# SYSTEMS AND METHODS FOR CONTROL CHANNEL SIGNALING

## Claim of Priority under 35 U.S.C. §119

**[001]** This application claims priority to U.S. Provisional Patent Application Serial No. 60/667,705, filed April 1, 2005 which is incorporated herein by reference in its entirety.

**[002]** The present Application for Patent is related to the following co-pending U.S. Patent Applications:

"Varied Signaling Channels For A Reverse Link In a Wireless Communication System" having Attorney Docket No. 060055, filed concurrently herewith, assigned to the assignee hereof, and expressly incorporated by reference herein; and

"Mobile Wireless Access System" , having Attorney Docket No. 060081, filed concurrently herewith, assigned to the assignee hereof, and expressly incorporated by reference herein; and

"Scalable Frequency Band Operation In Wireless Communication Systems" having Attorney Docket No. 060061, filed concurrently herewith, assigned to the assignee hereof, and expressly incorporated by reference herein

## BACKGROUND

### I. Field

**[003]** The present document relates generally to wireless communication and, amongst other things, to channel information feedback for wireless communication systems.

### II. Background

**[005]** An orthogonal frequency division multiple access (OFDMA) system utilizes orthogonal frequency division multiplexing (OFDM). OFDM is a multi-carrier modulation technique that partitions the overall system bandwidth into multiple (N) orthogonal frequency subcarriers. These subcarriers may also be called tones, bins, and frequency channels. Each subcarrier is associated with a respective sub carrier that may be modulated with data. Up to N modulation symbols may be sent on the N total subcarriers in each OFDM symbol period. These modulation symbols are converted to the time-domain with an N-point inverse fast Fourier transform (IFFT) to generate a transformed symbol that contains N time-domain chips or samples.

[006] In a frequency hopping communication system, data is transmitted on different frequency subcarriers during different time intervals, which may be referred to as "hop periods." These frequency subcarriers may be provided by orthogonal frequency division multiplexing, other multi-carrier modulation techniques, or some other constructs. With frequency hopping, the data transmission hops from subcarrier to subcarrier in a pseudo-random manner. This hopping provides frequency diversity and allows the data transmission to better withstand deleterious path effects such as narrow-band interference, jamming, fading, and so on.

[007] A problem that must be dealt with in all communication systems is that different transmission techniques of multiple transmission techniques may be utilized for each access terminal. Further, an access terminal may be in communication with multiple base stations. All of these permutations require a great deal of feedback to fully report.

[008] Therefore, it is desired that provide feedback for the utilization of multiple transmission modes and for communication with multiple base station while minimizing the resources needed to provide the feedback from the receiver to the transmitter.

## SUMMARY

[009] One or more aspects are provided that allow for different reverse link reporting types to different sectors. Further, the reporting types may comprise instructions that relate to the type of forward link transmission of the access terminal. The reporting types may also relate to a scheduling mode that is being utilized or being desired to be utilized at the access terminal.

[0010] It is understood that other aspects of the present disclosure will become readily apparent to those skilled in the art from the following detailed description, wherein is shown and described only exemplary aspects of the invention, simply by way of illustration. As will be realized, the aspects disclosed are capable of other and different aspects and aspects, and its several details are capable of modifications in various respects, all without departing from the scope of the disclosure.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The features, nature, and advantages of the present aspects may become more apparent from the detailed description set forth below when taken in conjunction with

the drawings in which like reference characters identify correspondingly throughout and wherein:

**[0012]** Fig. 1 illustrates aspects of a multiple access wireless communication system;

**[0013]** FIG. 2A shows superframe structures for the forward and reverse links.

**[0014]** FIG. 2B shows an interlace structure for the reverse link.

**[0015]** FIGS. 3A and 3B show a frequency hopping control segment with two different sizes for one carrier.

**[0016]** FIG. 3C shows a frequency hopping control segment for four carriers.

**[0017]** Fig. 4 illustrates aspects of a transmitter and receiver in a multiple access wireless communication system;

**[0018]** Fig. 5 illustrates aspects of a method of determining a feedback type to provide; and

**[0019]** Fig. 6 illustrates aspects of another method of determining a feedback type to provide.

## DETAILED DESCRIPTION

**[0020]** Referring to Fig. 1, a multiple access wireless communication system according to one aspect is illustrated. A multiple access wireless communication system 100 includes multiple cells, e.g. cells 102, 104, and 106. In the aspect of Fig. 1, each cell 102, 104, and 106 may include an access point 150 that includes multiple sectors. The multiple sectors are formed by groups of antennas each responsible for communication with access terminals in a portion of the cell. In cell 102, antenna groups 112, 114, and 116 each correspond to a different sector. In cell 104, antenna groups 118, 120, and 122 each correspond to a different sector. In cell 106, antenna groups 124, 126, and 128 each correspond to a different sector.

**[0021]** Each cell includes several access terminals which are in communication with one or more sectors of each access point. For example, access terminals 130 and 132 are in communication access point 142, access terminals 134 and 136 are in communication with access point 144, and access terminals 138 and 140 are in communication with access point 146. As used herein, transmission from an access point are referred to as forward link and from the access point are referred to as reverse link.

**[0022]** In some aspects, each access terminal 130, 132, 134, 136, 138, and 140 may be in communication with two or more sectors of one or more cells. This may be done in order to allow handoff between different sectors, or cells, for proper capacity

management, and/or for other reasons. In order to provide the capability to communicate with multiple sectors it is useful for the access terminal to determine channel conditions with respect to the one or more sectors. This may be done based upon pilot or beacon signals transmitted from the one or more sectors. This channel information, e.g. channel quality information (CQI), may then be provided to each of the one or more sectors in order to allow, for example, more accurate power, rate, and other control for transmission to and from each of the access terminals and to support soft, softer, and other types of handoff.

**[0023]** The set of sectors for which the access terminal has an assigned resource, e.g. a Media Access Control (MAC) ID, belong to what may be termed an access terminal's active set. An exemplary active set may consist of, for example, with respect to access terminal 134 of serving sector 120, along with sectors 118, 122, 124, and 126. In such situations, sectors 118, 122, 124, and 126 may have certain communication with access terminal 134 as described herein.

**[0024]** It should be noted while the above discussion states that MACID is the resource for members of an active set, other resources such as session information, from session with it or another sector, terminal IDs, or other information may be used in addition to, or in lieu of, the MACID.

**[0025]** The last sector from which the access terminal successfully received a forward link assignment may be called the forward link serving sector (FLSS). The last sector from which the access terminal successfully received a reverse link assignment may be called the reverse link serving sector (RLSS). The sector that the access terminal determines is the desired sector for reverse link data transmissions may be called a desired reverse link serving sector (DRLSS). The sector within the active set that the access terminal determines is a desired sector for forward link data transmissions may be called a desired forward link serving sector (DFLSS).

**[0026]** The sectors of the active set are members of one or more synchronous subsets. Different subsets may have different timing, e.g., are synchronized by different sources. The sectors with same timing may be referred to as members of a synchronous subset. The RLSS and FLSS of the access terminal may be members of the same synchronous subset to ease signaling overhead for control messages. In certain aspects, the access terminal may choose the DRLSS to be a member of the same synchronous subset as the RLSS. A synchronous subset that does not contain the FLSS is referred to as a non - synchronous subset.

**[0027]** At the very least, in certain aspects, the access terminal is able to transmit all of the control channel messages available, other than those specifically intended for sectors or access points other than the FLSS, to the FLSS. It may also be able to transmit these messages to members of the same synchronous as the FLSS. In addition, the access terminal may be limited to transmitting only limited control channels to each sector that is a member of a non-synchronous subset.

**[0028]** The actual control channel messages that are to be reported, as well as the frequency and timing of their transmission, to the FLSS or any other sector are based upon instructions from the FLSS or that other sector. The instructions may comprise the type of control channel to be transmitted, along with its timing in terms of frames, frequency, and the number of transmissions may be included in the instructions or additional instructions. Also, requests for single instance reporting may be provided from one or more sectors. Further, each instruction may constitute a request for reporting of one or more control channel types, with the same or different reporting requirement.

**[0029]** It should be noted that an access terminal may transmit all of its control channel messages to the FLSS, regardless of to which sector or access point, the control channel message applies. Also, the access terminal may transmit the control channel message to specific target sector of the control channel message. In addition, a combination of these approaches may be utilized for the different sectors.

**[0030]** Further, in channelized systems, e.g. those where the bandwidth is divided into co-existent carriers where user communication may be constrained in less than all of the bandwidth or carriers, the access terminal may transmit control channels in only the carriers it is constrained to communicate data in and/or other carriers as instructed.

**[0031]** As used herein, an access point may be a fixed station used for communicating with the terminals and may also be referred to as, and include some or all the functionality of, a base station, a Node B, or some other terminology. An access terminal may also be referred to as, and include some or all the functionality of, a user equipment (UE), a wireless communication device, terminal, a mobile station or some other terminology.

**[0032]** The transmission techniques described herein may also be used for various wireless communication systems such as a CDMA system, a TDMA system, an FDMA system, an orthogonal frequency division multiple access (OFDMA) system, a single-carrier FDMA (SC-FDMA) system, and so on. An OFDMA system utilizes orthogonal

frequency division multiplexing (OFDM), which is a modulation technique that partitions the overall system bandwidth into multiple (K) orthogonal subcarriers. These subcarriers are also called tones, bins, and so on. With OFDM, each subcarrier may be independently modulated with data. An SC-FDMA system may utilize interleaved FDMA (IFDMA) to transmit on subcarriers that are distributed across the system bandwidth, localized FDMA (LFDMA) to transmit on a block of adjacent subcarriers, or enhanced FDMA (EFDMA) to transmit on multiple blocks of adjacent subcarriers. In general, modulation symbols are sent in the frequency domain with OFDM and in the time domain with SC-FDMA.

**[0033]** System 100 may use various subcarrier structures for the forward and reverse links. For a distributed subcarrier structure, the K total subcarriers are arranged into S non-overlapping sets such that each set contains N subcarriers that are uniformly distributed across the K total subcarriers. Consecutive subcarriers in each set are spaced apart by S subcarriers, where $K = S \cdot N$. Thus, set $s$ contains subcarriers $s$, $S+s$, $2S+s$, ..., $(N-1)\cdot S+s$, for $s \in \{1,...,S\}$. For a block subcarrier structure, the K total subcarriers are arranged into S non-overlapping sets such that each set contains N consecutive subcarriers. Thus, set $s$ contains subcarriers $(s-1)\cdot N+1$ through $s \cdot N$, for $s \in \{1,...,S\}$. In general, the subcarrier structure used for each link may include any number of sets, and each set may include any number of subcarriers that may be arranged in any manner. In an aspect that is assumed for much of the description below, the block subcarrier structure is used for the reverse link.

**[0034]** System 100 may support a single carrier or multiple carriers for each link. In an aspect, multiple (C) subcarriers are available for each carrier supported by the system. Each carrier may also be partitioned into multiple (P) subband. A subband is a range of frequency within the system bandwidth. In an aspect, each carrier spans approximately 5 MHz, $C = 512$, $P = 4$, $S = 32$, and $N = 16$. For this aspect, a single-carrier system has $K = 512$ total subcarriers that are arranged into four subbands, and each subband includes 128 subcarriers. For this aspect, the single-carrier system has 32 subcarrier sets, and each set includes 16 subcarriers. For this aspect, a system with four carriers has $K = 2048$ total subcarriers that are arranged into 16 subbands.

**[0035]** It should be noted that subbands may be segments of a different number of subcarriers than described above, may in total span less than all of the carrier, and may

have a different number of subcarriers between one or more of the subbands in each channel.

**[0036] FIG. 2A** shows exemplary superframe structures 200 that may be used for the forward and reverse links. The transmission timeline for each link is partitioned into units of superframes. Each superframe spans a particular time duration, which may be fixed or configurable. For the forward link, each superframe includes a preamble followed by M frames, where $M > 1$. A frame may refer to a time interval in a transmission timeline or a transmission sent during the time interval. The superframe preamble carries overhead information that enables the terminals to receive forward link control channels and subsequently access the system. Each subsequent frame may carry traffic data and/or control channel messages. For the reverse link, each superframe includes M frames, where the first frame may be extended by the length of the superframe preamble on the forward link. The superframes on the reverse link may be substantially time aligned with the superframes on the forward link.

**[0037]** FIG. 2A shows specific superframe structures for the forward and reverse links. In general, a superframe may span any time duration and may include any number of frames and other fields. The superframe structure for the reverse link may be the same or different from the superframe structure for the forward link.

**[0038] FIG. 2B** shows an interlace structure 210 for the reverse link. Referring back to FIG. 2A, for each link, the frames in each superframe may be arranged into groups, with each group including Q consecutive frames, where $Q > 1$. Q interlaces may be formed for each link with this grouping of frames. In an aspect, which is shown in FIG. 2B, interlace 1 includes frames 1, $Q+1$, $2Q+1$, and so on, interlace 2 includes frames 2, $Q+2$, $2Q+2$, and so on, and interlace Q includes frames Q, 2Q, 3Q, and so on. The Q interlaces are offset from one another by one frame. In an aspect that is assumed for much of the description below, $Q = 6$, six interlaces are formed and may be used to send six packets in an interlaced manner, one packet in each interlace, as described below.

**[0039]** System 100 may support frequency division duplexed (FDD) and/or time division duplexed (TDD). For FDD, the forward and reverse links are allocated separate frequency bands, and transmissions may be sent simultaneously on the two links, as shown in FIG. 2A. For TDD, the forward and reverse links share the same frequency band, and transmissions for the two links may be sent in different frames.

For example, the forward link may be allocated odd-numbered frames, and the reverse link may be allocated even-numbered frames. Alternatively, other allocations, e.g. where one is a multiple of the other, may be utilized as well.

**[0040]** In an aspect, a control segment is sent on the reverse link. The control segment carries various control channel messages for the reverse link. In an aspect, the control segment is mapped to a fixed region of time and frequency in each control frame. A control frame is a frame in which the control segment is sent. In another aspect, the control segment hops in a pseudo-random or deterministic manner from control frame to Control frame to achieve frequency diversity.

**[0041]** **FIG. 3A** shows an aspect of a control segment 300 for a single carrier. For this aspect, $Q = 6$ and the control segment is sent on one interlace, or every $6^{th}$ frame. For this aspect, the control segment spans an entire regular-size frame. If the control segment is sent on interlace 1, then for the extended reverse link frame 1, the control segment may be sent in the time interval corresponding to forward link frame 1, as shown in FIG. 3A. If the control segment is sent on interlace 2, 3, 4, 5 or 6, then the control segment may be sent in the entire frame for each frame in that interlace.

**[0042]** **FIG. 3B** shows an aspect of an extended control segment 310 for a single carrier. For this aspect, $Q = 6$ and the control segment is sent on one interlace in two regular-size frames. For the aspect shown in FIG. 3B, the control segment is sent in the entire extended reverse link frame 1, reverse link frames 6 and 7, reverse link frames 12 and 13, and so on. The control segment may also be sent in other RF frames for other interlaces.

**[0043]** Sending control channel messages in the control segment across an entire frame as shown in FIG. 3A or across multiple frames as shown in FIG. 3B, instead of across a portion of a frame, may improve link budget for terminals located at the edge of coverage. These terminals typically have an upper limit on transmit power. A longer control segment allows these terminals to transmit control channel messages with more energy spread over a longer period of time, which improves the likelihood of correctly receiving the control channel messages. In general, the control segment may be sent across an entire frame, across a portion of a frame, across multiple frames, across portions of multiple frames, and so on.

**[0044]** In an aspect, the control segment occupies at least one subcarrier in each control frame. For the aspect shown in FIG. 3A, $P = 4$ and the control segment is sent on at

least one of the four subcarriers in each control frame. In an aspect that is assumed for much of the description below, the size of the control segment is scalable in frequency, e.g., in units of subcarriers. For this aspect, the control segment may span one, two, or possibly more subcarriers in each control frame. The subcarrier(s) for the control segment may be contiguous or may spread across the system bandwidth. In other aspect, the size of the control segment may be scalable in time or both time and frequency.

**[0045]** In general, the control segment may be mapped to a time-frequency region that covers F subcarriers and spans T symbol periods, where $F \geq 1$ and $T \geq 1$, as shown in the upper left corner of FIG. 3A. The control segment includes U transmission units, where $U = F \cdot T$. A transmission unit is one subcarrier in one symbol period. For clarity, much of the following description is for the aspect in which the control segment occupies one or more subcarriers and spans an entire control frame, except for reverse link frame 1. In an aspect, $K = 512$, $P = 4$, and $T = 8$. For this aspect, the control segment (1) covers an integer multiple of 128 subcarriers in 8 symbol periods of a control frame and (2) includes an integer multiple of 1024 transmission units, e.g., 1024, 2048, 3072 or 4096 transmission units.

**[0046]** FIG. 3A also shows frequency hopping for the control segment. The control segment may hop across frequency in different control frames, as shown in FIG. 3A. The frequency hopping may be pseudo-random or deterministic.

**[0047]** FIG. 3A further shows an exemplary frequency-hopping scheme for traffic channels. A traffic channel is a means for sending data from a transmitter to a receiver and may also be called a channel, a physical channel, a physical layer channel, a data channel, and so on. Each traffic channel may be mapped to a specific sequence of time-frequency blocks that hop across frequency in different frames to achieve frequency diversity, as shown in FIG. 3A. In an aspect, a time-frequency block corresponds to one set of subcarriers in one frame. A frequency hopping (FH) pattern indicates the specific time-frequency block to use for each traffic channel in each frame. FIG. 3A shows a sequence of time-frequency blocks for one traffic channel *y*. The other traffic channels may be mapped to vertically and circularly shifted versions of the time-frequency block sequence for traffic channel *y*.

**[0048]** In an aspect, the frequency hopping for the traffic channels avoids the control segment. In another aspect, the frequency hopping for the traffic channels is pseudo-random with respect to the control segment. For this aspect, a number of (e.g., eight)

subcarrier sets may be allocated for the control segment in each control frame. Each traffic channel that collides with the control segment is then mapped to a subcarrier set allocated to the control segment. For this aspect, the traffic channels and the Control segment swap subcarriers whenever a collision occurs.

**[0049] FIG. 3C** shows an aspect of a frequency hopping control segment 320 for four carriers. For this aspect, one instance of the control segment is provided for each carrier. In an aspect, the control segment instance for each carrier carries reverse link control channel messages for that carrier and is independent of the control segment instances for the other carriers. The four control segment instances for the four carriers (1) may have the same or different sizes, (2) may hop together or independently of one another, and (3) may be sent on one interlace, e.g., every $6^{th}$ frame.

**[0050]** FIGS. 3A and 3B show some aspects of the control segment. In another aspect, the control segment may be sent in multiple interlaces. In yet another aspect, the control segment may be selectively enabled or disabled in each frame in which the control segment might be sent.

**[0051]** System 100 may utilize various control channel messages to support data transmission on the forward and reverse links. The control channel messages typically carry small amounts of control channel messages for the physical layer. The specific control channel messages to use for each link may be dependent on various factors such as, e.g., the manner in which traffic data is transmitted, the manner in which control channel messages is transmitted, the design of the traffic channels and the control channel messages, and so on.

**[0052]** In certain aspects, the reverse link control channels include one or more of a channel quality indicator channel (R-CQICH), spatial directional mode reporting channel (R-BFCH), segment sensitive scheduling channel (R-SFCH), pilot channel (R-PICH), request channel (R-REQCH), and acknowledgement channel (R-ACKCH).

**[0053]** The R-CQICH may be used by the access terminal to transmit forward link channel quality, e.g. quantized CQI values, for different sectors to the access network, to the RLSS or any other sector in its active set to which it can transmit. The R-SFCH is a feedback channel that may be used by the access terminal to transmit the forward link channel quality measured for segments of subcarriers for the FLSS. The R-BFCH is a feedback channel that is used by the access terminal to transmit the beam and supplemental CQI, or complete CQI to enable SDMA, precoding, beamforming, or combinations thereof. The R-PICH may be a broadband pilot channel. The R-REQCH

may be used by the access terminal to request resources. The R-ACKCH may be used by the access terminal to acknowledge the forward link transmission.

**[0054]** In certain aspects, the access terminal may be instructed to transmit at least one of R-CQICH, R-BFCH, R-SFCH, R-PICH, R-REQCH, and R-ACKCH on the control segment of the FLSS. In addition, the access terminal may be instructed to transmit only the R-CQICH on the control segment of each sector that is a member of non-synchronous subset. For those sectors that are members of the synchronous subset of the FLSS or RLSS, the instructions may be provided for any channel, however, reporting may be constrained by the ability to generate an adequate measurement. Further, in most aspects, reporting to members of the synchronous subset may be limited to R-CQICH.

**[0055]** Several exemplary aspects of the format for the messages of the control channels described above are shown in one or more tables below. In each of the tables, any field of the message may be combined with another field from the message. Further, alternative messages that provide substantially the same information may also be utilized. Also, any reserved fields may be omitted as appropriate.

**Exemplary R-REQCH message format (Table 1)**

| Field | Length (bits) |
|---|---|
| QoS Flow | 2 |
| MaxNumSubCarriers | 2 |
| DRLSS | 3 |
| Reserved | 3 |

QoSFlow — These bits specify the RLP QoS flow corresponding to the request. The access terminal may indicate the QoS of the highest QoS flow that contains data available for transmission. The QoS priority order may be as follows: 00 highest, 01 second, 10 third, and 11 lowest.

MaxNumSubCarriers — These bits specify the maximum number of subcarriers the access terminal can currently support, such that both the buffer level of the QoS flow and the number of subcarriers that the access terminal can support using the available transmit power are satisfied.

DRLSS — This field may be set to the 3-bit ActiveSetIndex corresponding to the access terminal's DRLSS.

Reserved — The Reserved bits may be set to 0.

**[0056]** The R-REQCH message may be limited to those access terminals that have no reverse link channel assignments, access terminals in handoff, or those that need additional or different reverse link resources. R-REQCH messages from different access terminals, or at different times, may utilize scrambling or other orthogonal codes to multiplex access terminals over the same subcarriers and time resources.

**[0057]** The information provided via the R-CQICH may be utilized for many purposes including, for example, for rate prediction, forward link power control, beam selection, precoding weight adjustment, and scheduling in various forward link transmission modes. Additionally, in certain aspects, the information of R-CQICH may indicate a request for handoff to another sector by transmitting channel information received from its pilots, when that sector is not the FLSS. In certain aspects, the channel information contained in R-CQICH may vary depending on the type of CQI reports. Each access terminal may support multiple CQI report formats, depending on the CQI reporting mode.

**[0058]** The access terminal's channel feedback reporting mode may be set based upon an instructed reporting mode that is negotiated or otherwise instructed from the access network. The access terminal's reporting mode can be one of the following, or some other mode: the Single Code Word CQI Reporting Mode(CQISCW), the Multiple Code Word CQI Reporting Mode (CQIMCW), or SISO CQI Reporting Mode (CQISISO).

**[0059]** Further, other reporting modes, e.g. those that relate to a specific transmission type, e.g. SDMA, precoding, beamforming, or combinations thereof. In such cases, these modes would be reported using combinations of the control channels that relate to the mode and then report CQICH if instructed.

**[0060]** Examples, of the different reporting modes are shown in Table 2 below. .

**Reporting Modes (Table 2)**

| | **CQIReportingMode** | | |
|---|---|---|---|
| | **CQISISO** | **CQISCW** | **CQIMCW** |
| **Possible CQI Reports** | CQICHPilot | CQICHPilot | CQICHPilot |
| | CQICHCTRL | CQICHCTRL | CQICHCTRL |
| | | CQICHSCW | CQICHMCW |

**[0061]** The format for the CQICHPilot report is shown below. The CQICHPilot report may be sent periodically by each access terminal, at a pre-determined rate, to enable the access network to assess the reverse link control channel performance. The rate and

time of CQICHPilot reporting is negotiated with, or otherwise instructed for, each access terminal, and can vary from terminal to terminal based upon any system determined parameters.

**Format for CQICH Pilot Report (Table 3)**

| Field | Length (bits) |
|---|---|
| ReservedValue | 10 |

ReservedValue The ReservedValue is set to 0.

**[0062]** The format for the CQICHCTRL is shown below in Table 4. This report is primarily used to indicate handoff of the forward link serving sector. Specifically, the fields DFLSSFlag and ActiveSetIndex may be used to indicate handoff for the forward link sector. This report may also provide the baseline forward link channel quality for all sectors in the active set. This may be used by the access points in different sectors for forward link power control of the forward link control channels.

**Format for CQICHCTRL report (Table 4)**

| Field | Length (bits) |
|---|---|
| FormatType | 1 |
| CQIValueSISO | 4 |
| DFLSSFlag | 1 |
| ActiveSetIndex | 3 |
| Reserved | 1 |

FormatType This bit is set to the value 0.

CQIValueSISO Indicates forward link SISO CQI value.

DFLSSFlag If the ActiveSetIndex is the current DFLSS, the DFLSSFlag bit may be set to 1; otherwise, the DFLSSFlag bit may be set to 0.

ActiveSetIndex Indicates the sector to which the CQIValueSISO corresponds.

Reserved This field is set to the value 0.

**[0063]** Each access terminal may be instructed to report CQICHCTRL in periodic intervals. The periodicity is negotiated between the access network, via one or more of the sectors, and each access terminal. Each CQICHCTRL transmission can be targeted for different sectors in the active set. The access terminal may choose which target sector to send the CQICHCTRL for.

**[0064]** The format for the CQICHSCW is shown below. This report is used by MIMO-SCW access terminals to indicate the MIMO forward link channel quality. A format bit in this report is used by the access terminals to toggle back and forth between the CQICHSCW and CQICHCTRL report. This toggling feature is needed to allow the SCW access terminals to also send CQICHCTRL report and support handoff. In certain aspects, the access terminal does not send this report to sectors other than the FLSS.

**Format for CQICHSCW report (Table 5)**

| Field | Length (bits) |
|---|---|
| FormatType | 1 |
| CQIValueSCW | 5 |
| Rank | 2 |
| Reserved | 2 |

| | |
|---|---|
| FormatType | This bit is set to the value 1. If this bit is set to 0, then the remaining 9 bits are interpreted as corresponding to the CQICHCTRL report. |
| CQIValueSCW | Indicates forward link MIMO SCW CQI value for the reported Rank. |
| Rank | Indicates the desired number of MIMO layers in the forward link MIMO SCW transmission. |
| Reserved | This field is set to the value 0. |

**[0065]** The format for the CQICHMCW is shown below. This report is used by MIMO-MCW access terminals to indicate the MIMO forward link channel quality. A format bit in this report may be used by the access terminals to toggle back and forth between the CQICHMCW and CQICHCTRL report. This toggling feature may be used to allow the SCW access terminals to also send CQICHCTRL report and support handoff. Depending on the number of independent streams being transmitted the CQIMCW message may consist of one or two parts In certain aspects, the access terminal does not send this report to sectors other than the FLSS.

**Format of first part of CQICHMCW report (Table 6A)**

| Field | Length (bits) |
|---|---|
| FormatType | 1 |
| MCWIndex | 1 |
| CQIValueMCWLayer1 | 4 |
| CQIValueMCWLayer2 | 4 |

FormatType Indicates the CQIMCW report format. This bit is set to the value 1 when MCW is reported. If this bit is set to 0, then the remaining 9 bits are interpreted as corresponding to the CQICHCTRL report.

MCWIndex This bit is set to the value 0 to indicate the CQI report is the first part of the CQICHMCW report.

CQIValueMCWLayer1 Indicates the forward link MIMO MCW layer 1 CQI value.

CQIValueMCWLayer2 Indicates the forward link MIMO MCW layer 2 CQI value.

**Format of second part of CQICHMCW report (Table 6A)**

| Field | Length (bits) |
|---|---|
| FormatType | 1 |
| MCWIndex | 1 |
| CQIValueMCWLayer3 | 4 |
| CQIValueMCWLayer4 | 4 |

FormatType Indicates the CQIMCW report format. This bit is set to the value 1 when MCW is reported. If this bit is set to 0, then the remaining 9 bits are interpreted as corresponding to the CQICHCTRL report.

MCWIndex This bit is set to the value 1 to indicate the CQI report is the second part of the CQICHMCW report.

CQIValueMCWLayer3 Indicates the forward link MIMO MCW layer 3 CQI value.

CQIValueMCWLayer4 Indicates the forward link MIMO MCW layer 4 CQI value.

**[0066]** In certain aspects, the R-SFCH and R-BFSCH messages may be sent in lieu of, or in addition to, R-CQICH messages. This may be done in order to facilitate transmission modes that the access terminal is operating in, while still minimizing the overhead used. Further, the reporting frequency of each these, may as previously discussed, vary as appropriate by the access network instructions.

**[0067]** The CQI value reported for CQICH or SFCH may be a CQI that is computed based upon any gains that are, or may be provided, due to precoding, SDMA, beamforming, or any combination thereof. The factors that are used to calculate the CQI

may be chosen by the access terminal based upon its current forward link transmission mode, desired transmission mode, or assigned transmission mode. In some cases, any gains from SDMA may be excluded from the calculations of CQI. The CQI may be, though need not be, calculated to achieve target performance in terms of erasure rate and error rate.

**[0068]** If SDMA is to be employed or desired to be employed for forward link transmission, the BFCH is provided. The access terminal generally transmits the BFCH channel only to the reverse link serving sector, although if it can effectively determine broadcast pilots from another sector in its active set it may provide this other sector as well, especially if the access terminal is requesting or in handoff.

**[0069]** In certain aspects, the channel information contained in R-SFCH may vary depending on the type of reports. The reports can vary depending on the reporting mode. The R-SFCH reports indicate the forward link channel quality on a particular sub-band, segment, or other group of subcarriers. The forward link channel quality can include gains from precoding, beamforming, STTD etc. However, in a certain aspect, the access terminal may choose to only indicate the preferred sub-band, segment, or other group of subcarriers in the R-SFCH report, and not send any information about the forward link channel quality. This is done by setting the CQI value to 0. This feature can be used to increase performance of R-SFCH reports, for example, improve the decoding complexity and performance of R-SFCH report.

**SFCH Report for each CQIReportingMode (Table 7)**

| | CQIReportingMode | | |
|---|---|---|---|
| | **CQISISO** | **CQISCW** | **CQIMCW** |
| **SFCH Report** | SFCHSISO | SFCHSCW | Not defined |

**[0070]** The format for the SFCHSISO report is shown below. This report is used by the SISO access terminal to indicate the forward link channel quality on a particular sub-band, segment, or other group of subcarriers.

**[0071]**

Format for SFCHSISO report (Table 8)

| Field | Length (bits) |
|---|---|
| SubBandIndex | 4 |
| SubBandCQIValueSISO | 4 |
| Reserved | 2 |

SubBandIndex Indicates the subband, segment, or other group of subcarriers for which the SubBandCQIValueSISO is reported.

SubBandCQIValueSISO This field indicates the CQI Value for the reported SubBandIndex. However, the AT may set these bits to 0, to obtain improved performance. This feature can be negotiated between the AP and AT.

Reserved This field is set to the value 0.

**[0072]** The format for the SFCHSCW report is shown below. This report is used by the SCW access terminal to indicate the MIMO forward link channel quality on a particular sub-band

**Format for SFCHSCW report (Table 9)**

| Field | Length (bits) |
|---|---|
| SubBandIndex | 4 |
| SubBandCQIValueSCW | 4 |
| SubBandRank | 2 |

SubBandIndex Indicates the Subband, or other segment identifier, for which the SubBandCQIValueSCW is reported.

SubBandCQIValueSCW This field indicates the CQI Value for the reported SubBandIndex or other segment index. However, the access terminal may set these bits to 0 . This feature can be negotiated between the access point and access terminal.

SubBandRank Indicates the desired number of MIMO layers in the forward link MIMO SCW transmission for the reported SubBandIndex or other index. However, the AT may set these bits to 0, to obtain improved performance. This feature can be negotiated between the AP and AT.

**[0073]** Further, multiple sets of subbands, with each set spanning overlapping parts of the carrier may be stored in a codebook thus allowing multiple ranges of sizes to be scanned for reporting a preferred segment.

**[0074]** In certain aspects, the channel information contained in R-BFCH may vary depending on the type of reports. The reports can vary depending on the reporting mode. The R-BFCH reports indicate the beam index to be used for precoding and SDMA, and a SDMA CQI value offset to enable SDMA transmission. However, in a certain aspect, the access terminal may choose to only indicate the preferred beam-index, and not send any information about the SDMA CQI value offset . This is done by setting the SDMA CQI value offset to 0. This feature can be used to increase

performance of R-BFCH reports, for example, improve the decoding complexity and performance of R-BFCH report. In another aspect, the access terminal may indicate SDMA CQI value offset relative to the CQI value sent on the R-SFCH report. In another aspect, the access terminal may indicate SDMA CQI value offset relative to the CQI value sent on the R-CQICH report. In another aspect, the access terminal may indicate an absolute SDMA CQI value that is not relative to or an offset of any other CQI value in R-CQICH or R-SFCH.

**[0075]** The format for the BFCHBeamIndex report is shown below.

**Format for BFCHBeamIndex**

| Field | Length (bits) |
|---|---|
| BeamIndex | 6 |
| SDMADeltaCQI | 3 |
| Reserved | 1 |

| | |
|---|---|
| BeamIndex | The BeamIndex field indicates the desired beam |
| SDMADeltaCQI | SDMADeltaCQI indicates the integer CQI offset relative to the CQI value in R-SFCH or relative to the CQI Value in R-CQICH. This can be negotiated with the Access Network. |
| Reserved | This bit is set to the value 0. |

**[0076]** In the above, while an offset is reported in these cases, full CQI reporting for the SDMA beam(s) may also be utilized. Further, the same reporting may apply to precoding, where the beamindex may correspond to a codebook entry. The CQI, or delta, may correspond to the beamindex.

**[0077]** The access point can control the periodicity of transmissions of each reverse link control channel on a per-access terminal basis to manage the overall load on the resources dedicated for transmitting channel information.

**[0078]** As discussed there are several types of channel information that the access terminal can feedback, depending on the type of transmission for which the access terminal is scheduled, desired to be scheduled, or otherwise instructed for the forward link. In one operating mode, the access terminal can send R-BFCH to provide feedback that may be used for adaptive precoding and/or SDMA on the forward link. In another mode, the access terminal can send R-SFCH to indicate preferred segments of subcarriers. .

**[0079]** The access terminal can transmit more than one reverse link control channel in a given reverse link frame. For example, the access terminal may transmit R-CQICH, R-SFCH and R-BFCH in a same reverse link frame.

**[0080]** The access terminal may transmit a pilot channel (PICH) in the control segment. This pilot sequence may be used, in addition or in lieu of some or all of the channel information reporting described above, to enable adaptive transmission such as reverse link preferred subcarrier or segment scheduling and SDMA in a TDD system.

**[0081]** The availability of all of the reverse link control channels, their average transmission interval and mode may be varied on a sector or access terminal specific basis. If one of these channels is unavailable due to constraints on the control segment, the access point may choose to enable the messages for the channels for specific access terminals through higher layer messages or in the data segments.

**[0082]** In some cases, the messages described above occupy a number of modulation symbols. In the case of orthogonal resources dedicated to channel information transmission, e.g. by using different codes or OFDM symbols, this number of symbols needs to be extended by a number of pilot symbols. Finally, these symbols may be replicated over the reverse link in order to provide channel and interference diversity.

**[0083]** The formats described above are exemplary may have different bit sizes, formats, combinations, or the like. Further, the values reported as CQI may be quantized or raw values.

**[0084]** An access terminal may simultaneously send at most one CQICH report per reverse link frame on each CQICH on the control segment of the RLSS. The access terminal may simultaneously send at most one CQICH report per reverse link frame on each CQICH on each of the sectors in its active. Although, depending on the resources and transmission rate of the access terminal other frequencies of reporting messages to the RLSS and members of the active set may be utilized.

**[0085]** The access terminal determines which synchronous subsets to send CQICH. The access terminal may apply different rules for each sector that has a different timing, because it receives its timing from a different source than one or more other sectors in the active set, that other sectors in its active sets depending on the type of reverse link control channel, the CQI value can indicate the information related to the type of transmission for which the access terminal is reporting. If quantization is being utilized, the access terminal may report the highest tabulated CQI value to allow for early packet termination and a desired system decoding error rate.

**[0086]** If the access terminal desires to be scheduled for a preferred segment of subcarriers or subcarriers the following reporting structure may be followed. The access terminal transmits the SFCH channel only to the reverse link serving sector, although if it can effectively determine broadcast pilots from another sector in its active set it may provide this to the other sector as well, especially if the access terminal is requesting or in handoff.

**[0087]** Referring to Fig. 4, a transmitter and receiver in a multiple access wireless communication system one aspect is illustrated. At transmitter system 410, traffic data for a number of data streams is provided from a data source 412 to a transmit (TX) data processor 414. In an aspect, each data stream is transmitted over a respective transmit antenna. TX data processor 414 formats, codes, and interleaves the traffic data for each data stream based on a particular coding scheme selected for that data stream to provide coded data. In some aspects, TX data processor 414 applies beamforming weights to the symbols of the data streams based upon the user to which the symbols are being transmitted and the antenna from which the symbol is being transmitted. In some aspects, the beamforming weights may be generated based upon eigenbeam vectors generated at the receiver 402 and provided as feedback to the transmitter 400. Further, in those cases of scheduled transmissions, the TX data processor 414 can select the packet format based upon rank information that is transmitted from the user.

**[0088]** The coded data for each data stream may be multiplexed with pilot data using OFDM techniques. The pilot data is typically a known data pattern that is processed in a known manner and may be used at the receiver system to estimate the channel response. The multiplexed pilot and coded data for each data stream is then modulated (i.e., symbol mapped) based on a particular modulation scheme (e.g., BPSK, QSPK, M-PSK, or M-QAM) selected for that data stream to provide modulation symbols. The data rate, coding, and modulation for each data stream may be determined by instructions performed on provided by processor 430. As discussed above, in some aspects, the packet format for one or more streams may be varied according to the rank information that is transmitted from the user.

**[0089]** The modulation symbols for all data streams are then provided to a TX MIMO processor 420, which may further process the modulation symbols (e.g., for OFDM). TX MIMO processor 420 then provides $N_T$ modulation symbol streams to $N_T$ transmitters (TMTR) 422a through 422t. In certain aspects, TX MIMO processor 420 applies beamforming weights, fixed or access terminal specific, or precoding weights to

the symbols of the data streams based upon the user to which the symbols are being transmitted and the antenna from which the symbol is being transmitted from that users channel response information.

**[0090]** Each transmitter 422 receives and processes a respective symbol stream to provide one or more analog signals, and further conditions (e.g., amplifies, filters, and upconverts) the analog signals to provide a modulated signal suitable for transmission over the MIMO channel. $N_T$ modulated signals from transmitters 422a through 422t are then transmitted from $N_T$ antennas 424a through 424t, respectively.

**[0091]** At receiver system 450, the transmitted modulated signals are received by $N_R$ antennas 452a through 452r and the received signal from each antenna 452 is provided to a respective receiver (RCVR) 454. Each receiver 454 conditions (e.g., filters, amplifies, and downconverts) a respective received signal, digitizes the conditioned signal to provide samples, and further processes the samples to provide a corresponding "received" symbol stream.

**[0092]** An RX data processor 460 then receives and processes the $N_R$ received symbol streams from $N_R$ receivers 454 based on a particular receiver processing technique to provide $N_T$ "detected" symbol streams. The processing by RX data processor 460 is described in further detail below. Each detected symbol stream includes symbols that are estimates of the modulation symbols transmitted for the corresponding data stream. RX data processor 460 then demodulates, deinterleaves, and decodes each detected symbol stream to recover the traffic data for the data stream. The processing by RX data processor 460 is complementary to that performed by TX MIMO processor 420 and TX data processor 414 at transmitter system 410.

**[0093]** The channel response estimate generated by RX processor 460 may be used to perform space, space/time processing at the receiver, adjust power levels, change modulation rates or schemes, or other actions. RX processor 460 may further estimate the signal-to-noise-and-interference ratios (SNRs) of the detected symbol streams, and possibly other channel characteristics, and provides these quantities to a processor 470. RX data processor 460 or processor 470 may further derive an estimate of the "operating" SNR for the system. Processor 470 then provides estimated channel information (CSI), which may comprise various types of information regarding the communication link and/or the received data stream. For example, the CSI may comprise only the operating SNR. The type of CQI provide, e.g. CQICH (SISO, SCW, and MCW), BFCH, and/or SFCH is determined based upon the currently scheduled for

the access terminal, instructions, or desired transmission mode. The CSI is then processed by a TX data processor 438, which also receives traffic data for a number of data streams from a data source 476, modulated by a modulator 480, conditioned by transmitters 454a through 454r, and transmitted back to transmitter system 410.

**[0094]** At transmitter system 410, the modulated signals from receiver system 450 are received by antennas 424, conditioned by receivers 422, demodulated by a demodulator 440, and processed by a RX data processor 442 to recover the CSI reported by the receiver system. The reported CSI is then provided to processor 430 and used to (1) determine the data rates and coding and modulation schemes to be used for the data streams and (2) generate various controls for TX data processor 414 and TX MIMO processor 420.

**[0095]** At the receiver, various processing techniques may be used to process the $N_R$ received signals to detect the $N_T$ transmitted symbol streams. These receiver processing techniques may be grouped into two primary categories (i) spatial and space-time receiver processing techniques (which are also referred to as equalization techniques); and (ii) "successive nulling/equalization and interference cancellation" receiver processing technique (which is also referred to as "successive interference cancellation" or "successive cancellation" receiver processing technique).

**[0096]** A MIMO channel formed by the $N_T$ transmit and $N_R$ receive antennas may be decomposed into $N_S$ independent channels, with $N_S \leq \min\{N_T, N_R\}$. Each of the $N_S$ independent channels may also be referred to as a spatial subchannel (or a transmission channel) of the MIMO channel and corresponds to a dimension.

**[0097]** For a full-rank MIMO channel, where $N_S = N_T \leq N_R$, an independent data stream may be transmitted from each of the $N_T$ transmit antennas. The transmitted data streams may experience different channel conditions (e.g., different fading and multipath effects) and may achieve different signal-to-noise-and-interference ratios (SNRs) for a given amount of transmit power. Moreover, in those cases that successive interference cancellation processing is used at the receiver to recover the transmitted data streams, and then different SNRs may be achieved for the data streams depending on the specific order in which the data streams are recovered. Consequently, different data rates may be supported by different data streams, depending on their achieved SNRs. Since the channel conditions typically vary with time, the data rate supported by each data stream also varies with time.

**[0098]** The MIMO design may have two modes of operation, single code word (SCW) and multiple-code word (MCW). In MCW mode, the transmitter can encode the data transmitted on each spatial layer independently, possibly with different rates. The receiver employs a successive interference cancellation (SIC) algorithm which works as follows: decode the first layer, and then subtract its contribution from the received signal after re-encoding and multiplying the encoded first layer with an "estimated channel," then decode the second layer and so on. This "onion-peeling" approach means that each successively decoded layer sees increasing SNR and hence can support higher rates. In the absence of error-propagation, MCW design with SIC achieves maximum system transmission capacity based upon the channel conditions.

**[0099]** In a SCW mode design, the transmitter encodes the data transmitted on each spatial layer with "identical data rates." The receiver can employ a low complexity linear receiver such as a Minimum Mean Square Solution (MMSE) or Zero Frequency (ZF) receiver, or non-linear receivers such as QRM, for each tone. This allows reporting of the channel estimates by the receiver to be for only the "best" layer and reduced transmission overhead for providing this information.

**[00100]** While Fig. 4 and the associated discussion refers to a MIMO system, other systems multi-input single-input (MISO) and single-output multi-input (SIMO) may also utilize the structures of Fig. 4 and the structures, methods and systems discussed with respect to Figs. 1, 5, and 6 herein.

**[00101]** Referring to Fig. 5, aspects of a method of determining a feedback type to provide is illustrated. A determination is made as to the applicable sector for which feedback is being provided, block 600. If the sector is a non-serving sector, only one of the CQICHCTRL is provided, block 604. If the sector is a serving sector, all CQI reports can be transmitted, block 602.

**[00102]** If the sector is a serving sector, then the reporting type is determined by the access terminal, block 602. This may be based upon an instruction from the FLSS or other sector. The feedback, e.g. reporting mode message(s), is provided then according to the reporting type. The frequency of the reporting is according to instructions, which may vary over time, received from the FLSS or other sector.

**[00103]** Referring to Fig. 6 aspects of another method of determining CQI reports to provide is illustrated. A determination is made as to the reporting mode. The reporting mode may be signaled using an assignment message that relates to the active set, from the FLSS or other members of the active set.. The reporting modes, as previously

described, may be a SISO mode, MIMO SCW mode, and a MIMO MCW mode. Additional, reporting modes may be available for SDMA, precoding, beamforming, and other transmission types.

**[00104]** In SISO mode, a control channel CQI, e.g. CQICHCTRL, type feedback is provided, block 702. In MIMO-SCW mode, a control channel CQICHCTRL and CQICHSCW feedback is provided, block 704. An example of the MIMO feedback provided for a MIMO SCW is shown in, and discussed above. In MIMOMCW mode a control channel CQICHCTRL and CQICHMCW feedback is provided, block 706. An example of the MIMO feedback provided for a MIMO SCW is shown in, and discussed with above.

**[00105]** The above processes may be performed utilizing TX processor 420 or 460, processor 430 or 470, and memory 432 or 472. Further processes, operations, and features described with respect to Figs. 1, 5, and 6 may be performed on any processor, controller, or other processing device and may be stored as computer readable instructions in a computer readable medium as source code, object code, or otherwise.

**[00106]** The techniques described herein may be implemented by various means. For example, these techniques may be implemented in hardware, software, or a combination thereof. For a hardware implementation, the processing units within a access point or a access terminal may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, other electronic units designed to perform the functions described herein, or a combination thereof.

**[00107]** For a software implementation, the techniques described herein may be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The software codes may be stored in memory units and executed by processors. The memory unit may be implemented within the processor or external to the processor, in which case it can be communicatively coupled to the processor via various means as is known in the art.

**[00108]** It should be noted that the concept of channels herein refers to information or transmission types that may be transmitted by the access point or access terminal. It does not require or utilize fixed or predetermined blocks of subcarriers, time periods, or other resources dedicated to such transmissions.

**[00109]** The previous description of the disclosed aspects is provided to enable any person skilled in the art to make or use the features, functions, operations, and aspects disclosed herein. Various modifications to these aspects may be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects without departing from their spirit or scope. Thus, the present disclosure is not intended to be limited to the aspects shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

**CLAIMS**

1. A wireless communication apparatus comprising:

a memory; and

a processor coupled with the memory, the processor configured to select a type of channel information feedback based upon a reporting format for the wireless communication apparatus

2. The wireless communication apparatus of claim 1, wherein the processor is configured to select the type based upon an instruction corresponding to the reporting format.

3. The wireless communication apparatus of claim 1, wherein the types include a SDMA CQI and a preferred segment CQI.

4. The wireless communication apparatus of claim 1, wherein the types further include a MCW, SCW, and SISO CQIs.

5. The wireless communication apparatus of claim 1, wherein the processor is configured to select multiple formats for multiple messages based upon the format type.

6. The wireless communication apparatus of claim 1, wherein the processor is configured to select based upon a type of transmission mode on a forward link to the wireless communication apparatus.

7. The wireless communication apparatus of claim 1, wherein the processor is configured to select two message formats one including a CQI value and the other including an offset of the CQI value in the one message.

8. The wireless communication apparatus of claim 1, wherein the processor is configured to select based upon a type of desired transmission mode on a forward link to the wireless communication apparatus.

9. A method comprising:

transmitting first channel information according to a first format to a first sector;

transmitting second channel information according to the first format to a second sector;

transmitting third channel information according to a second format to the first sector and

transmitting fourth channel information according to the first format to the second sector.

10. The method of claim 9, wherein the first sector comprises a serving sector and the second sector comprises a non-serving sector.

11. The method of claim 9, further comprising transmitting fifth channel information according to the first format to the second sector.

12. The method of claim 9, wherein the channel information comprises CQI.

13. The method of claim 9, wherein the second format comprises information identifying a preferred segment.

14. The method of claim 9, wherein the second format comprises information identifying a preferred SDMA index.

15. The method of claim 9, wherein the second format comprises a plurality of second formats each corresponding to one of a MCW, SCW, and SISO reporting format.

16. The method of claim 9, wherein the first sector comprises a member of a synchronous subset and the second sector comprises a member of a non-synchronous subset.

17. A wireless communication apparatus comprising:

means for transmitting first channel information according to a first format to a first sector;

means for transmitting second channel information according to the first format to a second sector;

means for transmitting third channel information according to a second format to the first sector and

means for transmitting fourth channel information according to the first format to the second sector.

18. The wireless communication apparatus 17, wherein the first sector comprises a serving sector and the second sector comprises a non-serving sector.

19. The wireless communication apparatus 17, further means for comprising transmitting fifth channel information according to the first format to the second sector.

20. The wireless communication apparatus 17, wherein the channel information comprises CQI.

21. The wireless communication apparatus 17, wherein the second format comprises information identifying a preferred segment.

22. The wireless communication apparatus 17, wherein the second format comprises information identifying a preferred SDMA index.

23. The wireless communication apparatus 17, wherein the second format comprises a plurality of second formats each corresponding to one of a MCW, SCW, and SISO reporting format.

24. The wireless communication apparatus 17, wherein the first sector comprises a member of a synchronous subset and the second sector comprises a member of a non-synchronous subset.

25. A method comprising:

determining a reporting mode of a wireless communication apparatus; and

selecting a type of channel information feedback based upon the reporting format for the wireless communication apparatus

26. The method of claim 25, wherein selecting comprises selecting based upon an instruction corresponding to the reporting format.

27. The method of claim 25, wherein the types include a SDMA CQI and a preferred segment CQI.

28. The method of claim 25, wherein the types further include a MCW, SCW, and SISO CQIs.

29. The method of claim 25, wherein selecting comprises selecting multiple formats for multiple messages based upon the format type.

30. The method of claim 25, wherein selecting comprises selecting based upon a type of transmission mode on a forward link to the wireless communication apparatus.

31. The method of claim 25, wherein selecting comprises selecting two message formats one including a CQI value and the other including an offset of the CQI value in the one message.

32. A apparatus for wireless communication comprising:

means for determining a reporting mode of a wireless communication apparatus; and

means for selecting a type of channel information feedback based upon the reporting format for the wireless communication apparatus

33. The apparatus of claim 32, wherein the means for selecting comprises means for selecting based upon an instruction corresponding to the reporting format.

34. The apparatus of claim 32, wherein the types include a SDMA CQI and a preferred segment CQI.

35. The apparatus of claim 32, wherein the types further include a MCW, SCW, and SISO CQIs.