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(54) **PROTOCOL CONVERSION AND BANDWIDTH REDUCTION TECHNIQUE PROVIDING MULTIPLE NB+D ISDN BASIC RATE INTERFACE LINKS OVER A WIRELESS CODE DIVISION MULTIPLE ACCESS COMMUNICATION SYSTEM**

(75) Inventors: **Thomas E. Gorsuch**, Merritt Island, FL (US); **Carlo Amalfitano**, Melbourne Beach, FL (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

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None
See application file for complete search history.

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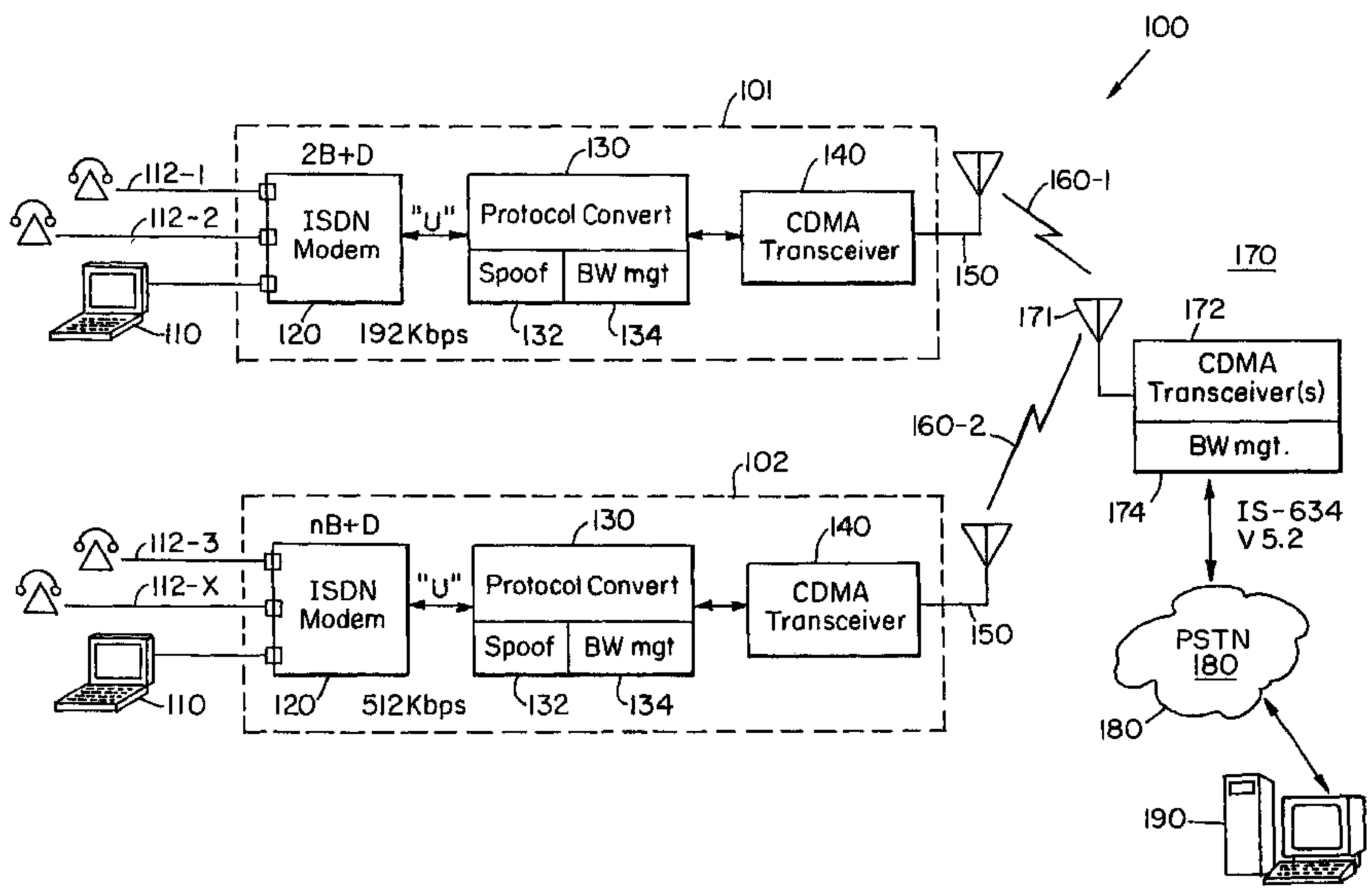
Primary Examiner — Steven H Nguyen
(74) *Attorney, Agent, or Firm* — Blakely, Sokoloff, Taylor & Zafman LLP

(57) **ABSTRACT**

A technique for integrating services digital network (ISDN) and code division multiple access (CDMA) or other digital wireless communication protocols by a technique that strips off lower protocol layers, such as layers one and two of the ISDN protocol and sending only layer three and above messages over a more efficient wireless protocol.

33 Claims, 4 Drawing Sheets



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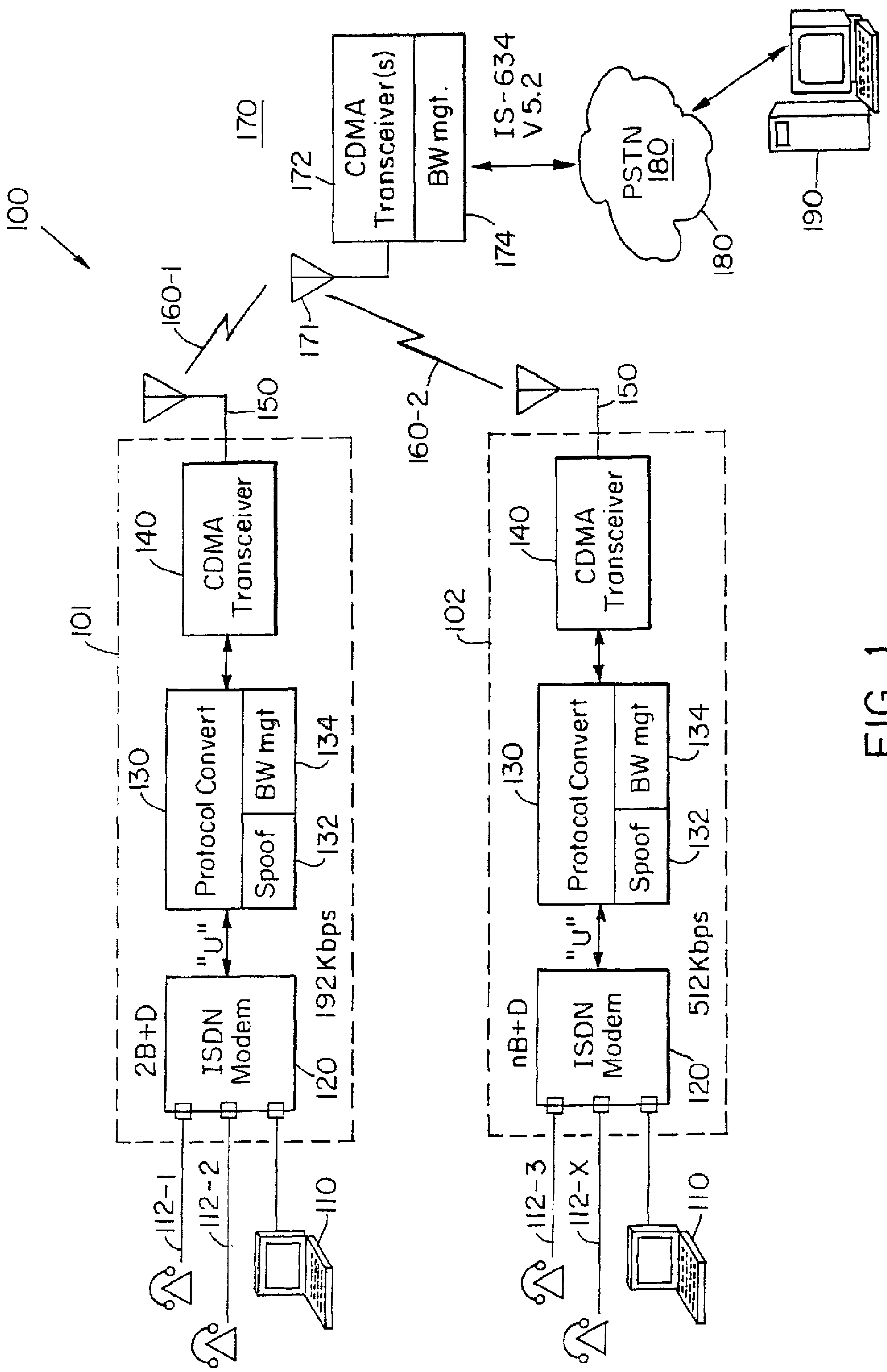
100
101
102
2B+D
nB+D
ISDN Modem
"U"
192Kbps
512Kbps
Protocol Convert
Spoof
BW mgt
CDMA Transceiver
CDMA Transceiver(s)
BW mgt.
170
172
174
171
IS-634
V5.2
PSTN
180
190
110
112-1
112-2
112-3
112-X
120
130
132
134
140
150
160-1
160-2

FIG. 1

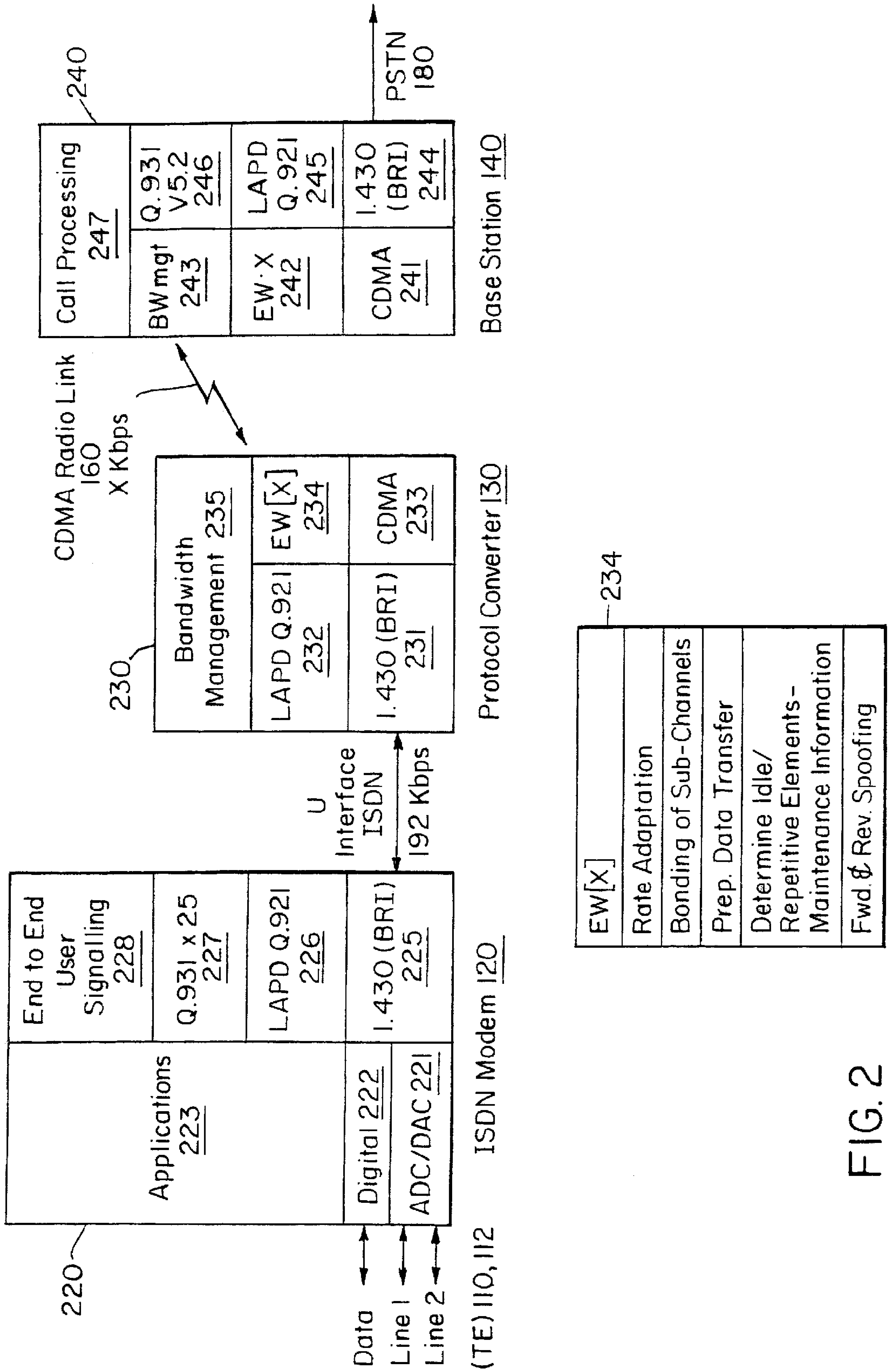
220
Applications 223
Digital 222
ADC/DAC 221
End to End User Signalling 228
Q.931 x 25 227
LAPD Q.921 226
I.430 (BRI) 225
ISDN Modem 120
Data
Line 1
Line 2
(TE) 110, 112
U Interface ISDN
192 Kbps
230
Bandwidth Management 235
LAPD Q.921 232
I.430 (BRI) 231
EW[X] 234
CDMA 233
Protocol Converter 130
CDMA Radio Link 160
X Kbps
240
Call Processing 247
BWmgt 243
EW·X 242
CDMA 241
Q.931 V5.2 246
LAPD Q.921 245
I.430 (BRI) 244
Base Station 140
PSTN 180
234
EW[X]
Rate Adaptation
Bonding of Sub-Channels
Prep. Data Transfer
Determine Idle/ Repetitive Elements-Maintenance Information
Fwd.& Rev. Spoofing

FIG. 2

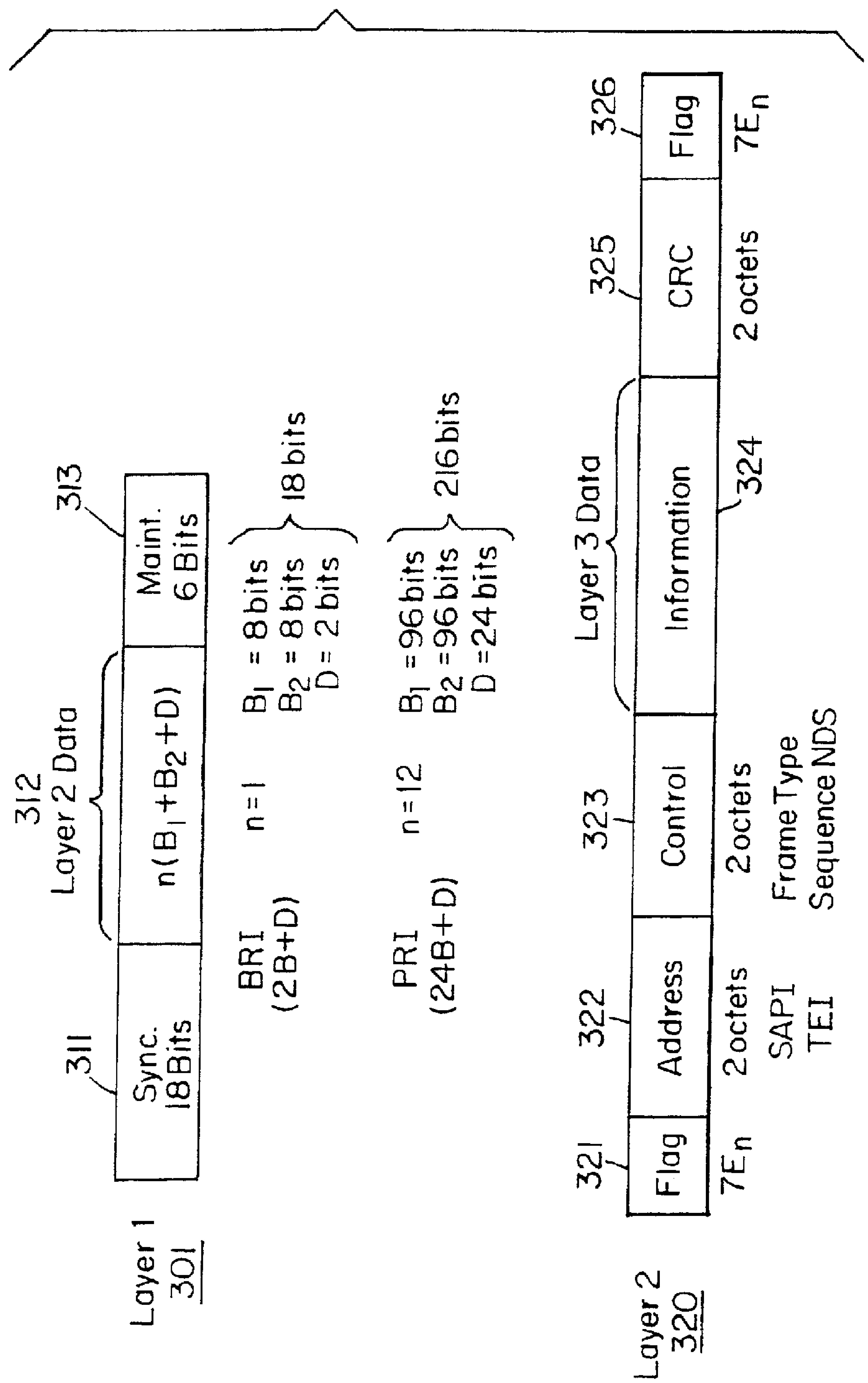
Layer 1
301
Sync.
18 Bits
311
312
Layer 2 Data
n(B1+B2+D)
Maint.
6 Bits
313
BRI
(2B+D)
n=1
B1 = 8 bits
B2 = 8 bits
D = 2 bits
18 bits
PRI
(24B+D)
n=12
B1 = 96 bits
B2 = 96 bits
D = 24 bits
216 bits
Layer 2
320
321
Flag
7En
322
Address
2 octets
SAPI
TEI
323
Control
2 octets
Frame Type
Sequence NDS
Layer 3 Data
Information
324
325
CRC
2 octets
326
Flag
7En

FIG. 3

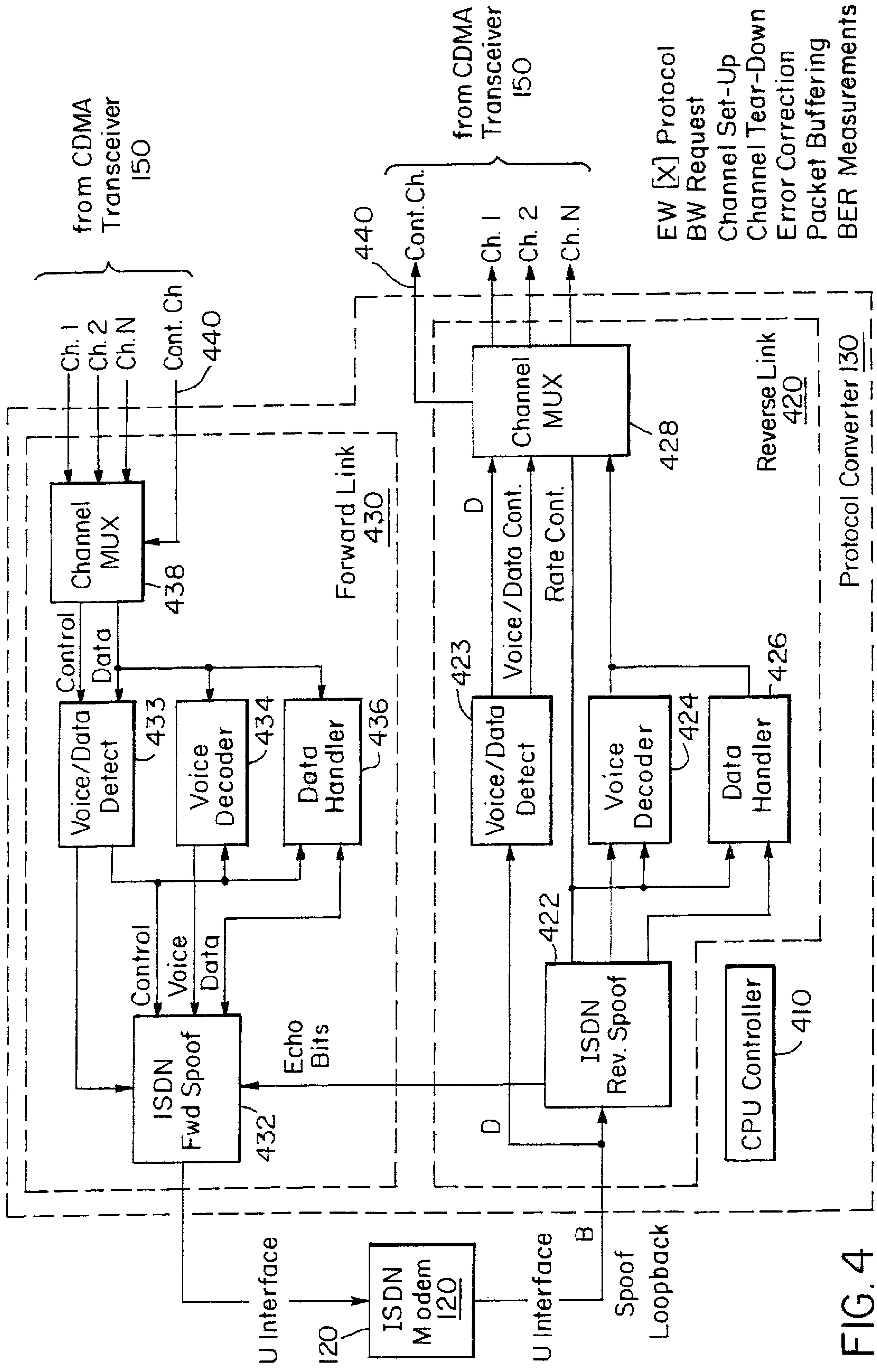
from CDMA Transceiver 150
Ch. 1
Ch. 2
Ch. N
Cont. Ch
440
Channel MUX
438
Forward Link 430
Control
Data
Voice/Data Detect
433
Voice Decoder
434
Data Handler
436
Control
Voice
Data
ISDN Fwd Spoof
432
Echo Bits
from CDMA Transceiver 150
Cont. Ch.
Ch. 1
Ch. 2
Ch. N
Channel MUX
428
Reverse Link 420
Protocol Converter 130
D
Voice/Data Cont.
Rate Cont.
423
Voice/Data Detect
Voice Decoder
424
Data Handler
426
422
ISDN Rev. Spoof
D
CPU Controller
410
EW [X] Protocol
BW Request
Channel Set-Up
Channel Tear-Down
Error Correction
Packet Buffering
BER Measurements
U Interface
120
ISDN Modem 120
U Interface
B
Spoof Loopback

FIG. 4

PROTOCOL CONVERSION AND BANDWIDTH REDUCTION TECHNIQUE PROVIDING MULTIPLE NB+D ISDN BASIC RATE INTERFACE LINKS OVER A WIRELESS CODE DIVISION MULTIPLE ACCESS COMMUNICATION SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS REFERENCE TO RELATED APPLICATION(S)

This application claims the benefit of prior pending U.S. Provisional Application Ser. No. 60/050,277 filed Jun. 20, 1997 entitled "Protocol Conversion And Bandwidth Reduction Technique Providing Multiple nB+D ISDN Basic Rate Interface Links Over a Wireless Code Division of Multiple Access Communication System", and a prior pending U.S. Provisional Application Ser. No. 60/050,338 filed Jun. 20, 1997 entitled "Dynamic Bandwidth Allocation to Transmit a Wireless ISDN Protocol Across a Code Division Multiple Access (CDMA) Radio Link".

BACKGROUND OF THE INVENTION

The increasing use of wireless telephones and personal computers by the general population has led to a corresponding demand for advanced telecommunication services that were once thought to only be meant for use in specialized applications.

For example, in the late 1980's, wireless voice communication such as available with cellular telephony was the exclusive province of the businessman because of relatively high subscriber costs. The same was also true for access to remotely distributed computer networks, whereby until very recently, only business people and large institutions could afford the necessary expensive equipment to access computer networks.

However, the general population now increasingly wishes to not only have access to computer networks such as the Internet and private intranets, but also to have access to such networks in a wireless fashion as well. This is particularly of concern for the users of portable computers, laptop computers, hand-held personal digital assistants, and the like, who would prefer to access such networks without being tethered to a telephone line. There still is no widely available satisfactory solution for providing low cost, high speed access to the Internet and other computer networks using the existing wireless telephone systems such as cellular. This unfortunate situation is most likely an artifact of several circumstances. For example, the typical manner of providing high speed data service in the business environment over the wireline network is not readily adaptable to the voice grade service available in most homes or offices. Such standard high speed data services therefore do not lend themselves well to efficient transmission over standard cellular wireless handsets.

Furthermore, existing cellular network was originally designed only to deliver voice services. At present, the modulation schemes in use continue their focus on delivering voice information with the maximum data rate services in the range of only 9.6 kbps being available. This is because the cellular switching network in most countries, including the United States, uses analog voice channels having a bandwidth from about 300 to 3600 Hertz. Such a low frequency channel does not lend itself directly to transmitting data at rates of 28.8 kilobits per second (kbps) or even 56.6 kbps that is now commonly available using inexpensive wire line modems, and which rates are now thought to be the minimum acceptable data rates for Internet access.

Switching networks with higher speed building blocks are just now coming into use in the United States. Although certain wireline networks, called Integrated Services Digital Networks (ISDN), capable of higher speed data access have been known for a number of years, their costs have only been recently reduced to the point where they are attractive to the residential customer, even for wireline service. Although such networks were known at the time that cellular systems were originally deployed, for the most part, there is no provision for providing ISDN-grade data services over cellular network topologies.

SUMMARY OF THE INVENTION

The present invention provides high speed data and voice service over standard wireless connections via a unique integration of ISDN protocols and existing cellular signaling such as is available with Code Division Multiple Access (CDMA) type digital cellular systems.

The technique consists of establishing a logical connection using a higher layer protocol, such as a network layer protocol, from an ISDN subscriber unit, such as may be connected to a portable computer node, to an intended peer node, such as another computer. The network layer logical connection is made through a wireless channel which provides a physical layer connection between the portable computer node, through a base station, and the intended peer node. In response to relatively low utilization of the wireless channel, the physical layer channel is released while maintaining the appearance of a network layer connection to the higher level protocols.

This has two consequences. First, it frees wireless channel bandwidth for use by other subscriber units, without the overhead associated with having to set up an end to end connection each time that data needs to be transferred. In addition, and perhaps more importantly, by allocating wireless channels only when needed, the bandwidth necessary to provide a temporary but very high speed connection at critical times. These may occur, for example, when a particular subscriber unit requests that a web page file be downloaded from the Internet.

More specifically, the technique, which is here called spoofing, involves stripping off the two lower layers of the ISDN protocol while reformatting layer three and higher layer messages for transmission using a more efficient CDMA based encapsulated protocol.

For example, the network level connection can be maintained by looping back data and removing the sync and maintenance bits at the ISDN physical layer one. Spoofing of the second layer of the ISDN protocol, e.g., the LAPD protocol, is carried out by removing all repetitive protocol elements such as the flag bits from the ISDN data link layer two messages.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views.

FIG. **1** is a block diagram of a wireless communication system making use of a protocol converter according to the invention.

FIG. **2** is an Open Systems Interconnect (OSI) style layered protocol diagram showing the relationship between various protocols used in the invention.

FIG. **3** depicts ISDN layer one and layer two frame formats.

FIG. **4** is a detailed block diagram of the protocol converter which performs spoofing and bandwidth allocation according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Turning attention now to the drawings more particularly, FIG. **1** is a block diagram of a system **100** for providing high speed data and voice service over a wireless physical link by seamlessly integrating Integrated Services Digital Network (ISDN) formatted signaling such as received from a standard wireline ISDN modem with the signaling required by a digitally modulated wireless air interface such as Code Division Multiple Access (CDMA).

The system **100** consists of two different types of components, including subscriber units **101**a and **101**b (collectively **101**) and base stations **170**. The subscriber units **101** and base stations **170** cooperate to provide the functions necessary in order to achieve the desired implementation of the invention. The subscriber unit **101** provides wireless data services to a portable computing device **110** such as a laptop computer, portable computer, personal digital assistant (PDA) or the like. The base station **170** cooperates with the subscriber unit **101** to permit the transmission of data between the portable computing device **110** and other computing devices **190** such as those connected to the base station **170** either directly or through the Public Switched Telephone Network (PSTN) **180** via the radio channels **160**.

More particularly, data and/or voice services are also provided by the subscriber unit **101** to the portable computer **110** as well as one or more other devices such as telephones **112-1**, **112-2** (collectively referred to herein as telephones **112**. (The telephones **112** themselves may in turn be connected to other modems and computers which are not shown in FIG. **1**). In the usual parlance of ISDN, the portable computer **110** and telephones **112** are referred to as terminal equipment (TE). The subscriber unit **101** provides the functions referred to as a network termination type 1 (NT-1). The particular subscriber unit labeled **101**a is meant to operate with a so-called basic rate interface (BRI) type ISDN connection that provides two bearer or “B” channels and a single data or “D” channel with the usual designation being 2B+D.

The subscriber unit **101** itself consists of an ISDN modem **120**, a device referred to herein as the protocol converter **130** that performs the various functions according to the invention including spoofing **132** and bandwidth management **134**, a CDMA transceiver **140**, and subscriber unit antenna **150**. The various components of the subscriber unit **101** may be realized in discrete devices or as an integrated unit. For example, an existing conventional ISDN modem **120** such as is readily available from any number of manufacturers may be used together with existing CDMA transceivers **140**. In this case, the unique functions are provided entirely by the protocol converter **130** which may be sold as a separate device. Alternatively, the ISDN modem **120**, protocol converter **130**, and CDMA transceiver **140** may be integrated as a single subscriber unit **101**.

The ISDN modem **120** converts data and voice signals between the terminal equipment **110** and **112** to format required by the standard ISDN “U” interface. The U interface is a reference point in ISDN systems that designates a point of the connection between the network termination (NT) and the telephone company.

The protocol converter **130** performs spoofing **132** and basic bandwidth management **134** functions, which will be described in greater detail below. In general, spoofing **132** consists of insuring that the subscriber unit **101** appears to the terminal equipment **110**, **112** as though it is connected to the public switched telephone network **180** on the other side of the base station **170** at all times. The bandwidth management function **134** is responsible for allocating and deallocating CDMA radio channels **160** as required.

The CDMA transceiver **140** accepts the data from the protocol converter **130** in a particular format and reformats this data in appropriate form for transmission through a subscriber unit antenna **150** over the CDMA radio channels **160-1**. Data is then received at the base station **170** and is processed by the base station equipment **172**. The base station unit **170** typically consists of one or more base station antennas **171**, multiple CDMA transceivers **172**, and a bandwidth management functionality **174**. The base station **170** couples radio signals to the public switch telephone network **180** in a manner which is well known in the art. The base station **170** may communicate with the PSTN **180** over any number of different efficient communication protocols such as primary rate ISDN, or other LAPD based protocols such as IS-634 or V5.2.

It should also be understood that signals travel bidirectionally, i.e., data signals originate at the portable computer **110** are coupled to the PSTN **180**, and data signals received from the PSTN **180** are coupled to the portable computer **110**.

Other types of subscriber units such as unit **101**b may be used to provide higher speed data services. Such subscriber units **102** typically provide a service referred to as nB+D type service that may use a so-called Primary Rate Interface (PRI) type ISDN protocol with the terminal equipment **110**, **112**. These units provide a higher speed service such as 512 kbps across the U interface. Operation of the protocol converter **130** and CDMA transceiver **140** are similar for the nB+D type subscriber unit **101**b as previously described for subscriber unit **101**a with the understanding that the radio links **160-2** to support subscriber unit **102** must either be greater in number or each have a greater bandwidth.

Turning attention now to FIG. **2**, the invention may be better understood in the context of a Open Systems Interconnect (OSI) layered protocol model diagram. The three protocol stacks **220**, **230**, and **240** are for the ISDN modem **120**, protocol converter **130**, and base station **170**, respectively.

The protocol stack **220** used by the ISDN modem **120** is conventional for ISDN communications and includes, on the terminal equipment side, the analog to digital conversion (and digital to analog conversion) **221** and digital data formatting **222** at layer one, and an applications layer **223** at layer two. On the U interface side, the protocol functions include Basic Rate Interface (BRI) such as according to standard 1.430 at layer one, a LAPD protocol stack at layer two, such as specified by standard Q.921, and higher level network layer protocols such as Q.931 or X.227 and high level end to end signaling **228** required to establish network level logical connections.

The lower layers of the protocol stack **220** aggregate two bearer (B) channels to achieve a single **128** kilobits per second data channel in a manner which is well known in the art. Similar functionality can be provided in a primary rate interface such as used by subscriber unit **102** to aggregate multiple B channels to achieve up to 512 kilobits per second data rate over the U interface.

The protocol stack **230** associated with the protocol converter **130** consists of a layer one basic rate interface **231** and a layer two LAPD interface **232** on the U interface side, to match the ISDN modem stack **220**. At the next higher network layer, a bandwidth management functionality **235** spans both the U interface side and the CDMA radio link side of the protocol converter stack **230**. On the CDMA radio link side **160**, the protocols depend upon the particular air interface in use. An efficient wireless protocol, referred to herein as EW[x] **234**, encapsulates the layer one **231** and layer two **232** ISDN protocol stacks in such a manner that the terminal equipment **110** may be disconnected from one ore more CDMA radio channels **160** without interrupting the higher network layer connection.

The base station **170** contains the matching CDMA **241** and EW[x] **242** protocols as well as bandwidth management **243**. On the PSTN side, the protocols may convert back to basic rate interface **244** and LAPD **245** only include higher level network layer protocols as Q.931 or V5.2 **246**.

Call processing functionality **247** allows the network layer to set up and tear down radio channels **160** and provide other processing required to support end to end connections between nodes as is known in the art.

The particular invention of interest herein is in the protocol stack **230** associated with the protocol converter **130**. In particular, the spoofing function performed by EW[x] **234** include the necessary functions to keep the U interface for the ISDN connection properly maintained, even without the continuous availability of a radio channel **160** of sufficient bandwidth for the duration of the network layer connection. This is necessary because ISDN expects to send and receive a continuous stream of synchronous data bits regardless of whether the terminal equipment at either end actually has any data to transmit. Without the spoofing function **132**, radio links **160** of sufficient bandwidth to support at least a 192 kbps data rate would otherwise be required throughout the duration of an end to end network level connection, whether or not data actually needs to be transmitted.

EW[x] **234** therefore involves having the CDMA transceiver **140** loop back continuous synchronous data bits over the ISDN communication path to spoof the terminal equipment **110**, **112** into believing that a sufficiently wide wireless communication path **160** is continuously available. However, only when there is actually data present on the terminal equipment to the wireless transceiver **140** does the side bandwidth be allocated. Therefore, unlike the prior art, the network layer need not allocate the assigned wireless bandwidth over the radio channels **160** for the entirety of the network layer communications session. That is, when data is not being transmitted between the portable computer **110** and the remote node bandwidth management function **235** deallocates initially assigned radio channel bandwidth **160** and makes it available for another transceiver and another subscriber unit **101**.

This is accomplished operating on both the ISDN layer one and layer two frames. As shown in FIG. **3**, the format of an ISDN layer one frame **310** is shown as including a number of fields such as a sync bit field **311**, data field **312**, and maintenance bit field **313**. The data field **312** includes either 18 bits or 216 bits, depending upon whether the device is a BRI device **101**a or PRI type device **101**b.

The layer two frame **320** format includes an initial flag field **312**, address field **322**, control field **323**, layer **10** three data field **324**, a cyclic redundancy check field **325**, one or more terminating flag fields **326**. The flag fields typically include the binary patterns 7E (hexadecimal).

The address field **322** identifies service access points and terminal equipment addresses, the control field **323** identifies frame type and sequence numbers, and the cyclic redundancy check field **325** includes checking information as is known in the art. The information field **324** encapsulates information used by layer three.

In accordance with the invention, information specific to layer one and layer two is stripped off by the spoofer **132** so that only layer three information is fed to the CDMA function **323**. In addition, the EW[x] protocol **234** loops back all repetitive "echo bits" such as the layer two flag bits **321**, **326**, and layer one sync and maintenance bits, such as to keep the U interface operating as though the higher level wireless connection was continuously available.

Therefore, only non-repetitive layer three information is sent through the CDMA transceiver, which occurs only during session set up and when actual information must be sent from end to end.

To understand more fully how this is accomplished, turn now to FIG. **4** which is a more detailed functional diagram of the components of a protocol converter **130**. It can be seen that an exemplary protocol converter **130** consists of a microcontroller **410**, reverse link processing **420**, and forward link processing **430**. Reverse link processing **420** further includes ISDN reverse spoofer **422**, voice data detector **423**, voice decoder **424**, packet processor **426**, and channel multiplexer **428**. The forward link processing **430** contains analogous functions operating in the reverse direction, including a channel multiplexer **438**, voice data detector **433**, voice decode **434**, packet processor **436**, and ISDN forward spoofer **432**.

In operation, the reverse link **420** first accepts channel data from the ISDN modem **120** over the U interface and forwards it to the ISDN reverse spoofer **432**. Any echo bits (e.g., the aforementioned layer one sync bits **311** and maintenance bits **313** as well as layer two flag bits **321**, address **322**, control **323**, and CRC **325** bits) are removed from data received and, once extracted, and sent to the forward spoofer **432**. The remaining layer three and higher level bits are thus information that needs to be send over a wireless link.

This extracted data is sent to the voice decoder **424** or packet processor **426**, depending upon the type of data being processed.

Any D channel data from the ISDN modem **120** is sent directly to voice data detection **423** for insertion on the D channel inputs to the channel multiplexer **428**. The voice data detection circuit **423** determines the content of the D channels by analyzing commands received on the D channel.

D channel commands may also be interpreted to control a class of wireless services provided. For example, the controller **410** may store a customer parameter table that contains information about the customers desired class of service which may include parameters such as maximum data rate and the like. Appropriate commands are thus sent to the channel multiplexer **428** to request one or more required radio channels **160** for communication. Then, depending upon whether the information is voice or data, either the voice decoder **424** or packet processor **426** begins feeding data inputs to the channel multiplexer **428**.

It should also be understood that each of the radio channels **160** is not necessarily of a sufficient bandwidth to individually carry an ISDN bandwidth of 56 kbps or even 128 kbps. Rather, in the preferred embodiment, the radio channels **160** are actually rather narrow in bandwidth, such as only sufficiently wide enough to support, say, an 8 kbps data rate. The radio channels **160** are thus allocated to particular network layer connections only upon demand. For more details of a preferred process for allocating radio channels **160**, reference should be made to our co-pending U.S. application entitled "Dynamic Bandwidth Allocation to Transmit a Wireless Protocol Across a Code Division Multiple Access (CDMA) Radio Link," Ser. No. 08/992,760, filed on even date herewith and assigned to H.Q. Wireless, Inc., the assignee of this application.

In any event, the channel multiplexer **428** performs the necessary multiplexing of radio channels **160**.

The channel multiplexer **428** may make further use of a voice data control signals provided by the voice data detection circuits **423**, depending upon whether the information is voice or data.

In addition, the CPU controller **410**, operating in connection with the channel multiplexer **428**, provides the necessary implementation of the EW[x] protocol between the subscriber unit **101** and the base station **170**. For example, radio channel requests, channel setup, and channel tear down commands are sent via commands placed on a control channel **440**. These commands are intercepted by the equivalent functionality in the base station **170** to cause the proper allocation of radio frequency channels **160** to particular connections.

The packet processor **426** provides an estimate of the data rate required to the CPU controller **410** so that appropriate commands can be sent over the control channel **440** to allocate an appropriate number of radio channels. The packet processor **426** may also perform packet assembly and buffering of the layer three data into the appropriate format for transmission over the CDMA radio links **160**.

The forward link **430** operates in analogous fashion. In particular, signals are first received from the channels **160** by the channel multiplexer **438**. In response to receiving information on the control channels **440**, control information is routed to the voice data detection circuit **433**. Upon a determination that the received information contains data, the received bits are routed to the packet processor **436**. Alternatively, the information is voice information, and routed to the voice decoder **434**.

Voice and data information are then sent to the ISDN forward spoofer **432** for construction into proper ISDN protocol format. This assembly of information is coordinated with the receipt of echo bits from the ISDN reverse spoofer **422** to maintain the proper expected synchronization on the U interface with the ISDN modem **120**.

It can now be seen how an ISDN communication path may be paused even though wireless bandwidth initially allocated for transmission is reassigned to other uses when the ISDN path is idle. In particular, the reverse **422** and forward **432** spoofers cooperate to loop back non-information bearing signals, such as flag patterns, sync bits, and other necessary information, so as to spoof the data terminal equipment connected to the ISDN modem **120** into continuing to operate as though the allocated wireless path over the CDMA transceiver **150** is continuously available.

Therefore, unless there is an actual need to transmit information from the terminal equipment being presented to the channel multiplexers **428**, or actual information being received from the channel multiplexers **438**, the invention may deallocate initially assigned bandwidth thus making it available for another CDMA transceiver **150** associated with another subscriber unit **101** of the wireless system **100**.

The CPU controller **410** may also perform additional functions to implement the EW[x] protocol, including error correction, packet buffering, and bit error rate measurement.

EQUIVALENTS

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

For example, other digital wireless modulation schemes and services may be used that provide multiple access to a given radio channel, such as frequency division multiple access (FDMA) or time division multiple access (TDMA). However, at the present time FDMA modulation schemes do not appear to be as efficient as CDMA since they may require multiple channel radio frequency circuits to accomplish the same results herein. Furthermore, TDMA protocols may require additional synchronization, especially for the reverse link.

Those skilled in the art will recognize or be able to ascertain using no more than routine experimentation, many equivalents to the specific embodiments of the invention described specifically herein. Such equivalents are intended to be encompassed in the scope of the claims.

What is claimed is:

1. For use with a digital communication network having a first digital communication path for coupling Integrated Services Digital Network (ISDN) communication signals with a first wireless transceiver at a first site, said first wireless transceiver being operative to conduct wireless communications with a second wireless transceiver at a second site, a method of controlling bandwidth utilization of said network comprising **[**the steps of**]**:

(a) in response to establishment of a communication session between said first and second sites, controlling said first wireless transceiver to appear to said first digital communication path as though the bandwidth is continuously available during said communication session for wireless communications between said first and second transceivers, irrespective of **[**the**]** *a* need to transport ISDN communication signals between said first and second sites; **[**and**]**

(b) in the absence of said need to transport ISDN communication signals between said first and second sites, making said bandwidth available for wireless communication by another wireless transceiver of said digital communication network*; and*

looping back synchronizing and maintenance bits on the IDSN link to spoof an ISDN physical layer protocol.

2. A method as in claim **1** additionally comprising the step of:

(c) maintaining a connection at a network layer above a data link layer by establishing a lower level connection and using radio frequency bandwidth only when required.

[3. A method as in claim **1** additionally comprising the step of:

looping back synchronizing and maintenance bits on the ISDN link to spoof an ISDN physical layer protocol.**]**

4. A method as in claim **1** additionally comprising the step of:

looping back an LAPD layer protocol by removing flag bits.

5. For use with a digital communication network having a first digital communication path for coupling data communication signals with a first wireless transceiver at a first site, said first wireless transceiver being operative to conduct wireless communications with a second wireless transceiver at a second site, a method of controlling wireless communication bandwidth comprising **[**the steps of**]**:

(a) in response to establishment of a communication session between said first and second sites, controlling said first wireless transceiver to appear to said first digital communication path as though the bandwidth is continuously available during said communication session for wireless communications between said first and second transceivers, irrespective of a need to transport data communication signals between said first and second sites**[**; and**]**, *wherein the data communication signals include layer two frames including a serial number and a frame type;*

(b) in the absence of said need to transport data communication signals between said first and second sites, making said bandwidth available for wireless communication by another wireless transceiver of said digital communication network*;*

(c) combining, by at least one of the first or second transceiver sites, a plurality of bearer channels onto a single data channel, and allocating a plurality of radio channels based on a required data rate;

(d) maintaining a connection at a network layer above a data link layer by establishing a lower level connection and using radio frequency bandwidth only when required; and

(e) looping back a higher layer protocol by removing flag bits.

[6. A method as in claim **5** additionally comprising the step of:

(c) maintaining a connection at a network layer above a data link layer by establishing a lower level connection and using radio frequency bandwidth only when required.**]**

7. A method as in claim **5** additionally comprising **[**the step of:

(d)**]** *: (f)* looping back synchronizing and maintenance bits on the link layer to spoof a physical layer protocol.

[8. A method as in claim **6** additionally comprising the step of:

(e) looping back a higher layer protocol by removing flag bits.**]**

9. A method as in claim **5** wherein the first and second wireless transceivers use Code Division Multiple Access (CDMA) to conduct wireless communication.

10. A digital communication system comprising:

a first wireless transceiver located at a first site, said first wireless transceiver being coupled to receive data communication signals from a first digital communication path, and being operative to conduct wireless communications:

a second wireless transceiver located at a second site, said second wireless transceiver being operative to conduct wireless communication with said first wireless transceiver;

means for establishing a communication session between said first and second sites, and for controlling said first wireless transceiver to appear to said first digital communication path as though communication bandwidth is continuously available during said communication session for wireless communication between said first and second transceivers, irrespective of a need to transport data communication signals between said first and second sites, *wherein the data communication signals include layer two frames including a serial number and a frame type*;

means for making said bandwidth available for wireless communication by another wireless transceiver of said digital communication network, in the absence of said need to transport data communication signals between said first and second sites; **[**and**]**

means for maintaining a connection at a network layer above a data link layer by establishing a lower level connection and using radio frequency bandwidth only when required, *wherein at least one of the first or second wireless transceivers is operable to combine a plurality of bearer channels onto a single data channel and allocate a plurality of radio channels based on a required data rate; and*

means for looping back synchronizing and maintenance bits on the link layer to spoof a physical layer protocol.

[11. A system as in claim **10** additionally comprising:

means for looping back synchronizing and maintenance bits on the like layer to spoof a physical layer protocol.**]**

12. A system as in claim **10** additionally comprising:

means for looping back a higher layer protocol by removing flag bits.

13. A system as in claim **10** wherein the first and second wireless transceivers use Code Division Multiple Access (CDMA) to conduct wireless communication.

14. A method as in claim 5 further comprising: facilitating use by a code division multiple access (CDMA) transceiver of a CDMA user device of a data traffic channel and a control channel associated with a packet data communication session; and transmitting information indicative of a data rate associated with the data traffic channel on the control channel.

15. A method as in claim 5, wherein transported communication signals by at least one of the first or second transceiver sites include address information and cyclic redundancy check.

16. A method as in claim 5, wherein the data communication signals include control data, a cyclic redundancy check and data provided by layer 3.

17. A method as in claim 5, wherein at least one of the first or second transceiver sites transmits control information including channel set-up requests, channel tear-down request and channel requests.

18. A method as in claim 17, wherein the control information is transmitted over a control channel.

19. A method as in claim 5, further comprising encapsulating data for transmission in the data communication signals.

20. A method as in claim 5, further comprising storing customer class of service data in storage associated with a controller.

21. The method of claim 5 wherein the plurality of radio channels are code division multiple access (CDMA) code channels.

22. A system as in claim 10 further comprising: a controller configured to control a transceiver of a code division multiple access (CDMA) user device to facilitate use of a data traffic channel and a control channel associated with a packet data communication session and to transmit information indicative of a data rate associated with the data traffic channel on the control channel.

23. A system as in claim 10, wherein transported communication signals by at least one of the first or second transceiver sites include address information and cyclic redundancy check.

24. A system as in claim 10, wherein the data communication signals include control data, a cyclic redundancy check and data provided by layer 3.

25. A system as in claim 10, wherein at least one of the first or second transceiver sites transmits control information including channel set-up requests, channel tear-down request and channel requests.

26. A system as in claim 25, wherein the control information is transmitted over a control channel.

27. A system as in claim 10, wherein at least one of the first or second wireless transceivers is operable to encapsulate data for transmission in the data communication signals.

28. A system as in claim 10, wherein at least one of the first or second wireless transceivers is operable to store customer class of service data in a storage associated with a controller.

29. A system as in claim 10 wherein the plurality of radio channels are code division multiple access (CDMA) code channels.

30. A digital communication system comprising: a first wireless transceiver located at a first site, said first wireless transceiver to receive data communication signal from a first digital communication path, and being operative to conduct wireless communications;

a second wireless transceiver located at a second site, said second wireless transceiver to conduct wireless communication with said first wireless transceiver;

a controller to establish a communication session between said first and second sites, and to control said first wireless transceiver to appear to said first digital communication path as though communication bandwidth is continuously available during said communication session for wireless communication between said first and second transceivers, irrespective of a need to transport data communication signals between said first and second sites, wherein the data communication signals include layer two frames including a serial number and a frame type;

a bandwidth management device to make said bandwidth available for wireless communication by another wireless transceiver of said digital communication network, in the absence of said need to transport data communication signals between said first and second sites; and

the controller to maintain a connection at a network layer above a data link layer by establishing a lower level connection and using radio frequency bandwidth only when required, to loop back a higher layer protocol and to control a transceiver of a code division multiple access (CDMA) user device to facilitate use of a data traffic channel and a control channel associated with a packet data communication session and to transmit information indicative of a data rate associated with the data traffic channel on the control channel, wherein the control channel is not adapted to carry voice or data traffic, and wherein at least one of the first or second wireless transceivers is operable to combine a plurality of bearer channels onto a single data channel and allocate a plurality of radio channels based on a required data rate.

31. A system as in claim 30, wherein transported communication signals by at least one of the first or second transceiver sites include address information and cyclic redundancy check.

32. A system as in claim 30, wherein the data communication signals include control data, a cyclic redundancy check and data provided by layer 3.

33. A system as in claim 30, wherein at least one of the first or second transceiver sites transmits control information including channel set-up requests, channel tear-down request and channel requests.

34. A system as in claim 33, wherein the control information is transmitted over a control channel.

35. A system as in claim 30, further comprising encapsulating data for transmission in the data communication signals.

36. A system as in claim 30, further comprising storing customer class of service data in storage associated with a controller.

37. The system of claim 30 wherein the plurality of radio channels are code division multiple access (CDMA) code channels.

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