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(54) **TDD FRAME FORMAT**

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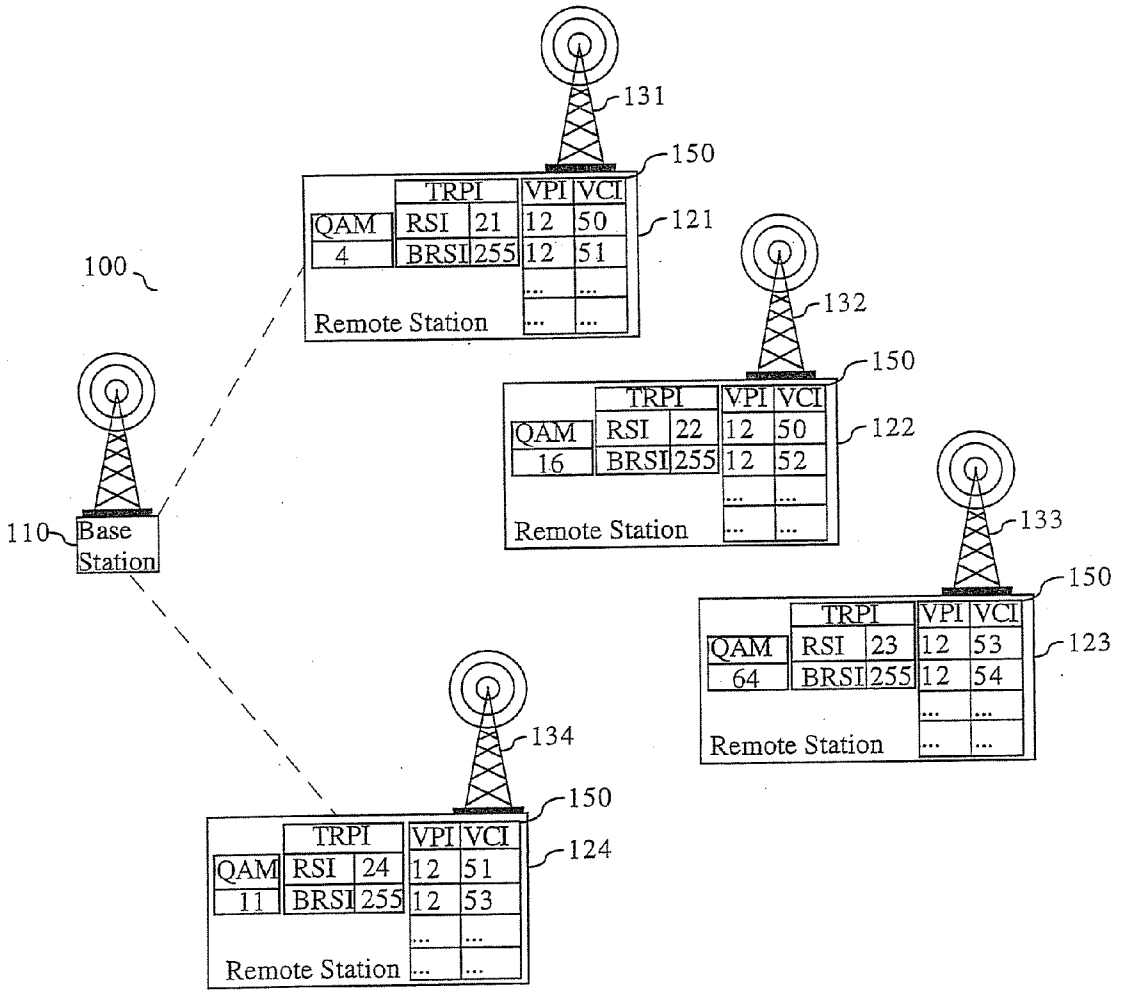
(57) **ABSTRACT**

A method of operating in a point-to-multipoint communication system with a base station and a plurality of remote stations, wherein the communication system enables transmission of data in a multicast mode with different Quadrature Amplitude Modulation (QAM) levels, carries switched point-to-point traffic without compromising the switched nature of the traffic in a broadcast environment, contains circuits for evaluating the Remote Station Identifier (RSI) and switch field tag portions of received Asynchronous Transfer Mode (ATM) cells using a series of registers to match the RSI and the unique remote address, and embeds multicast address data capable of identifying intended remote stations at varying QAM levels.



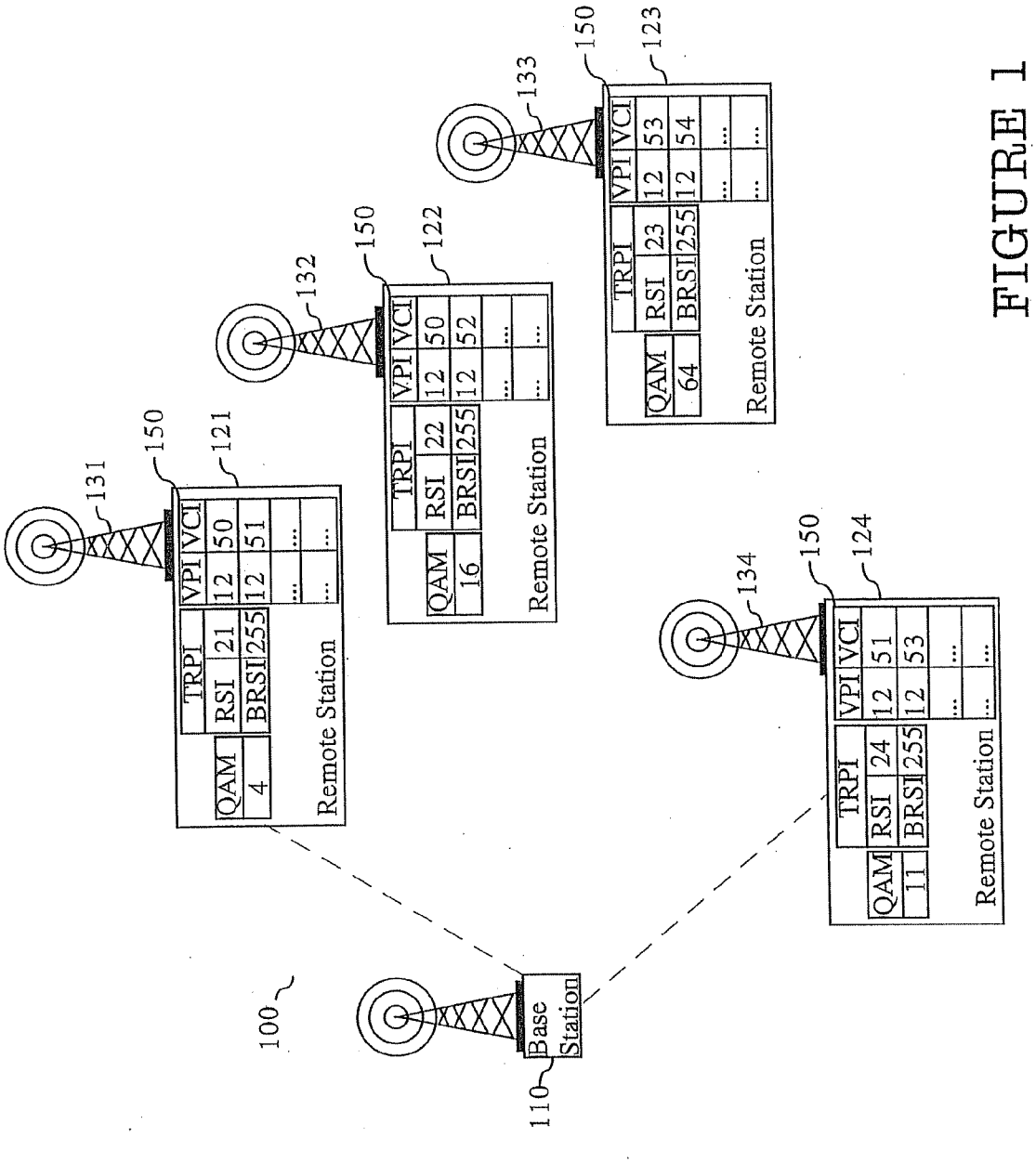

100
Base Station
110
131
150
121
Remote Station
TRPI
RSI 21
BRSI 255
QAM 4
VPI VCI
12 50
12 51
132
150
122
Remote Station
TRPI
RSI 22
BRSI 255
QAM 16
VPI VCI
12 50
12 52
133
150
123
Remote Station
TRPI
RSI 23
BRSI 255
QAM 64
VPI VCI
12 53
12 54
134
150
124
Remote Station
TRPI
RSI 24
BRSI 255
QAM 11
VPI VCI
12 51
12 53

FIGURE 1

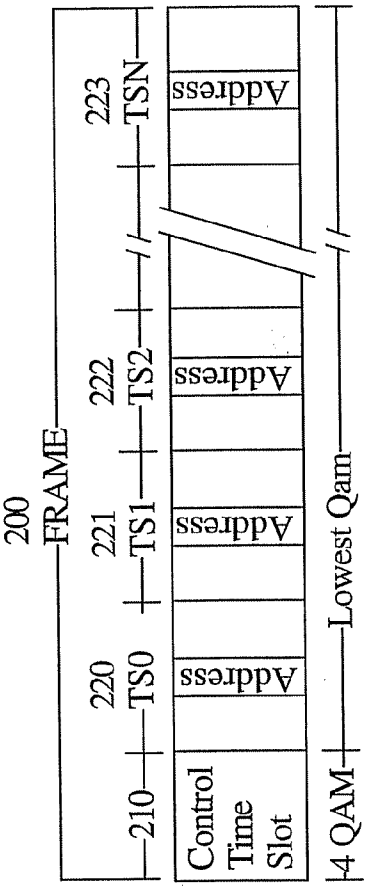



FIGURE 2

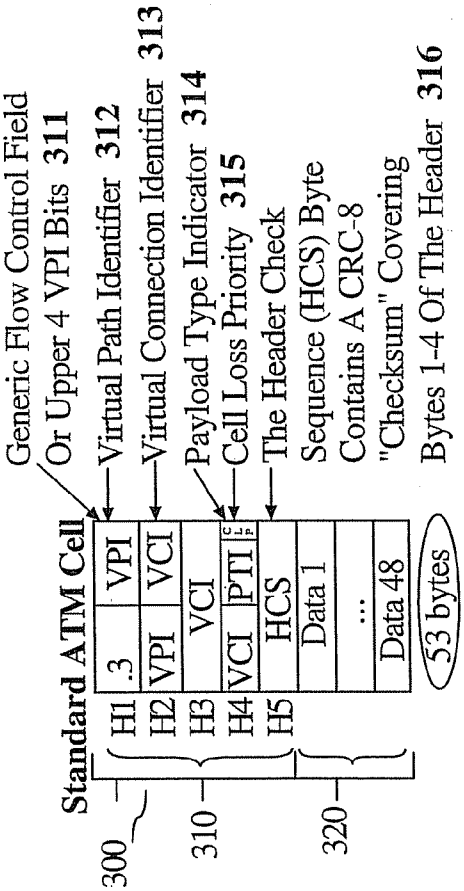



FIGURE 3a

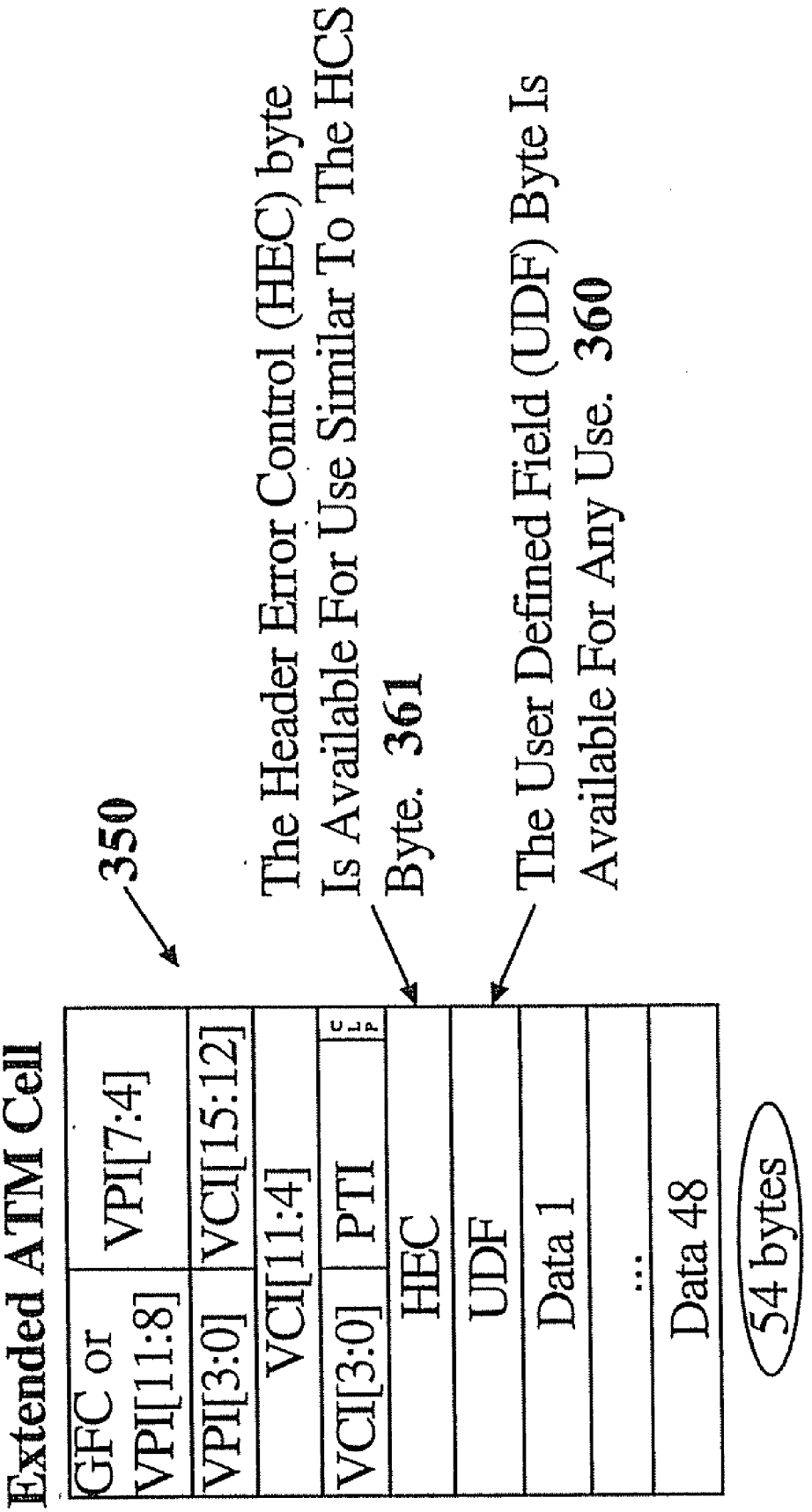

Extended ATM Cell
350
GFC or VPI[11:8]
VPI[7:4]
VPI[3:0]
VCI[15:12]
VCI[11:4]
VCI[3:0]
PTI
CLP
HEC
UDF
Data 1
...
Data 48
54 bytes
The Header Error Control (HEC) byte Is Available For Use Similar To The HCS Byte. 361
The User Defined Field (UDF) Byte Is Available For Any Use. 360

FIGURE 3b

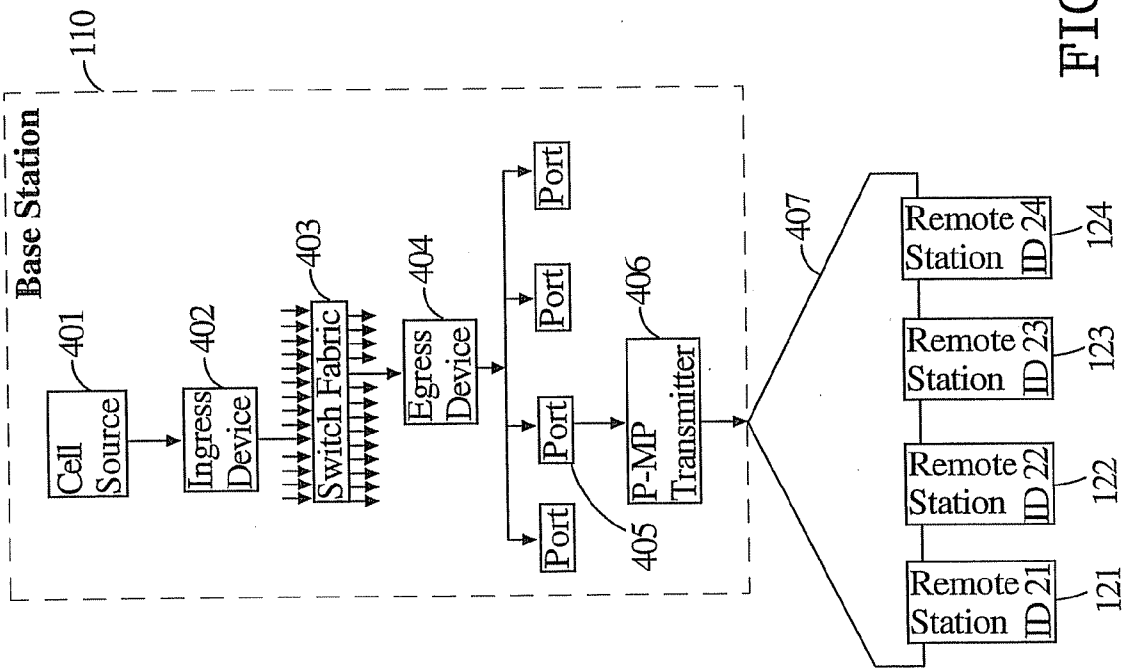

110
Base Station
401
Cell Source
402
Ingress Device
403
Switch Fabric
404
Egress Device
Port
Port
Port
Port
405
406
P-MP Transmitter
407
Remote Station ID 24
124
Remote Station ID 23
123
Remote Station ID 22
122
Remote Station ID 21
121

FIGURE 4

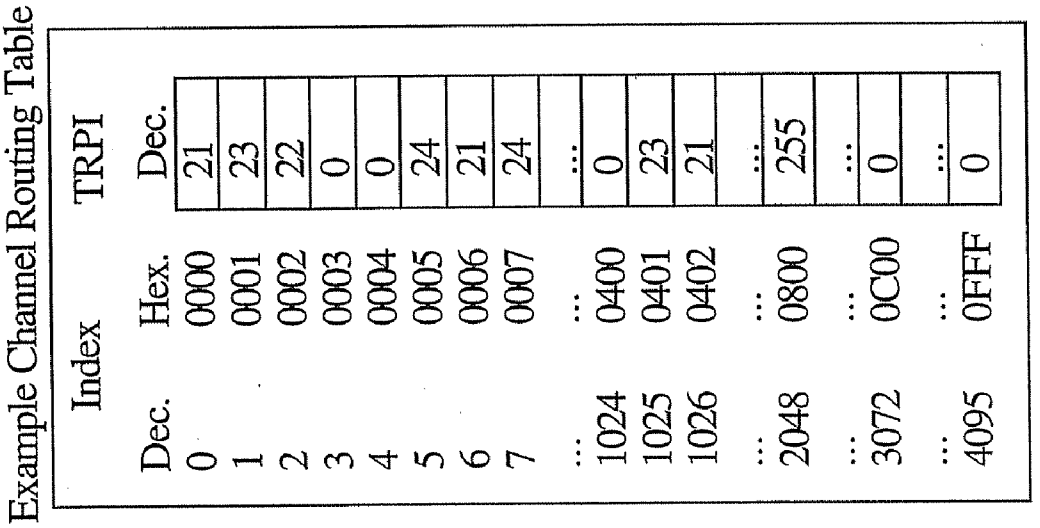

Example Channel Routing Table
Index
TRPI
Dec.
Hex.
Dec.
0 0000 21
1 0001 23
2 0002 22
3 0003 0
4 0004 0
5 0005 24
6 0006 21
7 0007 24
... ... ...
1024 0400 0
1025 0401 23
1026 0402 21
... ... ...
2048 0800 255
... ... ...
3072 0C00 0
... ... ...
4095 0FFF 0

FIGURE 5

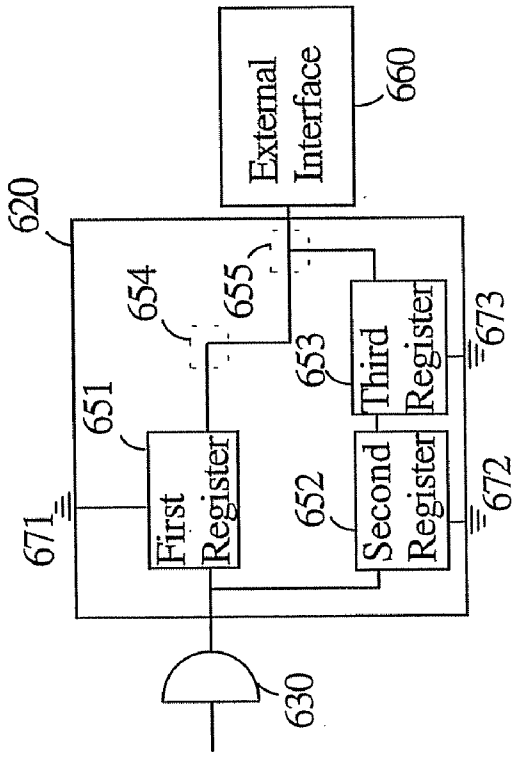



FIGURE 6

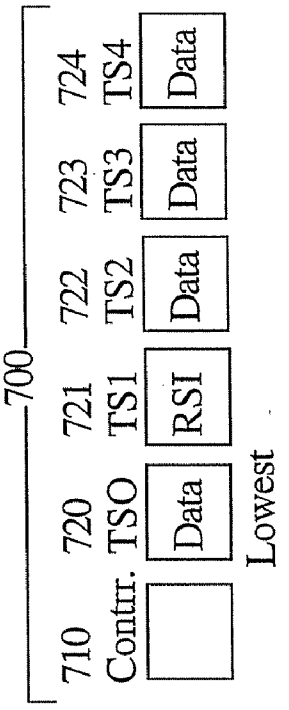



FIGURE 7

# TDD FRAME FORMAT

## CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is related to co-pending and commonly assigned PCT International Application No. PCT/US02/03323 entitled "Dynamic Bandwidth Allocation", PCT/US02/03322 entitled "Demodulator Bursty Controller Profile", PCT/US02/03193 entitled "Demodulator State Controller", PCT/US02/03189 entitled "Frame to Frame Timing Synchronization", the disclosures of which are hereby incorporated herein by reference. The aforementioned applications are related to commonly assigned U.S. Pat. No. 6,016,313 entitled "System and Method for Broadband Millimeter Wave Data Communication" issued Jan. 18, 2000 and currently undergoing two re-examinations under application Ser. No. 90/005,726 and application Ser. No. 90/005,974, U.S. Pat. No. 6,404,755 entitled "Multi-Level Information Mapping System and Method" issued Jun. 11, 2002, U.S. patent application Ser. No. 09/604,437, entitled "Maximizing Efficiency in a Multi-Carrier Time Division Duplex System Employing Dynamic Asymmetry", which are a continuation-in-part of the U.S. Pat. No. 6,016,313 patent which are hereby incorporated herein by reference.

[0002] The present application is related to and is being concurrently filed with commonly assigned U.S. patent application Ser. No. _____, entitled "Look-Up Table for QRT", U.S. patent application Ser. No. _____, entitled "Hybrid Agent-Oriented Object Model to Provide Software Fault Tolerance Between Distributed Processor Nodes, U.S. patent application Ser. No. _____, entitled "Airlink TDD Frame Format", U.S. patent application Ser. No. _____, entitled "Data-Driven Interface Control Circuit and Network Performance Monitoring System and Method", U.S. patent application Ser. No. _____, entitled "Virtual Sector Provisioning and Network Configuration System and Method", U.S. patent application Ser. No. _____, entitled "System and Method for Supporting Automatic Protection Switching Between Multiple Node Pairs Using Common Agent Architecture", U.S. patent application Ser. No. _____, entitled "System and Method for Transmitting Highly Correlated Preambles in QAM Constellations", the disclosures of which is hereby incorporated herein by reference.

## BACKGROUND OF THE INVENTION

[0003] Point-to-Point communication systems are prevalent in which data is transferred from one computer network to another through a switch network. An Asynchronous Transfer Mode (ATM) network is an example of such a point to point communication system.

[0004] A typical ATM network consists of multiple interconnected ATM switch nodes, ingress and egress portals to and from other networks or equipment. As ATM cells enter ingress ports and traverse the network, the ATM switches examine each ATM cell header to determine where to send the cell. The cell might pass to another ATM switch or to an egress portal. In all cases, the interconnections between nodes are Point-to-Point, meaning any one port connects to just one other port.

[0005] ATM networks are circuit-switched connection-oriented networks, as opposed to broadcast or packet-switched connectionless networks. A circuit-switched network requires the establishment of a circuit before data can flow. The ATM standards define ATM circuits as Virtual connections (VC); each comprising a sequence of fixed length cells from a single point of origin to a single destination point. A virtual connection may be either a virtual channel or a virtual path. A virtual channel is a single point to point data connection, such as a telephone call. A virtual channel is unidirectional; it takes two channels, one in each direction, to establish a bi-direction connection. A virtual path is a group of virtual channels all following the same route. An ATM network conveying a virtual path should not be aware of the number of virtual channels carried within. The VC set up phase determines the route of cells through the network; all cells belonging to a virtual connection follow the exact same path through the network.

[0006] ATM networks rely on a switch tag embedded in the header of each cell to determine how to direct the cell. ATM switches in the path extract the switch tag and perform some calculation to determine the output port that leads to the next node. The numerical value of a switch tag is significant only to the two nodes on each end of each point to point interconnection. Each node typically translates the switch tag to a new value before passing the cell to the next node. Since the switch tag value is only locally significant, an outside observer cannot identify the endpoint destination of a cell by examining the switch tag; it is the virtual connection setup phase that determines the paths. Switch tag translation permits multiplexing of VCs from multiple sources with identical switch tag numbering onto a shared physical carrier.

[0007] In contrast to an ATM network, Point-to-Multipoint networks are connectionless and frequently rely on a shared broadcast medium to communicate. For example, an Ethernet LAN subnet contains one or more "broadcast domains". Each broadcast domain connects all of its nodes onto a shared medium, such as interconnected copper wire. Whenever one node transmits a data packet, all other nodes in the broadcast domain receive the packet. Each node examines an IP destination address within every data packet and keeps only those packets with an IP address matching the recipient's address.

[0008] Data packet traffic between broadcast domains propagate based on the destination IP address. Unlike ATM networks, the destination IP address identifies the endpoint of the packet; the destination identifier doesn't change as the packet travels from node to node. All nodes have a way to determine which of its ports lead toward the destination node. Packets bound for the same destination may follow different paths as well. At any point in the network, the routing tag can tell an outside observer the destination of each packet. This forwarding technique is labeled "packet switching' and is the primary data transfer technique of the Internet.

[0009] Multicasting or point-to-multipoint transmission of data messages is accomplished in prior art Point-to-Point communication systems by making multiple copies of the data message and routing through a switch network to each of the intended recipients, ATM cells are typically multicast by this method. However difficulties arise in attempting to multicast data messages in a wireless or broadcast environment. Wireless systems, such as U.S. Pat. No. 6,016,313 which is incorporated herein by reference, don't route, they

broadcast. All recipients within transmission range of and compatible with the transmitter receive the broadcast data messages. Therefore informing the recipients which data messages are intended for them is essential.

[0010] ATM cells contain switch tags, as discussed above, that contain all routing information necessary to direct a cell to its final destination. One solution for broadcasting ATM cells over a broadcast network includes replicating each broadcast cell (ATM cell designated to be transmitted over a broadcast network) and inserting a unique VPI/VCI combination that corresponds to a particular recipient in a broadcast domain. The copies of the broadcast cells each with a VPI/VCI combination unique for each intended recipient are then broadcast to all recipients in the broadcast domain. As such each broadcast cell is broadcast multiple times, once for each intended recipient participating in the multicast. Each remote within the broadcast domain would then look at every broadcast cell's header and keep only the ones containing matching VPI/VCI. In a multicast involving 25 intended recipients within a broadcast domain of 50 remote stations, the same broadcast cell would be replicated and broadcast 25 times. Each of the fifty remote stations would have to examine each of the 25 broadcast cells to determine if they were the intended recipients. As a result 25 cells would be broadcast and the header of the cells would be examined 1250 times by the remotes, all in the attempt to send the same message to 25 recipients. This approach is obviously an inefficient solution.

[0011] Additionally when broadcasting to a plurality of remotes, it is necessary to consider the individual capabilities of each of the intended remote stations particularly the Quadrature amplitude modulation (QAM) level. The data messages must be broadcast in a manner receivable for each of the intended remotes without the requirement of tailoring the transmission to each of the intended remotes. Such tailoring would result in broadcasting the same data message numerous times to account for intended remote stations differences, again resulting in an inefficient use of bandwidth and increased computational load on both the base station and the remote stations. Thus there is a need for an improved method for casting and multicasting data in a broadcast mode.

[0012] The subject matter of the present invention adapts a broadcast Point-to-Multipoint architecture to include Point-to-Point traffic.

[0013] Multicasting is used synonymously with broadcasting through out the application, however multicasting retains is characteristic of being a subset of broadcasting and thus should not be viewed to narrow the scope to the present invention beyond this characteristic.

## SUMMARY OF THE INVENTION

[0014] An object of the invention is a method, in a point-to-multipoint communication system with a base station and a plurality of remote stations, that enables transmission of data in a multicast mode to intended remote stations with different QAM levels. The method includes embedding, in each time slot, one or more multicast addresses capable of identifying intended remote stations and, transmitting the data at the lowest QAM level of the intended remote stations.

[0015] Another object of the invention is a method of operating in a broadcast mode in a communication system with a base station and a plurality of remote stations, each remote station with circuits for evaluating the Remote Station Identifier (RSI) and switch tag field portions of received ATM cells. The method includes using the RSI as unique remote and broadcast address and evaluating, at each of the plurality of remote stations, the RSI of the ATM cells for a match with the unique remote address of the evaluating remote station. Additionally, evaluating, at each of the plurality of remote stations, the RSI of the ATM cells for a match with a broadcast address of the evaluating remote station. The method includes routing the cells by the evaluating remote station if a unique remote RSI match and, if the RSI matches the broadcast address of the evaluating remote station, evaluating the validity of the switch tag. Then using the switch tag for routing instructions where the switch tag is valid.

[0016] Yet another object of the invention is a method of operating in a broadcast mode, in a communication system with a base station and a plurality of remote stations, each remote station with circuits for evaluating RSI and switch tag portions of received ATM cells. The method includes using the RSI as unique remote and broadcast address; using a 1st register to match the RSI and the unique remote address; and using a 2nd register to match the RSI and the broadcast address. Additionally the method includes using a 3rd register to determine whether the ATM cell's switch tag matches a set of switch tags assigned to the remote. Then applying received cells to the 1st register and the 2nd register; passing cells to router if they pass 1st register, and applying received cells to the 3rd register if they pass 2nd register. The method also includes passing cells to router if they pass 3rd register.

[0017] Still another object of the present invention is a method of transmitting multicast data in a broadcast mode to intended remote stations where the intended remotes have different QAM levels, in a point-to-multipoint adaptive time division duplex communication system for broadband short distance radio communication of bursty data from one computer network to another computer network, with a base station and a plurality of remote stations. The method includes embedding in each time slot one or more multicast addresses capable of identifying intended remote stations; and, transmitting the multiple copies of the multicast data, with same multicast address data, each at different QAM levels.

[0018] Another object of the invention is a method of multicasting to intended remotes using ATM protocol, in a point to multipoint communication system with a plurality of remotes. The method includes embedding a Temporary remote path identifier in each ATM cell and, filtering on the switch tag at each of the plurality of remotes.

[0019] Additionally an object of the invention is a method in a point to point communication system, using framed protocol, with a plurality of remotes, where the improvement includes inserting a broadcast field in the forward portion of the frame to be broadcast.

[0020] These and many other objects and advantages of the present invention will be readily apparent to one skilled in the art to which the invention pertains from a perusal of the claims, the appended drawings, and the following detailed description.

## BRIEF DESCRIPTION OF FIGURES

[0021] FIG. **1** is a representative point-to-multipoint broadcast system.

[0022] FIG. **2** is an embodiment of a broadcast data frame with multiple time slots of the present invention.

[0023] FIG. **3***a* is a representation of standard ATM cell architecture

[0024] FIG. **3***b* is an embodiment of an extended ATM cell in accordance with the present invention

[0025] FIG. **4** is an embodiment of a base station in accordance with the present invention

[0026] FIG. **5** is an embodiment of a Channel Routing Table in accordance with the present invention

[0027] FIG. **6** is an embodiment of a remote station circuit of the present invention.

[0028] FIG. **7** is an embodiment of a broadcast data frame for a framed protocol communication system

## DETAILED DESCRIPTION

[0029] FIG. **1** is a representation of a point-to-multipoint communication system with a base station **110** and a plurality of remote stations **121-124**. The number of remote stations is not limited to those shown, the remote stations shown are representative of N such remotes. Furthermore, the remote stations can be capable of operating as a base station, the designation of remote station or base station is reflective of the particular role not necessarily the physical properties or instrumentation of the particular station. The communication system **100** may operate as a TDD, TDMA, ATDD or any other applicable wireless platform system allowing for broadband short distance radio communication of bursty data from one computer network to another computer network.

[0030] The base station and the remote stations are equipped transmitters and receivers capable of wireless interoperation with each other. The plurality of remote stations may demodulate at different quadrature amplitude modulation levels (QAM). The maximum QAM level for each remote may be a result of instrument limitations of a remote station or as a result of geography (i.e. distance from the base station). The representative remotes in FIG. **1** operate at different QAM levels for illustration purposes only, with remote **121** operating at 4 QAM, remote **122** and remote **124** at 16 QAM, remote **123** at 64 QAM as indicated in FIG. **1**. The remotes are capable of demodulating at QAM level up to their maximum QAM levels.

[0031] The remotes **121-124** are each assigned a unique remote address, which represents only one of the plurality of remotes within a broadcast domain. The unique remote address can be in the form of a remote station identifier (RSI) or a Temporary Remote Path Identifier (TRPI). The remotes **121-124** have unique remote addresses of **21**, **22**, **23** and **24** respectively as indicated in FIG. **1**. The use of unique remote addresses allows each remote to distinguish signals, which are intended for them.

[0032] The remotes also may have one or more broadcast addresses, which represent combinations of all or some of the remotes within a broadcast domain. The broadcast address can be in the form of a RSI in which case it is referred to as a Broadcast Remote Station Identifier (BRSI) or a TRPI in which case it is referred to as a Broadcast Temporary Remote Path Identifier (BTRPI). In the plurality of remotes, as shown in FIG. **1**, each remote has a broadcast address of **255**, again as shown in FIG. **1**. In the preferred embodiment the RSI is an eight-bit number. RSIs between 1 and 128 are reserved for unique remote addresses and the RSIs between 129 and 255 can be reserved for broadcast addresses, with an RSI of 0 being invalid.

[0033] The remotes also have a set of valid switch tags. In FIG. **1**, the set of valid switch tags is composed of VPI/VCI values designated **150-154** respectively for each remote **120-124**. The set of valid switch tags may be modifiable as desired.

[0034] In order to allow the transmission of data in a multicast or broadcast mode to the intended remote stations, embedded in each time slot is the multicast address capable of identifying the intended remote station or intended remote stations from the RSI corresponding to a unique remote address or a broadcast address.

[0035] FIG. **2** shows a representation of the format for a frame **200** of data for transmission over the communication system **100**. The data can also be in the form of an ATM cell. The frame is divided into a control time slot **210** and N data time slots. Within each multicast data time slot the multicast address **225** is embedded, the multicast address being in the form of a RSI or TRPI. The control time slot **210** is modulated at 4 QAM so that all the remotes whether operating at 4 QAM or higher are able to demodulate the control signal. The multicast data time slots TS**0**-TSN **220-223** respectively are transmitted at the highest QAM receivable by all the intended remotes, in other words the data is transmitted at the lowest QAM selected from the highest QAM of each of the intended stations. For example, a broadcast intended for remote stations **121**, **122** and **123** would be transmitted at 4 QAM, since the highest QAM remote station **121** can receive is 4 QAM and such is the lowest QAM level from the group of intended remotes. If the data in all the time slots of the frame were intended only for remote **123**, the data would be transmitted at 64 QAM, since 64 QAM is the highest QAM remote station **123** can receive, and consequently is the lowest maximum QAM level from the group of intended remotes. The base station **110** dynamically determines the lowest QAM level on a frame by frame basis from information about the intended remote stations. Using the above example, a first frame intended for remote stations **121**, **122** and **123** would be transmitted at 4 QAM, and a second frame intended for only **123** would be transmitted by the base station at 64 QAM. Such remote station information can be obtained from a database or from information communicated from each of the remote stations. The selection of a maximum QAM level for a particular time slot or frame allows for more efficient use of the available spectrum by increasing information density to the remote stations having suitable communication attributes.

[0036] Alternatively, the base station can transmit the data at multiple QAM levels. Where the specific QAM level of each of the intended remotes is not known, but known to be one of a plurality of different QAM levels or is not important to be known, the base station **110** transmits the data with the same multicast address multiple times. The time slots con-

taining the same data and being transmitted at and each of the different QAM levels possible for reception by the intended remote stations.

[0037] For illustration, where a broadcast cell is intended for remotes **121-124**, yet information regarding the QAM level of remote **121** is not known or is not important, the base station would transmit the control time slot **210** at 4 QAM and TS**0220** would be modulated at 4 QAM. Subsequent time slot TS**1221** would contain the identical data and address as TS**0221** but would be modulated at 16 QAM. Time slot TS**2222** would likewise contain identical information as TS**0220** but would be modulated at 64 QAM. Each remote station can demodulate the control time slot at 4 QAM and the time slots corresponding to its maximum QAM. Therefore the data would be capable of reception by all the remotes, since the data was transmitted at each of the possible QAM levels.

[0038] In a communication system using ATM protocol, the unique remote address and the broadcast address are preferably in the form of a TRPI and appended to the beginning of the cell.

[0039] Similarly in a point-to-point communication system using framed protocol, a broadcast address field is inserted in the forward portion of the frame only if the data in the frame is intended for broadcast. FIG. **7** represents much the same frame as FIG. **2**, however it is used in system using framed protocol. The frame **700** includes a control time slot **710** and additional time slots T**0**-TN **720-724** respectively. The frame **700** is intended for broadcast as such a broadcast field is placed in TS**0720**. The broadcast field contains address information such as a RSI or TRPI. In the implementation, as shown in FIG. **7**, the destination of all the time slots within the frame are governed by the contents of the broadcast field. Whereas in previous implementations, each time slot had it own address that may or may not be similar to other time slots in the frame. Preferably, as shown in FIG. **7**, the address field is placed after the control time slot **710**. The broadcast field is modulated at the lowest QAM level of the intended remotes as discussed previously.

[0040] In the transmission of ATM cells in a broadcast or multicast manner as described though out, an approach that modifies the standard ATM cell architecture is preferred. FIG. **3***a* represents a standard ATM cell **300**. Standard ATM cell architecture contains a 5 byte header **310** followed by a 48 byte data payload **320**. Within the cells header are fields for generic flow control **311**, VPI **312**, VCI **313**, payload type indicator **314**, cell loss priority **315** and the header check sequence **316**. The cell header contains an 8 bit or 12 bit virtual path indication and a 16 bit virtual channel indication field. The VPI and VCI fields in combination constitute the switch tag described above. The standard ATM cell is 53 bytes.

[0041] The standard ATM header fields eligible to contain the routing address or RSI are the switch tag fields, however the modification of these fields are undesirable. The VCI field must be undisturbed when used for Virtual Path connections. It is also unfavorable to place the identifier within the VPI field, since to do so would violate the switched nature of ATM because the VPI must be translatable from node to node. Additionally the VPI is small; embedding a RSI would dramatically restrict the number of usable VC due to unusable or undesirable bit combinations. Due to these limitations, a non-standard or extended ATM cell is preferred.

[0042] The extended ATM cell **350** in FIG. **3***b* is similar to the standard ATM cell with the addition of a User Defined Field (UDF) **360**. The Header Error Control Field (HEC) **361** is another name for the HCS field. The UDF is one byte following the cell header fields and preceding the data payload. The extended ATM cell **350** has a size of 54 bytes. An output channel field is contained within the HEC and UDF.

[0043] The Output Channel identifier is derived from each cell's switch tag. Each individual Output channel value represents a single VC (virtual connection, either a virtual channel or a virtual path) and acts as a routing tag transporting ATM cells through a core switch fabric. As the cells exit the switch fabric the receiving egress devices examine the Output channel field to identify which output port should receive the cell. There are no restrictions on the value of the output channel identifier; all possible bit combinations are thus useable. The output channel mechanism is not an uncommon feature of industry-standard ATM ingress/Egress device components, in that it doesn't violate the switched nature of ATM because the switch fabric and its ingress and egress devices act collectively as a single node rather than a sequence of nodes.

[0044] For the output channel identifier to contain the RSI would require the RSI to pass through one node to another node without being subject to switch tag translation. The cells would have to identify the destination Remote station before translating the cells' switch tag. This would clearly violate the intent of ATM since ATM cells as described previously are switched based on a freely translatable switch tag. Implementing the RSI directly into the Output channel field creates a non-uniform ATM switch design, because not all cells entering the switch fabric are bound for a Point-to-Multipoint broadcast. Since the output channel identifier corresponds to an individual VC, a look up table within the communication system is used to translate the output channel value to a RSI. The look up table permits multiple output channel values per RSI.

[0045] FIG. **4** illustrates the determination of the RSI for an ATM cell. A cell Source **401** forwards all cells for all VC to the switch Fabric ingress device **402**. Ingress device **402** examines each cell's switch tag fields and generates two additional fields. The first field is a fabric output tag that tells the switch fabric which Egress device receives the cell. The second field, is the output channel and behaves like an extended VPI field since is derived from the VPI/VCI fields and it dictates to the egress device which port **405** receives the cell. The switch fabric **403** delivers the cell to egress device corresponding to the fabric output tag. Egress device **404** examines the output channel and forwards the cell to the intended port **405**, which in turn passes the cell to the P-MP transmitter **406** which broadcasts in broadcast domain **407**. The egress device embeds the output channel value within the HEC and UDF fields of the extended ATM cell.

[0046] The output channel value has no intrinsic meaning; it is simply an index number into a look-up table within the egress device. The base station software selects an unused output channel number at the time of establishment of each VC.

[0047] In the exemplary base station of FIG. **4**, the output channel is a 14-bit number that identifies one of 16,384 VC per switch Fabric Egress Device **404**. The remaining 2 bits are ignored by Device **404**. The Egress device identifies the destination port using the output channel value. If the output channel values are distributed between the ports, then it is convenient for the Egress device to use 2 bits of the output channel to identify the destination port. This results in 4,096 VC per Port, per transmitter, per field. As previously eluded to if the RSI were directly embedded within the output channel field, only 4 bits could be used to describe only 16 possible VPI values per Remote station, thus restricting the number of Virtual paths and most importantly forcing pre-assignment of the Virtual path connection to each remote station. Such preassignment would prevent reassignment to other remote station, because the output channel would contain the RSI. In this example the remaining 4,016 output channel values would be unusable.

[0048] FIG. **5** is an abbreviated exemplary look up table for a Point-to-Point transmitter with initialized entries. The base station sets up several VC and corresponding output channel values for each remote:

[0049] Remote Station **121** with a RSI of 21 has VCs at entry 0, 6, and 1026;

[0050] Remote Station **122** with a RSI of 22 has a VC at entry 2;

[0051] Remote Station **123** with a RSI of 23 has VCs at entry 1, 1025;

[0052] Remote Station **124** with a RSI of 24 has VCs at entry 5 and 7.

[0053] Using the look up table in FIG. **5**, if the switch fabric ingress device injects a cell into the switch fabric accompanied by an output channel value of 1025, the transmitter **406** will use 1025 as the index into the Look up table and retrieve the RSI "23". The transmitter than broadcasts the cell into region **407**. Remote **123** will accept the cell and all the other remotes reject the cell.

[0054] A benefit of using the look up table is the 4,096 output channel numbers may be assigned to the remote stations within field **407** in any combination. Thus the number of VC as reflected by the output channel values is independent of the number of remotes and furthermore the number of VC per a particular remote is independent of the total number of VC. In the example in FIG. **4**, there can be one output channel assigned to each remote station **121**, **122**, **123** and the remaining 4093 output channels assigned to remote station **124**. Or the 4096 output channel might be distributed as evenly as possible depending upon the needs of the system.

[0055] An additional took up table can be used in conjunction with the output channel identifier to determine which transmitter or broadcast domain the intended remote stations are associated with. The use of the additional look up table allows variable assignments of the designated output channel bit values to the available transmitters.

[0056] FIG. **6** is a representation of a circuit **620** within each of a plurality of remotes. The circuit at each remote station evaluates the RSI and switch tag field portions of received ATM cells. ATM cells are standardized frames with a data payload and a header containing routing and other control information. The routing information includes the switch tags VPI/VCI.

[0057] An ATM cell broadcast from the base station **110** is received at all of the remotes within range of the transmission. The circuit evaluates the RSI of the ATM cell to determine if the RSI matches the unique remote address of the evaluating remote. Upon determining a match indicating the ATM cell is intended for the particular remote, the cell is then routed to an external interface. The cells are directed via information provided by the cell's switch tag. A cell with a RSI matching the unique remote address should necessarily have a valid switch tag as it would represent a point to point transmission to that particular remote station. However, it may be desirable to evaluate the validity of the switch tag prior to routing.

[0058] The circuit **620** also evaluates the RSI of the ATM cell to determine if the RSI matches a broadcast address or BRSI of the evaluating remote station. The remote station may have a plurality of broadcast addresses, each corresponding to different combinations of remote stations. Upon determining a match of the broadcast address BRSI of the cell, the remote station evaluates the validity of the switch tag. Each remote has an assigned set of valid switch tags. If the switch tag is valid, the ATM cell is routed to an external interface **660**, again directed via information provided by the cells switch tag. In evaluating the switch tag, the VPI/VCI may be used or alternatively the VPI only. Each remote may have multiple switch tag filters, each switch tag filter corresponding to a respective switch tag that is a set of switch tags assigned to each remote for evaluating the validity of the ATM cell's switch tag. ATM cells that are not passed to the router or with invalid switch tags are discarded by the receiving remote.

[0059] By way of illustration, the base station **110** broadcasts an ATM cell intended for remote station **121**. The ATM cell is transmitted at 4QAM, the determination of which was described earlier. The ATM cell has appended RSI of "21" and a switch tag VPI/VCI of 12/50. The ATM cell is received at all the remotes in transmission range, which includes remotes **121**, **122**, **123** and **124**. Remote station **121** receives the signal and demodulates the ATM cell and gleans the RSI and switch tag information from the cell. The RSI is evaluated by the circuit **620** and matches it to the unique remote address. The cell is then routed through the external interface **660** via the switch tag information.

[0060] The signal with the ATM cell is also received at remotes **122**, **123**, and **124**. The RSI is compared to the unique remote address of each remote and in this example will not match. Simultaneously or sequentially the non-intended remotes compare the RSI to the broadcast address of each remote, and again in this example does not match. As a result the cell is discarded from each non-intended remote. The result is a point-to-point transmission of the cell in a broadcast mode.

[0061] In another example, base station **110** broadcasts an ATM cell intended for remotes **122** and **123**. The ATM cell is transmitted at 16 QAM, with an appended RSI of "255", which is the broadcast address for all of the remotes, and a switch tag VPI/VCI of 12/53. The signal containing the cell is received at each remote, and upon evaluation it is found that the RSI does not match any of the unique remote

addresses of the remotes. However, the RSI is found to match a broadcast address for each of the remotes. The cell's switch tag is then evaluated at each remote. The cell's switch tag is within the set of valid switch tags assigned to remotes **122** and **123** as seen in FIG. **1**, and thus the cell is routed through the external interface **660**. In remotes **121** and **124**, not withstanding the QAM level, the cells switch tag is not within the set of valid switch tags assigned to them and therefore the cell is discarded. The result being that the ATM cell was multicast to remotes **122** and **123** in a broadcast mode.

[**0062**] In a particular embodiment as shown in FIG. **6**, the ATM cells are received at the remote station via receiver **630**. The cells are applied in parallel to a 1st register **651** and a 2nd register **652**. The 1st register attempts to match the RSI of the cell with the unique remote address of the receiving remote. Upon a match the cells are transmitted to an external interface **660** where it is routed, absent a match the signal containing the ATM cells is discarded via ground **671**. The particular design of the registers and their operation are readily known and not discussed further.

[**0063**] The 2nd register also receiving the signal containing the ATM cell attempts to match the RSI with the broadcast address or BRSI of the receiving remote. Upon a match, the cells are sent to a 3rd register which is connected in series to the second register, absent a match the signal is discarded via ground **672**. The 3rd register attempts to validate the switch tag of the cell with the set of valid switch tags assigned to the receiving remote. Upon a determination at the 3rd register that the switch tags are valid the cells are transmitted to an external interface **660** for appropriate routing via information from the switch tag. Again, if the switch tag is invalid the signal with the cell is discarded via ground **673**.

[**0064**] A 4th register **654**, if desired, can also be placed in series with the first register **651** to evaluate the switch tags of the cell prior to being routed to the external interface. Alternatively the 3rd register can be in series with both the 1st and 2nd registers in position **655** and thus evaluate the switch tag of a cell matching the unique remote address or broadcast address.

[**0065**] While the present invention have been described, it is to be understood that the embodiments herein are illustrative only and the scope of the invention is to be defined solely by the appended claims when accorded a full range of equivalence, many variation and modification naturally occurring to those of skill in the art from a perusal here of.

**1-8**. (canceled)

**9**. In a communication system with a base station and a plurality of remote stations, each remote station with circuits for evaluating RSI and switch tag field portions of received ATM cells, the method of operating in a broadcast mode comprising the steps of:

a. using the RSI as unique remote and broadcast address;

b. evaluating, at each of the plurality of remote stations, the RSI of the ATM cells for a match with the unique remote address of the evaluating remote station;

c. evaluating, at each of the plurality of remote stations, the RSI of the ATM cells for a match with a broadcast address of the evaluating remote station;

d. routing the cells by the evaluating remote station if a unique remote RSI match; and,

e. if the RSI matches the broadcast address of the evaluating remote station, evaluating the validity of the switch tag; and, using the switch tag for routing instructions where the switch tag is valid.

**10**. The method of claim 9, wherein the communication system is a time division duplex communication system.

**11**. The method of claim 10, wherein the communication system is an adaptive time division duplex communication system.

**12**. The method of claim 11, wherein the communication system is for broadband short distance radio communication of bursty data from one computer network to another computer network.

**13**. The method of claim 12, wherein step (d) further comprises the step of evaluating the validity of the switch tag prior to routing.

**14**. The method of claim 12, wherein the remote stations have multiple broadcast addresses.

**15**. The method of claim 12, wherein the switch tag is VPI or VPIIVCI.

**16**. The method of claim 12, comprising the steps of:

a. Using a 1st register to match the RSI with the unique remote address;

b. Using a 2nd register to match the RSI with the broadcast address; and,

c. Using a 3rd register to determine the validity of the switch tag.

**17**. The method of, claim 12, wherein cells with invalid switch tags are discarded.

**18**. The method of claim 12, wherein broadcast mode is multicasting.

**19**. The method of claim 12, where each remote has multiple switch tag field filters, each switch tag filter corresponding to a respective switch tag in a set of switch tags assigned to each remote.

**20**. The method of claim 12, wherein each of the plurality of remote stations is capable of acting as the base station.

**21**. In a communication system with a base station and a plurality of remote stations, each remote station with circuits for evaluating RSI and switch tag portions of received ATM cells, the method of operating in a broadcast mode comprising the steps of:

a. using the RSI as unique remote and broadcast address;

b. using a 1st register to match the RSI and the unique remote address;

c. using a 2nd register to match the RSI and the broadcast address;

d. using a 3rd register to determine whether the ATM cell's switch tag matches one in a set of switch tags assigned to the remote.

f. applying received cells to the 1st register and the 2nd register;

g. passing cells to router if they pass 1st register;

h. applying received cells to the 3rd register if they pass 2nd register; and,

i. passing cells to router if they pass 3rd register.

**22**. The method of claim 21, wherein the communication system is a time division duplex communication system.

**23**. The method of claim 22, wherein the communication system is an adaptive time division duplex communication system.

**24**. The method of claim 23, wherein the communication system is for broadband short distance radio communication of bursty data from one computer network to another computer network.

**25**. The method of claim 24, wherein each of the plurality of remote stations has multiple broadcast addresses.

**26**. The method of claim 24, wherein the plurality of remotes shares a common broadcast address.

**27**. The method of claim 24, wherein the switch tag is a VPI or VPIIVCI.

**28**. The method of claim 24, wherein each of the plurality of remote stations is capable of acting as the base station.

**29-30**. (canceled)

**31**. In a point to multipoint communication system with a base station and a plurality of remotes, the method of multicasting to intended remotes using ATM protocol comprising the steps of: embedding a Temporary remote path identifier in each ATM cell; and filtering on the switch tag at each of the plurality of remotes.

**32**. The method of claim 31, wherein the communication system is a time division duplex communication system.

**33**. The method of claim 32, wherein the communication system is an adaptive time division duplex communication system.

**34**. The method of claim 33, wherein the communication system is for broadband short distance radio communication of bursty data from one computer network to another computer network.

**35**. The method of claim 34, wherein the temporary remote path identifier is a broadcast temporary remote path identifier recognized by each of the plurality of remotes.

**36**. The method of claim 34, wherein the switch tag is a VPIIVCI.

**37**. The method of claim 34, wherein the switch tag is a VPI.

**38-49**. (canceled)

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