry data management event cycle.

The inventions RCTT Units coupled with the 2.4GHz ISM nodes in fact create a microcosmic telemetry data spread spectrum cellular system within a system. The invention creates a fundamental change in the means and methods of managing wireless data telemetry and other SCADA related services. The invention therefore adds significant capacity and essentially transforms portions of conventional trunked mobile radio, non-trunked mobile radio, cellular, PCS-CDMA-TDMA-GSM 800-900MHz, PCS-CDMA-TDMA-GSM 1750-2200MHz, paging networks, GEO satellites and mobile satellite networks without changing any of the conventional network element configurations in
these host selected networks. For example the inventions USPR telemetry data management network can be used for marine security, tracking, and cargo tracking applications on conventional VHF/UHF marine/mobile frequencies. VHF has greater range up to 50 miles, compared to 10 to 15 miles for cellular and PCS. The USPR network means and method would be ideal for VHF marine offshore telemetry data communications. The invention can provide hybrid VHF, S-band and L-band Inmarsat and other LEO compatible RCTT Units and mini-hubs. This is an important feature so that when a vessel sails beyond the range of terrestrial based VHF and cellular USPR based communications, the RCTT Unit could switch to LEO satellite frequencies that support USPR telemetry data management protocols.

Regardless of the host network platform, the inventions USPR telemetry data management facility controls all network synchronization via its Global Position Satellite (GPS) cesium clock Primary Reference Signal (PRS) that synchronizes all forward packet protocols being transported on the FTMC channels with time code updates. The data transmission scheme is essentially a continuous concatenated data packet architecture that is similar but markedly different than cellular forward overhead control channel data packet (FOCC) streaming. However the inventions FTMC transmits telemetry control data with complete data bit and data character flexibility that is not possible in forward control channel technology today. Furthermore the inventions protocols are completely fraud proof because the FTMC coupled with the inventions USPR hub completely governs all network access and packet flow. The FTMC channel provides the RCTT Unit with RTMC channel assignment and channel re-assignment on the fly in order to off set possible over loads in terms of telemetry data event duration and to correct failures of host network base site and repeater performance. This feature is used to extend the RCTT Units program and address/user data capabilities that contain and use unique identifier codes, command and control, and radio firmware and software programming.

The inventions protocol means methods are also transported via the public switched telephone network (PSTN). The PSTN allows for complete interconnection and integration of the USPR network with existing host analog cellular, PCS, trunked mobile radio and mobile satellite network management centers. In this way the invention creates a virtual telemetry data network within the structures of conventional wireless and wireline
telephony and trunked mobile radio networks on an unprecedented scale. The inventions
USPR telemetry data management hub interconnects and utilizes the worldwide signaling
system seven (SS7) networks, and completely utilizes interim standard (IS) 41 (A, B, C,
D) and all future SS7 IS-41 type automatic roaming related networks. This is especially
novel for DTMF telephony based trunked mobile radio and non-trunked mobile radio data
packet routing procedures.

The invention uses special application specific nodes that are tangentially based on
the open frequency hopped protocol known as 80C51. These nodes communicate in the
unlicensed and licensed spread spectrum ISM2.3-2.45GHz bands. The invention modifies
this spread spectrum technology in unique and innovative way that utilize its means and
methods in the most efficient and cost saving ways possible. The 2.4GHz ISM spread
spectrum nodes use a frequency hop based protocol that is controlled by its transceiver and
is effectively applied to circumvent interference and fading. A shaped, binary FM
modulation scheme is applied to minimize transceiver complexity. The gross data rate is
typically 1MB/s. A time division duplex (TDD) scheme is used for full duplex
transmission. The spread spectrum baseband protocol is a combination of circuit and
packet switching. Slots can be reserved for synchronous packets.

The synchronous frequency hopping clock is completely synchronized with the
inventions USPR PRS code that is delivered via the FTMC channels. Each packet is
transmitted and received via a different hop frequency. A packet nominally covers a single
slot, but can be extended to cover up to five slots of gross data capacity, depending on data
payload needs of that application specific data telemetry event need. The invention uses
this ISM packet capacity in a store and forward-handoff from node to node scheme
mirrored snap shot scheme. The inventions ISM terminal scheme can support an
asynchronous data channel, up to three simultaneous synchronous voice channels, or a
channel that simultaneously supports asynchronous data and synchronous voice link.
However the invention will utilize this voice link channel capacity and modify it for data
only, since all of its intended application specific uses will be data only for the sole
support of wireless telemetry with some exceptions. The asynchronous channel can
support an asymmetric link of maximally 721 Kbps in either direction while permitting
57.6 KBPS in the return direction, or a 432 Kbps symmetric link. However, the inventions
USPR system protocol will always need be completely synchronized in order to maintain efficient host network bandwidth management. Furthermore the spread spectrum base band radio clock synchronization will be controlled the inventions USPR networks Primary Reference Source (PRS) master timing system and operates and synchronizes all USPR wireless and wireline based network elements.

The spread spectrum frequency hopped base band radio front end portion of the RCTT Unit mini-hub terminal manages a link controller protocol that is uniquely synchronized to the inventions PRS master timing system. This PRS signal is received from the USPR network FTMC-CDTMA packet protocol in the form of time code data bit fields that extends this synchronization to The 2.4GHz nodes. The 2.4GHz nodes are arranged and inter linked in the USPR virtual networks via a piconet scheme whereby all application specific 2.4GHz nodes are arranged in an ad hoc fashion.

These spread spectrum devices are peer units and identical in terms of implementation patterns dictated by the topological scheme of all telemetry related application specific devices that are operating in a selected application point of use (APU). However, when establishing a piconet and the inventions extended piconet, one or more spread spectrum 2.4GHz nodes can act as in master mode and the other(s) as route/relay (RR) nodes and end nodes. Depending upon the radio propagation characteristics of a selected APU all nodes can be assigned to operate in master mode, route and relay mode and end node on a per event basis. One RCTT Unit mini-hub can be configured with up to eight separate spread spectrum radio transceivers that act as spread spectrum front end controllers with each managing up to eight ISM 2.4GHz nodal groups or piconets.

The ISM PART 15 baseband radio coupled with the inventions RCTT unit’s spread spectrum transceiver front end air interface protocols will also support a scatternet topology. Scatternet topologies support multiple independent and non-synchronized piconets, however the UPSR network will require that all application specific 2.4GHz ISM nodes in the scatternet be completely timed coded to its master PRS. during all non-autonomous telemetry data communications that transpire on the UPSR network back end frequencies. This important feature is necessary so that one 2.4GHz ISM application specific telemetry node and its attached application specific device can be controlled from
the inventions USPR network telemetry data management facility and communicate efficiently beyond the conventional limits of conventional spread spectrum 2.3-2.45GHZ node control capacity.

Today there are many digital cordless telephones that operate in the ISM 2.4Ghz bands. For example Panasonic Corporation’s model KX-TGM240 cordless phone has a range of up to one mile. Users can travel up to one mile away from the plug in base station before losing the ISM 2.4GHz signal. The inventions ISM 2.4GHz nodes, ISM 2.4GHz mini-hubs, ISM 2.4GHz master mode (MM) nodes and ISM 2.4GHz route/relay (RR) nodes also have an effective range of up to one mile. That is, one of the inventions spread spectrum node can be one mile away from another node or RCTT Unit mini-hubs embedded spread spectrum transceivers. The inventions eight and nine node groups, piconets, or scatternets can have an effective range of up to eight to nine miles from RCTT Unit mini-hub to the end node in the group or net. This creates an effective and flexible application specific data telemetry microcosmic cellular system.

The USPR/ISM PART 15 operations scheme supports both point-to-point and point-to-multi-point connections. Several application specific piconets can be established and linked together ad hoc while maintaining accurate synchronization with the UPRS PRS timing signal that is continuously, or intermittently transmitted on the forward broadcast channels. This topological schemes works well because each piconet is identified by a different frequency hopping sequence. All 2.4GHz ISM application specific duplex-communication nodes, that are communicating on the same piconet are synchronized to this hopping sequence which is controlled and synchronized by the RCTT units internal PRS clock, that is originally synchronized by the USPR telemetry data management hub via the host trunked mobile radio, cellular or PCS network. This important synchronization is maintained even when the RCTT unit mini-hubs back end base band radio is in passive sniff mode (PSM) and is only receiving periodic PRS clock time codes from the inventions FTMC synchronized data protocols.

Furthermore, the invention’s data protocols and procedures can support agricultural and industrial robotic controls for the control and management of manufacturer apparatus, heating and air conditioning control (HVAC), mobile irrigation
control apparatus, electrical water valve servos, oil pipeline flow controls, industrial robotic systems, large parameter security applications, agricultural area security and other related applications. Mobile applications such as automobile anti-theft and recovery. Unique emergency 911 responses and other related applications are also supported. The invention also supports farm and construction equipment telemetry tracking and management. However the inventions USPR network is designed mainly to support and serve the needs of fixed or stationary wireless telemetry applications worldwide.

In order to efficiently manage the inventions unique synchronized USPR virtual network there is provided a unique Code Division Timed Multiple Access (CDTMA) concatenate-packet radio protocol that is continuously or periodically transmitted on the forward channels of host network forward radio frequencies. This approach is completely tailored for wireless data telemetry. The RCTT Unit is continuously provided with synchronization, data payload, user data-addressing delivery, authentication, cyclic redundancy check (CRC) verification on received reverse status response channel packets, checksum coupled with identifier codes, RCTT Unit RTMC channel assignment, and command and control of all integrated application specific telemetry devices. RCTT Units are designed to passively sniff the forward USPR broadcast channel in order to maintain synchronization when the RCTT Unit is in sleep or standby mode. In some applications where source power is limited, this sleep mode is an important feature.

The invention provides for the integration of IS-41B+ SS7 automatic roaming protocols for trunked mobile radio networks that supports USPR virtual telemetry data network services in a completely novel and innovative way. Furthermore this will allow RCTT Unit telemetry data to be transported over the same public and private networks that are used by cellular, PCS and mobile telephony satellite networks. The inventions IS-41/SS7 automatic roaming solution is used for providing bi-directional data links to trunked mobile radio networks that are supporting the inventions USPR telemetry data management network means and methods throughout the world. These trunked mobile radio networks are typically linked via the heretofore disclosed microwave line-of-sight, fiber optic and T1/T3 trunked data links. The invention also provides SS7/IS-41B+ data links and automatic roaming protocols over the heretofore disclosed utility telecommunications networks that utilize microwave line-of-sight, fiber optic and other
telecommunications infrastructure as an SS7 TCAP and MAP 70 byte data packet transport.

Another important aspect of the invention is that the USPR network scheme can be interfaced with specialized Wireless Local Loop (WLL) cellular, PCS, trunked mobile radio and mobile satellite wireless communications networks that serve fixed telemetry application specific devices and services in urban, rural and other remote areas around the world. Today there is a great effort in the U.S. and Canada to build out extensive analog and digital trunked mobile radio networks that operate in the 800MHz and 900MHz bands. Also these support voice, text, and data communications in full duplex means and methods. Therefore the invention utilizes the best of both worlds of trunked mobile radio on the forward channels, and cellular control signaling, and voice-traffic channels for reverse telemetry data transport and management. Another advantage of using analog and digital cellular and PCS control channels and digital traffic channels is that cellular and PCS uses a frequency reuse scheme at each base site. Trunked mobile radio has sever limitations for reverse channel access, especially in highly concentrated urban environments where both radio systems have significant radio propagation penetration.

In rural service areas the invention's USPR telemetry data network is perfect for utility mobile radio, microwave backend support and fiber optic networks are ubiquitous. In many rural area cellular and PCS simply does not supply adequate service.

**SUMMARY OF THE INVENTION**

Accordingly, it is an object of the invention to provide a unique microcosmic digital wireless telemetry data network that is in fact an overlay of a specialized code division timed multiple access (CDTMA) bi-directional wireless telemetry data protocol. This protocol operates seamlessly as a means and method of providing an elegant, simple yet efficient and low cost universal synchronized packet radio wireless telemetry data system network. The inventions CDTMA protocol operates in the following conventional trunked radio and satellite networks: host analog and digital cellular, IS-95 CDMA, IS-136, IS-136 Plus-high speed, wideband PCS, IMT-2000/3G, GSM-CDMA-3G, GSM 115bps general packet radio service, CDMA 2000, CDMAOne, CDMA Quicknet
Connect, narrowband PCS, Cellular Digital Packet Data (CDPD), Personal Handy phone System (PHS), analog and digital cordless telephone network systems and the like.

Additional systems and standards the inventions USPR network uses and innovates as host networks include: analog and digital trunked mobile radio traffic/voice channels, and trunked mobile radio control channels; that operate with frequencies that range from 50MHz to 900Mhz. Other systems include analog and digital: Motorola iDEN Digital Trunked Radio (SMR), Nextel Enhanced Specialized Mobile Radio (ESMR) Ericsson EDACS mobile trunked radio networks, Mobitex packet radio, RD-LAP Trunked Radio, Uniden Trunked Mobile Radio, Johnson Trunked Mobile Radio, G.E. Trunked Mobile Radio, Trunked Mobile radio using specialized LTR means, methods and protocols. Motorola Flex two way paging trunked networks, one way paging trunked networks, Ardis packet radio networks, RAM packet radio networks, Metrocom packet radio networks, Cellnet packet radio networks, American Mobile Satellite Networks, Geo Synchronous Satellite networks that support paging such as Skytel mobile satellite, Big LEO, Little LEO, Orbcomm LEO satellite systems, Elippso, LEO One, Globalstar LEO, Iridium LEO, ECCO 1 LEO, VITA LEO, Teledesic LEO satellites, LMDS networks and trunked mobile radio networks that use physical voice channels, digital traffic channels, analog control channels, digital control channels, satellite beacon channels, authentication channels and other such mediums. The invention enables its USPR telemetry data management network without any need to add to or change host network infrastructure or disruption to existing conventional user, voice, data, authentication and control traffic.

It is an another object of the invention to fully utilize existing public and privately owned and operated telecommunications networks such as public; electrical, gas and water utility systems and the like that include; microwave line of sight network nodes, fiber optic Sonet based fiber optic networks, and trunked mobile radio networks with allocated frequencies specific to a selected public or private utility company. These can networks support the inventions unique CDTMA wireline and host wireless network protocols that communicate bi-directionally with the inventions RCTT Unit stand-a-lone terminals, and the inventions RCTT Unit mini-hubs.
It is another object of the invention to provide a radio communications telemetry terminal (RCTT) Unit mini-hub that combines through innovative circuit design, firmware and software design: F.C.C. licensed, and unlicensed spread spectrum: direct sequenced, frequency hopped FSK or BPSK techniques to produce an FSK or BPSK signal, data chirp and other spread spectrum hybrid modulation schemes. These spread spectrum schemes communicate digitally with specialized: Metrocom compatible spread spectrum nodes, Cellnet compatible spread spectrum nodes, and unlicensed 2.3-2.45GHz nodes that communicate bi-directionally with the RCTT Unit mini-hubs spread spectrum baseband front end transceiver(s) signal and data packet processors. In this way the RCTT Unit is in fact a wireless mini-hub-microswitch that manages up to 72 spread spectrum nodes in a given application point of use (APU) like a cellular mobile switching center (MSC) switch that manages a plurality of base sites that reuses assigned radio spectrum.

The inventions spread spectrum terminal/nodes are akin to cellular, and PCS base sites, in that the inventions RCTT Unit mini-hub manages these unlicensed and licensed ISM 2.4GHz 80C51 compatible and licensed Cellnet packet radio, and Metrocom packet radio and the like network compatible spread spectrum frequencies with the inventions compatible spread spectrum terminal/nodes by assigning spread spectrum frequencies/channels, thus creating, transmitting and receiving connectionless based spread spectrum protocols for wireless spread spectrum telemetry data terminal/node (SSTD): forward channel; broadcast asynchronous paging/polling, forward channel node/terminal programming, asynchronous reverse channel status response exception reporting, asynchronous paging acknowledgement reporting, asynchronous heartbeat reporting.

The inventions RCTT Unit mini-hub manages these spread spectrum terminal/nodes by assigning frequencies, creating, transmitting and receiving connection based spread spectrum protocols for wireless spread spectrum telemetry data terminal/node (SSTD): spread spectrum forward telemetry management channel (SS-FTMC); concatenated synchronous paging/polling data packet streams/bundles, SS-FTMC node/terminal programming via concatenated data packet streams/bundles, synchronous spread spectrum reverse telemetry management channel (SS)-(RTMC) concatenated paging/polling response data packet streams/bundles, spread spectrum reverse telemetry
management channel (SS-RTMC) concatenated status/response data packet streams/bundles, SS-RTMC concatenated acknowledgement/heartbeat data packet streams/bundles and the like. The inventions spread spectrum telemetry data protocols are managed by the RCTT Unit mini-hub in a demand assigned multiple access (DAMA) scheme, or a permanently assigned multiple access (PAMA) scheme that is compatible to the inventions connectionless and connection based protocols spread spectrum telemetry data protocols.

Thusly, with the RCTT Unit mini-hub, the invention creates a microcosmic application specific telemetry data cellular spread spectrum frequency reuse network; that manages and assigns all spread spectrum frequency channels to specialized spread spectrum application specific telemetry data terminal/nodes; within an existing macrocosmic: analog and digital cellular, wideband PCS, narrowband PCS, trunked mobile radio network, one way paging network, two way paging network, big LEO satellite network, little LEO network, high earth orbit (HEO) satellite network, medium earth orbit (MEO) satellite network, geosynchronous (GEO) satellite network; base site, base station, repeater station, and selected satellite boresight and radio propagation footprint.

The RCTT mini-hub is configurable as mini-hub-concentrator that acts as a mini cellular switch that in fact manages all spread spectrum public and licensed frequencies that support cordless telephones, and 2.3-2.45GHz application specific operating nodes in the field. The invention creates a highly efficient microcosmic wireless cellular telemetry data management technology that operates in complete autonomy to the base band backend network such as cellular, PCS, mobile satellite, and trunked mobile radio networks and the like. In fact the invention converts conventional wireline and wireless voice and data networks into wireless data telemetry networks without adversely effecting or changing conventional host network element configurations, and data and voice protocols. Said networks support and transport the inventions USPR-CDTMA: FTMC and RTMC, and SS-FTMC and SS-RTMC protocols without disruption or conflict with the conventional host network data and voice traffic.
In still another object of the invention, the RCTT Unit mini-hub concept can extend into the internet world wide web (WWW) whereby the mini-hub back end is interconnected to the internet via an RS-232 interface. The RCTT Unit mini-hub communicates with the spread spectrum nodes via the 2.4GHz frequency hopped bidirectional medium, and sends and receives TCP/IP protocols via the internet utilizing e-mail and other means to send application specific telemetry data status reports from the mini-hub to an ASP, conversely receive TCP/IP based instruction sets from the ASP via the internet. These instruction sets are further relayed to the spread spectrum ISM 2.4GHz nodes. Also the invention provides 80C51 instruction set compliant RCTT Unit mini-hub, instruction set compliant baseband spread spectrum baseband modem functions that provide frequency hopped spread spectrum, and direct sequence spread spectrum protocols. Direct sequence spread spectrum ISM band protocols operate in MSK on the air modulation schemes. The invention provides the means and methods of controlling and communicating with up to 72 ISM 2.4GHz nodes from one RCTT Unit mini-hub in a unique and elegant way using direct sequence, frequency hopping and data chirp algorithmic procedures.

Another object of the invention is to provide a unique Universal Synchronized Packet Radio Telemetry data management hub facility USPR Hub. This USPR Hub facility completely manages all forward and reverse data telemetry concatenate and non-concatenate data packet streams, concatenated paging packet streams, asynchronous FTMC programming and paging packets, and RTMC exception report packets that are sent to and from the invention’s RCTT units that are operating in any application point of use (APU). These packet formats and protocols operate seamlessly regardless of the particular platform characteristics of the host wireless and wireline communications network. A key feature of the USPR Hub is that it can manage the invention’s CDTMA-FTMC-RTMC protocols simultaneously in exponential algorithmic fashion in any of the heretofore, and aforementioned wireless and wireline systems disclosed.

Another object of the invention is to provide the invention’s CDTMA-FTMC-RTMC protocols simultaneously in exponential algorithmic fashion utilizing the Lojack motor vehicle anti-theft and recovery network and national and international trunked mobile radio and non-trunked mobile radio public for safety networks operated by a
multiplicity of police agencies. The Lojack network typically utilizes FCC assigned frequencies allocated for police agencies for motor vehicle anti-theft and recovery means and methods. The invention significantly improves upon Lojack’s current conventional network protocol means and methods.

Another object of the invention’s CDTMA-FTMC-RTMC and SS-FTMC and SS-RTMC protocols and supported data packet protocols simultaneously in exponentially distributed connection based and connectionless based algorithmic processes and procedures utilizing a Cellnet spread spectrum utility network and or a Metrocom network. Accordingly, the invention also provides a unique electrical and gas meter co-located integration of its spread spectrum nodal system to support a multiplicity of application specific services. This nodal system creates a microcosmic wireless telemetry data system using Cellnet’s and Metrocom’s network for the host wireless and wireline network for the backend base band managed and control the USPR Hub and RCTT Unit mini-hub. The RCTT Unit mini-hub manages the unlicensed and licensed spread spectrum frequencies using the inventions means, methods and algorithmic procedures. The nodal system in conjunction with the RCTT Unit mini-hub and the USPR Hub manages the inventions unique motor vehicle and personnel tracking system.

Another object of the invention is to provide the means and methods for managing application specific telemetry data nodes that operate in public and privately designated spread spectrum frequency bands. The inventions spread spectrum nodes enable bi-directional digital data communications with application specific apparatus that are integrated with said nodes such as: electrical pre-pay service, point of sales (POS) terminals, gambling terminals and the like.

Another object of the invention is to provide its heretofore-disclosed CDTMA telemetry data management protocols in LMDS networks.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate a preferred embodiment of the invention and together with a
general description given above and the detailed description of the preferred embodiments
given below, serve to explain the principles of the invention.

Fig. 1, is a logical block diagram of the USPR Telemetry Data Management
Virtual Network protocol, according to the invention.

Fig. 2, is a logical block diagram of the USPR Telemetry Data Management
Virtual Network protocol, according to the invention.

Fig. 3, is schematic depiction of the RCTT Unit as mini hub-concentrator,
according to the invention.

Fig. 4, is a block diagram of the code division timed multiple access (CDTMA)
concatenate data packet protocol, according the invention.

Fig. 5, is a logical diagram depicting the USPR telemetry data management system
operating in a plurality of host wireless networks, according to the invention.

Fig. 6, is a block diagram of a synchronous concatenated multi-nodal ISM FTMC
2.4Ghz paging data communications event, according to the invention.

Fig. 7, is a logical diagram depicting the USPR ISM FTMC and RTMC protocol
communicating with a plurality of ISM 2.4GHz nodes, according to the invention.

Fig. 8, Is a diagram of the RCTT Unit mini-hub communicating and controlling
eight ISM 2.4GHz nodal groups, according to the invention.

Fig. 9, is a logical representation of a Primary Exception Reporting (PER) reverse
channel data packet, according to the invention.

Fig. 10, is a logical representation of a Secondary Exception Reporting (SER)
reverse control channel data packet, according to the invention.
Fig. 11, is schematic diagram that depicts the route/relay ISM 2.4GHz protocol means and methods, according to the invention.

Fig. 12, is a diagram that depicts an asynchronous ISM 2.4GHz broadcast frequency hopped page, according to the invention.

Fig. 13, is a depiction of two nodal groups that support multiple application specific services, according to the invention.

Fig. 14, is a depiction of a meter with an RCTT Unit installed as a portal for a plurality of application specific wireless telemetry services, according to the invention.

Fig. 15, is a depiction of a combined voice and data application specific virtual telemetry network, according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Reference will not be made in detail to the present preferred embodiments of the invention illustrated in the accompanying drawings. In describing the preferred embodiments and applications of the invention, specific terminology is employed for the sake of clarity. However, the invention is not intended to be limited to the specific terminology so selected, and it is understood the each specific element includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

Accordingly, there is provided a Universal Synchronized Packet Radio system that is designed to enable a complete wireless application specific data telemetry metaverse that can dynamically adapt, adjust and redefine itself while adapting to real world limitations and demands of any known topographical and climatic environment known to exist on the earth today. Someday, the inventions means and methods can be utilized and adapted for space stations and space colonies on the Moon, Mars and other space borne installations whereby efficient and low cost wireless telemetry data solutions will be needed. The invention enables revolutionary automated control and management of wireless data telemetry application specific devices while operating simultaneously within
conventional terrestrial wireless, wireline, and space segment host network physical infrastructure elements, and protocol limitations. The invention manipulates and adapts conventional limitations and transforms said limiting factors into tangible assets.

Furthermore, the invention completely enables a vast array of wireless data telemetry management services without disrupting or interfering with conventional voice, data, control, on-board satellite telemetry, ground station control/telemetry of satellite, and authentication traffic that is managed by these networks. The invention provides a virtual network overlay scheme that is enabled by its unique CDTMA protocol, novel host management paradigm, and complete integration of telephony, cellular, PCS and satellite based circuit switched, internet TCP/IP, unlicensed and licensed spread spectrum frequencies using conventional off-the-shelf components in completely novel and innovative means and methods. The inventions CDTMA protocol is embodied in the Forward Telemetry Management Channel (FTMC), Reverse Telemetry Management Channel (RTMC) and USPR telemetry data management hub DSP based Host protocol management facility that managed the base band backend protocols and procedures. The invention provides the means, methods and apparatus to completely communicate with and control its novel Radio Communications Telemetry Terminal (RCTT) that can be configured as an innovative mini-hub-concentrator or stand-alone application specific telemetry data terminal.

Another object of the invention is to provide RCTT Units that are configured to operate as wireless mini-hub-concentrators or microswitches. The RCTT Unit stand-alone-terminal or mini-hub is completely remotely programmable from the USPR telemetry data management host-hub via the heretofore said CDTMA protocols via selected host wireless and wireline network that supports USPR telemetry data protocols. RCTT Units can be configured and programmed to operate as a stand-alone-unit or each can be programmed to operate as a “mini-smart-switch.” The RCTT Unit as mini-switch or hub communicates with the USPR telemetry data management host on the host network backend or further communicates on the front end with spread spectrum ISM PART 15-802.11 compliant 80C51 instruction set protocol based 2.3-2.45GHz wireless nodes that are integrated with application specific devices. The invention can use any spread spectrum modulation
scheme: direct sequence, frequency hopped, or data chirped, that is used in licensed and unlicensed spread spectrum bands worldwide.

In this way the invention creates a microcosmic wireless telemetry data cellular system within the operational area of any known trunked radio platform that includes but is not limited to: macrocosmic analog and digital cellular telephony systems, PCS, mobile LEO satellite, Geo Satellite, trunked mobile radio, EDACS, iDEN, LTR protocols, LMDS networks, flex paging networks, Roamer Paging Networks, Narrow Band PCS networks, Public Safety Radio frequencies, Ardis Data Networks, RAM Mobile Data Networks, Metrocom Spread Spectrum Networks, Cellnet, Lojack Motor vehicle Anti-Theft and Recovery Networks and the like.

An application specific device can be integrated with a selected RCTT Unit in stand-alone mode, or via the ISM PART 15 80C51 instruction set compliant 2.3-2.45GHz node or other designated and selected spread spectrum management air interface protocol. The invention completely manipulates 80C51, 802.11 compliant synchronous connection oriented (SCO) protocols originally meant to support voice communications in order to enable ISM-SS-FTMC and ISM-SS-RTMC telemetry data only forward and reverse messaging and forward paging. The invention also completely manipulates asynchronous connectionless (ACL) used for conventional packets into an effective medium for enabling spread spectrum 2.4GHz based application specific exception report data packets, and connectionless ISM-SS-FTMC and forward broadcast paging data packets. An application specific device includes but is not limited to: electrical power meters, gas meters, propane tank gauges, oil well status systems, agricultural system management, irrigation systems, commercial and residential security systems, building system control management systems such as HVAC, lighting, entry access, cathodic protection, wind farms, medical supply tanks, printer/scanners, elevator system condition reporting and control toll booths, robotic toys that are integrated with the invention spread spectrum nodes that communication via visual or auditory cues via conventional television-computer monitor, WEB TV and the like.

Other application specific systems include; vending machines, copier machines, office printers, traffic control management systems, water quality management systems,
waste water management, well level monitoring, farm building management systems such as grain bin temperature control systems, tobacco holding barns, air quality management systems, earthquake monitoring, personal security, intelligent home management, and the like. Additional application specific devices include mobile systems such as; fleet management systems, motor vehicle tracking systems, global positioning system (GPS) receivers, motor vehicle anti-theft systems, motor vehicle diagnostics, emergency 911 systems and the like.

This protocol enables a completely novel Reverse Telemetry Management Channel (RTMC) and a Forward Telemetry Management Channel (FTMC). Both the RTMC and FTMC communicate with one or more RCTT Units. Each RCTT Unit is controlled by the inventions USPR telemetry data management host facility via the inventions CDTMA telemetry data management protocol, that enables the inventions RTMC and FTMC protocol operations scheme. Furthermore the invention provides a cellular system within a cellular system. In fact the invention completely changes the current paradigm in terms of how wireless data telemetry application specific systems are managed, controlled and communicated with while operating in a conventional wireless and wireline network. The service radius of an RCTT Unit mini-hub coupled with 72 or more spread spectrum nodes can vary because of local terrain and morphology as well as site specific installation characteristics. However, the invention and operates with completely chameleon like flexibility in that installation and system performance dynamics are not necessarily hampered by topographical barriers such as trees, hills, and mountains in rural settings, and tall and densely placed buildings in urban environmental settings.

Conventional telemetry networks like Cellnet, Metrocom and other wireless LAN/WAN telemetry systems are not nearly as flexible, and depend upon built out infrastructure with the usual nightmare of building out an infrastructure driven network. The invention completely utilizes existing host network infrastructure and network elements. The inventions novel internodal spread spectrum bucket "route/relay" brigade protocol, that is coupled with the complete backend USPR-CDTMA host-wireless and wireline network protocol. The inventions flexibility completely revolutionizes wireless telemetry data service paradigms. In addition to installation and APU site planning flexibility, the invention enables complete dynamic configuration flexibility. Each RCTT
Unit mini-hub and its associated assemblage of spread spectrum nodes, their radio emissions, data packet bucket-route/relay-brigade are remotely programmable from the inventions USPR hub and associated host system; in accord with APU climactic cyclical changes in foliage density, rain fall, snow fall, new building structures and the like. Spread spectrum node packet sizes are variable and maximum packet length can be set dynamically on a per event basis for a particular application specific service.

USPR spread spectrum wireless telemetry data packets range from 250 bytes to two kilobytes whether or not a given telemetry data event requires: asynchronous singular or synchronous concatenated; exception report packets, paging packets, programming packets, acknowledgement packets, heartbeat packets. Therefore packet sizes and bit pattern formats essentially remain the same.

Referring to Fig. 1, the RCTT Units firmware and software is fundamentally programmed at the factory in terms of the basic parameters of its operational functions. When an RCTT unit is delivered to a service provider/user and installed in an application point of use (APU) high level application specific and application point of use (APU) specific programming. These initial programming and configuration parameters will transpire between the USPR telemetry data management host-hub facility and the RCTT unit via the host wireless and wireline network. Once installed in a selected APU the following actions, procedures and protocol-based operations occur. Upon power up, the RCTT Unit sets itself into passive sniff mode (PSN). However, when a selected RCTT Unit is paged in a cellular or PCS environment, or the RCTT Unit detects a CDTMA Invoke or polling event in a cellular, trunked mobile radio or two-way paging, SMR, ESMR, or LMDS host network environment it scans its set frequency range for forward channel (FTMC) broadcast 50.

In some host wireless networks such as cellular, PCS and Telephony based satellite one RCTT Unit will have to be called, paged or polled first in order to establish a common broadcast point when it actualizes master mode (MM) upon initial invocation algorithmic procedures that further enables a plurality of RCTT Units to first listen for the FTMC CDTMA data packet signatures and then subsequently “join in” upon exact time coded command bit field embodied in a selected FTMC data packet. Then the RCTT Unit joins
in via the currently assigned RTMC channel. This time critical feature is necessary to enable the inventions telemetry data “join-in” feature without having to modify or add base station radio transceivers or other infrastructure specific to serving cellular, PCS, and trunked mobile radio base station, repeaters, control centers, mobile switching centers and the like.

Once the RCTT Unit is called, paged or polled it immediately scans and searches its assigned frequency range and seeks the FTMC data protocol signature 51. This condition or operational status solely depends upon whether a particular RCTT Unit is the initial telemetry terminal called, paged or polled so that it will operate in master mode (MM), or passive sniff mode (PSM). Typically if the RCTT Unit is the first telemetry terminal initialized it will operate in master mode (MM) and subsequently paged or polled RCTT Units installed in the same application point of use (APU) will operate in passive sniff mode (PSM) until they receive further instructions via the FTMC. When the RCTT Unit detects the FTMC protocol and locks onto the forward channel frequency 52 the RCTT Unit also synchronizes with its contained digital signal processor (DSP) and the unit sets its time code to the match the FTMC time code increments contained in its CDTMA time code bits generated and originated by the inventions USPR telemetry data management hub DSP host system 53. Next, the selected RCTT Unit detects its unique 10 to 64 digit or character identification number or code and awaits authentication algorithm challenge order bits 54. If the selected RCTT Unit is the first terminal in an a selected APU to be called, paged or polled it is then initialized to operate in master mode (MM) for this particular USPR telemetry data communications event. Any RCTT Unit is designed to operate in master mode (MM) if it is in fact the first RCTT Unit to be called, paged or polled in a selected application point of use (APU). However, a selected RCTT Unit does not go into full master mode (MM) until further FTMC based actions occur beyond initialization.

Once a selected RCTT Unit is called, paged, or polled and has completed the heretofore mentioned processes and procedures, further algorithmic actions occur. For example, once the RCTT Unit is synchronized and time coded by the FTMC which is sent over the selected host wireline and wireless network by the USPR telemetry data management hub facility and its embodied DSP host system, it confirms its unique
authentication challenge based upon the last received polynomial instruction set 55. This instant polynomial instruction set algorithm was last downloaded in a prior USPR telemetry data communications event received by the selected RCTT Unit. Also, the RCTT Unit does have to transmit an immediate authentication challenge response via the RTMC. Challenge response bits are embedded within the status response portion of any RTMC channel packets that are transmitted by a selected RCTT Unit. Once authenticated the RCTT Unit then detects its designated address/program data that are attached to the FTMC concatenate data packet string so designated to be detected 56. Once detected the selected RCTT Unit downloads the packet header, program address, and other instruction sets 57.

Once downloaded the selected RCTT Unit responds to received FTMC program instruction sets and performs its required functions 58. If the selected RCTT Unit’s received program instruction set order does not include an RTMC status response packet 59 it will perform the designated program instruction sets. If for example, the RCTT Unit is configured as a mini-hub-concentrator/switch it may send the received FTMC program instruction sets to one or a plurality of its ISM 2.4GHz nodes but does not access the RTMC. Actually, an incredible amount of application specific device management activity may transpire without the RCTT Unit mini-hub needing to access the RTMC channel operating in a selected host wireline or wireless network.

Referring to Fig. 3, depicted here is an RCTT Unit configured to operate as n RCTT Unit wireless mini-hub-switch 91. The mini-hub is a microcosmic reflection of a cellular, PCS mobile switching center (MSC), or trunked mobile radio control center switch (CC). The RCTT Unit mini hub is broadly comprised of a front end 163 that contains firmware, software, controller units, radio transmitter and receivers to support spread spectrum 2.4GHz telemetry data internodal communications. The front-end components manage and control base band spread spectrum frequency hopped algorithms, and synchronization schemes. The spread spectrum front end also manages bi-directional circuit and packet switched instruction set and status response packets that contain condition reports of the application specific device that is in fact attached and integrated with the selected spread spectrum 2.4GHz application specific telemetry communications node.
In Fig. 3, the RCTT Unit min-hub front-end radio communicates with each spread spectrum 2.4GHz node 158 in the unlicensed PART 15 band. A frequency hopped transceiver is applied to combat interference and fading. A shaped, binary FM modulation scheme is applied to minimize transceiver complexity. The gross data rate for example is 1Mb/s. A Time-Division Duplex (TDD) is used for full duplex bi-direction transmission of instruction set and status response application specific data packets. The air interface radio message that communicates between the spread spectrum 2.4GHz node 158 and the RCTT Unit mini-hub front end is based on a nominal antenna power of 0dBm. The air interface complies with the FCC rules for the spread spectrum ISM band at power levels up to 0dBm. Spectrum spreading is accomplished by frequency hopping in 79 hops displaced by 1 MHz, starting at 2.402GHz and stopping at 2.480GHz. The maximum frequency hopping rate is 1600 hops/s. The nominal air interface link range is 10 centimeters, but can be extended to more than 100 meters by increasing the transmit power. The invention extends this range by providing selected spread spectrum 2.4GHz nodes 158 that communicate with up to eight embedded spread spectrum transceivers acting in master mode (MM) 243. Each spread spectrum 2.4GHz node is communicated with via a spread spectrum frequency hopped scheme.

Each hopped frequency that is designated for a spread spectrum node is considered an air interface link. The link type defines what type of application specific telemetry data packets can be used on a particular link. Some conventional spread spectrum ISM baseband technology supports two link types: Synchronous Connection Oriented (SCO) type used for voice and Asynchronous Connectionless (ACL) type used for packet data. These conventional spread spectrum ISM 2.4GHz based technologies use an architecture that joins master-slave pairs of the same piconet that use different link types, and the link type may change arbitrarily during a spread spectrum ISM data packet transmission event. Each link type supports up to sixteen different packet types. Four of these are control packets and are common for both SCO and ACL links. Both link types use a TDD scheme for full-duplex transmissions.

The SCO link is symmetric and typically supports time-bounded voice traffic. SCP packets are typically transmitted over reserved intervals. Once the connection is
established, both master and slave units may send SCO packets without being polled. One
SCO packet format allows both voice and data transmission, with only the data portion
being retransmitted when corrupted. The ACL link is packet oriented and supports both
symmetric and asymmetric traffic. The master unit controls the link bandwidth and
decides how much piconet bandwidth is given to each slave, and the symmetry of the
traffic. Sometimes nodes must be polled/paged before they can transmit data in order to set
new frequencies if deemed necessary by the RCTT Unit mini-hub. The ACL link also
supports broadcast messages from the master mode (MM) to all other spread spectrum
nodes in the piconet. The invention eliminates much of conventional 80C51 ISM protocol
complexity. The invention system does not need conventional voice capability, and other
types of packets and packet flow variability. For the purpose of supporting application
specific telemetry data, simplicity and data packet type and flow predictability is the
preferred means and method for the invention's unique spread spectrum ISM technological
configuration and implementation. Also the invention modifies existing spread spectrum
ISM 2.4GHz data communication technology by using off-the-shelf spread spectrum
radios and ISM system controllers. The invention simply modifies the firmware and
software of these conventional ISM PART 15 2.4GHz systems to support USPR telemetry
data management and communications.

The invention eliminates the voice portion of the conventional ISM specification
except for digital voice based CODEC data packets and thus utilizes this voice capacity to
support SCO based application specific telemetry concatenate data packets. The invention
creates a route “bucket brigade” relay protocol for concatenated data packet and singular
data burst forward and reverse data packet flow. In a traditional bucket brigade scenario,
buckets of water are relayed from a line of people staring from a water source to the fire.
Typically each time a full bucket passes from one person to the next, a little water spills
out. The invention uses this relay principle to pass concatenate packet string from one
spread spectrum 2.4GHz node in master mode (MM) while “spilling” ISM FTMC and
ISM RTMC data packet information at each application specific node point. When the
RCTT Unit mini-hub 91 relays a spread spectrum ISM based FTMC concatenate packet
string from node in master mode (MM) to node set in route and relay (RR), or end node
unit, or from its embedded master ISM baseband front end transceiver(s), to a series of
spread spectrum ISM 2.4GHz nodes in master mode (MM) 243b and or individual ISM
2.4GHz nodes 158a, 158b, 158c, 158d, 158e, 158f and 158g. Each node in this route/relay event receives the entire ISM FTMC concatenate data packet string, mirrors or snap shots the portion of packet or packets that are designated for its use, and then passes the spread spectrum ISM based FTMC concatenate packet string to the next spread spectrum node in master mode (MM) hub, or other nodes until all the designated master mode (MM) nodes and receive its specified application specific data packets.

The invention also eliminates the variability of packet flow data rates, differentiation in link bandwidth in terms of what occurs in a given spread spectrum ISM session or application data packet transmission event from master to slave and visa versa. Simplicity and predictability of the inventions application specific data packet flow is greatly desired when considering the types of real world environments application specific wireless telemetry data devices operate in. Some applications require critical power source management. Solar powered and battery powered application specific implementations require critical power management scenarios. When a given data communications network is designed to manage significant changes in data rates, data packet payload sizes on a per event basis the magnitude of power consumption and network overhead rises critically. The higher complexity of given system gives rise to costly network elements, and increased magnitude of network element manufacture and failure. Wireless data network solutions must be low cost. The types of revenues realized from each application telemetry data device is small. Therefore, the invention has redesigned these spread spectrum ISM technologies to fundamentally operate at the core of their architectural simplicity. Simplicity for data networks lends to increased reliability, packet flow predictability and low cost.

The implementation of application specific wireless telemetry data systems and services operating in real world application points of use (APU) demand flexibility simplicity and predictability. The invention strictly adheres to this rule. In some implementations the invention uses small concatenated packet strings to support its specialized packet string relay based protocols that are in fact relayed from the RCTT Unit mini-hub 91 to one or a plurality of ISM 2.4GHz nodes in master mode (MM) 243 and or to one or a plurality of ISM 2.4GHz application specific telemetry data nodes 158. By using the SCO connection oriented voice feature of selected ISM PART 15 selected
technology for the purpose of transmitting and thus relaying extended concatenate application specific telemetry data packet strings, the invention enables a unique wireless telemetry data packet protocol. For example if an RCTT Unit mini-hub 91 needs to transmit an ISM based concatenate telemetry data packet string to three application specific devices is a selected piconet 45 or extended piconet 46 and 47 the following protocol flow occurs. However, the invention uses the ACL feature set to provide ISM RTMC non-predictable exception reporting capability. This is a critical feature in order to support security related applications and to enable power outage reporting for utility companies and the like. However, the same relay principle applies.

Before any connection in a piconet or extended piconet from any RCTT Unit minihub to an ISM 2.4GHz 80C51 instruction set compliant node in master mode (MM), and or to one or a plurality of ISM 2.4GHz nodes, all nodes are in standby mode. In this mode, an unconnected node-unit periodically “listens” for application specific telemetry message every 1.28 seconds. Each time a device wakes up, it listens on a set of 32 hop frequencies defined for that unit. The connection procedure for exception reporting, or for a spread spectrum ISM based FTMC or ISM based RTMC concatenated data packet string relay is initiated by any of the devices which then becomes the master for the event. An important exception to this rule is when the RCTT Unit mini-hub relays an ISM based FTMC data packet string to a selected ISM 2.4GHz sub-mini hub or node. If for example there is a plurality of spread spectrum ISM 2.4GHz nodes in master mode (MM) or 2.4GHz nodes in route relay mode, or end node mode that the spread spectrum ISM based FTMC or RTMC concatenate data packet must pass through and by relayed by in order to reach its nodal destination, these intermediate nodes remain in route relay mode or end node mode on a per event basis only.

An initial connection procedure is made by transmitting page message from the RCTT Unit mini-hub if the address of a selected ISM 2.4GHz node in master mode or other selected spread spectrum ISM 2.4GHz node is all ready known, or by an inquiry message followed by the subsequent page message if the address is unknown. In the initial page-state the RCTT Unit mini hub will send a train of 16 identical page messages on 16 different hop frequencies defined for the node to be paged. If no response, the RCTT Unit mini hub transmits a train on the remaining 16 hop frequencies in the wake-up sequence.
The maximum delay before the RCTT Unit mini-hub reaches a node is twice the wakeup period, 2.56 seconds while the average delay is half the wake up period 0.64 seconds. An inquiry message is used to find nodes with currently unknown devices. The invention will only use this feature if for some reason a specific spread spectrum 2.4GHz node has not reported as a response to a transmitted spread spectrum ISM based FTMC concatenate data packet string. Since all USPR telemetry data network spread spectrum ISM based network elements are always known the conventional ISM inquiry feature will be used only upon narrow range of application specific exceptions.

The invention uses a power saving mode which can be used for connected units in piconet or extended piconet if no status response data needs to be transmitted from one or a plurality of spread spectrum 2.4Ghz nodes to the inventions RCTT Unit mini-hub. The RCTT Unit mini-hub can put one or more ISM 2.4GHz nodes into hold mode, where only an internal timer is running. However this timer is controlled and constantly reset every time a spread spectrum based FTMC concatenate telemetry data packet string it transmitted from the RCTT Unit mini-hub from the ISM front end, that was timed and synchronized from the USPR telemetry data management networks telemetry data management hubs PRS system. This PRS time code increment is transmitted from the host wireless network that is currently serving one or a plurality of RCTT Unit mini-hubs that are in fact operating in a selected APU, utilizing the FTMC concatenate telemetry data protocol that is compatible with the cellular, PCS, trunked mobile radio or satellite that is transporting the USPR protocols from the USPR telemetry data management hub.

The inventions spread spectrum nodes can also demand to put into hold mode. Data packet transfer restarts instantly when the spread spectrum nodes transition out of hold mode. The hold mode is used when connecting several piconets and extended piconets, or managing only low power device such as a solar powered water level sensor. Two more low power modes are used, the ISM spread spectrum sniff mode and Park mode. In the sniff mode a ISM node listens to ISM FTMC traffic and ISM RTMC traffic emanating to and from the RCTT Unit mini-hub spread spectrum transceiver front end at a reduced rate, this reducing the duty cycles. The sniff mode interval is programmable and depends on the application. In the Park mode, a spread spectrum node is still synchronized to the RCTT Unit mini-hub but does not participate in the concatenated or data burst data
packet traffic. Referring to Fig. 3, in fact the inventions spread spectrum 2.4GHz node set to master mode (MM) 243, 243b by the inventions RCTT Unit mini-hub 91 and or USPR Hub 105 creates the extended ad hoc piconet approach. The invention extends the conventional piconet scheme with its unique route-bucket-brigade-relay spread spectrum protocol. Conventional ISM piconets have a maximum capacity of eight slave ISM nodes. With the use of a plurality of spread spectrum 2.4GHz nodes set to master mode (MM) 243b each controlling and serving eight or more spread spectrum 2.4GHz nodes, one RCTT Unit mini-hub 91 can control and monitor 72 individual ISM 2.4GHz nodes, with eight embedded spread spectrum 2.4GHz transceivers that communicate with up to eight nodal groups controlling these individual nodes.

One RCTT Unit mini-hub 91 can control a total of 72 integrated application specific devices when considering that eight spread spectrum 2.4GHz master mode nodes 243, 243b are also connected and controlling eight application specific devices. The invention creates an ISM PART 15 technological revolution, since the invention transforms conventional multi-service ISM PART 15-80C51 technology into a singular application specific telemetry service based technology, the limitations of 32 hop frequencies, 16 hop frequencies for paging and access are exploited and made more flexible. Because of the completely synchronized and controlled spread spectrum ISM based FTMC and ISM based RTMC concatenate telemetry data packet protocols, coupled with unique controls of communication intervals used by the ISM 2.4GHz sub-mini-hubs, and the ISM 2.4GHz nodes, 72 application specific telemetry data devices can be controlled by one RCTT Unit mini-hub.

When or more spread spectrum ISM 2.4GHz application specific nodes need to transmit an exception status report, it utilizes the Asynchronous Connectionless type interaction to support this exception report requirement. However, each spread spectrum ISM 2.4GHz node is completely synchronized with the inventions RCTT Unit mini hub 91 and the USPR primary reference source (PRS) that is continuously transmitted from the USPR telemetry data management hub 105 and its associated DSP host via a primary data link 240 from and to an LMDS node 239 controlled by the backend 164 of the RCTT Unit mini-hub 91. Another key host wireless and wireline communications network that the invention utilizes as an RCTT Unit and RCTT Unit mini-hub 91 backend support network.
is TCI’s cable television/broadcom network. Whereby the USPR Hub is interconnected to a multiplicity of cable television headends that act as collector points of the inventions RCTT Unit and RCTT Unit mini-hub that is interconnected on the unit’s backend to cable television/broadcom network at commercial and residential building electrical and gas meters. Another network is Cellnet’s narrow band 928/952MHz Utility network system. The USPR hub 105 can utilize Cellnet’s network to transport its CDTMA FTMC and RTMC concatenated packet streaming protocol to and from the inventions RCTT Unit mini-hub 91 that is configured to communicate in the 928/952MHz band allocated by the F.C.C for energy utility applications. The invention uses the Cellnet microcell controller (MCC) 376, the Cellnet cell master (CM) 375 and the Cellnet system control center 374 as a data communications transport. This data communications transport uses the internet world wide web (WWW) 124, the PSTN 93 for the inventions USPR CDTMA protocol in a DAMA or PAMA architecture. The invention dramatically improves the efficiency of the Cellnet Network with the utilization of spread spectrum 2.4GHz node(s) 158 to improve the cost effectiveness of their networks. Matter of fact, the Cellnet Network can be used to support all of the disclosed application specific services and devices. The invention uses Metrocom’s similar network in the same way. Its Ricochet and proposed high speed data communications network can be used in the same means and method as the Cellnet Network.

Referring to Fig. 3, if a selected ISM 2.4GHz node 158g needs to transmit an exception report to the associated RCTT Unit mini-hub 91, it must pole the closest ISM 2.4GHZ node 158f to detect whether or not it is busy. If not it simply relays the exception report packet to the idle node, and it further relays it to the next node until it reaches the RCTT Unit mini-hub 91. The RCTT Unit mini-hubs 91 front-end subsystem 163 contains an ISM link controller firmware and software that is designated the inventions link controller system (LCS) 44, that can be part of an 80C51 2.45GHz chipset that supports spread spectrum ISM 2.4GHz 80C51 compatible node communications. However, the invention uses other chipsets such as specialized application specific integrated circuits (ASIC) proprietary to the inventions innovative means and methods in order to enable its completely unique telemetry data communications using other spread spectrum digital communications protocols utilized by such communications company’s as Cellnet and Metrocom. The LCS manages spread spectrum ISM FTMC link set up, authentication,
link configuration, and other concatenated data protocols. Referring to Fig. 3, LCS 44 manages the sending of ISM based synchronous FTMC concatenated data packets, and receiving ISM based synchronous RTMC concatenated data packets, acknowledgement packets, heartbeat packets, asynchronous forward channel broadcasts for spread spectrum nodes, asynchronous reverse channel exception reports packets and the like.

The LCS 44 manages link address inquiries, initial ISM 2.4GHz node 158, ISM 2.4GHz node set in master mode (MM) 243, and RCTT Unit mini-hub 91, front end subsystem link connection set up. The LCS 44 also manages whether or not a specific ISM 2.4GHz node should be set in passive sniff mode (PSM), or active access mode (AAM). In sniff mode a spread spectrum2.4GHz nodes duty cycle along with power consumption is significantly reduced: it listens to the only ISM slot that contains its node I.D. The LCS designates a digital timed frequency hopped slot that contains a Particular ISM 2.4GHz nodes I.D. number. These timed slots are transmitted at regular intervals from the inventions RCTT Unit mini-hub 91, and the ISM 2.4GHz set in master mode (MM) 243. Like all ISM 2.4GHz nodes, the master mode node (MM), route and relay node (RR) and end node are completely managed by the RCTT Unit mini hub combined front end 163 and backend 164 subsystem 159 and therefore does not act independently or autonomously like the RCTT Unit mini hub 91. Also all spread spectrum nodes can be set dynamically by the RCTT Unit mini-hub 91 to operate in master mode (MM), route and relay mode (RR) and end node on a per event basis. In some instances certain nodes can be set permanently to operate in any of three disclosed modes for these aspects solely depend upon the type of applications the nodes are serving and the physical topographical characteristics of each application point of use (APU) that the nodes are operating in. The LCS subsystem 44 can also instruct and set an ISM link on hold. In hold mode, turning off the spread spectrum ISM 2.4GHz node receiver for longer periods saves power where power consumption for an spread spectrum ISM 2.4GHz node and its integrated application specific device is critical. Any application specific device can wake up its integrated spread spectrum ISM 2.4GHz node with an average latency of four seconds. This aspect is defined by the program instructions currently running within the means and algorithms of the LCS 44 firmware and software which can be set dynamically by the USPR Hub 105.
The LCS 44 can also set a selected ISM 2.4GHz node in Park or passive sniff mode (PSM) like the RCTT Unit mini hub 91, in that is does not need to communicate via the spread spectrum ISM based RTMC internodal link channel but needs to stay synchronized with the USPR telemetry data management network primary reference signal (PRS) that is maintained by the RCTT Unit mini-hub 91. In PSM the 2.4GHz node wakes up at regular intervals to listen to the ISM based FTMC internodal kink channel in order resynchronize with rest of the extended piconet 45,46, and 47 and with the application specific telemetry data devices that are in fact controlled by a plurality of RCTT Unit mini hubs and selected ISM 2.4GHz nodes currently operating in a selected application point of use (APU) 49. Furthermore, upon wake up each spread spectrum ISM 2.4GHz node set in master mode (MM) 243, and each ISM 2.4GHz node 158 listens for active access mode (AAM) instruction sets that accompany its assigned spread spectrum frequency hopped time slot that contains its unique I.D. Contained within these instruction sets maybe polling orders to report its current status via the ISM based RTMC concatenate data packet protocol along with other status response orders.

The inventions spread spectrum 2.4GHz node set in master mode (MM) 243 is capable of detecting a special ISM based FTMC concatenate packet protocol that is transmitted from the RCTT Unit mini-hub 91 and its front end sub system 163, to the first ISM 2.4GHz node 158a. When each node receives its ISM based FTMC instruction, it further relays the remaining ISM based FTMC concatenated packet string to the next ISM 2.4GHz node and or to ISM 2.4GHZ master mode node 243, 243b that is operating in a selected extended piconet 45, 46 and 47. This process depends upon how many ISM 2.4GHz nodes are included in the instant ISM FTMC accumulated concatenate data packet string.

Referring to Fig.3, the ISM based FTMC accumulated concatenated data packet protocol is transmitted from the RCTT mini-hub front end 163 to the ISM 2.4GHz master mode node (MM) 243b that resides in what would be the conventional ISM 2.4GHz node 158a. This node 158a precedes the typical ISM 2.4GHZ end node 158d with multiple extended piconeks 46,47 topological scheme. The extended piconet 46 shows that the typical end node position is occupied by the inventions ISM 2.4GHz master mode node 243b. This master mode node 243b is interfaced with its own application specific device.
while it relays command and instruction sets to another extended piconet 47 that embodies ISM 2.4GHz nodes 158f and 158g. These ISM 2.4GHz nodes are in fact configured to recognize and detect the inventions specialized ISM 2.4GHz master mode node based data packet protocol 48 that is in fact an extension of the FTMC protocol. This specialized ISM protocol is transmitted from the RCTT Unit mini hub 91 to the first ISM 2.4GHz node 158a that is operating in a selected extended piconet 45.

The ISM 2.4GHz master mode node 243b relays the inventions data packet burst or concatenated stream to the next ISM 2.4 GHZ node 158d which in fact relays the same packet protocol to the next ISM 2.4GHz node 158e that is operating is yet another extended piconet 46 that in fact relays the ISM 2.4GHz sub-mini hub protocol 48 to the next ISM 2.4GHz node 158f operating in yet another extended piconet 47. In turn this ISM 2.4GHz sub-min-hub protocol 48 is also returned to the invention RCTT Unit mini-hub 91 via the same described inter-nodal network while each application specific status response packet is added to the concatenate ISM data packet string as it passes and is relayed through each ISM 2.4GHz node 158g, 158f, and the ISM 2.4GHz master mode node 243b, the next ISM 2.4GHz node 158e, 158d, and 158a. Finally the last node that adds its status response data packet to the ISM based RTMC data string in the selected extended piconet topology returns the accumulated ISM based RTMC concatenate data packet string to the RCTT Unit mini-hub 91. By using the RTMC protocol coupled with the ISM 2.4Ghz master mode node enables a means to extend the number of ISM 2.4GHz nodes each RCTT Unit mini-hub 91 can manage efficiently.

In another important aspect, the invention does not need conventional ISM voice capabilities and uses limited asynchronous packet burst protocols for forward spread spectrum channel paging and reverse channel exception reports. Therefore the inventions uses the ISM 2.4GHz front-end means and method to manage synchronous and synchronous application specific telemetry data only communications. The asynchronous channels are used solely for nodal exception status reporting. In fact the asynchronous channels are synchronized in a defacto means. Since the RCTT Unit mini-hub, and spread spectrum 2.4GHz node are all time and synchronized, even the asynchronous channels are synchronized in a passive indirect sense because of the inherent time coding characteristics of spread spectrum frequency hopping. The entire USPR network is
completely controlled, timed and synchronized from the host DSP system located within
the USPR telemetry data management hub, all the way through the selected host wireline
and wireless network, each stand-alone RCTT Unit, each RCTT mini-hub, and each
individual ISM 2.4GHz node. All exception reports transported via the asynchronous
channels are completely clocked or timed based upon that last PRS timed code update
provided by the RCTT Unit mini-hub that communicates with the macrocosmic USPR
network.

Referring to Fig.1, while all the heretofore mentioned application specific data
activity can occur without the RCTT Unit selecting an assigned RTMC channel, often
times each unit will need to report its accumulated application specific telemetry status
response and exception report based data. For example of the selected RCTT Unit receives
an order includes an RTMC response order 60 the following processes and procedures
transpire. An important feature of the inventions CDTMA telemetry data protocol
transpires when a selected RCTT Unit has been called, or polled and is set to operate in
master mode (MM). This initial call or polling protocol event originates from the USPR
telemetry data management hub. Upon completion of paging, calling or polling, the RCTT
Unit acknowledges the call, page or polling event by transmitting its own application
specific data contained within the data structures of its RTMC protocol.

Once the inventions USPR telemetry data management hub receives this
acknowledged RTMC protocol from the selected RCTT Unit, the hub sends a page, or
polling increment to a plurality of selected RCTT Units operating in the same APU area as
the RCTT Unit operating in master mode RCTT-MM Unit. Simultaneously, the USPR
telemetry data management hub begins transmitting its FTMC protocol to all paged and
polled RCTT Units. While the RCTT-MM Unit is transmitting its RTMC protocol to a
selected base station in a trunked mobile radio environment, or selected base site in a
cellular environment, or a satellite operating in an LEO environment for example, the
other paged or polled RCTT Units have scanned, detected the FTMC and have stabilized
and locked on the frequency channel that the FTMC is transmitting over. Referring to Fig.
1, subsequently, selected RCTT Units detect the current RTMC channel designation
assignment order 61 allocated and incremented for each RCTT Unit that is configured and
operating as a stand-alone terminal that is in fact integrated with one application specific

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device. Or the RTMC channel designation order received from the FTMC is detected and
received by one or more RCTT Units configured and operating as a mini-hub that controls
and communicates with a plurality of spread spectrum 2.4GHz application specific nodes
operating in master mode (MM), route relay mode (RR) and or end node mode (EN). Next
one or a plurality of RCTT Units synchronizes with the currently assigned RTMC channel
signaling protocol that is being transmitted to the currently serving base station, base site,
LMDS node or satellite from a selected RCTT Unit-MM that is operating in a designated
APU 49 as shown in Fig. 3.

Referring to Fig. 1, when one or a plurality of RCTT Units stabilize its internal
time code algorithm, based on the time code increment received from the currently
transmitting FTMC, each RCTT Unit seizes its assigned time code increment that is being
transmitted via the currently transmitting RTMC that is in fact originating from the
currently operating RCTT Unit-MM. In fact the RTMC is algorithmically guided within
its data signaling structure by the time code increment being currently received by the
FTMC. Furthermore, the RTMC transmits its time code increment in timed digital slots if
the wireless data platform is in fact digital such as is the case with CDMA cellular or
TDMA cellular. These RTMC based signaling slots completely enable each RCTT Unit to
join in at a precise increment of timed and assigned access. In an analog cellular
environment, the RCTT Unit-MM will receive an FTMC protocol that is a DSP sub
modem based protocol that in effect creates digital slot assignments in an analog radio
transmission environment. Therefore whether or not the currently serving host-wireless
network is analog or digital, the inventions FTMC and RTMC signaling and RCTT Unit
join-in assignment feature operates in the same means and method.

Referring to Fig. 1, Therefore upon complete timed coded assignment, one or a
plurality of selected RCTT Units will transmit their RTMC status response data packets
63. Next the serving base station, base site, LMDS node or satellite receives the
concatenate RTMC status response telemetry data packet string from a selected plurality
of RCTT Units in a complete synchronous and sequentially patterned means and method
64. For the sake brevity the term base site or base station will encompass all cellular and
PCS base sites, trunked mobile radio repeaters and base stations, dispatch mobile radio
repeaters, LMDS communication transmission towers and transceiver nodes, one way
paging transmission base stations, two way paging base stations, specialized mobile radio (SMR) base stations, enhanced specialized mobile radio (ESMR) base stations LEO, satellites and the like. Next the currently serving base station relays said RTMC concatenate telemetry data packet string to the currently serving mobile switching center (MSC) or control center (CC) and the like via a primary data link 65. For the sake of brevity the term mobile switching center (MSC) and or control center (CC) shall encompass the use of the terms satellite gateway earth station (GES), LMDS headend, one way or two way paging control center switching center and the like.

Referring to Fig. 2, when the MSC and or control center receives the RTMC concatenate data packet string it immediately analyses said packet string 66. In some configurations, the term analyses is not entirely accurate. For example when the USPR telemetry data management hub transmits a call, or page via a host cellular, PCS or telephony based satellite network to a selected RCTT Unit in master mode (MM), both forward and reverse-return data packet transport paths or primary communication links have been established using conventional signaling means and methods well known to those whom practice the art. As soon as the host network assigns forward and reverse circuit switched or virtual circuit switched primary and secondary communication paths the selected RCTT Unit (MM) then transmits its own application specific telemetry status data, simultaneously transmits the specialized RTMC signaling protocol and the currently serving MSC/CC relays the RTMC status packet string to the USPR telemetry data management hub and on to its associated DSP host 67 in a bent piped routing fashion.

Referring to Fig. 2, next the USPR telemetry data management hub authenticates each application specific packet that is attributed to each RCTT Unit that was ordered to report via the currently serving FTMC channel. Authentication is accomplished via the heretofore-mentioned polynomial algorithmic process and procedure. Therefore upon reception of the complete concatenate packet string that is comprised of a multiplicity of RTMC based packets sent from a plurality of RCTT Units, the USPR telemetry data management hub separates and stores each RTMC application status response packet 68 into user data bases. Upon completion of this task the ASP receives the selected RTMC status response data packet and analyses packet for further action 70. The selected RCTT Unit monitors the currently serving FTMC concatenate data packet string broadcast for
further activity 71. The selected ASP database determines that it is deemed necessary to send page, polling or call-based query to the inventions USPR telemetry data management hub. Subsequently, USPR telemetry data management sends ASP query/order 72 to associated USPR telemetry data management hubs host DSP system. Said order is received by USPR telemetry data management hub and its associated DSP host system that relates to the inventions FTMC DSP based assemblage process that enables functional wireline and wireless CDTMA protocols. Furthermore the USPR telemetry data management hub and its associated host first authenticates and verifies the selected ASP account, and the selected RCTT Unit’s electronic serial number, identifier, and current polynomial setting that is stored in individual user data bases for each authorized RCTT Unit operating in a selected APU 73. The USPR telemetry data management hub’s authentication center 106 as shown in FIG. 5 maintains a unique polynomial and authentication challenge order setting for each RCTT Unit 94, 95, 96,100,277 and 278.

Referring to Fig. 3, once authenticated the USPR telemetry data management hub 105 assembles the FTMC concatenate packet string 88 and the host DSP 130 adds selected RCTT Unit FTMC concatenate packet 167 payload that contains programming and instruction sets 179a, in addition to the packet header which contains the 10-16 character I.D. 174a, current polynomial setting factor in the authentication increment 176a, optional RTMC channel # assignment 177a, RCTT Unit DSP synchronization increment 178a, and time code increment 175a that is used to constantly update the selected RCTT Unit 96 time code generator. This FTMC 88 time code increment 175a is completely aligned with the USPR telemetry data management hubs 195 PRS signal 129 as shown in FIG. 5.

Referring to Fig. 2, once the selected RCTT Unit FTMC data packet payload is added to the concatenate FTMC data packet string 74. Next the FTMC concatenate packet string is relayed through host network elements 75. In a generic sense the FTMC and RTMC CDTMA protocols are managed similarly regardless of the host wireline and or wireless network being used for transporting and delivering a given USPR telemetry data management event. When the FTMC concatenate data packet is transported to a selected base site via primary data link it is converted to an appropriate air interface protocol and transmitted to one or a plurality of RCTT units operating in a selected APU 76. Depending upon the polling, paging or call set up algorithm utilized a plurality of RCTT Units detect FTMC concatenate data packet header. I.D., authentication polynomial, synchronization
increment, time code increment, data payload with its contained program and instruction sets 77. Upon completion of the heretofore mentioned procedure, one or a plurality of RCTT Units responds to its received program or instructions sets by initializing the passive sniff mode (PSM) 78, or 78a one or a plurality of RCTT units responds by initializing active access mode (AAM) 79, or 79b, one or a plurality of RCTT Units responds by initializing master mode (MM) 80. Next, if one or a plurality of RCTT Units is configured as an RCTT Unit mini hub, it may respond by polling one or a plurality of its spread spectrum and or ISM 2.4GHz nodes 81. One or a plurality of ISM 2.4GHz nodes forwards/ transmits ISM FTMC packets in a node to node relay algorithm until it reaches the last node that is part of the selected nodal event group (NEG). Furthermore, once the last ISM 2.4GHz node has received its ISM FTMC packet, and is ordered to report its application specific status to its assigned RCTT Unit mini-hub 82 either directly via an assigned ISM RTMC 2.4GHz frequency for that event only, or in the heretofore mentioned node to node relay algorithm 83, whereby a plurality of spread spectrum ISM 2.4GHz nodes that are integrated to selected application specific devices, and each device responds to ISM FTMC order 84. Accordingly, each ISM 2.4GHz node reports in a sequential fashion that acts to algorithmically contribute to the instant collective concatenate ISM RTMC packet assemblage until it reaches its assigned RCTT Unit mini hub 85.

Referring to Fig. 3, the RCTT Unit mini hub 91 contains a back end 164 system that operates along with the ISM front end 163 as an integrated whole. Both the ISM 2.4GHz 80C51 Part 15 front end 163 and the base band backend 164 are controlled and manage by the RCTT Unit mini hubs central processor unit (CPU) 270. The invention creates a microcosmic electronic ISM nodal exchange (ENX) system that controls a plurality of ISM nodal groups in the same way a switch in an MSC controls base sites with base site controllers (BSC). For example in GSM environment one base site controller (BSC) controls one to three base transceivers stations (BTS). In the same way the inventions RCTT Unit mini hub can control eight ISM nodal groups that are comprise eight individual ISM 2.4GHz nodes per group. The RCTT unit mini-hub 91 controllers all ISM Part 15 frequencies that are used for all ISM 2.4GHz frequencies. The inventions spread spectrum (SS) link controller sub-system 44 is specially designed to efficiently assign frequencies on a per event basis.
The inventions USPR telemetry data management network uses licensed and unlicensed spread spectrum frequencies for telemetry data only, therefore the 32 ISM hop frequencies defined for each ISM 2.4GHz node can be manipulated and thus allocated for considerable application specific usage expansion. The inventions RCTT Unit mini hub 91 ISM baseband front end 163 is completely governed by the its internal CPU 270, random access memory (RAM) 159, read only memory (ROM) 269 and digital signal processor (DSP) 271. However, it is the backend 164 with its host wireless network bi-directional data handling capabilities that are key to the successful management of application specific telemetry data devices. If the RCTT Unit is configured a stand-alone wireless data telemetry control communications terminal unit, or if it is in fact configured as an RCTT Unit mini-hub 91 that controls up to 72 spread spectrum ISM 2.4GHz Part 15 80C51 protocol compliant, or other spread spectrum protocols. One of the most important aspects relating to the success of the inventions means and methods is how efficiently all of these systems communicate with the inventions USPR telemetry data management hub 105 via the host wireless and wireline networks.

The invention does in fact operate generically in all heretofore mentioned wireline and wireless host networks. It important to understand some of the specific USPR telemetry data management hub and DSP host processes and procedures that serve specific wireline and wireless networks. The inventions USPR telemetry data management hub and its DSP host system are designed to multiple versions of the CDTMA protocol in order to support RCTT Units, RCTT Unit mini-hubs, and ISM 2.4GHz nodes in any host wireline or wireless network. One of the key host wireless telephony networks is AMPS analog cellular, specifically Interim Standard (IS) 553. The invention operates seamlessly in this rather robust and mature cellular telephony network. For example when serving one or a plurality of RCTT Units operating in an IS-553 compatible analog cellular network, the following protocols and procedures apply.

Referring to FIG. 5, in one example the ASP 120 needs to send a query/order to determine the current status of one or a plurality application specific telemetry data devices that are integrated with one a plurality of stand-alone RCTT Units 100, or RCTT Unit mini hubs 94, 95, 96, operating in selected application points of use (APU) 97, 98, 99
and 274. Upon determining that in fact one or a plurality of RCTT Units need to be polled, a query/order is sent to the inventions USPR telemetry data management hub 105 via the internet world wide web (WWW) 124 in the form of TCP/IP socket frame relay 122 protocol to the USPR telemetry data management hub 105 and its USPR network management subsystem (NMS) 121. Once detected and acknowledged it is further processed in accord with the operational standards, processes and procedures of the selected wireline and wireless that is currently serving a selected RCTT Unit 100 for example. Upon completion of ASP query/order authentication procedures the NMS 121 formats FTMC data packets for each RCTT Unit 100 that is operating in a given host wireless network, in this case an IS-553 compatible cellular network's APU 274. Accordingly the program and instruction set data must be formatted and delivered accord with the data packet format being utilized within the structures of the FTMC protocol used in compliance with the air interface channel limitations of the selected AMPS IS-553 cellular telephony network.

In one possible scenario hundreds or thousands of RCTT Units can be operating in a selected AMPS IS-553 compatible cellular network. Referring to FIG. 5, the USPR telemetry data management hub 105 is comprised of a plurality of specialized network elements such as its associated host DSP system 130 that is NT and or Unix based, the message store and forward stack (MSS) 108, the FMTC distribution stack 118, the RTMC distribution 119, programmable telephony switch 127, multiport frame relay router 268, primary reference signal (PRS) generator 129 and its associated global positioning system (GPS) 103. Also included in the USPR telemetry data management hub element configuration are a plurality of NT or Unix based data management, data processing and data storage terminals 121.

Contained within the network management subsystem is the USPR authentication polynomial-data base system 106 that stores the current polynomial setting and individual challenge order algorithm for each RCTT Unit that is authorized for commercial operation. Each of these USPR telemetry data management hub network elements is designed and configured to support any FTMC and RTMC packet format that is used by any host wireline and wireless network air-interface protocol standard. Accordingly, once it is determined what type of host wireline and wireless network the selected RCTT Unit is
operating in then the query/order is configured to meet the compatibility requirements of
the forward channel algorithmic mechanism specific to that network. Referring to FIG. 5,
in this example host networks represented are AMPS IS-553 compatible cellular wireless
telephony, and trunked mobile radio networks. The cellular telephony base site 101 for
example is operating adjacent to a trunked mobile radio network base station repeater 102
whereby both host networks are supporting the inventions CDTMA protocol. The
CDTMA protocol is embodied in the FTMC and RTMC protocol that controls and
communicates with a selected RCTT Unit 100 operating in this selected APU 274. This
RCTT Unit 100 is configured to communicate with the USPR telemetry data manage hub
105 via associated mobile trunked radio network elements and cellular mobile radio
network elements. This particular RCTT Unit is configured as a dual mode terminal and is
able to receive FTMC concatenate data packets via trunked mobile radio forward
channels. This same RCTT Unit 100 can also transmit RTMC data packets to the USPR
telemetry data management hub 105 via cellular mobile telephone network elements.

For example if the selected ASP originated query/order is directed towards a one
RCTT Unit 100 and the query/order is not time critical then the query/order can wait until
a plurality of RCTT Units are to be paged or polled in order to initialize a USPR telemetry
data management event, assuming there is a plurality of RCTT Units operating a selected
APU. However, in this case the query/order is in fact time critical. Therefore, this selected
query/order is to be processed immediately. Because the USPR telemetry data
management hub 105 supports a high volume of activity that is occurring simultaneously
in a plurality of host wireless networks, FTMC concatenate packet assembly 118 and
RTMC disassembly 119 processes and procedures are constantly being managed by the
programmable switch 127, the MSS 108, and the USPR host/DSP system 130.

In order to efficiently support the magnitude of FTMC concatenate data and
RTMC status response data packets that are transported by selected host wireline and
wireless networks the USPR telemetry data management hub is designed to manage a
plurality of RCTT Units and ISM 2.4GHz nodes simultaneously regardless of the standard
or operational schemes utilized by said wireless networks. Therefore the USPR hub
maintains control of the constant streaming of forward and reverse data packet activity that
is also being dynamically routed and managed.
For example essential FTMC concatenate packet assembly formats and procedures and RTMC disassembly processes and procedures remain uniformly consistent at the primary wireline physical, data, network and transport layers in accord with ISO OSI reference model. The ISO is a seven layer protocol scheme that is known to those whom practice the art. The ISO model is used by the invention to demonstrate specific algorithmic procedures for physical and logical connections. These important procedures apply regardless of the type of host wireless network and its specific air interface standard. However what distinguishes one type of host wireless network and its endemic air interface standard is the type of USPR telemetry data event setup and tear down protocol that is utilized while communicating with the RCTT Unit 100, and the RCTT Unit mini-hub 94 that is connected to a plurality of ISM 2.4GHz nodes a,b,c,d, and e, operating in a selected scatternet 97. Also another key factor is how each host wireless network accepts and manages the inventions asynchronous primary exception reporting (PER) and secondary exception reporting (SER) data packet events. Both PER and SER data packet events can operate in an asynchronous algorithmic method and thus is separate to the inventions completely synchronized CDTMA protocol. However, both PER and SER data packets can be utilized in accord with the inventions synchronized CDTMA protocol and are key USPR network protocol event elements. One of the key features of the USPR telemetry virtual data network scheme approach is that regardless of how each host wireless networks air interface or space segment interface operates, USPR wireline data packet communications management is managed essentially the same with some variations. The USPR data management hub is designed to manage these variants. For the sake of brevity the focus for demonstrating the inventions means and methods for operating in a selected host wireless will encompass the process and procedures for successful managing RCTT Units, RCTT Unit mini hubs, and ISM 2.4GHz nodes in an IS-553 analog cellular telephony network.

In an IS-553 analog cellular platform environment the USPR telemetry data network application specific telemetry data event transpires in the following algorithmic process and procedures. Referring to Fig. 5, the application service provider (ASP) 120 sends a query/polling order request to the USPR hub 105 via the internet world wide web (WWW) 124. The internet transports this TCP/IP compatible query/polling packet to the
USPR Internet address node represented here by the socket frame relay router 122 represented here. This router 122 examines the TCP/IP packet address and further points it to the USPR plurality of data management terminals that make up the network management subsystem 121. One or a plurality of data management terminals algorithmically determines that this particular TCP/IP based query/order and its contained identification attribute represented by the ASP’s identifier, the RCTT Units mobile identification number (MIN) and electronic serial number (ESN). In this case the identification attribute data is algorithmically linked to a RCTT Unit 100 operating in a selected IS-553 AMPS cellular telephone compatible host network APU 274. TCP/IP internet compatible protocols and data content formats are well known to those whom practice the art, therefore graphic and further written explanations are deemed unnecessary. Once ASP query/polling packet and RCTT Unit identification, and ASP authentication is complete the query/polling packet is forwarded to the host DSP processing system 130. The host DSP system 130 formats the packet in accord with the inventions FTMC concatenate packet program data bit format increment. Also, since this particular query/polling requests an immediate status response report from the selected RCTT Unit another important procedure transpires. The host DSP system 130 queries a special database called the host network activity monitor system (HNAM) 117 that monitors all USPR SS7/X.25 public and private network based out-of-band signaling call/data event set up network activity.

The HNAM system is provided by the invention order to verify whether or not a continuous FTMC concatenate data packet stream is currently being transported to a selected host wireless network that is currently transporting and transmitting and receiving USPR telemetry data management information. Another function of the HNAM system is that it also maintains records of current FTMC and RTMC channel assignments in a given host wireless network, application group activity, APU activity, and other pertinent RCTT Unit activity information. For example if the APU and the application group that includes the RCTT Unit in question is active it means that its identifier is currently included in the FTMC concatenate packet stream is being broadcast. Once it is determined this selected IS-553 compatible AMPS cellular telephony network is carrying continuous USPR telemetry data traffic, the host DSP system 130 orders the programmable telephony switch 127 to route the FTMC data payload, RTMC channel assignment and other information to
the FTMC concatenate packet distribution system 118. Once the FTMC distribution system detects the presence of the new FTMC packet sent from the USPR network management subsystem 121 it adds the packet-payload to the currently transported stream that is continuously relayed through associated wireline network elements such as the trans-mux system 268, the T1/T3 span 132 network that is connected the PSTN 93 that is further connected to the currently serving cellular telephony mobile switching center (MSC) 104. Furthermore, the MSC routes the currently operating FTMC concatenate packet stream to the cellular base site 101 that is serving one or a plurality of RCTT Unit(s) 100.

Referring to Fig. 4, depicted here is a logical procedure flow of an FTMC concatenate data packet stream 88, and three examples of RTMC data packets 170, 171, and 172. This representation specifies FTMC and RTMC CDTMA telemetry data protocols that will operate efficiently in an analog cellular system that conforms to IS-553 AMPS cellular standards. However, the inherent protocol structure described here is not limited just to IS-553 AMPS cellular specifications. The inventions CDTMA approach will operate in any of the heretofore mentioned wireless host network platforms with some variation as to its implementation and operational scheme. Specifically what typically differentiates one air interface standard from another are the algorithms that govern call or telemetry data event set up/origination and tear down/termination procedures. The invention strictly adheres to all cellular, PCS, trunked mobile radio, and satellite air interface and space segment operational standards, while at the same time manipulating said standards to reap maximum flexibility from the limits set forth in each host network air interface, and traffic bandwidth management protocols. The concept is a key hallmark to the inventions overall innovative technical approach. Accordingly in this example the FTMC concatenated data packet stream 88 is comprised of a logical assemblage of three distinct data packets 167, 168 and 169. Each of these data packets is designated for one of the three RCTT Units depicted here 94, 95 and 96. RCTT Unit 96 is configured as a concentrator mini hub that manages a plurality of ISM 2.4GHz nodes operating in a selected piconet 45.

Referring to Fig. 4, each FTMC packet 167,168 and 169 is comprised of discrete incremental data units. In packet 167 it is graphically noted that this packet is comprised
of time code data bits 175a, RTMC Unit DSP synchronization bits 178a, RTMC channel
assignment bits 177a, program and command and control data 179a, authentication-
polynomial algorithmic bits 176a and 10-16 character RTCT Unit identifier bits 174a. In
FTMC packet 168 the RTMC channel assignment increment is replaced by filler data bits
171 because RTCT Unit 95 is not required to transmit and report its current operational
status to the USPR hub 105. However, this RTCT Unit 95 can still receive program data
179b, authentication polynomial update data 176b, DSP synchronization bits 178b, and
time code update data 175b and not effect other RTCT Units that are tuned and monitoring
the same active and assigned FTMC forward channel. In fact one RTCT Unit cannot
download another units programming and command and instruction sets, because it will
not recognize another units 10-16 character I.D. 174a, 174b, 174c as shown in FTMC
packet 167, 168 and 169. The recognition algorithmic procedure is not unlike a
conventional Pocsag or Flex pager that will not accept a transmitted message if it does not
recognize its capcode as part of the message payload.

Referring to Fig. 4, in accord with IS-553 AMPS cellular operational schemes a
base site 101 always transmits a supervisory auditory tone (SAT). The concept of SAT and
its practical uses are well known to those whom practice the art of wireless
communication. Therefore there is no reason to describe all the uses of SAT in analog
cellular for the purpose of this disclosure. There are three SAT tones, 5970Hz, 6000Hz,
and 6030Hz spaced 30 Hz apart. Each IS-553 compatible base site transmits an assigned
SAT frequency when any of a plurality of assigned forward voice channels are
transmitting voice and analog data information to a selected mobile terminal. Adjacent
base sites are assigned and transmit different SAT tone frequencies than its closest
neighbors so that unpredictable cellular radio propagation signals do not interfere with one
another. Each SAT tone is also phased differently in typical 120 degree offset from
another. The SAT generator in a typical analog cellular base site radio cannot deviate by
more than plus or minus 15Hz while receiving the signal. The SAT detector in a selected
mobile terminal uses this criterion to continuously accept or reject a returned SAT that a
conventional mobile and the inventions analog version of its RTCT Unit must transmit on
its assigned RTMC channel during a telemetry data event. It has been observed that two
SAT frequencies with two different audio tone amplitudes can arrive at one cell in a base
site, if the desired SAT tone is weaker than the undesired one by a certain given ratio, then the SAT tone will deviate by the ascribed plus or minus 15 Hz.

The filter of bandwidth of the SAT tone detector relates to call-drop timing, which is based on the unacceptable measured voice quality level. In theory, the level of radio signal propagation of SAT is different in different cellular operational environments. Usually the smaller the filter bandwidth, the lower the call drop rate is attained. But voice quality may poor before dropping the conventional voice call. The invention exploits this robust SAT transmission phenomenon in that when a selected RCTT Unit is receiving SAT via a transmitting FTMC channel and returning the same SAT in the same phase via an active RTMC channel it can stop its transmission to allow another adjacent RCTT Unit to transmit its status response data packets on the same assigned RTMC channel without loss of RTMC transmission continuity. It is of key importance that all other adjacent RCTT Units that are receiving FTMC concatenated telemetry data packets in the instant event must return the exact SAT frequency and phase in order to transmit RTMC status response telemetry data packets on the same assigned RTMC channel frequency that the master mode RCTT Unit is transmitting over. The same fundamental concept extends into other host wireless network frequency, protocol and modulation schemes whether the medium is digital or analog and the operational air interface channels are physical or logically defined. In some wireless cellular platforms such as TACS and NMT cellular, analog block coding is used instead of SAT tones to measure forward and reverse channel signal strength and heretofore mentioned phenomenon, but the purpose and result is essentially the same. The invention fully and effectively exploits these conventional technological facts. These fundamental concepts extend into the wireless arenas of trunked mobile radio, and other heretofore disclosed wireless networks.

Referring to Fig. 4, The FTMC channel is transmitting program information contained in the program, command and instruction data fields, 179a, 179b, and 179c respectively that causes RCTT Unit 94 to currently operate in master mode (MM) 295, and RCTT unit 95 to operate in passive sniff mode (PSM) 296, and the RCTT Unit 96 to operate in active access mode (AAM) 297. Only the two RCTT Units 94 and 96 must return SAT 282a and 282c when bursting or transmitting its own status response packets 170 and 172 respectively. However the RCTT Unit 95 is PSM mode does not have to
recognize and process the current SAT frequency 5970Hz and phase variant 281 that is transmitting via the FTMC 88 in order to download current FTMC program 179a, 179b, 179c time code 175a, 175b and 175c DSP synchronization bit information 178a, 178b and 178c. In an analog cellular environment the first RCTT Unit 94 to be initialized by polling or paging via the forward overhead control channel (FOCC) automatically begins operating in master mode (MM).

In terms of how a conventional host cellular network handles the page response, it is simply a conventional voice call set up whereby full duplex voice channels are assigned, transmitted and received between the currently serving base site 101 and the RCTT Unit 94 operating in master mode (MM). In Fig. 3, a cellular page 279 is first transmitted by the base site 101 via the FOCC the RCTT Unit 91 in master mode before any voice or traffic channels are assigned. In a mobile trunked radio network its base station repeater 110 operating between 800 to 900Mhz 169 for example will simply be ordered to poll 280 a selected RCTT Unit 91 by the USPR hub 105. In this case the RCTT Unit is polled using its 10-16 identification code, and is not polled using a ten digit MIN as the case when paging a cellular, PCS or telephony LEO satellite 147 compatible RCTT Unit 91.

Referring to Fig. 4, in addition to it’s USPR telemetry network assigned 10-16 digit or character identification number, each analog cellular, digital cellular or PCS and telephony based satellite compatible RCTT Unit is assigned a separate non-dialable 10 digit mobile identification number (MIN) such as 175-421-1061. The use and utilitarian function of MIN numbers is well known to those whom practice the art, and further explanation of its multiplicity of use in terms of paging, polling and related PSTN functions are not necessary for the purposes of this disclosure. When an RCTT Unit 94 is the first terminal paged or polled for the purpose of initializing a multiple-RCTT-Unit-telemetry-data event, the primary procedure is to simply complete what appears to be a conventional cellular, PCS or trunked mobile radio call one RCTT Unit 94 and cause the designated RCTT Unit 94 to activate master mode (MM) 295. The next or secondary procedure is to initialize multiple telemetry data communications events with a plurality of adjacent RCTT Units operating in a selected APU, using the RCTT Unit 94 in master mode (MM) 295 as an application specific zone terminal leader.
One of the primary novelties of the invention is that the RCTT Unit 94 in master mode (MM) 295 acts as a protocol bridge that enables the first five layers of the OSI model; a physical layer, data link, network link, transport and session layer from the serving base site or base station radio that is designed to enable conventional voice and circuit switched data information. Referring to Fig. 4, the RCTT Unit 94 in master mode (MM) 295 in conjunction with the inventions DSP host 130, USPR hub 105, and any defined T1/T3 PSTN wireline network, creates this enabling bridge similarly like a cellular, PCS and trunked mobile radio control channel, signaling channel, control set up channel, and authentication channel data protocol. In an analog AMPS IS-553 compatible cellular telephone system a base site 101 is typically configured with from one to three sectors cells. Each cell is comprised of one control channel transceiver that broadcasts continuously; FOCC based pages, filler, busy/idle bit (BIS) information, and other mobile station maintenance and control information. This same transceiver also is configured to received RECC set up control channel information intermittently from a plurality of mobile stations operating in radio propagation footprint area of said currently serving base site 101. In addition to the control channels, each sector typically comprises from 16 to 50 plus full duplex voice/traffic channels.

A typical analog control channel transceiver is configured to transmit and receive data in the following fashion. AMPS IS-553 analog control channels and voice channels transmit and receive at frequencies within the 800MHz bands with a channel bandwidth of 30KHz. The wideband data signal used by the control channels is a non-return-to-zero (NRZ) binary data stream encoded to a Manchester biphase code. It modulates to a plus or minus 8-KHz binary FSK with a transmission rate of 10KHz. Therefore, a burst of signals transmitted over the control channel and voice channel can be detected by both the base site transceiver and mobile station transceiver. In the same way the invention creates a specialized telemetry bi-directional channel that has elements of control channel like protocols with the addition of specialized application specific telemetry data system management protocols that enable the management of a plurality of remote wireless telemetry data communications terminals.

Data over cellular voice air interface channels is typically called circuit switched cellular data. Circuit switched cellular data is typically point to point whereby a landline
modem is interfaced with the PSTN, and a cellular wireless circuit switched modem
exchange data information in a full duplex modem protocol scheme similar to end to end
modems V.32 et al. Therefore, circuit switched end-to-end systems exchange data similar
to PSTN based point-to-point multi-layer OSI tradition based protocol schemes. Like
some circuit switched implementations the invention uses SS7 out-of-band signaling for
USPR telemetry data event set up for cellular, PCS and telephony satellite based telemetry
data system management. USPR also uses PSTN T1/T3 voice and traffic, land switching,
and mobile switching paths to transport USPR CDTMA FTMC and RTMC based
protocols to and from the USPR host to one or a plurality of RCTT Units.

The invention creates a novel hybrid approach for the enabling a telemetry data
management system that combines the best of control channel type signaling and system
access protocols without incurring the limitations of having to dedicate base site radio
transceivers for providing control channel only protocols. The invention also integrates
the open and random channel assignment features inherent in cellular network based
circuit switched data traffic protocols and algorithms without the limiting characteristics of
circuit switched cellular call set up and tear down procedures. Also circuit switched
provides point to point access allows only one wireless terminal can communicate with a
landline based host on a single event basis. The invention’s USPR CDTMA means and
methods provides a unique concatenated data packet protocol that enables multiple
wireless terminal access to a single host on a per event basis using a single forward and
reverse bi-directional channel with only one call set and tear down procedure while
serving a plurality of RCTT Units and ISM 2.4GHz application specific telemetry data
terminals and nodes. Therefore, any air interface voice or traffic channel, base site to MSC
data link, MSC to PSTN voice or traffic channel path can become a communications
medium that enables USPR telemetry data traffic on a per event basis. In one very
important respect circuit switched cellular does not serve wireless data telemetry very
well.

Today in the Telecommunications Industry many cellular networks are providing
circuit switched telemetry data services. How in its present form is simply severely
inefficient and costly to use. In order for host cellular carriers and telemetry data service
providers to make sufficient revenue, thousands of wireless terminals serving a
multiplicity of telemetry applications must be deployed in a concentrated urban area creating an environment whereby one base site may serve thousands of wireless telemetry units operating as AMR reporting mediums. Most telemetry data wireless communication units are concentrated in large highly populated urban areas where cellular and PCS bandwidth is at a premium. In a typical five second data transfer event that enables a 2 Kilobyte data packet transfer with a data rate of 9,600Bps the data packet itself only requires two seconds of total bandwidth time with the other three seconds consumed for call set up, tear down and modem to modem handshake and synchronization procedures. One of many ways the invention provides the means and method to efficiently use existing cellular, PCS and satellite network bandwidth is simply eliminating call set up and tear down procedures for every RCTT Unit that is operating in a selected APU. The invention eliminates a minimum of two seconds of valuable bandwidth for the same described circuit cellular data event.

For example the invention can eliminate 98 seconds of network bandwidth time when communicating with 50 RCTT Units during a single USPR telemetry data event whereby each RCTT Unit is transmitting and or receiving a 2 Kilobyte data packet. When considering that thousands of telemetry data events occur in certain base sites in a given 24 hour period, the savings in bandwidth is substantial. The inventions substantial bandwidth savings features applies not only to IS-553 AMPS cellular standard, but also include other analog and digital cellular/PCS standards such as TACS, NMT, IS-136 TDMA, IS-95 CDMA, GSM TDMA, Wideband TDMA, Wideband CDMA, G3 Wireless, analog and digital trunked mobile radio. Other host wireless telephony and non-telephony systems such as analog and digital two way paging, wideband and narrow band PCS and other heretofore disclosed wireless systems where call set up and tear procedures are required for data and voice communications event management.

Therefore an important feature of the invention is that it provides complete control of all USPR system access. Conventional control channel protocols allow mobile station to access in a complete random first to arrive first to serve fashion. During high traffic periods many cellular subscribers are blocked and are ordered to retry the call because many stations are blocked incessant busy status. All USPR host backend wireless network specific RCTT Unit communications terminals and ISM 2.4GHz nodes are robotically
controlled at all times. The invention even controls USPR system access during exception reporting events in an efficient and elegant fashion. Referring to Fig. 4, the RCTT Unit 94 operating master mode (MM) 295 is the terminal leader. Upon successful completion of a page or polling event to the selected RCTT Unit 94, it responds by initializing a conventional voice/traffic channel call set up. This call set up procedure is known to those whom practice the Wireless Telephony Art, therefore further description of this procedure is deemed unnecessary for the purposes of this disclosure.

Referring to Fig. 4, and Fig. 5, during paging procedure the USPR hub 105 and its inclusive programmable switch 127, receive T1/T3 PSTN routing instructions for connection to the assigned voice/traffic channels currently serving the RCTT Unit 94. The USPR DSP host 130 prepares DSP to DSP data protocol communications between its internal structures and the selected RCTT Units 94 DSP data management structures. Once the call set up procedure and bi-directional voice and traffic air interface channels have been assigned, and a stabilized communications link between the serving base site 101 and the RCTT Unit 94 has been established, the USPR DSP host 130 transmits appropriate FTMC initialization channel set up procedures to the selected RCTT Unit 94 integrated DSP system through pre-assigned USPR switch 127, the PSTN 93, serving cellular MSC 104, the currently serving base site 101 as shown in Fig. 4.

Referring to Fig. 4, once FTMC initialization process is complete the USPR host 130 causes the USPR hub 105 to transmit complete FTMC telemetry concatenated data packet stream to the RCTT Unit 94 in master mode (MM) 94. The serving the base site 101 transmits its assigned SAT 5970Hz 281 to the RCTT Unit 94. Its transceiver returns SAT frequency 5970Hz 282a. Upon complete SAT return, the RCTT Unit 94 transmits its RTMC data packet status response stream 170 through the heretofore mentioned wireline and wireless communications pathways to the USPR Host 130. A crucial component of the USPR CDTMA FTMC and RTMC protocol embodies the RTMC channel assignment bits 183c. This completely novel and crucial feature of the invention is used by the USPR hub 105 and its inclusive DSP host 130 for the circular and host initialized and controlled cyclical return of the current RTMC channel assignment bits contained first within the data payload of depicted FTMC data packets 167, 168 and 169. The RTMC channel assignment bits 177c embodied in the FTMC telemetry data packet 169 designated for
RCTT Unit 94 is to be used as channel assignment verification for a plurality of RCTT Units ordered by the USPR Hub to report application specific status. In this example the RCTT Unit 96 is designated to transmit its RTMC telemetry data status response packet 172 over the currently assigned and transmitting RTMC channel. This channel assignment information was first designated for the RCTT Unit 94 via FOCC control channels by the currently serving MSC, base site controller and base site FOCC control channel radio transceiver during the heretofore mentioned call set up initialization procedure and voice/traffic channel assignment procedure.

Referring to Fig. 4, the RCTT Unit 94 operating in master mode (MM) 295 the RTMC telemetry data status response packet 170 is comprised of a multiplicity data payload categories that are crucial components of the inventions USPR telemetry data communications and management network. This packet 170 and all RTMC data packets are comprised of a 10-16 character I.D. bit field 188c, a time code bit field 187c, an authentication data bit field 186c, an application specific status response data bit field185c, a DSP synchronization bit field184c, current RTMC reverse voice/traffic channel assignment bit field183c, and a tail flag field 180c. When the USPR telemetry data management hub 105 and its inclusive host DSP 130 receive this selected RTMC packet 170 it analyses every contained data bit. Referring to Fig. 5, for example, when the USPR hub 105 receives a selected RTMC telemetry data status response packet 170 as shown in Fig. 4. From the PSTN 93 wireline transport source as depicted in Fig. 5, the RTMC packet is forwarded to the USPR hubs trans-mux 268 that acts as a protocol gateway that in fact converts the concatenated RTMC data packet stream from a landline T1/T3 132 compatible DSO/DS1+ format to pulse code modulation (PCM) format.

This conversion process is necessary in order to facilitate packet flow through the bus fabric of the USPR programmable switch 127. These processes are governed by NT or Unix based host system(s) 130 in order to integrate protocol formats used by the RTMC packet distribution system 119 and other packet handling and storage systems such as the message storage stack (MSS) 108. The MSS 108 is a store and forward dynamic database that stores messages that are not time critical, and are to be sent to one or a plurality of RCTT Units via a selected FTMC concatenated data packet stream transported via a host wireless and wireline network route path at a pre-determined time of day, week or month.
These forward telemetry command and program set messages are sent from application service providers (ASP).

Conversely the MSS 108 is used to store status response messages sent from one or a plurality of RCTT Units via selected RTMC concatenated status response data packet streams routed from one or a plurality of RCTT Units operating in a plurality of host wireless and wireline networks. The MSS 108 is also used to store RTMC status response packets that are not deemed time critical such as RTMC telemetry status response packets that are sent from systems such as security alarm, fire alarm, and other similar application specific systems. These exception report status response packets are to be sent to, and processed by, selected application service providers (ASP) 120 for eventual appropriate human action or reaction to the received status response report. However when the inventions USPR system is used in a trunked mobile radio, SMR, SMR trunked, SMR business, ESMR, mobile dispatch, Maritime, transportation, public safety networks and the like another algorithm of the CDTMA protocol can be used. These heretofore disclosed mobile radio transceivers utilize DTMF telephony dial-up, DID, DOD protocols can used to initialize an RTMC and FTMC bi-directional concatenated packet stream event. Or the DTMF dial-up capabilities can be used to transmit exception report data packets.

Referring to Fig.4, The key here, is that the mobile radio DTMF dial-up can be used to route RTMC concatenated data packet streams, and exception report packet from the serving base station 101, the trunked mobile radio control center (CC) 86 and to the USPR Hub 105 from any of the heretofore disclosed trunked mobile radio, and mobile radio networks with the host network having to be specially configured. This RTMC-DTMF routing procedure can be used to initialize first an RTMC packet stream that instructs the USPR Hub 105 and its associated Host DSP system 130 to route the FTMC concatenated packet stream 88, or FTMC paging packet stream via PSTN, other private and public telecommunications networks such as SS7 to the selected RCTT Unit 95 or RCTT Unit mini-hub 96 regardless what location the inventions terminal is operating in any of the heretofore selected trunked mobile radio, and mobile dispatch networks. In fact this reverse method can be used in any of these networks without modifying or upgrading
any of these networks. Therefore, the invention creates a new paradigm in virtual
telemetry data management networks for mobile and station application specific services.

Referring to Fig. 5, once the RTMC status response concatenated packet stream
DSO/DS1+ protocol has been converted by the USPR trans-mux 268 it is forwarded to the
USPR programmable switch 127. The switch 127 routes the RTMC packet stream to the
Host DSP system 130. Once host DSP system 130 receives the RTMC concatenated data
packet stream it analyses a plurality of RTMC data packet(s) and its contained data-bit
payload information for data integrity. Such processes as checksum and other related
procedures are performed at this stage. If data checksum is compared and it is verified that
the expected RTMC packet payload matches the data bits contained in the authentication
field then the entire packet is forwarded to the RTMC distribution system 119. If the
checksum algorithm does not match from some reason, a data corruption message is sent
to the USPR network management subsystem 121 initializes an FTMC reorder designated
for any RCTT Unit that transmitted corrupted data. The USPR then simply responds by
initializing an RTMC resend order via the currently broadcasting FTMC concatenated data
packet stream that is currently serving a designated application specific zone that is part of
a selected APU. Checksum and other conventional error correction systems are well
known to those whom practice the art, therefore further detailed description of this process
is deemed unnecessary for the purposes of this disclosure.

Referring to Fig. 4, and Fig. 5, once a selected RTMC data packet 170 has been
forwarded from the host to the RTMC distribution system, each individual RTMC status
response packet is mirrored or snap shot and its duplicate is forwarded to a special data
base located in the USPR network management subsystem 121 for long term record
keeping purposes. The RTMC distribution system 119 examines each data bit field
comprising the complete data packet and is processed appropriate to its designated
function. For example, the 10-16 character data bit field 188c, and the authentication data
bit field 186c are sent to the authentication center database 106 that sets up, an
continuously updates and challenges an RCTT Units authentication polynomial setting.
This authentication data bit field 186, and the 10-16 character I.D. field is used together to
create a unique polynomial algorithmic code for each RCTT Unit on a per event basis. The
authentication center 106 compares the most recent setting sent to this particular RCTT
Unit, with the last polynomial setting ordered and sent to the RCTT Unit 94 that transmitted this particular RTMC status response data packet 170. The authentication center 106 will randomly define the next setting that is derived from a three part algorithm that is comprised of the 10-16 character I.D., its electronic serial number (ESN) stored in the RCTT Unit, and a secret e-squared mathematical factor that is mathematically dependent upon the last unique polynomial setting stored in the instant RCTT Unit.

The inventions novel authentication method creates an infinite string of unique polynomial settings for each RCTT Unit that is never duplicated by any other RCTT Unit. Each RCTT Unit therefore creates its own mathematical genetic code that is randomly derived while little possibility for unauthorized intervention. Each unique polynomial setting is stored in a database located at the USPR authentication center 106. This e-squared non-predictable factor is stored in the hub challenge order database located in the USPR authentication center 106.

The invention uses a specialized and unique derivative of the internationally used CAVE algorithm that is widely deployed in IS-136 TDMA, IS-95 CDMA digital cellular systems. If for example, a particular RCTT Unit polynomial setting does not properly match, the authentication center 106 sends a service block/access denied invoke order to the USPR network management subsystem stops any FTMC activity specific to a particular RCTT Unit. Next, the RCTT Unit in question must be examined in the field by qualified and authorized personnel. The time code bit field 187c part of RTMC status response data packet 170 is sent to the USPR network management subsystem 121 for time code comparison. This time code field 187c must match the time code field 175c located in the FTMC command and control packet 169 that the RCTT Unit 94 received as part of an RTMC status response invoke event. This time code must also match the PRS 129 code received at exact time the selected FTMC packet 169 was added to the FTMC concatenated data packet string 88 was first broadcast in a selected APU 274. If a mismatch occur, an alarm invoke is sent to a manned terminal 128 located at the USPR network management subsystem 121. An alarm system prints out the instant PRS mismatch event. The DSP synchronization bit field 184c is used by the host DSP 130 to enable a fast packet switched protocol that occurs during initial synchronization between the RCTT Units internal DSP system. This synchronization field is merely used as a
verification report increment that reflects what DSP synchronization instruction set an RCTT Unit received from the USPR host DSP 130, and thus transported by the currently serving FTMC concatenated data packet stream 88, and recognized by the specific RCTT Unit that an individual FTMC data packet 169 is so designated upon initial broadcast.

The status data bit field 185c contains bits that reflect the current application specific status of a given application specific device such as an electrical power meter and the like. The status data bit field 185c also contains bits that indicate the priority level of this contained information. If priority bits indicate that this portion of the packet needs to be immediately forwarded to its associated ASP 120, then status data bit field 185c is immediately forwarded to the USPR network management subsystem 121 where it is further examined, stored and converted to TCP/IP internet protocol. Once converted to TCP/IP it is then relayed via the USPR socket frame relay system 122 to the associated ASP 120 via the internet world wide web 124. If the instant status data bit field 185c is not deemed urgent, it is forwarded to the message storage stack (MSS) 108 for later retrieval by the associated ASP 120 upon request.

Referring to Fig. 4, and Fig. 5, the RTMC channel assignment bit field 183c reflects the current RTMC channel assignment and simply acts as a verification field for USPR record keeping purposes. As heretofore disclosed since this particular RTMC status response data packet 170 is used for more than just reporting status of RCTT Unit 94. This initial RTMC channel assignment field 183c acts an FTMC channel assignment instruction set for a plurality of RCTT Units that have been initialized by parallel paging/or polling actions that occurred during the algorithmic sequences of this instant telemetry data event. Once the USPR hub detects the presence of this instant RTMC status response packet 170 transmitted from the RCTT Unit 94 operating in master mode (MM) 295, it simply enters this current RTMC channel assignment into the individual FTMC telemetry data management packets 167 and 169, 177a and 177c respectively as shown in the FTMC concatenated data packet stream 88 when a plurality of RCTT units operating in the same APU are ordered to report application specific status. The tail flag bit field 180c is simply used to instruct the USPR host DSP system 130 that this RTMC status response data packet is successfully received. Once the tail flag bits are received, the host DSP system 139 prepares to receive the next RTMC status response packet designated for immediate
retrieval 172. All data bit fields in this packet 172; 10-16 I.D. character bit field 188b, time code bit field 187b, authentication bit field 186b, status response bit field 185b, DSP synchronization field 184b, and RTMC channel assignment bit field 183b, and the tail flag bit field 180b are used in an identical fashion as just described concerning the RTMC status response packet 170. However the RCTT Unit 96 is operating in active access mode (AAM) 297, and the RTMC channel assignment bit field 183b simply acts a verification indicator for the USPR hub 105.

Referring to Fig. 4 and Fig. 5, RCTT Unit 95 as detected FTMC packet 168 and responds to the noted absence of the RTMC channel assignment bit field. In its place is a filler data bit field 171. Because this filler data bit field 171 is contained in a FTMC command and control data packet designated for this RCTT Unit 95 alone, it responds not attempting RTMC channel access. The accompanying program command and control data bit field instructs the selected RCTT Unit to remain in passive sniff mode (PSM) 296. PSM in this case instructs RCTT Unit 95 to operate in power saving mode, and simply listen for time code information and DSP synchronization updates contained in the FTMC packets time code data bit field 175b, DSP synchronization data bit field 178b, and to respond internally to its received program command and control instruction sets contained in the program data bit field 179b.

Upon completion of the RCTT Unit 94 transmission of its RTMC status response data packet 170, RCTT Unit 96 is instructed to transmit its RTMC status response packet 172. But first other key process and procedures must occur in accord with the inventions novel CDTMA telemetry data management protocol. The RCTT Unit 94 operating in master mode (MM) 295, will passively detect and read all other FTMC command and control data packets, specifically it will key off the RTMC channel assignment bit field 177a, and passively read the time code data bit fields 175a located in FTMC packet 167 for a crucial innovative reason. When the RCTT Unit 94 operating in master mode (MM) 295 detects the RTMC channel assignment data bits 177a, it’s also uses or keys off the inclusive time code data bits 175a in order to cease transmitting SAT 282a at frequency 5970Hz for up to 1.5 seconds. Simultaneously, RCTT Unit 96 in fact transmits its assigned SAT 282c which is the same frequency 5970Hz and the exact same phase. Also RCTT Unit 96 will lock onto the SAT 281 being transmitted with the FTMC concatenated packet
stream broadcast. The currently serving cellular base site 101 and its inclusive voice/traffic channel transceiver cannot differentiate or discriminate which RCTT Unit transmitted this SAT tone 282c.

The host analog IS-553 compatible cellular system will allow up to two seconds if dropped SAT tone before it released the current call event. The inventions novel and elegantly simple approach creates a new paradigm in wireless telemetry data management. Once the selected RTMC status response data packet 172 has been successful transmitted it releases SAT 282c and ceases all RTMC activity. The RCTT Unit reverts to its currently ordered mode of operation. The next RCTT Unit is commanded to report in accord with the heretofore described manner. In this case RCTT Unit 96 was the last terminal to be instructed to report. Also all other FTMC program command and control data has been transmitted, received and processed accordingly. Also, this same CDTMA based SAT and RTMC signal control feature extends into digital cellular and PCS TDMA and CDMA FTMC and RTMC digital traffic channel management in terms of managing careful slot assignment. TDMA and CDMA cellular, PCS, analog and digital trunked mobile radio, trunked paging networks, spread spectrum networks such as Cellnet, Metrocom, and LMDS, Geo satellite, and mobile satellite digital traffic. Digital FTMC channel and RCTT Unit user-slot assignment is managed in a controlled interleaving means and method based on timed slot assignments, and digitally coded traffic control codes that have similar characteristics with analog SAT tone functions.

All users in a modern TDMA cellular system such as GSM allow multiple users to share a common channel on a defined schedule. Other users sharing the same physical channel have its own assigned, repeating time slot within a group of time slots called frames. A time slot in a TDMA based digital cellular or PCS environment is often called a channel. GSM for example sorts users onto a physical channel in accordance with simple FDMA techniques. Then the physical channels use is divided up in time into frames, during which eight different users share the same channel. The USPSR telemetry data system divides each TDMA frame into smaller increments, thus allowing multiple RCTT Units to use a single forward and reverse user frame assignment very efficiently without impacting conventional voice and data traffic. Radios in such TDMA systems transmit and receive on the same physical channel frequency, but never at the same time. One problem
that is critical in a TDMA cellular, PCS or satellite environment, is that by the time data bit information is sent from a transmitter and reaches a receiver, it is contaminated and distorted by five destructive influences; (1) the modulator, (2) the transmission medium, (3) noise sources, (4) fading phenomena, and (5) the demodulator. Everything that corrupts a radio signal originating at a transmitter on its way to receiver is called a channel.

When a conventional analog cellular mobile station is transmitting and receiving at the edge of base site cell footprint area destructive influences can be heard. Hisses, crackles, pops, interference and fading that sometimes annoy the users of analog cellular mobile stations. A user typically trains oneself to listen through all interference and distractions. The same phenomenon that causes these problems can completely destroy communications with digital radios. The USPR telemetry data management network supports mainly stationary application terminals the vagaries and unpredictable radio propagation characters of mobile applications do not dominate the inventions USPR-CDTMA performance and behavioral characteristics. RCTT Units operating in a stationary application point of use (APU), achieve a much higher rate successful telemetry data event completions. Therefore stationary RCTT Unit radio propagation performance predictability is much higher whether or not the host wireless telephony network platform is operating an analog FDMA, Digital FDMA-TDMA, digital FDMA-CDMA cellular modulation scheme.

A GSM TDMA channel spacing is 200Khz each physical channel frequency is further subdivided into eight different time slots numbered 0 to 7. Each of the eight time slots is assigned to an individual user. A set of eight time slots is referred to as a TDMA frame, and all the users of a single frequency share a common frame. If a conventional mobile station is assigned time slot number 1, it transmits only in this time slot and stays idle for the remaining seven slots with its transmitter momentarily turned off. The mobile stations regular and periodic switching on and off of its transmitter is called bursting. The invention fully exploits this feature so that its USPR CDTMA FTMC and RTMC concatenated packet protocols operate seamlessly with multiple RCTT Units as is the case in the heretofore disclosed and demonstrated operations in an analog IS-553 cellular system.
Referring to Fig. 4, shown here is a simple example of a TDMA eight user frame 173, assigned to a physical GSM channel 89. Each frame 173 is divided into eight time slots. If for example an RCTT Unit 94 that is operating in master mode (MM) 295, is assigned slot “1” 298a while operating in a GSM environment, the RTMC channel assignment bit fields 177c, and 177a as shown in FTMC concatenated data packet stream 88, would assign user time slots 298a, 298b, and 298c once the physical channel has been assigned in the same heretofore disclosed means and method of initial call/event set up has been complete. Every time the serving GSM compatible base site transmitted slot 1 on the forward channel, the RCTT Unit 94 upon completion of transmitting its own RTMC status response data packet 170, would continue transmitting TDMA signaling in order to maintain forward and reverse logical channel synchronization and timing. Upon reception of TDMA slot 298a, 298b, and 298c, a selected RCTT Unit 96 is ordered to transmit its RTMC status response data packet 172 in slot 1 timed increment as directed by the inclusive time code data bit field 175c, 175b, and 175a. Every other RCTT Unit that has been instructed to report during the same telemetry data event reports in time slot 1 until all the RCTT Units have completed bursting its RTMC status response data packet and the event is terminated appropriate to the operations standard of the host wireless platform.

The USPR telemetry data management network also supports RCTT Units that are IS-95 CDMA and wideband CDMA digital cellular compatible. While GSM TDMA, IS-136 TDMA and PCS wideband TDMA uses timing increments for slot, and frame logical channel management, CDMA in all its iterations is driven by specialized coding. Code Division Multiple Access (CDMA) places all users accessing a host digital cellular network on the same radio frequency channel at the same time. Just as in TDMA, digital cellular CDMA host network systems overlay CDMA schemes on a venerable FDMA frequency management plan. Mobile users of a common physical traffic channel frequency are separated from each other by superimposing a mobile station specific high-speed code on the modulation of each mobile station. Since the separating code has the effect of spreading the occupied bandwidth of each mobile stations radio transmissions the system is called a spread spectrum system. The spreading code comes from a long-code generator that is present in both the mobile station and the base station. The same applies to the IS-95 CDMA version of the RCTT Unit. Both IS-95 compatible mobile and base
stations use a 42-bit long-code mask. The base station mask code is a public mask and the mobile station or selected RCTT Unit coded mask is private and is based on the RCTT Units electronic serial number (ESN). The invention exploits the private coded mask in a unique and novel way that enables a plurality RCTT Units to received CDMA-FTMC channel concatenated data packet streams from one assigned CDMA traffic channel. Conversely this private coded mask manipulation enables a plurality of RCTT Units to burst or transmit RTMC status response data packets to one reverse CDMA traffic channel that is assigned to a selected RCTT Unit operating in master mode (MM) in a selected IS-95 compatible digital cellular network.

like GSM TDMA systems, IS-95 CDMA channels are constructed around the concepts of slots and frames. However slot and frames are assigned via a generated code instead of timed increments. The Long code generator creates a very long code from a mobile station specific mask supplied by an IS-95 CDMA mobile requesting a traffic channel. The mobile specific character of the traffic channels long code scrambles the forward traffic channel in a manner the target mobile or RCTT Unit can recognize as belonging to itself. One of the most important aspects of any CDMA technology is its ability to control transmitter power emitting from a mobile station during its burst transmission sequences. An RCTT Unit configured as an IS-95 CDMA compatible telemetry terminal will control its transmitted power carefully. The invention simply enables an RCTT Unit in master mode (MM) to detect its assigned code from the forward channel after successfully accessing the host IS-95 CDMA cellular network. The invention uses the voice/traffic channel in IS-95 CDMA cellular networks just as is the case with all other iterations and implementations of the inventions USPR means and methods. Since all digital cellular logical defined user channels transport voice as data details of its component parts must be considered. IS-95 CDMA payload data is produced by a variable-rate speech encoder with four possible output data rates: 9,600bps, 4,800bps, 2,400bps and 1,200bps. The rate depends on the speech activity. However, the inventions USPR CDTMA telemetry data packet protocols will flow at a constant rate of 9,600bps and in some cases 4,800bps because of vendor specific base site radio filtering. Like TDMA IS-95 CDMA uses a power bursting scheme.
Power levels of any CDMA compatible mobile station and a CDMA compatible RCTT Unit are controlled by the serving base station radio. Power output is gated on and off in the CDMA RCTT Unit to reduce the average power in the reverse traffic channel as it appears at the base station’s receiver. This has the effect of reducing the interference levels throughout the CDMA system and improves system capacity and performance. Like all other cellular system IS-95 CDMA cellular uses forward paging channels (PCH) and reverse access channels for mobile station control and access respectively. Conventional mobile stations and IS-95 CDMA compatible RCTT Units gain access to the host CDMA cellular network by first listening for a PCH channel for the purpose of decoding a possible paging message from the network. When the RCTT Unit decodes a page during the initialization of an USPR telemetry data network event and responds with access procedures. Or if the RCTT Unit initiates a telemetry data event during an exception report procedure via the currently serving CDMA reverse traffic channel, the unit must also initiate an access procedure.

Once paged by the serving CDMA PCH channel the RCTT Unit operating in master mode (MM) starts the access procedure by choosing and available an access channel and the building the proper logical channel structure for a reverse access channel. Once the structure is properly built, the RCTT Unit bursts access probes that are repeated at pseudo random times with increasing power levels with each repeat cycle until an acknowledgement from the serving base site PCH channel is received. The RCTT Unit adopts the PN code it detects on the base stations pilot channel and uses it to calculate its private coding mask in conjunction with its ESN structure. Simultaneously a plurality of selected CDMA compatible RCTT Units is paged by the same serving PCH channel with a global/secondary mobile identification number (MIN).

As heretofore disclosed, the selected RCTT Unit scans all CDMA physical channel frequencies looks on the coded channel frame which is same PN code used by the RCTT Unit operating in master mode (MM) and detects the FTMC concatenated data packet stream. Each RCTT Unit downloads all the program command and instruction data. RCTT Units that are selected to transmit its RTMC CDMA burst packets on the commonly assigned reverse traffic channel. Each RCTT Unit operating in AAM mode bursts a probe for the same private mask spreading code that is being transmitted to the RCTT Unit.
operating in master mode (MM) from the serving base site. The invention manipulates the technique of using an ESN to create a private masking code, by creating an additional data storage structure that holds a pseudo ESN that matches all other CDMA compatible RCTT Units operating in the same application group. Since each ESN is unique to each mobile station or RCTT Unit security and efficient CDMA traffic channel management is achieved. Also under F.C.C. rule 22.919, an ESN must be factory set and must not be alterable, transferable, removable or otherwise able to be manipulated in any way. Recently this rule has been made into federal law.

The invention does not manipulate the factory set ESN number and its storage entity called a number assignment module (NAM). However, the invention creates a common database within the internal data structures of all of its CDMA compatible RCTT Units that utilize an eight character hexadecimal code that resembles an ESN data bit field structure, but, it is only used for the purposes of the invention to create duplicate private mask codes for multiple RCTT Unit bi-directional telemetry data communication interactions over one forward and reverse CDMA traffic channel. Normal ESN functions such as enabling proper host and USPR network registration and authentication procedures is not effected because the original ESN NAM is not altered in any way. Also registration notification protocol procedures that are IS-95 and IS-41B, C and D revision compliant, and are not altered or compromised in any way.

Therefore the invention is able to provide duplicate private masking codes to that a plurality of CDMA compatible RCTT Units operating in PSM mode and AAM can received CDMA based FTMC data protocols on the same assigned CDMA forward traffic channel, and RCTT Units operating in AAM mode may transmit CDMA based RTMC status response data packets on the same assigned CDMA reverse traffic channel that is bursting from a CDMA compatible RCTT Unit operating in master mode (MM). Once an acknowledgement is received on the serving PCH channel, the serving base site assigns a traffic with a corresponding code called a Walsh code, and the RCTT Unit responds by changing its coding mask, with which it calculates its long code, from a public access channel coding mask to a private RCTT Unit specific channel coding mask. The invention exploits this public and private masking procedure so that a plurality of CDMA compatible RCTT Units can operate seamlessly in CDMA compatible cellular, PCS and
satellite networks without causing conflicts with conventional CDMA user voice and data traffic. This complicated coding mask procedure is know to those whom practice the CDMA art, therefore complete description of this process is deemed unnecessary for the purposes of this disclosure. Only the CDMA components necessary to provide description of the novel features of USPR CDMA implementations and operations need to be disclosed here.

Accordingly, the core idea of transmitting CDMA based FTMC concatenated telemetry data packet streams to a plurality of CDMA compatible RCTT Units operating on one assigned CDMA traffic channel. This feature ensures that all RCTT Units receive individual program command and instruction data in the same telemetry data event. Conversely the same RCTT Unit is able to transmit CDMA compatible RTMC status response data packets on the same assigned reverse CDMA traffic is completely novel in the CDMA cellular and PCS art today. CDMA trunked mobile radio will utilize the inventions process and procedures in the same way that digital cellular and PCS CDMA does.

Another important object of the invention is the USPR telemetry data management network’s CDTMA protocol also provides exception report status response telemetry data packets. The invention has defined two classes of exception reporting procedures, and event acknowledgements packet that involve specialized telemetry data packet event management protocols. The first or primary class of exception report methodology relates to the inventions CDTMA FTMC and RTMC concatenated telemetry data management protocol. Each stationary group or class of application specific telemetry data device has unique data packet protocol management requirements. Another important point is that when a multiple RCTT Unit event occurs there is never a mixture of RCTT Unit application specific devices. In a 50 RCTT Unit combined telemetry data communications event, all 50 will be of one application specific class. For example all fifty application specific devices in this case can be electrical measurement meters for the AMR category of USPR application specific classes of service. Therefore every USPR wireless data telemetry event that comprises a plurality of RCTT Units in that event is focused upon one application specific class of service (ACOS). This plan is important in order to maximize efficiency, performance predictability, and maintain a low cost for every event in terms of
host network accumulated airtime costs. Another reason for establishing a distinction between one ACOS and another is the following. Simply, an AMR application specific class event transpiring in a host trunked mobile radio environment needs to be managed differently than a AMR class operating in a host analog cellular environment. A security system class operating in an LEO satellite environment such as the Globalstar system must be managed differently than a security class of service operating in a GSM digital cellular environment for example. However, all such host wireless telephony systems can be managed from one USPR host hub system

Referring to Fig. 9, depicted is a reverse voice/traffic channel exception report data packet 200. Also depicted is a forward voice/traffic channel version of a forward exception programming, command and control data packets 201. In terms of the details of the invention, these packets are deemed primary exception report enabling telemetry data packets. These reverse and forward primary data exception report packets are formatted in the same way that FTMC and RTMC concatenated data packets are formatted except these packets are used in single forward and reverse channel events and are not used for FTMC and RTMC concatenated packet events that support communications with a plurality of RCTT Units. Also included is an acknowledgement data packet 202 that is sent from the USPR host or an RCTT Unit upon completion of certain autonomous telemetry data events. All three packets are similarly formatted. For example, all three packets use a 104-bit packet header 285, 285b and 285c. The term autonomous relates to whether an RCTT Unit operates by itself or as part of an application specific group. Also an RCTT Unit can autonomously invoke a singular USPR telemetry data event without being ordered by the USPR data management hub.

The header contains RCTT Unit 10-16 character I.D. information, and other bit fields specific to overhead control and other USPR network, RCTT Unit management information. All three packets are formatted around a rigid packet capsule 284, 294 and 203 that have a total payload capacity of 250 bytes. 288, 288b and 315. Each of the three examples also use packet padding 287, 287b and 287c that is typically comprised of binary data that acts as filler that is graduated in order to enable variable message bodies. If the message body 288, 288b and 315 is less then its limit of approximately 200 bytes 290, 290b and 206. Binary padding data bits are designed to take up the difference.
The reverse 200 and forward channel data packets 201 can be concatenated in multiples sufficient to deliver a predetermined telemetry data event payload. The synchronization bit fields 292 and 292b are used two or more packets together in a codified concatenated string. The reverse channel data packet 200 is used when an application specific telemetry system must report an exception event such as a fire alarm, burglar alarm or other such event. If for example an alarm report must be sent from an RCTT Unit that is not at present part of an USPR multiple RCTT Unit CDTMA event cycle, there must be away to enable an exception report status. In many host network management schemes there may never be a need for an exception report capability. For example in a trunked mobile radio network that provides constant USPR FTMC and RTMC bi-directional communications all exception reports are included in the RTMC status response data packets. Also any RCTT Units that are paged or polled yet are not ordered to report during the instant event may have an exception report to transmit. The invention provides the means and method to allow any non-schedules exception data packets to be burst at the end of a given RCTT Unit event that involves multiple unit communications. As long as the selected RCTT Units 10-16 character is broadcast as part of the concatenated FTMC string an RCTT Unit that needs to burst or transmit an exception report packet 200. However, the invention must provide the capability of enabling stand-alone exception report packet events whether or not there is a multiple RCTT Unit event transpiring in the same APU.

The forward channel message program and command data packet 201 is used only for standalone USPR telemetry management events when a selected RCTT Unit is to be polled, or paged in given host wireless network. Both reverse and forward single event telemetry data exception report packets are transmitted upon completion of a successful call set up and tear down in a host cellular, PCS or telephony based LEO or GEO satellite network. In a trunked mobile radio network, EDACS, two-way paging network, one way paging network, narrow band PCS network or other non-telephony based network telemetry data events are set up and torn down in accord with standard procedures endemic to the instant network.
Referring to Fig. 9, the acknowledge data packet 202 is an optional feature used as an important notification medium for a variety of USPR telemetry data management functions such as; this acknowledgement data packet is used to notify a selected RCTT Unit that the USPR host has received the instant exception report that was embodied in the instant reverse channel status response packet 200. Also another important feature of the Acknowledgement packet 202 is that it can be used in the USPR FTMC concatenated data packet stream at the conclusion of a multi-RCTT Unit telemetry data event. This acknowledgement packet can also be used as a heartbeat packet that is transmitted periodically to notify the USPR hub that its associated RCTT Unit, RCTT Unit mini-hub or specific ISM 2.4GHz node group is operating properly. The heartbeat packet approach can be used in an exception report basis, or as part of the inventions CDTMA FTMC and RTMC concatenated packet protocol schemes.

Certain application specific processes will call for an acknowledgement packet 202 to used as a medium for received data packet content checksum verification or form of error correction means. Also under certain robotic control scenarios, a FTMC concatenated acknowledgement data packet stream will invoke heretofore disclosed telemetry a data event completion algorithm. Another words, when a plurality of RCTT Units receive program information, and send RTMC status response data packets, the USPR host will send a plurality of FTMC concatenated acknowledgement data packets. In some scenarios, even if a RCTT Unit was not ordered to transmit an RTMC status response data packet, and only received updated FTMC program and command and control data instruction sets, it may be deemed necessary for a designated RCTT Unit to transmit an acknowledge data packet 202 within the processes and procedures of a multiple RCTT Unit telemetry data communications event. Other such important process can be verified by the use of acknowledgement data packets such as; authentication verification, RCTT Unit control information, radio performance reports, irradiated power level reports, back up battery information, maintenance information, an affirmation of time code and DSP synchronization status and other such key RCTT Unit monitoring. Conversely, the USPR acknowledgement packet response system is also used for USPR host to RCTT Unit responses that also deal with data integrity and other heretofore disclosed means and methods.
Referring to Fig. 10, depicted here is a secondary exception report and USPR data acknowledgment report packet 218. This packet is formatted for use in wireless telephony networks such as analog cellular, digital PCS, telephony satellite and other such networks. Also a variation of this packet can be used for trunked mobile radio networks and other such wireless-telephony wireless networks. Trunked mobile radio networks such as the Motorola iDen System, and the Ericsson EDACS System utilizes control channels in the same way as analog AMPS, TACS, and NMT cellular systems. Typically this packet format is used for control and out-of-band signaling functions. For the purposes of this disclosure the IS-553 analog cellular version of this packet will be discussed. In fact the depicted format shown here is the compatible configuration for use in an AMPS IS-553 compatible cellular network. Accordingly, this secondary exception report and USPR event acknowledgement data contains key RCTT Unit control, authentication, application specific device status and other important information. This packet is divided into three sections. The first word group or section 219 is concerned with RCTT Unit identification, and host wireless and wireline packet routing information. In a host analog cellular network, this first section 219 is also used for registration notification purposes. This REGR section 219 is comprised of three data block words. The first word 222 contains the primary mobile identification number (MIN) 232 and other pertinent network and packet control information. The second word 223 contains the secondary MIN 233, which is the number plan area (NPA) designation.

In common telephony parlance this NPA is also known as the area code. Also in included in this word are the cellular event order and order qualifier bits 234. This information is used by the serving base site and MSC to determine whether or not the event is a registration notification or a call origination. A registration event only allows for this section 219 to be transmitted from an RCTT Unit to a host wireless network. An origination order must be used to cause the other two sections 220, and 221 respectively to be transmitted and processed properly by the host wireless network. The next word in the first section of the triad 224 is used primarily to contain the RCTT Units electronic serial number (ESN) 235. The ESN is used for authentication within the processes and procedures of host wireless network authentication and user identification procedures. The inventions USPR network hub also uses this number for authentication and identification procedures.
Referring to Fig. 10, the next section 220 contains 16 four or eight bit characters depending on what type of host wireless network this packet is being utilized in. In this iteration each character or digit is comprised of four bits. These characters are used in host wireless telephony networks as conventional dialed digits. There are technologies known in the art today that use dialed digits for the transport and delivery of application specific telemetry data information to virtual network providers such as Aeris Communications based in San Jose California. The invention provides this packet for application specific telemetry data transport for trunked mobile radio networks that interconnect with the PSTN and other telephony wireline networks such as SS7 out of band signaling networks. The invention provides for specialized application specific data transport from RCTT Units that are compatible with these trunked radio networks and is configured to transmit this packet 218 via trunked mobile radio network base station repeaters, control center switches and to the USPR Hub via the heretofore SS7 in-band signaling network. This packet is used to automatically route the inventions digital voice based CODEC, preamble packets and applications data packets from any host trunked mobile radio network control channels, and side band set up channels and voice channels since these networks are telephony architecture. Such trunked mobile radio networks can utilize this completely novel approach including but not limited to Motorola iDen and Ericson EDACS using IS-41A, B, C, D, E type or equivalent protocols and procedures.

For trunked mobile radio and cellular networks the packet section 220 of the instant multiword packet 218 is only included when the service order is an origination. Registration and origination procedures are will known to those practice the cellular, PCS, satellite and otherwise related wireless telephony art, therefore specific detailed disclosure of these conventional protocols are omitted. An RCTT Unit operating in a host wireless telephony network will always burst an origination version of this packet of the event warrants the inclusion of additional information beyond what can be provided in section one.

The packet may include section one 219 and two 220 only. Section three 221 is added only if the event warrants the additional data bit capacity and or the host wireless network is configured to process all three sections of this depicted packet. Some wireless
telephony networks are configured to detect, analyze and process 16 characters of dialed digit information that comprises data D word 225 and data E word 226. The included eight characters in the data D word 229 and the eight characters in data E word 230 added together comprise 16 characters of dialed digits or application specific information.

These characters can represent global positioning information, AMR status information and other heretofore disclosed application specific information. The same is the case for section three 221. By adding the two data words in this section, total application specific digits are characters come to 32. Also these 16 to 32 characters can be used as USPR telemetry data event acknowledgement data. Upon completion of an autonomous RCTT Unit event the packet can be sent as a successful event completion indicator. In some cases this entire packet or an abbreviated version of it can be used as an USPR telemetry data event medium. Such information as checksum and other error correction indicators can be formatted within the conventional parameters of this contained dialed digits.

The origination version of this packet must also be used in order to set up an autonomous USPR telemetry data event that involves only one RCTT Unit. Or this packet is used as an event invoke medium that encompasses an RCTT Unit initializing a master mode (MM) scenario that involves a plurality of additional RCTT Units. In other words the origination version of this packet is used to initialize a conventional call set up that belies the fact that it originates a singular or multiple USPR RCTT Unit telemetry data event.

One of most powerful and important components of the invention is its unique, novel and elegantly efficient use of its RCTT Unit mini-switch-hub, and spread spectrum ISM 2.4Ghz nodes. Also, how the inventions RCTT Unit mini-hub is designed to manipulate 32 ISM 2.4Ghz frequencies, ISM paging frequencies, and ISM node frequency assignment on a per-event basis. The invention is first technology the creates a cellular telephony based; telemetry data communications network that is a microcosmic reflection of how a cellular mobile switching center (MSC) manages and assigned cellular base site frequencies. Integrating an eight to 32 bit microcontroller-CPU 270 that provides very high level of integration, Low-power consumption and low cost. Together with the ISM
front-end baseband spread spectrum subsystem modem 44, and the host network base
band FM/TDMA/CDMA modem, includes an internal eight to 16 bit controller with ROM
269, RAM 159 and all necessary peripheral functions. The CPU 270 can use a radically
modified 80C51 or other off the shelf instruction set that enables simultaneous
management of 72 ISM nodes on the front end of the RCTT Unit mini-hub, and the
inventions CDTMA-FTMC-RTMC protocols on the back end. A frequency hop
transceiver is applied to circumvent interference and fading. A shaped, binary FM
modulation scheme is applied to minimize transceiver complexity.

The air interface radio message that communicates between the ISM 2.4GHz node
158 and the RCTT Unit mini-hub front end is based on a nominal antenna power of 0dBm.
As disclosed, the air interface complies with the FCC rules for the spread spectrum ISM
band at power levels up to 0dBm. Spectrum spreading is accomplished by frequency
hopping in 79 hops displaced by 1 MHz, starting at 2.402GHz and stopping at 2.480GHZ.
The maximum frequency hopping rate is 1600 hops/s. The nominal air interface link range
is 10 centimeters, but can be extended to more than 100 meters by increasing the transmit
power. The invention extends this range by providing selected ISM 2.4GHz nodes 158 that
communicate with ISM 2.4GHz master mode node 243. Each ISM 2.4GHz node is
communicated with via a spread spectrum frequency hopped scheme that is dynamically
assigned by the RCTT Unit mini-hub 91 on a per event basis, and controlled by the
associated ISM 2.4GHz master mode node 243b that manages a eight ISM node group.
Each hopped frequency that is designated for a node is considered an air interface link.
The link type remains consistent for a standard uniform USPR ISM telemetry data packet
format is used all air interface links.

As previously disclosed, certain conventional ISM baseband technology supports
two link types: Synchronous Connection Oriented (SCO) type used for voice and
Asynchronous Connectionless (ACL) type used for packet data. Each link type supports
up to sixteen different packet types. Four of these are control packets and are common for
both SCO and ACL links. Both link types use a TDD scheme for full-duplex
transmissions. The invention eliminates the voice portion of the conventional ISM
specifications and thus utilizes this voice capacity to support SCO based application
specific telemetry concatenate data packets. The inventions bucket brigade approach to
packet flow is a model of efficiency, uniformity and simplicity. When the RCTT Unit mini-hub 91 relays an ISM based FTMC concatenate packet string to an ISM 2.4GHz master mode node 243b and or individual ISM 2.4GHz nodes 158a, 158b, 158c, 158d, 158e, 158f and 158g, each one receives the entire ISM FTMC concatenate data packet string. Then the node mirrors or snap shots the portion of packet or packets that are designated for its use, and then passes the ISM based FTMC concatenate packet string to the next ISM sub-mini hub, or node until all the designated sub-mini hubs and nodes receive its specified application specific data packets. 80C51 ISM protocols allows for variability in terms of choosing what packet types and sizes can be used by the invention. However, for efficiency sake, the invention uses a standard uniform ISM FTMC, ISM RTMC, and exception report packet format and capacity.

As heretofore disclosed, the invention eliminates the variability of packet flow data rates. Therefore ISM link bandwidth management if predictable in terms of what occurs in a given ISM application data packet transmission event from an RCTT Unit mini-hub, to a spread spectrum node and visa versa. As mentioned before any connection in a piconet or extended piconet from any RCTT Unit min-hub to one or a plurality of ISM 2.4GHz nodes, require that all nodes designated for a specific paging/polling event are in standby passive sniff mode (PSM) mode. In this mode, an idle node-unit periodically “sniffs” for application specific telemetry message every 1.28 seconds. Each time a device wakes up it listens on a set of 32 hop frequencies defined and assigned by the RCTT Unit-mini-hub for each spread spectrum 2.4GHz node in its operational domain. However, the invention adds another important step above and beyond conventional 80C51 instruction set parameters. In Fig. 3, the RCTT Unit-mini-hub 91 maintains an ISM node profile database (NPD) 210 for all active and reserved ISM spread spectrum frequencies.

The NPD module is able to store currently ISM node profiles that include assigned, frequencies for completely managing up to 8 ISM 2.4GHz embedded transceivers and 72 individual ISM 2.4GHz nodes. The NPD database has the capacity of storing 72 comprehensive ISM node entries. The 72 NPD database entries are dynamically addressable from the CPU 270 and its associated RAM module 159 in order to maintain a robust USPR telemetry data event management scheme. This NPD module stores currently assigned ISM 2.4GHz node profiles: (1) each individual node I.D. and MAC
address (2) node paging frequencies, (3) exception report frequencies, (4) ISM FTMC receive frequencies, (5) ISM RTMC access frequencies, (6) current operational modes; Park mode, Hold mode, PSM mode, AAM mode, not operational, out-of-service and the like.

Accordingly, the invention in fact creates an ISM 2.4GHz based microcosmic digital spread spectrum cellular telemetry data network. Whereby each 2.4GHz node is completely controlled like a separate mobile subscriber station operating in a cellular network. However, unlike a conventional cellular subscriber station each 2.4GHz node can be commanded by the RCTT Unit mini-hub to communicate with other 2.4GHz nodes in a concatenated route “bucket brigade” relay fashion that is similar to how roaming mobiles are handed off from channel to channel, or base site to base site. Each RCTT Unit mini-hub operates like a combined mobile switching center (MSC) and cellular base station controller (BSC). An RCTT Unit mini-hub can be configured to have from one to eight-separate spread spectrum ISM 2.4GHz TDD or full duplex data communications capable transceivers.

This feature solely depends upon the polling and reporting capacity needs of each installed ACOS system in a selected APU. For example an electrical power meter (AMR) ACOS will have different polling and reporting requirements as opposed to an oil well management ACOS, or a propane tank ACOS. Another capacity related issue involves the potential exception-report probability ratio of a given ACOS. For example the exception-report probability ratio of a security related ACOS is much higher than an agricultural irrigation management ACOS. In a security related ACOS, the theoretical capacity needs of 72 spread spectrum ISM 2.4GHz nodes integrated with commercial and residential security panels must allow for possibly 72 security panels needing to report simultaneously.

With flexible ISM 2.4GHz node RCTT Unit mini-hub ISM channel exception report access protocols, the invention allows for only small increments of delay between the origination and termination procedures in order accommodate all 72 exception reports without any ISM data packet collision or service access denial from the RCTT Unit mini-hub. A security related RCTT Unit mini-hub that serves a large security ACOS group
must be configured with eight internal ISM 2.4GHz transceivers embodied in the
heretofore mentioned specialized ISM radio cards that adhere to such standard card slot
formats such as PCM/CIA. The RCTT Unit wireless mini-hub must be configured with
full ISM profile database flexibility coupled with complete ISM data event frequency
management. Because of its cellular like frequency management capabilities, the RCTT
Unit mini-hub, and its set of 72 security related spread spectrum ISM 2.4GHz nodes can
be completely managed efficiently.

Referring to Fig. 5, in some ACOS ISM configurations, the RCTT Unit mini-hub
will access a mirrored ISM profile data base (PDB) 212 that is co-located at the USPR
Hub 105. The ISM-PDB 212 acts as a back up data base that stores all current ISM
2.4GHz node; paging, ISM-FTMC, ISM-RTMC, exception report access channel access,
acknowledgement packet access, heartbeat packet access spread spectrum hopped
frequency assignments. Other pertinent ISM 2.4GHz node profile information included in
the ISM-PDB 212 is current operational mode assignment, such as: active access mode
(AAM), passive sniff mode (PSM) park mode, ISM hold mode, ISM standby mode,
inquiry message mode, ISM master, mini-hub mode and the like. ISM 2.4GHz node
configuration depends upon the desired operations scheme, and capacity of a selected
application specific group implementation in a given USPR APU, that directly relates to
the application class of service (ACOS) being served and managed. Complete flexibility is
an important hallmark of the inventions protocol means and methods. The USPR telemetry
data network is the first complete virtual telemetry network system that can operate in any
host trunked wireless and satellite based wireless network known in the art today. The
USPR CDTMA protocol and USPR hub system establishes an optimum operations
environment unparalleled in the history of wireless SCADA/telemetry data system
creation.

Referring to Fig. 8, depicted is an RCTT Unit mini-hub 91 managing 72 ISM
2.4Ghz nodes operating in various status-state configurations. Each nodal group 259a,
259b 259c, 259d, 259e, 259f, 259g and 259h is being communicatively managed by a
selected ISM 2.4GHz nodes; 260i, 261i, 262i, 263i, 264i, 265i, 266i and 267i operating in
permanent master-mode (PER-MM), 243a, 243b, 243c, 243d, 243e, 243f, 243g and 243h.
In some configurations designated ISM 2.4GHz nodes will be initially set up to take some
of the processing load from the RCTT Unit mini-hub 91 ISM transceivers 211, and the
ISM front end processing and management algorithms. An important note here is that any
of the inventions ISM 2.4GHz nodes can operate in ISM master mode (MM) 214a, 214b
that is dynamically assigned on a per event basis by the RCTT Unit mini-hub 91. As
disclosed, any RCTT Unit can operate in master mode (MM) if so instructed by the USPR
hub. The RCTT Unit mini-hub 91 also instructs any ISM 2.4GHz node to operate in
dynamic Master Mode (MM) as commanded by the USPR hub, or autonomously by the
RCTT Unit mini-hub 91. In some ACOS implementations, the USPR hub sends command
and instructions to each ISM 2.4GHz node via the host wireless network and the
dynamically ordered by the serving FTMC concatenated packet stream 88 as depicted in
Fig. 4. The ISM 2.4GHz node program, instruction sets, hopped frequency assignments,
operation modes; master mode (MM), park, standby, route relay (RR), AAM, PSM, turn
off, turn on, application specific programs are all sent in the program data bit fields 179a,
179b, and 179c of the depicted FTMC forward channel packets 167, 168, and 169
respectively. The RTMC status response packets 170 and 172 also transport ISM 2.4GHz
node status to the USPR Hub 130 to verify heretofore mentioned ISM 2.4GHz node and
collective nodal group or piconet 259a operating in a selected APU 99 status.

Referring to Fig. 8, this information is also sent to and from the selected RCTT
Unit mini-hub 91. Accordingly, before any spread spectrum ISM 2.4GHz node based
application specific telemetry data communications are initialized, all nodes that are
ordered to participate and receive ISM FTMC stair-stepped/frequency hopped
concatenated data packets are paged and commanded to be set in ISM FTMC standby
mode. Simultaneously each participating node is also ordered to reset its ISM FTMC
frequency to a common hopped receive frequency that all nodes in up to a complete eight
nodal group, or single piconet 259a will receive the FTMC concatenated packet stream
simultaneously. Or through the inventions ISM FTMC 250a, 250b, 250c and or /ISM
RTMC 251a, 251b node route/relay protocol controlled by the RCTT Unit mini-hub 91
internal firmware and software as depicted in Fig. 11. In this RCTT Unit mini-hub 91
instructed mode, an idle spread spectrum ISM 2.4GHz node periodically listens for query
messages every 1.28 seconds on one set of 32 hopped frequencies potentially assigned to
each node by the RCTT Unit mini-hub 91 as depicted in Fig. 8.
In most geographic regions the number of hop frequencies is 32 except for Japan, Spain and France. However one of the key features of the inventions ISM means and methods is that all spread spectrum 2.4GHz node frequencies are not assigned by randomly selected long codes or spread spectrum PN codes, all Spread Spectrum long code and PN code algorithms are programmed to set the exact frequency called for by the RCTT Unit mini-hub like conventional cellular mobile switching center (MSC) and base site controller (BSC). All ISM 2.4GHz nodes are assigned frequencies under stringent control by the RCTT Unit mini-hub 91 and or the USPR hub’s inclusive ISM profile database (PDB) 212 as depicted in Fig. 5. This stringent spread spectrum 2.4GHz node frequency management control algorithmic scheme is a key enabling feature of the invention. Referring to Fig. 8, each time an spread spectrum 2.4GHz node wakes up and listens to either simultaneously transmitted and/or routed and relayed by query orders originating from the RCTT Unit mini-hub 91. The telemetry data connection procedure is initiated by one of the RCTT Unit mini-hub 91 ISM 2.4GHz transceiver A 211 dynamically assigned by the RCTT Unit mini-hubs 91 internal spread spectrum 2.4GHz node program profile database and spread spectrum subsystem.

For example, once the RCTT Unit mini-hub 91 checks its ISM profile database and verifies current application specific node group or piconet 259a paging frequency assignment for each participating ISM 2.4GHz node, 260a, 260b 260c, 260d, 260e, 260f, 260g and 260h it prepares to send a page. If the currently set frequencies if this nodal group or piconet 259s do not conflict with current pacing frequencies set for node group or piconets 259b, 259c, 259d, 259e, 259f or 259h than the RCTT Unit mini-hub 91 transceiver A 211 prepares to transmit a simultaneous global page or route/relay node to node page message. Transceiver A’s 211 clock and hopping sequence are used to synchronize all other nodes in the group or piconet. However, RCTT Unit mini-hub ISM transceiver clocks are all timed to the USPR PRS system via continuously updated time code data bit fields. If the spread spectrum 2.4GHz nodes 260a through 260h are physically placed in a radio propagation environment whereby each node has approximately equal access to the ISM spread spectrum signal transmitted from the RCTT Unit mini-hub, than a simultaneous global page is sent and received by each node. During an ISM broadcast page or ISM FTMC page event, all spread spectrum 2.4GHz nodes that are designated to participate in a given data communications event can be assigned an
optional three bit MAC address in addition to the 10-16 character I.D. However, the 10-16 character I.D. serves almost all addressing, routing and processing needs envisioned.

If for example, each node is physically placed whereby only a few can receive a simultaneous page, then a route and relay page algorithm is initialized whereby each ISM 2.4GHz node hands off or hands over the page message data packet string to the next node participating in the page order. Embodied in each concatenated ISM 2.4GHz node route/relay page packet message are instructions for internodal page message handling and instructions to have key ISM 2.4Ghz nodes in a selected ISM nodal group or piconet, extended piconet and the like to become ISM 2.4GHz master mode (MM) nodes. Once designated the ISM node dynamically acts as the control point for sections of nodal group/piconets that do not have direct line-of-sight radio link capability between a selected ISM node and the selected RCTT Unit mini-hub 91 ISM transceiver such as A 211. Typical radio propagation environments are subject to path loss due to signal fading, absorption, and reflection due to the effect of foliage loss attenuation especially when managing high frequencies. Mountains, hills, buildings all add to the problems of placing any radio, especially radios that operate in the Gigahertz bands.

Referring to Fig. 11, for example the RCTT Unit mini-hub 91 has been instructed by the USPR hub that all spread spectrum ISM 2.4GHz nodes 260a, 260b, 260c, 260d, 260e, 260f, 260g and 260h and each application specific device must perform an application specific function, and then report the results of the ordered function. Accordingly, while ISM 2.4GHz nodes 260a, 260b, 260c, 260d and 260e have sufficient line-of-sight signal strength, ISM 2.4GHz node 260f has marginal radio path integrity and node 260g and 260h have no direct radio link path connectivity. Therefore, ISM 2.4GHz node 260e is designated as the master mode (MM) operant 214a that will act as the route/relay point for nodes in the group or piconet during the instant telemetry data paging, ISM FTMC, and ISM RTMC event that do not have direct line-of-sight with the RCTT Unit mini-hub 91. For this event, ISM 2.4GHz node 260e in master mode (MM) 214a acts as the event controller for nodes 260f, 260gh and 260h. Because of the physical topography of a particular APU, these depicted isolated ISM 2.4GHz nodes will have to relay ISM exception reports to nodes in the same group that have sufficient line of site radio signal strength to the RCTT Unit mini-hub 91.
The initialization phase of a planned synchronous data telemetry event involves the transmission of concatenated ISM FTMC pages to some nodes, and simultaneously transmission of asynchronous ISM broadcast pages to still other nodes. There are three page message types each with its own group of embodied command/action codes: (1) RCTT Unit mini-hub global page that causes all spread spectrum ISM 2.4GHz nodes to respond in accord with contained instruction sets, commands and action codes. This particular page message is an amalgamation of the conventional ISM inquiry message and the connecting pageinvoke. The invention uniquely modifies and significantly improves on the conventional means and methods and optimizes wireless data telemetry application usage of ISM 2.4GHz 80C51 technology and other spread spectrum based protocols. Since the RCTT Unit mini-hub always knows its 10-16 I.D. address and physical location of any selected spread spectrum ISM 2.4GHz node under its control auspices the conventional ISM node search function of the 80C51 inquiry message is deemed not needed by the invention. Simply if a selected spread spectrum 2.4GHz node is paged and does not respond as ordered then the node is deemed non operational and is either repaired or replaced in the field by qualified personnel.

This forward page message has four spread spectrum 2.4GHz node Command/Action codes: (a) set to this designated ISM FTMC (SS) hopped frequency, receive, recognize and wait for the next concatenated forward ISM FTMC telemetry “bucket route/relay brigade” or simultaneous distributed data packet stream via the RCTT Unit mini-hub. (b): set to this designated ISM hopped frequency for next Reverse Channel exception report. (c): set this ISM hopped frequency and respond with an optional ISM acknowledgement report, in accord with received time coded instructions. And (d), set selected ISM node to master mode (MM), as a route/relay point for down stream nodes that are operating adjacent and can detect the hand over channel signal but cannot detect direct link transmission power emanating from the RCTT Unit mini-hub ISM transceiver. (2) Next page message type is a nodal group(s) specific or piconet(s) specific page that serves the same utilitarian functions as the full RCTT unit mini-hub global page albeit on a smaller more localized scale. (3) This page message has all the features of the other two, but is only sent to one ISM 2.4GHz node at a time. Unlike other ISM 80C51 based wireless technologies one of the fundamental means and methods of the invention is that
all USPR ISM based data packet messages are coded with unique identifiers. Also, like conventional one way and two way pagers, each of the inventions ISM 2.4GHz nodes are designed to only recognize messages that contain a 10-16 and in some cases a 10-64 character identifier that resides in the node designated page/polling packet header.

The invention provides complete hopped frequency assignment flexibility because it is coupled with flexible time coded (TC) ISM packets and ISM node reporting instruction sets. Because of this there is little possibility of interference from other adjacent application specific telemetry data nodes. Also the invention is designed to avoid interference from other conventional ISM 80C51 communications, or cause interference to other non-USPR spread spectrum 2.4GHz nodal communications. With the exception of asynchronous broadcast pages and asynchronous ISM reverse channel exception reports, all ISM RTMC, ISM paging responses and ISM RTMC route/relay packet transmission activity is driven and governed by ISM FTMC originated time coded spread spectrum ISM 2.4GHz node response assignment. This works in conjunction with ISM hopped frequency management, all governed by the selected RCTT Unit mini-hubs ISM front end and selected ISM transceiver. There are for example 16 different hopped frequencies available for paging 2.4GHz nodes. There are 32 hopped frequencies designated for each ISM 2.4Ghz nodes. The inventions ISM baseband technology supports two link types: Synchronous Connection Oriented Concatenated (SCOC) used primarily for ISM concatenated FTMC packet streams, and route/relay paging packet streams that are managed in a node to node “bucket brigade” route/relay fashion. And, Asynchronous Connectionless Exception (ACE) report packets, and simultaneous ISM Asynchronous Connectionless Paging (ACP) paging broadcast messages (ACP) type used for ISM 2.4GHz node broadcast paging and status response exception report packet data. In conventional 80C51 SCO protocols this link type is used for connection based voice communications. The invention radically modifies this feature for more efficient and predictable concatenated telemetry data connections and packet stream communications whereby a voice service like circuit switched connection is necessary.

Different 2.4GHz nodes operating in master mode (MM), route relay (RR) mode or asynchronous receive broadcast mode, or transmit asynchronous packet mode. The same nodal group or piconet can use different link types during a selected event, and the link
type can change depending upon the communicate need determined by the RCTT Unit mini-hub during the same instant event. Each link type supports ISM FTMC, ISM RTMC, ISM paging and ISM exception report concatenated and singular packet types. Both link types use a time division duplex (TDD) scheme for full duplex transmissions. The SCOC link type is symmetric and supports timed bound ISM FTMC and ISM RTMC, and synchronous “bucket brigade” code driven concatenated ISM paging packets. The inventions spread spectrum 2.4GHz nodes must be first paged and ordered to report ISM RTMC concatenated packet streams. ISM RTMC concatenated status reporting packet streams cannot be transmitted autonomously. However, ISM node reverse channel exception report packets can be transmitted autonomously without the ISM 2.4GHz node being paged first.

The RCTT Unit mini-hubs ISM 2.4GHz transceiver controls the dynamically assigned channel or link, and it also controls link bandwidth and determines how much nodal group or piconet bandwidth is given to each node on a per event basis. The determining factor is governed by what type of event is transpiring: ISM FTMC, ISM RTMC, exception reporting, ISM FTMC paging, and ISM broadcast paging. Error correction is based upon automatic repeat request (ARQ) scheme for all communications. An ARQ scheme is applied in which data transmitted in one hopped frequency slot is directly acknowledged by the recipient in the next slot. For an ISM data packet transmission to be acknowledge both the header error check and the cyclic redundancy check must be right.

The USPR spread spectrum ISM 2.4GHz nodal baseband provides nodal protection and telemetry data encryption mechanisms at the physical layer. Authentication and encryption is implemented in the same way in each ISM 2.4GHz node, appropriate for the ad hoc USPR ISM network topological footprint characteristics. Link connections may require one way polynomial check, two-way nodal challenge, or no authentication. Whether or not ISM 2.4Ghz nodal authentication is used is based upon the type of application enabled by the USPR network. There is a high degree of authentication processes and procedures built in to the RCTT Unit mini-hub and its communications with the USPR hub via the selected host wireless and wireline networks. Authentication is deemed not necessary for paging events.
Therefore the invention enables a unique point-to-point circuit switched cellular data service protocol scheme that is combined with SS7 network node to node route/relay communication topology schemes. The invention sets up route/relay connections from the RCTT Unit mini-hub to all selected spread spectrum 2.4GHz nodes under its control and management dynamically on a per event basis like a two way TDD “domino effect” embodied in the inventions novel wireless data communications route relay mode (RR). This domino effect causes all selected spread spectrum 2.4GHz nodes to receive on the dynamically assigned forward ISM FTMC hopped frequencies, and then report back on the dynamically assigned ISM RTMC assigned frequencies, all set in accord with time coded assignments during the heretofore disclosed ISM FTMC procedures. All of this unique activity is controlled by the inventions RCTT Unit mini-hub in the field, and by the USPR hub via the selected host wireless and wireline network.

Referring to Fig. 6, depicted is a concatenated synchronous connection oriented concatenated (SCOC) 300 ISM FTMC paging event 215 and optional 217 paging response 216, that is based upon the inventions CDTMA symmetrical ISM concatenated packet protocol. The invention enables up to eight ISM FTMC and eight ISM RTMC packets to be concatenated in one ISM telemetry-data-event. Each packet can occupy from one to five slots, for a total of up 40 slots being used for one ISM FTMC and ISM RTMC symmetrical event. This specification applies whether or not the symmetrical event is a concatenated forward ISM FTMC program or paging event with appropriate ISM RTMC paging or status response report, the inventions ISM CDTMA protocol operates the same. The depicted ISM FTMC paging packets 236a, 236b and 236c occupy one forward synchronous ISM slot each.

Therefore this depicted event occupies three forward and three reverse ISM slots symmetrical slots simultaneously in accord with the governing time code (TC) data bit fields 205, 205b, and 205c that basically act as the invoke increment for the transmission of reverse SCOC 301 ISM RTMC page response data packets 237a, 237b and 237c. These packets act as the acknowledgement return result 216 that is in fact an optional feature 217. That is, each ISM 2.4GHz node does not have to return an acknowledgement ISM RTMC paging data packets. However each node must return acknowledgement ISM
RTMC data packets if so ordered by the RCTT Unit mini-hub 91, that may or may not be originally instructed from the USPR hub facility. Also these nodes that return a symmetrical ISM RTMC paging response stream must be in route/relay (RR) mode for that event. In some scenarios, the RCTT Unit mini-hubs internal program sets may require autonomous ISM RTMC paging acknowledgement reports independent of the USPR hub in order to check various maintenance issues, authentication checks and other such aspects.

Each forward ISM FTMC paging packet, 236a, 236b and 236c is comprised of six distinct data bit fields: time code (TC) 205, 205b and 205c, synchronization data bits, 203, 203b and 203c, program data bits 308, 308b, and 308c, ISM frequency set bits 309, 309b and 309c, page action bits 310, 310b and 310c, and the ISM node 10-16 character identification bits 249, 249b and 249c. The program data bit fields 308, 308b and 308c in these ISM FTMC paging packets have different purpose and function than the program data bit fields contained in the ISM FTMC forward concatenated packet streams 250 as depicted in Fig. 7. In Fig. 6, the information and instruction sets contained in the program data bit fields do not deal with an invocation of an application specific status response order. These program data bit fields 308, 308b and 308c are closely linked to the ISM frequency data bit fields, and page action bit fields and relate to how the ISM frequency assignment interrelates to: (1) set this ISM frequency for the next synchronous ISM FTMC page event, or (2) set this ISM frequency for the next scheduled asynchronous broadcast page event, or (3) set this ISM frequency for the next synchronous ISM RTMC event, and/or (4) set this ISM frequency to the next exception report hopped frequency (ERHF). Each ISM FTMC paging packet that is designated for one node will contain instructions in the page action data bit fields 310, 310b and 310c to instruct the node that this packet is singular or is part of a bundled group. In this case the first packet 236a is one of three contained in this instant ISM FTMC paging concatenated stream: 236b and 236c respectively.

This process works in a similarly way to the number of words coming (NAWC) bit fields 313 in contained block code data packets used in analog control channel words as shown in Fig. 10. Each ISM 2.4GHz node is configured to receive and handoff up to eight concatenated ISM FTMC paging, ISM FTMC program, and ISM RTMC status response
packets in the time and space limitations of one USPR ISM internodal telemetry data communications event. Each node will act in accord with contained instructions, and will simply snap-shot or mirror its own data packet and then handoff the packet bundle to the next node in terms of hierarchical linearity of what packet arrives first.

Referring to Fig. 6, when a designated ISM 2.4GHz node 260e receives all three ISM FTMC paging packets 236a, 236b and 236c that comprise the current packet bundle or stream, it checks to the ISM I.D. data bit field 249 to verify that this packet in fact belongs to it, and checks the program data bit field 308 contained in the packet to see if it sets itself to master mode (MM) 214a or route relay (RR) mode 314a. Another important part of the ISM FTMC paging procedure is that it also create setup algorithms within each participating node in order to prepare the participating ISM 2.4GHz nodes 260e, 260f and 260g for a synchronous symmetrical ISM FTMC program concatenated telemetry data communications event. In still another scenario, this ISM FTMC paging event can cause each participating node 260e, 260f and 260g to respond with individual asynchronous reverse channel status response packets that are essentially formatted in the same way as each ISM RTMC packet 237a, 237b and 237c depicted here but are transmitted separately at different reporting time periods.

Referring to Fig. 11, the invention provides unique nodal group/piconet 259a, and 259b configuration flexibility. In Fig. 8, nodal group/piconet 259a and 259b are part of an eight nodal group that also includes the remaining six nodal groups: 259c, 259d, 259e, 259f, 259g and 259h. For the purposes of this instant example, the ISM 2.4GHz nodes 260i, 261i, 262i, 263i, 264i, 265i, 266i and 267i that are operating in permanent master mode: 243a, 243b, 243c, 243d, 243e, 243f, 243g, and 243h are not included in the aforementioned description. These master mode nodes are essentially external versions of the ISM transceivers used as internal ISM transceivers 211 by the RCTT Unit mini-hub 91. These master mode nodes 243a, 243b, 243c, 243d, 243e, 243f, 243g and 243h also help manage the other eight nodes in its nodal group as master mode node.

One of the inventions novel hallmarks is its unlimited flexibility in terms of how one or a plurality of nodal groups/piconets are customized for each application specific implementation scenario that adapts to any topographical environment. Once placed, the
topological geometry of radio propagation characteristics must be measured so that when seasons change in a given APU, variations in how foliage, rainy seasons, and other factors cyclically attenuate each ISM 2.4GHz nodes receive and transmit capabilities must be carefully considered. As part of this important point certain ISM 2.4GHz nodes can be set up as permanent master mode (MM) mini-hubs. Whereas other nodes will be set depending on the seasonal conditions of any selected APU. For example ISM 2.4GHz nodes 260c as shown in Fig. 8, and Fig. 11, is designated to operate in dynamically assigned master mode (MM) 214a for maybe six months out of a given year during the Fall and Winter months because heavy weather. Whereas in the Summer months, this node will not have to operate in master mode (MM) 214a, and nodes 260f, 260g, and 260h will be able to receive robust signaling and other ISM transmissions directly from the RCTT Unit mini-hub 91. The USPR Hub manages these periodic changes in the geometric topological by accessing crucial ISM nodal group and APU database profiles that store key topographical and radio topological statistics. At certain preprogrammed periods, the USPR hub automatically flags and instructs each RCTT Unit mini-hub when changes are needed regarding which ISM 2.4GHz nodes must modify selected ISM node operation modes in accord with seasonal changes and other user requested modifications via FTMC concatenated data packet streams sent to and received by the selected RCTT Unit mini-hub, via the currently serving host wireline and wireless network. This further manages complete connectivity to selected ISM 2.4GHZ nodes via defined and managed ISM FTMC concatenated frequency hopped message paging and programming formats that are unique to the wireless application specific data communications world.

Referring to Fig. 6 and Fig. 11, other ISM FTMC page packet fields include synchronization data bits 203, 203b and 203c. These fields maintain packet modem protocol synchronization. In relation to the instant telemetry data event, the RCTT Unit mini-hub 91 transmits the selected concatenated ISM FTMC page packet bundle to ISM 2.4GHz node 260e. Node 260e is first unit to receive the concatenated ISM FTMC paging packet bundle or stream, that is comprised of three ISM FTMC concatenated paging invoke packets, 236a, 236b and 236c. Once received, the node 260e detects a three packet bundle, detects its own 10-16 character I.D., snap shots its own paging data packet 236a, detects and records its own time coded (TC) instruction set 205a that governs internal node system timing. Reads instruction sets that instructs the instant node 260e to wait for a
predetermined increment of time before it transmits its own ISM RTMC status response
data packet 237a. The node 260e reads its program data, 308 sets its next ISM frequency
309, and reads page action instruction set 310. As instructed, the node 260e sets itself to
master mode (MM) 214a that it can manage the remaining packet based communications
thus designated for node 260f and 260g.

Once in master mode (MM) 214a the selected ISM 2.4GHz node 260e quickly
examines the other two packets 236b and 236c respectively and determines that the
complete packet bundle comprised of ISM FTMC paging packets; 236a, 236b and 236c,
must be route/relayed to ISM 2.4GHz node 260f. Also the node 260e detects that the
program data order 308 contained in its own packet, and the program orders 308b and
308c in the packets designated for the other two nodes 260f, and 260g require that all three
nodes 260e, 260f and 260g must transmit ISM RTMC paging response acknowledgement
packets, 237a, 237b and 237c. Therefore node 260e as part of its master mode (MM) 214a
instruction set, will await for packets 237a and 237b until an internal timer expires before
it transmits its own packet 237c to the RCTT Unit mini-hub 91 via its associated ISM
transceiver A 211. If for example, the spread spectrum ISM 2.4GHz node 260e does not
detect ISM RTMC paging response packets 237a, and 237b, within a programmed and
preset timed limitation it will in fact burst or transmit its own packet 237c without the
other two. The RCTT Unit 91 will have to invoke an ISM FTMC page event reorder to
cause the node(s) in question to transmit their ISM RTMC paging acknowledge packets.
All ISM nodes in route/relay mode 314a that have received orders to burst an ISM RTMC
paging acknowledgement packet will also wait until its internal timer expires.

In some important scenarios the invention offers another unique optional feature.
Because of definable application specific link bandwidth limitations, the invention
provides for the means and methods of removing one ISM packet at a time after each node
reads, routes and relays other packets for a plurality of ISM nodes in the same group or
piconet. For example ISM FTMC paging packet 236a can be removed and only the other
two packets, 236b and 236c are routed relayed to ISM 2.4GHz nodes 260f, whereby this
node removes its own designated packet and only relays the packet 236c to node 260g.
The remove and route scenario will only work in applications whereby the processing of
overhead procedural impact on event bandwidth is not critical. However, in the instant
event, current link bandwidth allows for route/relay of complete concatenated packet bundles over a multiple range of frequency hopped digital slots.

Once the spread spectrum ISM 2.4GHz node 260f recognizes its own 10-16 character I.D. 249b as it receives and processes the full multi-node packet bundle it detects and counts the other ISM FTMC concatenated paging packets 236a and 236c respectively. Upon detecting of its own program data 308, it responds to the embedded commands and sets itself in route/relay mode 314a. Once set, the node 260f bursts or the entire packet bundle. Node 260e again is in the same effective radio propagation footprint as the other two nodes 260f and 260g it will also receive and detect the same packet bundle. However, it will detect its own 10-16 character I.D. field, and the page action data bit field 310 that contains a previous process flag bit (PFB) 317 set to binary “1” inserted by its own software during the first packet bundle receive and process algorithm that transpired when the instant packet bundle was first detected by the ISM 2.4GHz node 260e as last line-of-sight node in the associated nodal group 259a that is controlled by the RCTT Unit mini-hub 91. The PFB bit is always set to binary “0” if the associated ISM FTMC paging packet stream/bundle or ISM FTMC programming packet bundle has not detected and processed by the designated spread spectrum application specific node 260e. This process flag bit (PFB) 317 will indicate to the node 260e that this bundle has all ready been processed and thus ignore this packet bundle if set to binary 1. This feature is a key enabling factor in relation to the inventions route/relay bucket brigade spread spectrum data packet protocol.

Spread spectrum node 260g will recognize the packet bundle when it detects its 10-16 character I.D. field 249c, program data 308c, and other heretofore mentioned instruction sets; 205c, 203c, 309c, 310c and thus respond as ordered by the RCTT Unit mini-hub 91. The invention draws upon conventional cellular mobile station call handoffs and PCS call mobile terminal handovers that manage a roaming mobile stations call continuity from channel to channel and base site to base site. The inventions ISM spread spectrum nodes combine and integrate: (1) the base site, (2) the application specific terminal that is integrated with a specific device, and the (3) selected medium of application specific data: spread spectrum physical, session, and transport enabling layer that in fact manages and makes possible the unique bucket-data packet-brigade protocol in
accord with the unique control and management capabilities of the inventions RCTT Unit mini-hub 91 and the USPR Hub and its inclusive host subsystem. The invention creates a quantum revolution in the world of wireless telemetry data.

Accordingly, node 260g detects the contained end/node instruction set and thus becomes the selected and dynamically programmed end node 316a for this particular USPR telemetry data event, and therefore the end point for the current concatenated ISM FTMC paging packet stream. Upon completion of its internal processes ISM 2.4GHz node 260g burst its own ISM RTMC paging acknowledgement data packet 237a, as depicted in Fig. 6. Spread spectrum or ISM node 260f, that is set in route/relay mode 314a detects the selected ISM RTMC paging acknowledgement data packet 237a, assembles its own ISM RTMC paging acknowledgement data packet 237b attaches packet 237a and bursts both packets in the form of a concatenated bundle to node 260e that is still in master mode (MM) 214a. Spread spectrum node 260 receives said packet bundle assembles its own ISM RTMC paging acknowledgement data packet 237c attaches the two ISM RTMC paging acknowledgement data packets 237a and 237b, thus creating a three packet bundle that is comprised of packets 237a, 237b and 237c and burst the concatenated packet bundle to the RCTT Unit mini-hub 91 via its designated spread spectrum transceiver A 211.

Upon reception of this packet bundle the RCTT Unit mini-hub 91 may (1) store received information, (2) respond to the contained paging responses autonomously (3) or transmit the results of this instant event to the inventions USPR-Hub 105 as depicted in Fig. 4, via a synchronous concatenated CDTMA RTMC host wireless network compatible status response packet 172 shown here, or via an RTMC exception report status response data packet that is received and processed by host network elements: cellular or PCS base site 101, or trunked mobile radio base station 110, or LMDS node 239, LEO satellite 117 as depicted in Fig. 3.

Referring to Fig. 7, in much the same way the ISM FTMC and ISM RTMC paging event transpired, the ISM FTMC programming and symmetrical 312 ISM RTMC status response event unfolds in the following and means and method. As disclosed the ISM FTMC paging event was essentially a preparation or set up protocol that enables a
plurality of processes and procedures. In terms of the heretofore telemetry data communications event, each participating node 260e, 260f, and 260g has been instructed to now wait for a spread spectrum frequency hopped ISM FTMC programming event via (1) the same spread spectrum hopped frequency that enables the paging event, or (2) during the course of the paging event the contained ISM hopped frequency assignment bit field 309, 309b and 309c as shown in Fig. 6. Each node has been instructed to receive the ISM FTMC programming event on yet another spread spectrum frequency hopped channel, because the previous frequency may have been assigned by the RCTT Unit-mini-hub 91 for use by a nodal group for another separate event.

Also during the course of the paging event, the RCTT Unit mini-hub 91 may have detected conventional spread spectrum cordless telephone traffic or such emissions and determined that another frequency is deemed a better selection for the instant ISM FTMC programming event. In Fig 7, each node 260e, 260f, and 260g has been instructed to dynamically set itself to a common or global spread spectrum frequency designated and assigned during the paging event by the RCTT Unit mini-hub for this event only. Upon completion of the disclosed ISM FTMC paging and symmetrical 312 ISM RTMC paging acknowledgement event the RCTT Unit mini-hub 91 prepares to burst a spread spectrum SCOC 300, ISM FTMC programming and symmetrical 312 SCOC 301 ISM RTMC status response multi-node telemetry data communications event that involves node 260e, 260f and 260g. Accordingly, the RCTT Unit-mini hub 91 re-checks the assigned ISM FTMC programming frequency set, selects a clear spread spectrum hopped frequency, enters it into the program data bit fields 209, 209b and 209c of each ISM FTMC packet 244, 245 and 246. In order to instruct each node to use said frequency for the symmetrical SCOC ISM RTMC status response packet burst 301, and transmits its SCOC ISM FTMC programming packet burst 300. Once transmitted the ISM 2.4GHz node 260e that is all ready operating in master mode (MM) 214a receives all three packets contained in the SCOC ISM FTMC programming packet burst 300. The ISM 2.4GHz node 260e detects its on ISM FTMC packet 244 via its 10-16 character I.D. bit field 249, authenticates the data packet via its last assigned polynomial instruction set by comparing its current setting with the instantly received authentication data bit field 208 that either reaffirms its current setting, or updates the setting in accord with authentication instruction sets sent to the RCTT Unit mini-hub 91 from the USPR Hub.
The selected ISM 2.4GHz node 260e updates in synchronization by reading the synchronization data bit field 203, and it updates its internal time code clock by reading the inclusive time code data bit field 205. Next the selected ISM 2.4GHz node 260e reads the program data bit field 209 and performs the following functions. The program data bit field 209 contains instructions for handling of packets 245 and 246 that are designated for node 260f and 260g respectively. Along with application specific node and integrated device instruction sets, contained within the program data bit field 209 is a two-bit process flag bit (PFB) 318. The PFB 318 serves the same functional role in terms of SCOC 300 FTMC concatenated programming packet stream 250 processing as it does in the SCOC 300FTMC concatenated paging packet stream 215. Also it is important to note that the PFB field is also utilized for all RCTT Unit-mini-hub 91 originated asynchronous forward spread spectrum node global broadcast, and singular node paging event management scenarios when the inventions bucket route/relay brigade protocol is used for interdependent-internodal communications. Therefore an important object of the invention is to provide the PFB field for all spread spectrum synchronous concatenated and asynchronous singular packet bursts and packet/bundle streaming that requires the inventions bucket route/relay brigade protocol. This unique protocol enables effective communications for isolated node morphological schemes that do not have direct line-of-sight signal emissions from the RCTT Unit mini-hub 91. The same functional case applies to the inventions asynchronous spread spectrum node originated reverse channel heartbeat, acknowledgement and exception report packets are transmitted in the same heretofore disclosed processes and procedures as depicted in Fig. 9, 202 and Fig. 10, 218.

Referring to Fig. 7, and Fig. 11, the ERHF data bit field 204 instructs the instant node to set its exception report hopped frequency to the latest channel set in accord with nodal group frequency ranges that are managed by the RCTT Unit mini-hub 91 spread spectrum frequency assignment data base located in ISM pro-DB module 210 as depicted in Fig. 3 and Fig. 11. Referring to Fig. 7, and Fig. 11, the ISM 2.4GHz node 260e sets the PFB bit field 318 to “01” in its own packet 244 and bursts the SCOC 300 ISM FTMC programming packet bundle 250 to ISM 2.4GHz node 260f that is operating in route/relay (RR) 314a mode as a result of the heretofore disclosed SCOC ISM FTMC paging event as depicted in Fig. 6. In Fig. 7 and Fig. 11, ISM 2.4GHz node 260f receives all three packets
244, 245 and 246. Once node 260f receives packet bundle it performs exactly the same processes and procedures as previously described for node 260e. When node 260f, and 260f received it’s designated SCOC ISM FTMC programming data packet, the program data fields 209 and 209b respectively contain instructions to set timers and await selected ISM RTMC status response packets 247 and 248 respectively. However as disclosed in the detailed paging event, nodes 260f and 260e will burst their ISM RTMC packets 248 and 249 once internal timers expires even if ISM node 260g fails to burst its ISM RTMC status response data packet 247. As disclosed, if RCTT Unit min-hub 91 fails to receive ISM RTMC data packet 247, it will initiate an SCOC reorder for node 260g only whereby 260f and 260e act as just bucket-route/relay-brigade portals.

Once node 260f completes its designated and instructed processes, it bursts the same packet bundle to node 260g that is currently operating as the end node 316a for this instant event. If for example node 260h was the end node for this event, and added another node to the current event pathway then node 260f would set its PFB 318 to “1” in order to indicate upon retransmission by the next receiving node 260g to node 260h that it had previously received this same packet bundle and therefore ignores the packet and does not repeat disclosed process. In this instant event, node 260f also reads its own packet, and detects instruction sets to burst its own SCOC 301 ISM RTMC status response packet 245. Once node 260g has received the packet bundle it processes its own ISM FTMC packet 246 and bursts its own SCOC RTMC 301 status response data packet to node 260f. Node 260g also terminates its end node 316a status and returns to either ISM active access mode (AAM) or ISM passive sniff mode (PSM). Node 260f receives and detects said ISM RTMC status response data packet 247. Once detected node 260 assembles or in some application specific cases has pre assembled the packet because of the initial received order contained in the associated SCOC ISM FTMC programming event.

Once node 260f has prepared the packet bundle that is comprised of packet 247 and 248 it burst and transmits the packet bundle to node 260e that is operating is ISM master mode 214a. Node 260e receives the associated packet bundle that is comprised of packets 247 and 248, adds its ISM RTMC status response packet 249 and transmits the bundle that is comprised of packets 247, 248 and 249 to the RCTT Unit mini-hub 91 and its inclusive spread spectrum transceiver A 211. Once transmitted node 260e will either
return to ISM passive sniff mode (PSM) or ISM active access mode (AAM) in accord with its current operational needs. For example if the application specific device that is integrated with node 260e must burst an exception report than node 260e will transmit an asynchronous connectionless exception (ACE) report to the RCTT Unit mini-hub 91. Or if it needs to change to PSM status it will to save power. However, because the associated nodal group 259a is morphologically arranged, node 260e will always primarily operate in ISM master mode 214a anytime it detects an SCOC FTMC paging event or SCOC FTMC programming event. This action concludes the instant SCOC FTMC 300 and SCOC RTMC 301 symmetrical 312 application specific internodal event that transpired within the USPR network element nodal group 259a.

Referring to Fig. 11, nodal group 259b is morphologically arranged in such a way as to serve the radio propagation requirements of this associated application point of use (APU). Each node is operating in accord with current radio propagation and application specific operational requirements. Node 261a and 261b are operating in ISM passive sniff mode 353. Node 261c is the permanently assigned as ISM master mode 214b. However when an SCOC ISM FTMC paging, SCOC ISM FTMC programming, and SCOC ISM FTMC status response or other such spread spectrum connectionless event is not occurring node 261c either sets itself to ISM PSM or ISM AAM in accord with its integrated application specific operational parameters. Node 261d is set to permanent end node 316b, because it is the last node within a nodal plurality. However node 261d also can operate in ISM PSM or ISM AAM in accord with its application specific operational parameters. Node 261e and node 261f are currently operating in ISM PSM 353. Nodes 261g and 261h are currently operating in ISM AAM 354, and are preparing to burst asynchronous connectionless exception (ACE) report packets using the last assigned spread spectrum ERHF channel. Note that because node 261g and 261h are in radio propagation proximity to the RCTT Unit mini-hub. Therefore in this particular case using other nodes for the inventions bucket route/relay brigade connectivity is deemed not necessary.

Referring to Fig. 12, is a spread spectrum asynchronous or synchronous nodal group specific global paging event 364. In this case RCTT Unit mini-hub 91 is bursting a nodal group 259a global paging packet 302. This packet format is identical to the paging
packet format characteristics heretofore disclosed and depicted in Fig. 6, 236a, 236b and 236c respectively. Referring to Fig. 12, the ISM 10-16 character data bit field 249d carries an I.D. that each spread spectrum node recognizes as a global page invoke medium that causes each node in a selected nodal group to respond with identical frequency assignment related processes, procedures and responses. The primary purpose for this packet is to act as a node assigned frequency enabler. The page action data bit field 305 in this case contains bits that indicate to each node 261a, 261b and 261c what algorithmic emphasis this global page action involves. In some instances the page action simply calls for a the next global page, or other type page be set to the ISM spread spectrum frequency contained in the ISM spread spectrum frequency data bit field 304. Therefore the page action is a frequency assignment page that relates to the next possible global page action that may occur. One reason this type of page action is important is that the last assigned global page frequency for this nodal group may be needed for some other forward telemetry messaging action. Or the last assigned frequency may be used by some other conventional spread spectrum transmission that is occurring in the some operational area as the instant nodal group. The page action can also relate to assigning the next frequency for an SCOC ISM FTMC programming concatenated packet stream event. Regardless, this global paging action is primarily associated with an entire range of spread spectrum frequency management processes and procedures. Therefore the other three fields are construed as filler data 365.

Referring to Fig. 13, depicted here are two USPR nodal groups 259c and 259d. These two nodal groups 259c and 259d are also shown in Fig. 8, as part of an eight nodal group network controlled and managed with one RCTT Unit mini-hub 91. Back to Fig. 13, nodal group 259c represents an application specific group operating in a shopping mall 319. Nodal group 259d represents an application group operating in a gambling casino that can be located in such a gambling Mecca as Las Vegas Nevada, or Atlantic City New Jersey, or Monte Carlo. This nodal group can also represent an APU within an Indian reservation, a gambling riverboat located on the Mississippi River and the like. In nodal group 259a each spread spectrum node is integrated with and managing an application specific device. For example spread spectrum node 262a is managing a merchant based point of sales (POS) device 321 that used to process purchases when a customer uses his credit card, debit card, or other such smart card. Node 262b is interfaced and manages a
stores security system. Node 262c manages an electrical power measurement meter 323. Node 262d manages a gas meter 324. Node 262e manages a personnel-tracking system 325 that is attached to a child’s wrist when he enters the shopping center in order to locate him if in fact becomes lost by the accompanying parent. Node 262f manages a merchandise tracking system 326 that detects merchandise that may be stolen.

Node 262g a wireless gambling personal digital assistant (PDA) 327. Node 262h manages and is integrated with a shopping mall fire protection and exception reporting system 328. It is important to note that the invention provides a unique means and method for managing a wide variety of application specific systems with one RCTT Unit mini-hub 91. In accord with that concept nodal group 259d is managing eight gambling based PDAs or communicators. For example node 263a is completely integrated with a gambling PDA whereby the user is playing video black jack 329. The invention’s PDA’s use a special multicolor graphic system with many unique embedded features that support multiple types of games of chance. In addition the inventions PDA also is able to receive advertising, casino show scheduling, travel information and the like. The inventions PDA is able to display and manage all games of chance. The gambling PDA can be integrated with the inventions spread spectrum node, or the gambling PDA can be integrated with a stand-a-lone RCTT Unit 95 as depicted in Fig. 4, and Fig. 15.

Referring to Fig. 13, he user simply places his bet, presses the bet button, the transaction is sent to the serving casino or riverboat betting application service provider (ASP) system that is either collocated at the casino or riverboat facility, or is relayed via wireless or wireline means to a specialized ASP central clearing house facility that is located within the duly authorized borders of a state, city or Indian reservation that in fact sanctions gambling. In addition the invention operates in complete accord with the United States Federal Statute Title 18 section 1084 that deals with transporting gambling information over telecommunications network. Because, the inventions host wireless and wireline network is configured as a closed loop system that does not allow gambling information or betting activity to extend across city, state and Indian reservation boundaries.
The user’s Black Jack bet is verified and the PDA user is acknowledged via the inventions heretofore disclosed forward telemetry messaging means and methods. Node 263b is completely integrated with a PDA that is being used to play video roulette 330. The roulette-betting algorithm is managed in the same disclosed means and method. Node 263c is completely integrated with a gambling PDA that is being used to play video slot machine related game of chance 331. The slot machine-betting algorithm is managed in the same disclosed means and method as previously disclosed. Node 263d is completely integrated with a gambling PDA that is being used to play video Baccarat 332. The Baccarat-betting algorithm is managed in the same means and method as previously disclosed. Node 263e is completely integrated with a gambling PDA that is being used to play video Keno 333. The Keno-betting algorithm is managed in the same means and method as previously disclosed. Node 263f is completely integrated with a gambling PDA that is being used to play video slot-machine related games 334.

The video slot-machine-betting algorithm is managed in the same means and method as previously disclosed. Node 263g is completely integrated with a gambling PDA that is being used to play video horse or dog racing and the like 335. The video horse or dog racing-betting algorithm is managed in the same means and method as previously disclosed. Node 263h is completely integrated with a gambling PDA that is being used to play video-sports betting and the like 336. The video-sports betting activity includes; betting on baseball games, football games, basketball games, tennis games, soccer games, motor vehicle races, boat races, Olympic Games, golf games, boxing matches, wrestling matches, lottery ticket purchases, national lotteries, state lotteries, provincial lotteries, stock trading, bond trading, and the like. The video sports betting algorithm is managed in the same means and method as previously disclosed.

Referring to Fig. 14, depicted here is the selected RCTT Unit mini-hub 91 programmed and configured as a motor vehicle traffic management system and internet world wide web (WWW) access portal(s) 342 that are installed at electrical meter sites and other such infrastructure points. The meter is comprised of typical components including the meter socket and pull box 338, the meter coil and power group 337. The RCTT Unit mini-hub 91 is installed within the same glass enclosed space 366 as the electrical power meter elements. Attached and integrated electronically with the RCTT Unit mini-hub 91 is
a GPS receiver and antenna combination 341. Also attached to the RCTT Unit mini-hub 91 is a multi-nodal spread spectrum antenna 340 and a cellular, PCS, trunked mobile radio, SMR, two-way paging, narrowband PCS, Motorola Flex compatible antenna 339. The RCTT Unit mini-hub 91 is configured to control and manage a combined motor vehicle traffic management and consumer/business based internet access nodal group (MTIA) 259e.

The invention provides a unique set of technological elements that utilize the USPR RCTT Unit-mini hub 91 and the multi-nodal microcosmic cellular telemetry architecture in a completely novel way. For example in one APU scenario the RCTT Unit mini-hub 91 can manage up to eight MTIA groups. Therefore enabling up to 72 residential, commercial and industrial meter sites to also serve as RCTT mini-hub and ISM 2.4GHz spread spectrum node sites. This MTIA nodal group 259e is comprised of eight spread spectrum-ISM 2.3-2.45GHz nodes that are integrated with selected application specific devices. For example node 264a, and 264b are integrated with the inventions specialized X, Y, Z, triangulation tracking system for automatic motor vehicle and personnel tracking, and identification 343 and 344 respectively. Node 264a and 264b are used together in conjunction with the RCTT Unit mini-hub 91 and its integrated GPS receiver 341. X, Y, Z triangulation is maintained first by receiving C/P timing correlation signaling 352 that is transmitted by a plurality of 24 GPS Navstar LEO satellites circling the Earth and algorithmically integrating this information with other of the inventions novel algorithmic processes and procedures.

The inventions RCTT Unit mini-hub 91 and its associated triangulation/location nodes 264a and 264b are used to combine the heretofore mentioned GPS timing information in conjunction with unique signaling timing bits (STB) 367 contained in the spread spectrum ISM FTMC paging, programming, and RTMC status response and acknowledgement synchronous and asynchronous data packet transmissions that are received by the RCTT Unit mini-hub 91 after being routed and relayed from each location node 264a and 264b. The STBs are controlled and calculated by the unique delay timing algorithms that are used to calculate distances between nodes via special signaling timing bits (STB) 367a, 367b, 367c, 367d, 367e, 367f and 367g if each are configured for triangulation/location services. When location nodes are initially installed, precise
longitude and latitude are established and recording within the data storage means of the RCTT Unit mini-hub 91, and within a special database located at the USPR hub.

Once downloaded in the RCTT Unit mini-hub 91 and or the USPR Hub, this unique means and methods is used to calculate location of objects and people for the inside of buildings, parking garages, large urban canyons of high rise buildings and the like whereby the low power and line of sight issues of satellite signal propagation are problematic. The inventions RCTT Unit mini-hub 91, uses its stationary longitude and latitude location established by its own GPS receiver, plus it compares the distances of the two location nodes 264a, and 264b based on the delay of its STBs to calculate distances between each node base upon comparing the delay measurements with the heretofore established longitude and latitude of the location nodes. In addition the RCTT Unit mini-hub measures spread spectrum location based acknowledgement data packet/beacon signals 372a and 372b that are transmitted from a motor vehicle or person based spread spectrum ISM 2.4GHz node 368 that transmits beacon signals that is used for location purposes during a USPR location event 373.

When the RCTT Unit mini-hub 91 receives the beacon signals 372a and 372b, it calculates the predictable delay from the associated location based nodes 264a and 264b, plus the time of arrival of the beacon packets 372a, 372b in algorithmic association with the relative position of RCTT Unit mini-hub, the relative longitude and latitude of each node 264a and 264b, and the accurate timing of the received GPS C/P correlative codes 352, thus deriving an accurate location of a motor vehicle or person utilizing a specialized spread spectrum mobile based node-terminal 368. The implications of this process and procedures can have a wide ranging effect upon the equipment and operating cost of mobile location services. Other elemental operations of this nodal group include the following. For example, apart from serving as location nodes, each node has its own additional application specific function. Node 264c is a traffic signal control system 345. Node 264d is a road condition reporting system 346. Node 264e is a motor vehicle radar exception reporting system 347 that monitors motor vehicle speeds. Node 264f is an air quality monitoring system 348. Node 264g is a business or consumer based wireless internet access portal 349 that supports a data throughput rate of 128Kbps. Node 264h is
an internet access portal that supports a data throughput rate of 64Kbps 350 that is essentially an air interface is compatible with T1/DSO protocols, and in band signaling.

Referring to Fig. 15, is an example of the inventions specialized USPR voice and data network 355. Although the invention is designed to support wireless data telemetry service, the inventions provides for unique analog and digital voice based telemetry services that enable unique features for emergency 911 response and emergency motor vehicle and personnel location services. The invention also provides for unique digital voice over internet world wide web (WWW) 124 protocols. The voice I.P. protocols act as a further means of providing secure "voice listen in" features that allow public and private police and medical response teams, and other such agencies to listen in and hear the details of what has occurred at a motor vehicle accident site. This system can also be used to monitor a potential crime scenario when a person transmits a distress message or other such heretofore disclosed location and reporting voice and data bits from a special protection voice and data based RCTT Unit 278. This terminal can either be mounted in a motor vehicle or worn as a personal voice and data location terminal.

Accordingly, there is provided a specialized 20 to 250 byte preamble packet that is formatted just like the reverse channel message packet 200, and the forward channel messaging packet 201 depicted in Fig. 9. The invention also utilizes the USPR acknowledgement data packet 202, that is either RCTT Unit originated or USPR hub-host DSP 130 originated, and is used to provide and deliver data checksum, verify the termination of a combined USPR voice and data event, and other related functions. Referring to Fig. 15, the USPR telemetry data system provides an innovative primary voice/data call route 357a, 357b and 357c protocol and a secondary voice/data call route 358a, 358b and 358c.

There is also provided a specialized protocol and host management system that enables a simultaneously combined voice-codec 360 and data communications event within the same combined wireline, internet and selected wireless air interface channel space. One of the most important features therefore is the RCTT Unit 95 originated preamble packet 363a, and the USPR hub-host DSP 130 originated preamble packet 363b. Another key element of the USPR voice and data management scheme is that the system
utilizes conventional programmable telephony switching that in conjunction with the
USPR DSP host can recognize and route a combined voice and data event to any
designated termination destination. The RCTT Unit embodies a unique automatic and or
manually controlled multi-plug-in browser that enables specialized internet access and
other related communications.

In one scenario a selected RCTT Unit 278 is configured as a motor vehicle based
voice, data and location based terminal that is also integrated with a GPS receiver. For
example if a driver is involved with an accident that causes an air bag to deploy and the
driver is partially incapacitated or pinned the system responds in accord with the following
innovative procedures. In modern motor vehicles that utilize air bags there is also a central
computer that controls fuel injection, suspension, security, and other pertinent automotive
system control. When an air bag is deployed as a result of a collision, the computer
automatically provides gravity of “G-force” information. The RCTT Unit 278 is
interconnected via wireless spread spectrum nodal DAMA air interface or via data cable.
When the air bag is deployed, the computer sends the G-force information to the RCTT
Unit 278 and it loads the information into its internal data storage elements.
Simultaneously, the integrated GPS receiver performs a correlation as it receives the GPS
Navstar satellite 351 C/P codes 352, correlates the data bits, and then sends longitude and
.latitude information to the same heretofore mentioned RCTT Unit data storage. Upon
completion of this process the RCTT Unit 278 initializes a selected host wireless network
voice/data call.

This particular RCTT Unit 278 is configured to communicate via analog or digital
 cellular, or trunked mobile radio operating in 100MHz to 900MHz, or specialized mobile
radio (SMR) or trunked SMR or an enhanced specialized mobile radio (ESMR), or LMDS
242, or a two way paging network, or NPCs network 306 that also supports digital
CODEC voice services as depicted in Fig. 5. Referring to Fig. 15, therefore the RCTT
Unit 278 is able to perform an initial out-of-band call set up algorithm. For the sake of
example the RCTT Unit 278 in this case initializes this voice/data event via an analog/or
digital cellular/trunked mobile radio network represented by the combined cellular MSC
and trunked mobile radio control center (MSC-CC) 86 and the base site 101. Referring to
Fig. 10, this exception report packet 218 can be also used to set up a primary route 357b
voice call data setup. Contained in this packet along with other heretofore disclosed information is the RCTT Units 278 cellular or trunked mobile radio non-dialable mobile identification number (MIN) represented by the primary MIN 232 and the secondary MIN 233. The number 175-421-1061 is associated with the USPR telemetry data management hub and its associated programmable switch 127b and home location register (HLR) 126. Referring to Fig. 15, this voice/data event set up packet (SUP) 218 is transmitted to the currently serving base site/station 101.

The base site 101 relays the SUP packet to the currently serving MSC/CC 86. The associated cellular or trunked mobile radio switch detects and analysis the packet and determines via contained MIN number that the packet is to routed to the USPR HLR 126 via the associated SS7 network 115. Upon completion of the analysis, the MSC/CC 86 routes the SUP packet to the USPR HLR 126 that performs authentication procedures known to those whom practice the Telephony Art, therefore details of this procedure are omitted. However, one important key element is that the USPR Hub always knows the location of any of its stationary or mobile RCTT Units and RCTT Unit mini-hubs. In a cellular, PCS, trunked mobile radio or telephony based satellite network the serving MSC/CC or ground station switch always forwards carrier identification codes (CIC) and serving switch numbers to the USPR Hubs HLR 126 via the voice/data set up packet (SUP) 218 that is sent to the HLR via the serving SS7 network 115. The USPR Hub and its associated ASP 120 and 120a respectively use this location information to derive and establish closest E-911 response center that can serve the motor vehicle that is involved in the accident that contains the associated RCTT Unit 278.

This Once the authentication procedure is completed the HLR 126 relays the information to its associated programmable switch 127b. The switch sets up a voice path between the Host DSP 130 and its own fabric and completes the path via the PSTN 93b to the MSC/CC 86 via means and methods know to those whom practice the Telephony Art. The MSC/CC sets up the voice path to the serving base site 101. The Base site completes the path to the RCTT Unit 278 when a bi-directional air interface channel link is established with the RCTT Unit 278. Therefore the current primary route 357b is established.
Once established, the RCTT Unit 279 and its internal DSP system and the USPR Host DSP 130 begin communications with sub-modem data protocols. Once the USPR Host DSP 130 and RCTT Unit 278 establish robust bi-directional data signaling, the RCTT Unit bursts its 250 byte preamble packet 363a that is routed from the serving base site 101 to the USPR programmable switch 127b and Host DSP 130 via the established path. The Host DSP 130 receives the RCTT Unit 278 originated preamble packet and analyzes the contained data. The data is comprised of the heretofore disclosed GPS information, G-force information and other pertinent information. Also contained in this packet is the conventional 10-64 digit call destination directory number. The number can be a 911 invoke, or a call to a private emergency response and the like. The key here is that now the secondary route 358a process and procedure is initialized. Once the USPR Host has read the contained data it snap-shots or mirrors the data and stores all information in a data base that is used to forward the instant information to an ASP 120a that serves as a E-911 call center in a location closest to the accident scene. Accordingly, the USPR Host DSP 130 instructs the programmable switch 127b to route the call to the E-911 ASP center 120a.

Once the switch 127b establishes the secondary route 358a to the E-911 premise equipment 356a the host basically forwards the preamble packet 363a to the E-911 ASP 120a. Once the packet 363a receives the packet, it processes the information, and forwards the location information and the G-force information to the appropriate medical/emergency response team. Part of the contained information indicates that this was an automatic event and not manually initialized by a human user. This may indicate that the user in pinned in the wreckage or otherwise is incapacitated. The emergency response team is therefore dispatched. Next, the E-911 ASP sets up the voice link to initialize and establish the novel audio listen in monitoring feature and E-911 staff attempt to vocally communicate with the possibly injured user.

If for example the voice link is lost due to any sort of technical problem, the E-911 ASP 120a can attempt to re-establish the voice path by simply setting up a conventional voice call to the USPR Hub switch 127b. Once the primary route 357a is established, the switch reestablishes the call path to the RCTT Unit via the heretofore-mentioned means and method. In addition the USPR Host 130 may send a host originated preamble packet
363b to the selected RCTT Unit 278 to update certain key information. The host originated preamble packet can contain instructions to cause the motor vehicle to shut off the engine ignition, or fuel pump, or unlock the doors or any other means that may enhance the safety of the user and the emergency response team. Once the preamble packet is sent and the RCTT Unit 278 receives said packet the voice path is reestablished. This special USPR preamble packet and routing feature can be used to create and support many other useful applications that enhance personal and public safety. The preamble packet concept and protocol can be used by the heretofore mentioned DTMF capable public, private and business based trunked mobile radio, and mobile radio transceivers such as the Kenwood TH-G71A FM Dual Bander, Motorola transceivers, Johnson, G.E. and the like that are configured as an RCTT Unit or RCTT Unit mini-hub. These transceivers can enable for the inventions specialized voice and data services to route and initialize voice and data communications events to and from the USPR Hub and its associated Host DSP in same way it operates in cellular, PCS and telephony satellite networks.

This same specialized USPR preamble packet protocol can be used to provide unique cellular, PCS, trunked mobile radio, and satellite telephony debit prepay, point of sales (POS) wireless gambling and the like. Simply, instead of sending location, G-force and other emergency information, the RCTT Unit originated preamble packet can contain credit card information, voice time accumulation information, and gambling bet placement information. Conversely, the USPR Host originated responses can provide acknowledgement packet information that verifies POS merchandise sales, credit card clearing information, gambling bet placement acknowledgement information and the like. The possibilities are endless.

In still another variation the USPR specialized voice and data system can serve the same E-911 scenario, or other application specific scenarios by utilizing the internet world wide web (WWW) 124 to support digitized CODEC voice and preamble packet data information. The invention uses a specialized node that converts analog voice 361 to digitized CODEC voice 360 for seamless transmission of digitized voice and the inventions preamble packet to any destination that supports simultaneous data and voice information via the internet and conventional frame relay and TCP/IP routers 122b. Finally the invention provides conventional voice call access via a customer premise
equipment (CPE) 356b and the PSTN 93c. Since the RCTT Unit 278 is assigned a non-dialable MIN, the USPR Hub system provides a PSTN caller using conventional telephony equipment to place calls to a selected RCTT Unit 278. There is provided a directory number stack 362 and an access number assignment database. If for example, if the RCTT Unit 278 is set up for conventional voice calls, it is assigned a 10 digit directory number. Simply, the caller dials the number. Next the PSTN 93c and its associated local exchange carrier (LEC) and interexchange carrier (IXC) switches set up the route path to programmable switch 127b. The switch recognizes the dialed number, performs a look up procedure and routes the call to the RCTT Unit 278 using the non dialable MIN via conventional interswitch call routing procedures. This feature also enables caller pays services and other such procedures.

The invention provides and incredible array of revolutionary protocols, methods and apparatus. The USPR telemetry data management network combines all the best features of a plurality of host wireless and wireline networks. In one example the invention uses the low frequencies 150 to 220MHz that trunked mobile radio networks use. These frequencies have great building penetration characteristics with the advantage of high emission power levels that range from 5watts to 50watts. While two way paging systems that use Motorola’s Flex protocols for wireless telemetry data use similar low frequencies, the power levels are severely inadequate to provide services for high density applications such as automatic meter reading (AMR), copier machine telemetry, gas meters, security systems and the like. The invention creates a revolution to enable the highly under utilized trunked mobile radio network, SMR, ESMR for high-density telemetry data services. Trunked mobile radio has dramatic advantages over narrow band paging because it uses a wideband channel scheme that provides a much more stable channel space. Also, trunked mobile radio provides much better data integrity and with relatively low data rates can completely eliminate intersymbol interference. Another advantage over two way paging for wireless telemetry data is that the USPR version of trunked mobile radio based RCTT Unit and RCTT Unit mini-hub management that message encryption and security is significantly better than anything paging can provide.

The invention also uses a multiplicity of micro browser protocols for its RCTT Unit, and RCTT Unit mini-hubs such as eXtensible Markup Language (XML). This XML
means and method can be used to provide debit, gambling, stock market transaction, and other such information within the data bit structures of the inventions preamble packets and acknowledgement packets. For example, XML protocol can deliver current cellular, PCS, trunked mobile radio and satellite based pay; current air time consumption, and remaining debit account balance to RCTT Units configured to support voice codec and analog real time voice information. This XML compatible information can be embodied in the USPR Hub host originated and RCTT Unit preamble and acknowledge data packets. The preamble and acknowledgement based packets can also be TCP/IP compatible in order to facilitate seamless transport over the internet world wide web (WWW).

Additionally, the invention utilizes Sun Solaris Java In Advanced Intelligent Networks (JAIN). JAIN is a telecommunications industry framework, based on Sun's Java Beans component architecture, designed to spur a new wave of services blending Internet and intelligent network technologies such the inventions USPR means and methods. The JAIN system is designed to drive convergence between conventional voice telephony networks and IP-based data networks. The invention completely utilizes the JAIN system within its USPR Hub, DSP-Host and RCTT Unit, and RCTT Unit mini-hubs firmware and software means and methods. The invention is also designed to be compatible with all Wireless Application Protocol (WAP) means and methods. With WAP the inventions RCTT Unit and RCTT Unit mini-hub and all its interfaced spread spectrum 2.3-2.45GHz nodes can access WAP compatible and XML compatible internet servers, and ISPs such as UP.Link Server and the like. The inventions RCTT Unit and RCTT Unit mini-hub can be compatible with Nokia, Ericsson, Mitsubishi, Sony, Motorola, Uniden, Wireless Link, Standard-Marantz handset and application specific cellular, PCS, Trunked mobile radio cards and the like. In fact the invention uses these cards by simply modifying firmware and software in order to facilitate its means, methods and protocols.
CLAIMS

What is claimed is:

1. A method of multiplexing data from a plurality of radio communication devices over a wireless communications channel, comprising:
   a) configuring one of the plurality of radio communication devices as a master radio communication device;
   b) the master radio communication device establishing the wireless communications channel;
   c) the plurality of radio communication devices identifying and selecting the wireless communications channel; and
   d) exchanging data between the master radio communications device and the plurality of radio communication devices via the wireless communications channel.

2. The method of claim 1, wherein the master radio communications device is a switch, the wireless communications channel is a wireless voice channel, and the plurality of radio communication devices identify and select the wireless communications channel by scanning all available frequencies and lock onto a data signature transmitted by the switch over the wireless voice channel.
Fig. 8
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H04J 1/00
US CL : 370/343
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 370/343, 344, 310, 315, 319, 320, 321; 455/507; 128/903, 904; 340/870.01

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>US 5,475,867 A (BLUM) 12 December 1995, Figure 2 and col. 2, lines 37-41.</td>
<td>1</td>
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</table>

Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search
15 MARCH 2001

Date of mailing of the international search report
18 APR 2001

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Form PCT/ISA/210 (second sheet) (July 1998)