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(54) POINT TO MULTI-POINT SERVICES USING HIGH SPEED SHARED CHANNELS IN WIRELESS COMMUNICATION SYSTEMS

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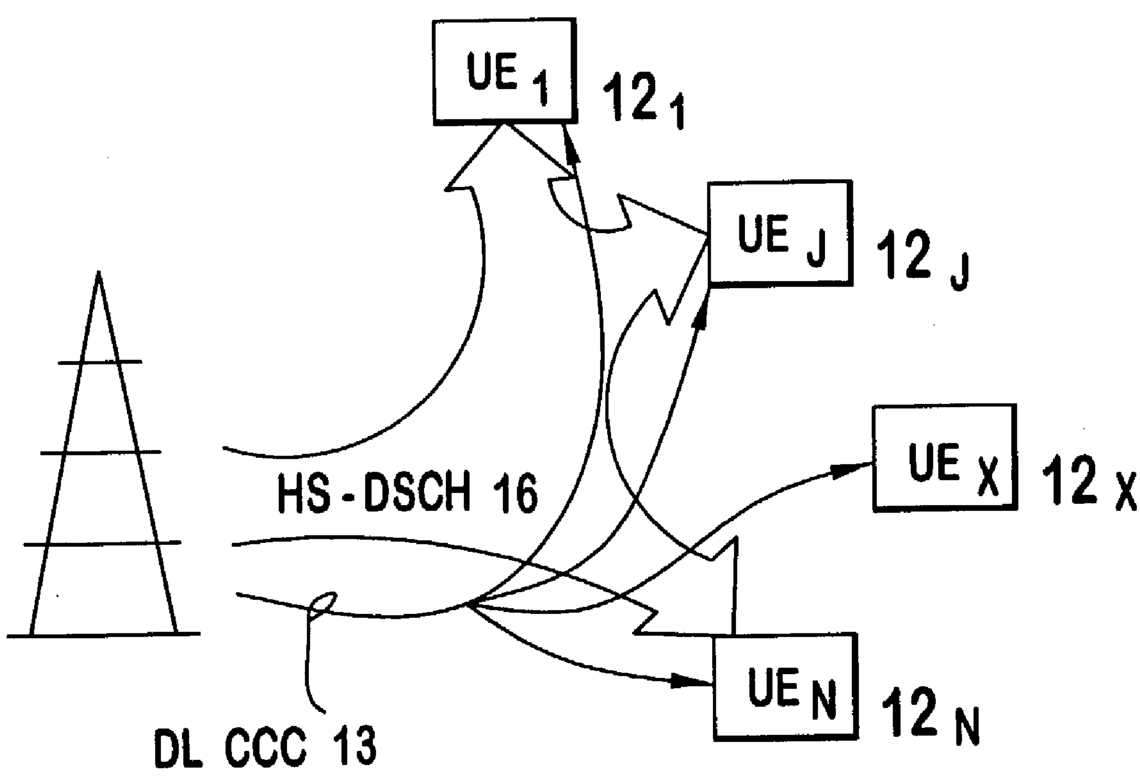
(57) ABSTRACT

Service data is transferred in a wireless communication system. A first service identification is transmitted for reception by a group of users of a cell in the system. The group of users does not include all of the users of the cell. Each of the group of users receives the service identification. Each of the group of users monitors for a second service identification being transmitted over a high speed downlink shared channel (HS-DSCH). The service data is transmitted over the HS-DSCH with the second service identification. Each of the group of users detects the second service identification and receives the service data of the HS-DSCH.



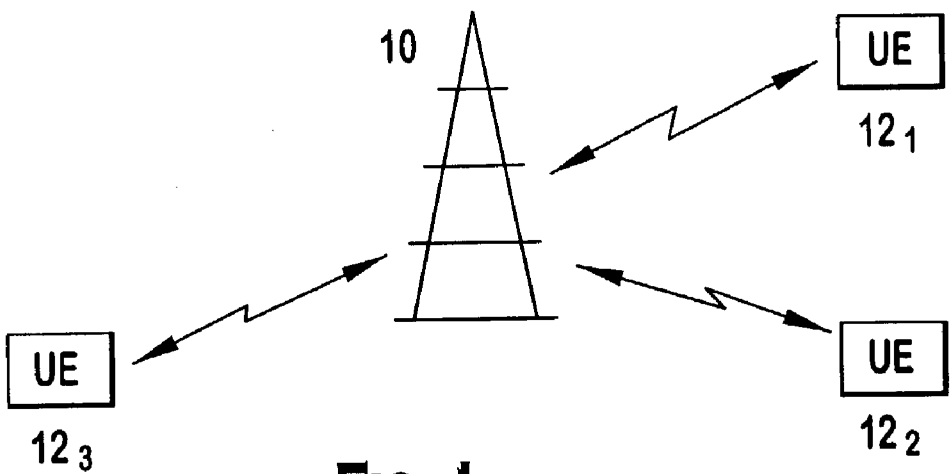

10
UE
12_1
UE
12_2
UE
12_3

FIG. 1

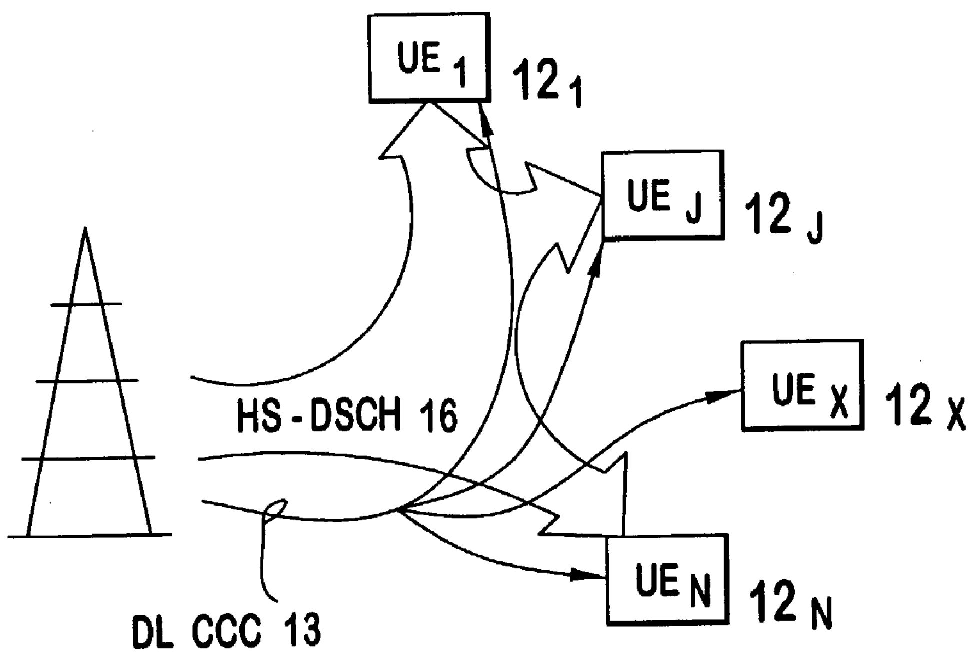

UE 1
12_1
UE J
12_J
UE X
12_X
UE N
12_N
HS-DSCH 16
DL CCC 13

FIG. 2

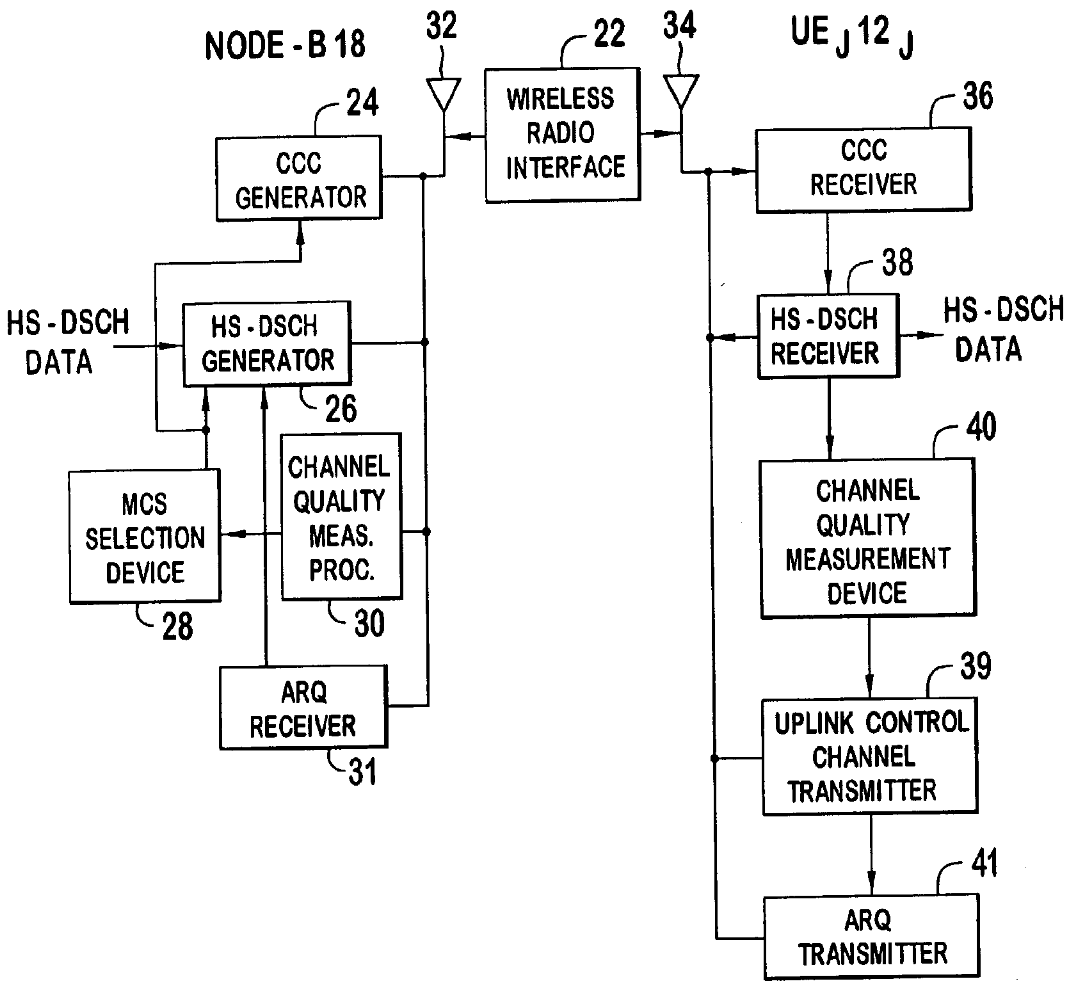

NODE - B 18
32
22
34
UE J 12 J
24
WIRELESS RADIO INTERFACE
36
CCC GENERATOR
CCC RECEIVER
38
HS - DSCH DATA
HS - DSCH GENERATOR
HS - DSCH RECEIVER
HS - DSCH DATA
26
40
CHANNEL QUALITY MEAS. PROC.
MCS SELECTION DEVICE
CHANNEL QUALITY MEASUREMENT DEVICE
28
30
39
ARQ RECEIVER
UPLINK CONTROL CHANNEL TRANSMITTER
31
41
ARQ TRANSMITTER

FIG. 3

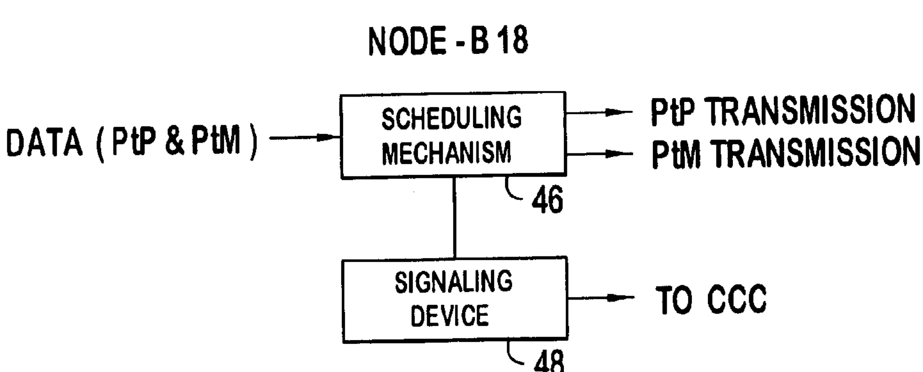

NODE - B 18
DATA (PtP & PtM)
SCHEDULING MECHANISM
PtP TRANSMISSION
PtM TRANSMISSION
46
SIGNALING DEVICE
TO CCC
48

FIG. 4

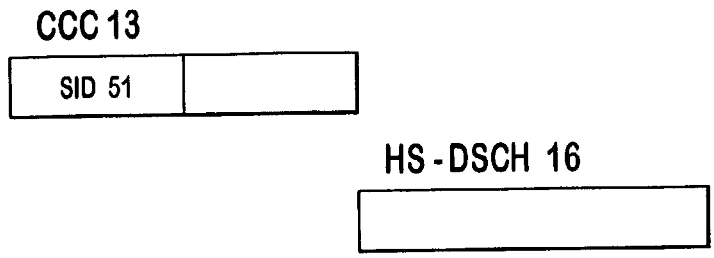


FIG. 5A

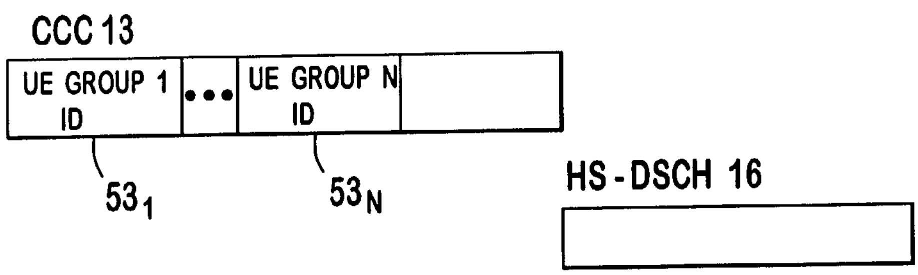


FIG. 5B

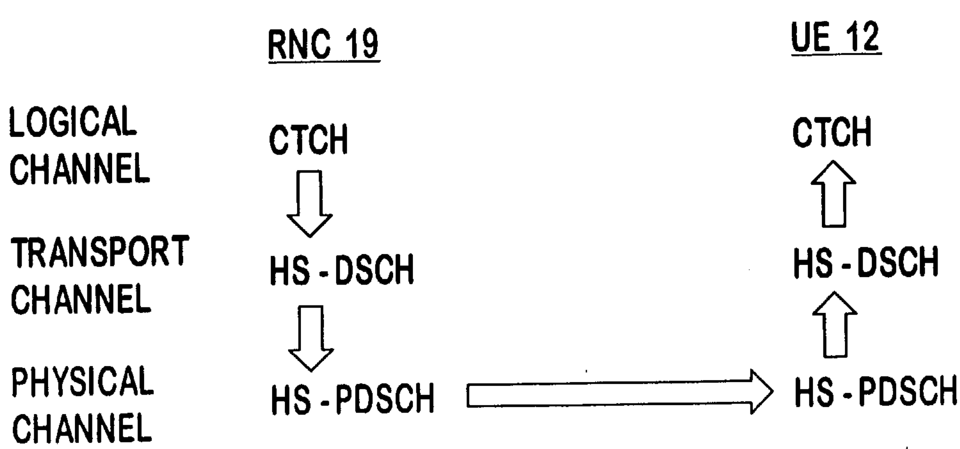


FIG. 7

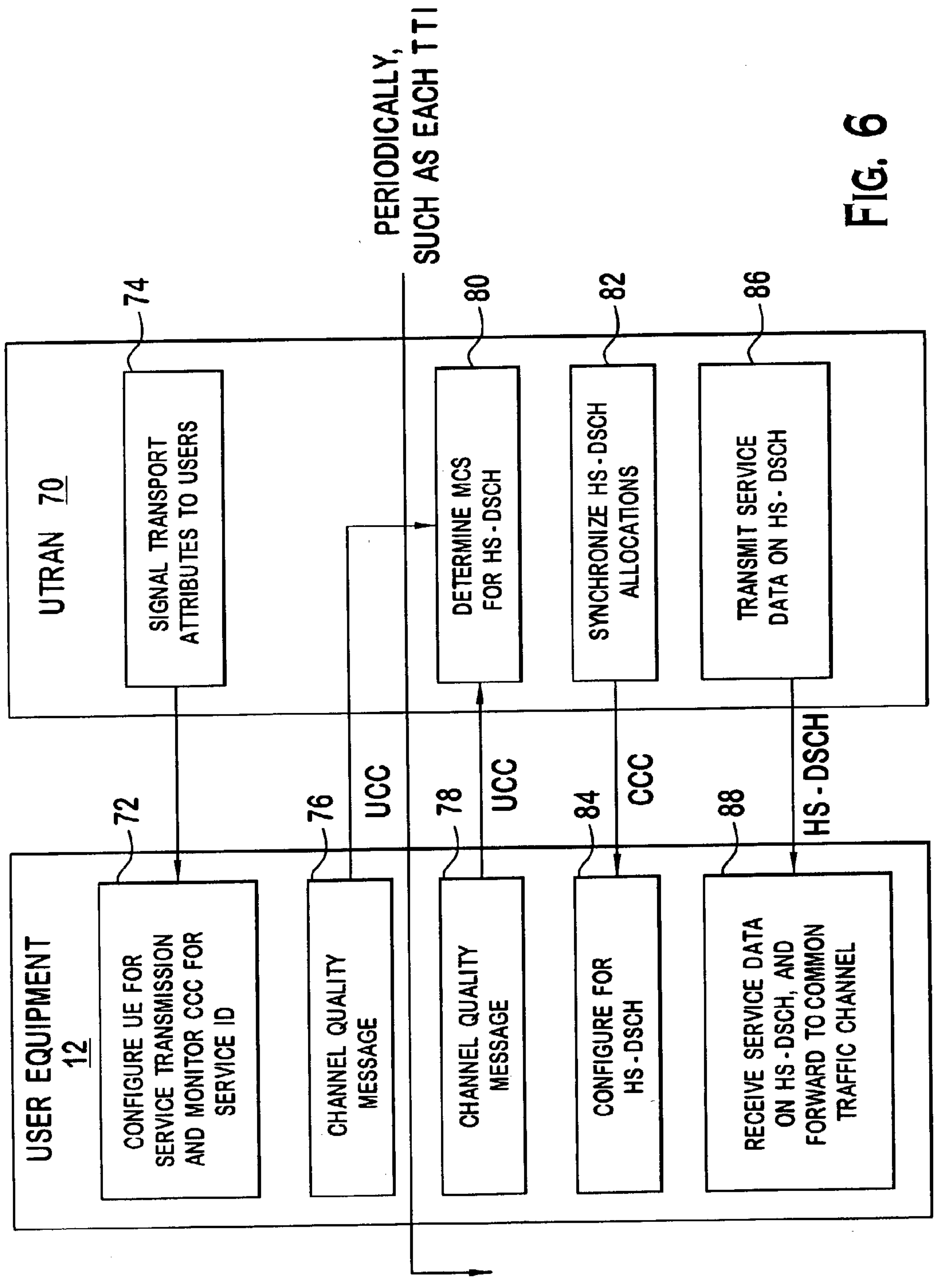

USER EQUIPMENT 12
CONFIGURE UE FOR SERVICE TRANSMISSION AND MONITOR CCC FOR SERVICE ID
72
CHANNEL QUALITY MESSAGE
76
UCC
CHANNEL QUALITY MESSAGE
78
UCC
CONFIGURE FOR HS-DSCH
84
CCC
RECEIVE SERVICE DATA ON HS-DSCH, AND FORWARD TO COMMON TRAFFIC CHANNEL
88
HS-DSCH
UTRAN 70
SIGNAL TRANSPORT ATTRIBUTES TO USERS
74
DETERMINE MCS FOR HS-DSCH
80
SYNCHRONIZE HS-DSCH ALLOCATIONS
82
TRANSMIT SERVICE DATA ON HS-DSCH
86
PERIODICALLY, SUCH AS EACH TTI

FIG. 6

POINT TO MULTI-POINT SERVICES USING HIGH SPEED SHARED CHANNELS IN WIRELESS COMMUNICATION SYSTEMS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from U.S. Provisional Application No. 60/377,036, filed on May 1, 2002, which is incorporated by reference as if fully set forth.

FIELD OF INVENTION

[0002] The invention generally relates to wireless communication systems. In particular, the invention relates to point to multi-point services in such systems.

BACKGROUND

[0003] There is a growing desire to use point to multi-point services in wireless communication systems. As shown in **FIG. 1** in point to multi-point, one service is sent from a single point, such as a base station, to multiple points, such as user equipments. Examples of point to multi-point services are multimedia broadcasts and multicast services.

[0004] In the third generation partnership program (3GPP) proposed system, one proposed channel that could be used for such services is the forward access channel (FACH). The FACH is a downlink common transport channel (TrCH) that can be received by all users. The FACH TrCH is broadcast by applying it to the secondary common control physical channel (S-CCPCH). The S-CCPCH is transmitted to all the cell users.

[0005] To limit the radio resourses allocated to the S-CCPCH, the S-CCPCH data rate is limited. To illustrate, if a high data rate service was transmitted over the S-CCPCH, it would need to be transmitted using a low data redundancy to achieve that high data rate. Since the S-CCPCH is transmitted to the entire cell, it is transmitted at a power level sufficient for reception by a user at the periphery of the cell at a desired quality of service (QOS). Broadcasting a high data rate service at this power level would increase interference to other users reducing the capacity of system, which is extremely undesirable.

[0006] Due to the broadcast nature of the S-CCPCH and FACH, the radio resources required for the S-CCPCH and FACH are rather static. The modulation and coding set (MCS) and transmission power level used by the S-CCPCH needs to be sufficient to maintain a desired QOS at the periphery of the cell.

[0007] A shared channel proposed for use in the 3GPP system is the high speed downlink shared channel (HS-DSCH). The HS-DSCHs are high speed channels which are time shared by the cell users (user equipments). Each transmission is targeted to a separate user and each user's transmission over the HS-DSCH is separated by time.

[0008] The HS-DSCH transmissions to a user are associated with an uplink and a downlink dedicated control channels. Each user sends measurements via layer **1** and layer **3** signaling in the uplink control channel. Using these measurements, a modulation and coding set (MCS) is selected for that user's transmissions. The MCS can be changed every 2 to 10 milliseconds. By carefully selecting the MCS for the user transmissions, the least robust (lowest data redundancy) MCS can be selected to maintain the desired quality of service (QOS). As a result, the radio resources are more efficiently utilized.

[0009] To determine when a particular user's transmission is being sent over the HS-DSCHI, that user first searches on the set of downlink control channel for its UE ID encoded in a cyclic redundancy code (CRC) and decodes the downlink control channel for HS-DSCH allocation information. After a predetermined period, the UE receives the HS-DSCH for a packet having its UE ID and decodes that packet for reception of user data.

[0010] Although the HS-DSCH allows for a more efficient utilization of radio resources, only point to point services can be handled by the HS-DSCH. To handle multiple reception points, multiple transmissions must be made over the HS-DSCH. Such multiple transmissions utilize a large amount of radio resources, which is undesirable.

[0011] Accordingly, it is desirable to have a flexible mechanism to provide point to multi-point services.

SUMMARY

[0012] Service data is transferred in a wireless communication system. A first service identification is transmitted for reception by a group of users of a cell in the system. The group of users does not include all of the users of the cell. Each of the group of users receives the service identification. Each of the group of users monitors for a second service identification being transmitted over a high speed downlink shared channel (HS-DSCH). The service data is transmitted over the HS-DSCH with the second service identification. Each of the group of users detects the second service identification and receives the service data of the HS-DSCH.

BRIEF DESCRIPTION OF THE DRAWING(S)

[0013] **FIG. 1** is an illustration of a point to multi-point service.

[0014] **FIG. 2** are illustrations of a preferred HS-DSCH and associated control channels.

[0015] **FIG. 3** is simplified diagram of a preferred Node-B and user equipment.

[0016] **FIG. 4** is a simplified diagram of a preferred Node-B with a scheduling mechanism for the preferred HS-DSCH.

[0017] **FIGS. 5A and 5B** are illustrations of preferred HS-DSCH signaling for the HSDSCH.

[0018] **FIG. 6** is an illustration of preferred signals for establishment and transmission of a point to multi-point service over a HS-DSCH.

[0019] **FIG. 7** is an illustration of channel mapping performed by the radio network controller and the user equipment for a point to multi-point service over a HS-DSCH.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0020] Although the preferred embodiments are described in conjunction with a preferred 3GPP proposed system, they can be utilized with other wireless systems using point to multi-point transmissions.

[**0021**] **FIG. 2** is an illustration of a preferred HS-DSCH **16** and its associated downlink control channel(s) **13** for use in transmitting a point to multi-point (PtM service. In **FIG. 2, a** group of users, UE 1 $\mathbf{12}_1$, . . . , UE J $\mathbf{12}_J$, . . . , UE N $\mathbf{12}_N$, are to receive the service over the HS-DSCH **16**. A downlink common control channel (CCC) **13** is utilized to allocate the HS-DSCH **16** for the users, UE 1 $\mathbf{12}_1$, . . . , UE J $\mathbf{12}_J$, . . . , UE N $\mathbf{12}_N$. The HS-DSCH **16** is sent by a base station **10** and is received by the group of UEs $\mathbf{12}_1$-$\mathbf{12}_N$. UEs, such as UE X $\mathbf{12}_X$, not registered for the service do not match the service identifier on the CCC **13**. Therefore, this UE, UE X $\mathbf{12}_X$, is not configured to receive data of the HS-DSCH **16**.

[**0022**] **FIG. 3** is a simplified diagram of a Node-B **18** and one of the UEs, UE J $\mathbf{12}_J$, for use in transferring data over the HS-DSCH **16**. At the Node-B **18**, a downlink control channel generator **24** produces the CCC signal for each UE $\mathbf{12}_1$-$\mathbf{12}_N$. For a UE J $\mathbf{12}_J$, after the CCC **13** is radiated by an antenna **32** or antenna array through the wireless radio interface **22**, it is received by an antenna **34** or an antenna array of the UE J $\mathbf{12}_J$ and processed by a CCC receiver **36** to recover control information of the channel, such as a modulation and coding set of the HS-DSCH **16**.

[**0023**] A HS-DSCH generator **26** produces the HS-DSCH signal for transfer through the wireless interface **22**. The HS-DSCH signal is received by the UE J $\mathbf{12}_J$ using its antenna **34** or antenna array. Information of the HS-DSCH **16** is recovered using the CCC information by a HS-DSCH receiver **38**. A channel quality measuring device **40** takes channel quality measurements/information of the HS-DSCH, such as the signal to interference ratio (SIR) or block error rate (BLER). Channel quality can also be derived from the downlink associated dedicated channel. The measurements/information is sent to the Node-B **18**, by an uplink physical control channel (UCC) transmitter, or by layer **3** signaling procedures.

[**0024**] Additionally, an automatic repeat request (ARQ) transmitter **41** at the user equipment **12** transmits acknowledgments (ACKs) and negative ACKs (NAKs) indicating whether the HS-DSCH information was received successfully. A ARQ receiver **31** at receives the ACK and NAKS. If a NAK is received by any of the HS-DSCH transmission users, the HS-DSCH transmission is typically repeated. The Node-B **18** checks the ACKs/NAKs for all users. Typically, if any user sends a NAK, a retransmission is made. However, a retransmission may only be triggered if only a number of NAKs exceeding a threshold is met. Typically, time limits are set for retransmissions. Preferably, the UEs **12** ACKing ignore subsequent retransmissions saving their power.

[**0025**] A channel quality measurement processor **30**, at the Node-B **18**, recovers the channel quality measurements/information from all the users of the HS-DSCH. A modulation and coding set (MCS) selection device **28** uses the channel measurements/information from each of the users registered to receive the PtM service (user group) to select a MCS for the HS-DSCH transmission. Preferably, the selected MCS is the least robust (highest data rate) that the channel conditions permit for the user within this PtM user group having the poorest received measured HS-DSCH signal quality. Preferably, the MCS is updated every transmission time interval (TTI), although a longer time period can be used. The CCC generator **24** produces the CCC indicating the selected MCS to UE $\mathbf{112}_1$, . . . , UE J $\mathbf{12}_J$, . . . , UE N $\mathbf{12}_N$ for proper reception of the HS-DSCH. The HS-DSCH generator **26** produces the HS-DSCH **16** using the selected MCS.

[**0026**] For services having multiple sub-streams of data, the transmission characteristics of the various sub-streams may be handled separately. To illustrate, a multimedia service may have an audio, video and text sub-streams. The QOS of each sub-stream may differ allowing different transmission attributes to be used by each sub-stream. This approach allows for better resource efficiency. Instead of transmitting each sub-stream to meet the highest QOS sub-stream requirements, they can be handled separately. The block error rate (BLER) is compared to a BLER quality target for each sub-stream.

[**0027**] **FIG. 4** is a simplified block diagram of a preferred scheduling mechanism for the Node-B **18**. The scheduling mechanism **46** is preferably used to schedule data every TTI, although a longer scheduling period may be used. The scheduling mechanism **46** receives point to point (PtP) and PtM data to be transmitted over the HS-DSCH. The scheduler is determining which users will receive PtP transmissions and which user groups will receive PtM transmissions in the next TTI.

[**0028**] Scheduling the transfer of data over the preferred time period allows for a more efficient utilization of radio resources. To illustrate, in a particular TTI little data may be available for dedicated PtP transmissions. The scheduling mechanism **46** may increase the amount of PtM data transmitted through the HS-DSCH channel due to the increased availability of the radio resources in that TTI. Similarly, the scheduler **46** may choose to transmit PtP services when PtM data is not available. Another scheduling criteria is QoS attributes, such as transmission latency and/or data throughput requirements of the PtP or PtM service. Scheduling on a TTI basis offers a greater ability to achieve these requirements while maintaining high utilization of HS-DSCH cell resources.

[**0029**] The scheduler **46** may also take into account physical transmission requirements. For example, one user or user group may require a more robust MCS than another. During the next TTI resources may only be available for a less robust MCS. The scheduler **46** may then schedule transmissions for PtP users or PtM user groups that maximize the use of available resources. Since data available for transmission with specific QOS requirements, available physical resources and channel quality measurements change on a TTI basis, the ability to schedule within this interval improves the number of satisfied users and the overall utilization and efficient use of physical resources.

[**0030**] The scheduler **46** also gets ACK/NAK feedback from all users in the PtM user group and schedules retransmissions until all users indicate successful reception of the transmission by sending a ACK, or a certain configured threshold is reached, or a service transmission time limit is reached or a retransmission limit is reached. The advantage of this approach is that only segments of a PtM service that are in error are retransmitted, rather than retransmitting the entire service transmission. Preferably, users that have previously generated an ACK will ignore any retransmissions.

[**0031**] A benefit of this approach is the ability to dynamically schedule on a TTI basis between PtP and PtM services rather than scheduling S-CCPCH with layer **3** procedures that require the order of 100 s of ms to seconds for channel allocations. This offers improved QOS and physical resource management. Additionally, it allows the UE to receive multiple services without the capability for reception of simultaneous channels, since overlapping physical allocations can be avoided. The multiple services are separated by time.

[**0032**] The Node-B **18** signals on the CCC **13** to the UEs $\mathbf{12}_1$-$\mathbf{12}_N$ the channel configuration that data for UE $\mathbf{12}_1$-$\mathbf{12}_N$ will be sent. The preferred scheduling for each TTI reduces resource conflicts between services, by maximizing use of radio resources. This assignment of channels is signaled to the users via the downlink CCC using a signaling device **48**. Without the mechanism **46**, the channels typically can not be reallocated on a TTI granularity and as a consequence the ability to maintain QOS with high utilization and efficient use of physical resources is restricted.

[**0033**] **FIGS. 5A and 5B** are illustrations of preferred HS-DSCH signaling for the HS-DSCH **16**. In **FIG. 5**A, each UE $\mathbf{12}_1$-$\mathbf{12}_N$ of the PtM user group is notified of the service transmission by detecting a PtM service ID **51** associated with all users of the service. That service ID **51** is encoded on the downlink common control channel **13**. After a predetermined time period, the users receive the HS-DSCH of the authorized service.

[**0034**] In **FIG. 5**B, each UE $\mathbf{12}_1$-$\mathbf{12}_N$ is notified of the service transmission by detecting an ID associated with its group of UEs, UE group ID 1 $\mathbf{53}_1$ to UE group ID N $\mathbf{53}_N$, encoded on the downlink common control channel **13**. After a predetermined time period, the users receive the HS-DSCH **16** indicated by the CCC **13** for a packet having a service ID of the authorized service.

[**0035**] **FIG. 6** is an illustration of preferred signals for establishment and transmissions of a point to multi-point service over HS-DSCHs. The RAN **70** signals to each user to receive the service the transport attributes of the transmission, **74**. Each user configures itself for reception of the transmission and monitors the CCCs for the PtM service group ID, **72**. Data to be sent for the point to multi-point service is received from the core network by the UMTS radio access network (UTRAN) **70**. The service/group/UE ID on the CCC indicates that the HS-DSCH transmission will occur shortly, after a specified time period on a specified HS-DSCH physical channel. Upon reception of the CCC each user configures itself for reception of the HS-DSCH transmission.

[**0036**] Each user may send channel quality information to the RAN **70** with layer **3** signaling procedures, **76**. The sending of the channel information is also reported on a TTI basis by physical layer signaling, **78**. Using the channel quality information for all the users within each PtM user group, the RAN **70** determines appropriate MCS of HS-DSCH transmissions to each PtM user group. To illustrate, the RAN **70** would typically set the MCS at a level for reception at a desired QOS by the user having the worst reception quality. To optimize the usage of radio resources, these parameters are preferably updated every time transmission interval (TTI), although a longer time period between updates may be used.

[**0037**] The UTRAN **70** synchronizes the HS-DSCH allocations, **82**, and each UE **12** configures the HS-DSCH reception, **84**. Service data is transmitted on the HS-DSCH, **86**. The service data transmitted on the HS-DSCH is received by the UE **12**. After verification, the service data is forwarded to the common traffic channel. The preferred architecture allows for the flexibility for transferring common traffic channel data over shared or dedicated channels as PtM or PtP transmission. This mapping is performed for both on the transmission and reception side of the wireless interface.

[**0038**] **FIG. 7** is an illustration of the preferred channel mapping at a radio network controller **19** and UE **12**. PtM data arrives at the RNC on a common traffic channel (CTCH). The CTCH is mapped onto the HS-DSCH for transfer to the user over the physical channel, HS-PDSCH. A UE **12** as illustrated here and typically multiple UEs receive the HS-DSCH transmission. UE **12** receives the HS-PDSCH and maps the HS-DSCH to the CTCH for processing by the UE **12**.

What is claimed is:

1. A method for transferring service data in a wireless communication system, the method comprising:

transmitting a first service identification for reception by a group of users of a cell in the system, the group of users not including all of the users of the cell;

receiving by each of the group of users the service identification;

monitoring by each of the group of users for a second service identification being transmitted over a high speed downlink shared channel (HS-DSCH);

transmitting over the HS-DSCH the service data with the second service identification; and

each of the group of users detecting the second service identification and receiving the service data of the HS-DSCH.

2. The method of claim 1 wherein the service data is being sent to a plurality of user groups, each group being sent a different first group identification over a downlink common control channel and a single service identification as the second service identification.

3. The method of claim 1 wherein each of the group of users is being sent a same first service identification over a downlink common control channel to all of the group of users.

4. A Node-B comprising:

an uplink control channel receiver for receiving block error rate information from a plurality of users of a high speed shared channel (HS-DSCH);

a modulation and code set selection device for selecting a modulation and coding set for a HS-DSCH transmission using the received block error rate information;

a HS-DSCH generator for producing data of the HS-DSCH transmission signal at the selected modulation and coding set and a service identification;

a downlink common control channel generator for producing a common control channel signal having a service identification; and

an antenna array for transmitting the HS-DSCH transmission signal and the downlink common control channel.

5. A Node-B comprising:

an input configured to receive point to point (PtP) and point to multi-point (PtM) data;

a scheduling mechanism for receiving the received data and scheduling the data for transmission as PtP and PtM transmissions, the PtM transmissions being sent over a high speed shared channel transmitting data to multiple users simultaneously; and

a signaling device for signaling the data schedule to users.

6. The Node-B of claim 5 wherein the scheduling is based on a data latency and data throughput requirements of the received data.

7. The Node-B of claim 5 wherein the scheduling is performed on a transmission time interval basis.

8. The Node-B of claim 5 wherein the scheduling is based on a robustness of the PtP and PtM transmissions.

9. The Node-B of claim 5 wherein the scheduling of retransmissions of PtM data is based on received acknowledgements and negative acknowledgements of all the users intended to receive the PtM data.

10. A method for transferring service data in a wireless communication system, the method comprising:

receiving data of a common traffic channel for transfer over a wireless interface;

mapping the common traffic channel to a shared channel;

transmitting the common traffic channel data through the wireless interface over the shared channel;

receiving the common traffic channel data after transmission through the wireless interface in the shared channel;

forwarding the received shared channel data to a common traffic channel.

11. The method of claim 10 wherein the mapping comprises mapping the common traffic channel to a shared transport channel.

12. The method of claim 10 further comprising selecting a common channel or a shared channel for mapping the common traffic channel to.

13. The method of claim 10 further comprising selecting a common channel, a shared channel or a dedicated channel for mapping the common traffic channel to.

14. The method of claim 10 wherein the wireless communication system is a 3GPP communication system.

15. The method of claim 10 wherein the shared channel is a high speed downlink shared channel.

* * * * *