UL Control Channels in IEEE 802.16m

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Purpose:

To discuss and adopt the proposed text in the next revision of the 802.16m SDD

Notice:

Release:

Patent Policy:

Scope and Keys

- UL Control Channels
  - Raging Channel (RCH)
  - Feedback Channel (FBCH)
  - ACK Channel for DL HARQ (ACKCH)
  - Sounding Channel (SNDCH)
  - Dedicated Control Channel (DCCH)
- UL Dedicated Control Channel
  - A persistent allocation channel for UL feedbacks
  - Feedback payloads are multiplexed on UL DCCH
    - Flexibility and MS’s selection of feedback payloads.

UL Control Channels

Ranging Channel (RCH)

- Ranging region
  - Semi-static definition in broadcast information.
- Random access using a CDMA code
  - Initial/Handoff Ranging, BW Request
- Partition of CDMA codes for BW Request
  - By requested BW volume.
  - By MS Tx power level (or required MCS level).

Feedback Channel (FBCH)

- Fast feedback region
  - Semi-static definition in broadcast information.
- DL channel information feedback
- Channel allocation on DL subframe control
- Additional information feedback
  - HO and FBSS feedback
  - BR indication, etc

ACK Channel for DL HARQ (ACKCH)

- HARQ ACK region
  - Semi-static definition in broadcast information.
- ACK/NAK signaling for DL HARQ Tx
  - ACK/NAK for unicast service
  - Aggregated NAK for multicast service
- Allocation for every DL HARQ burst transmission

Sounding Channel (SNDCH)

- Sounding region
  - Semi-static definition in broadcast information.
- UL channel estimation by MS signal
- Applied operations
  - DL closed BF and MIMO for TDD
  - UL amble (pilot) for FDD
    - UL BF and MIMO for FDD
    - UL band selection

Dedicated Control Channel (DCCH)

- Persistent allocation channel for UL feedbacks
  - Per-user channel
  - AMC-controlled feedback channel => efficiency
- High flexibility on multiplexing feedback payloads
  - Various payloads in size and period
  - PHY and MAC related feedbacks
- HARQ transmission on DCCH (TBD)

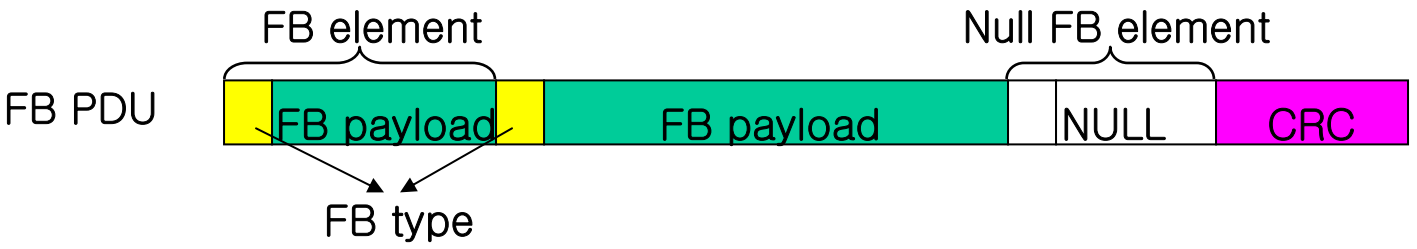
Dedicated Control Channel (DCCH)

Dedicated Control Channel

- Motivation from the legacy
  - Feedback Polling IE
    - Signaling overhead for every request of feedbacks
    - Only BS requests feedbacks and their types
  - MS can send MAC and PHY related feedbacks using MAC header without payload or MAC subheaders
    - Unexpected UL resource allocation if piggyback
    - Overhead and delay if BW request procedure
- Persistent allocation for MS’s feedbacks
  - Independent of FBCH (Feedback Channel)

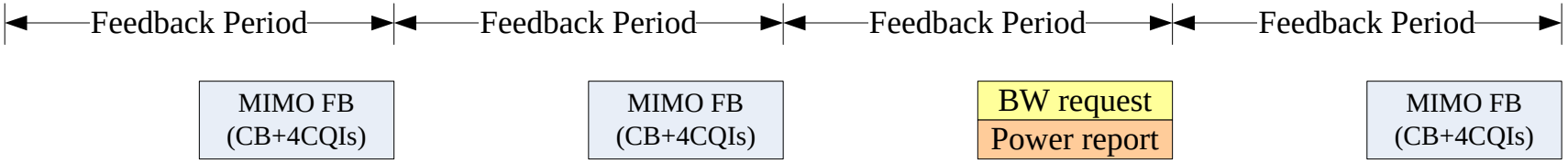
Feedback PDU

- No MAC header + One or more feedback elements + CRC
- Feedback element
  - Feedback type and feedback payload
    - Fixed length and format according to the feedback type
  - Null feedback element
    - Type 0 + Null payload (00…)
    - For padding or no feedback case



Allocation and Characteristics

- Allocation by DL subframe control or MAC management msg.
- Allocation information
  - Resource position and period
  - Transmission format (MCS)
  - [HARQ related information]
- UL DCCH Characteristics
  - Allocation for MSs that require many feedbacks
  - MS selects FB type and payload based on its need
  - BS indicates the minimum rate (frequency) for each FB type
- An example of multiplexing UL feedbacks on DCCH



An Example of Feedback Contents

- Null Padding
- Aggregated bandwidth request
- Average DL CINR
- Preferred DL TF
- UL transmit power
- Band CINR: BITMAP + n CQIs
- Differential Band CINR
- Post-Rx CINR I: CQI for MS
- Post-Rx CINR II: 4 CQIs
- Precoding I: Codebook + CQI
- Precoding II: Codebook + 4 CQIs
- BR and UL transmit power
- BR and average DL CINR
- SDU SN report
- Incremental bandwidth request
- Rate change request for ertPS
- CINR standard deviation
- MIMO type
- Anchor change request: BSID
- CQICH allocation request
- NBR CINR and RSSI
- UGS grant management: SI+PM+FLI+FL
- ERTPS grant management: PSI+PSOBR+FLI+FL
- BR and sleep control
- PHY channel report: Tx Power + Headroom
- CINR statistics: Average + Standards
- BR and NACK request

SDD Texts

11.x UL Control Channels

UL control channels consist of the following channels:

- Ranging Channel (RCH)
- Feedback Channel (FBCH)
- ACK Channel for DL HARQ (ACKCH)
- Sounding Channel (SNDCH)
- Dedicated Control Channel (DCCH)

11.x.1 Raging Channel (RCH)

Ranging region is defined in broadcast information and RCHs are in the ranging region. MS may try random access sending a CDMA code in the RCH. The CDMA code is uniquely identified and BS sends a response with the identification of the CDMA code. CDMA codes are partitioned into several logical separations for initial ranging, handoff ranging, and bandwidth request. CDMA codes for bandwidth request are classified logically to two sets: requested BW set and Tx power set. When receiving a CDMA code within BW request separation, BS can allocate UL resources as response according to requested BW and MS's tx power.

11.x.2 Feedback Channel (FBCH)

Feedback region is defined in broadcast information and BS allocates feedback channels in the feedback region for MSs. This feedback may contain DL channel measurement report (channel quality indication, CQI) or UL control signal such as HO and FBSS feedbacks and BR indication, etc.

11.x.3 ACK Channel for DL HARQ (ACKCH)

HARQ ACK region is defined in broadcast information and ACK channel for DL HARQ is allocated in order for MS to send a ACK/NAK feedback signal of DL HARQ burst transmission for unicast service. For multicast service a channel can be shared by MSs to feedback aggregated NAK signals for a DL multicast burst transmission.

11.x.4 Sounding Channel (SNDCH)

Sounding region is defined in broadcast information. UL resources in the sounding region are allocated for a MS to send known-pattern signals. When receiving the signals, BS may estimate the radio channel of allocated UL resources. This channel sounding operation can be required for DL closed beamforming and MIMO for TDD, UL band selection for FDD, UL beamforming and MIMO for FDD.

SDD Texts

11.x.5 Dedicated Control Channel (DCCH)

UL resources are allocated periodically for a MS to efficiently send UL control feedbacks. The UL resources are used persistently by MS after first allocation until BS changes or deallocates the UL resources. The UL control feedbacks are multiplexed in the format of feedback PDUs which consist of feedback type and feedback element in a fixed size according to feedback type. A CRC is located in the end of the UL resources. MS schedules UL control feedbacks and may select some of UL control feedbacks in priority for the limited UL resources.