

IEEE 802.16m Uplink Control Channels

Document Number:

IEEE C802.16m-08/273,

Date Submitted:

2008-05-05

Source:

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*<<http://standards.ieee.org/faqs/affiliationFAQ.html>>

Venue:

TGm Call for Contributions on Project 802.16m System Description Document (SDD), IEEE 802.16m-08/016r1

Topic: Uplink Control Structures

Base Contribution:

IEEE C802.16m-08/272

Purpose:

Discussion and adoption of SDD text

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Proposed Process for drafting SDD Text

- **1) Define the required functionality for the uplink control**
 - ➔ e.g. MIMO, Channel Quality, Random Access
- **2) Identify the physical channels for uplink control**
 - ➔ e.g. Fast feedback, Indications, Sounding
- **3) Map required functionality to physical channels**

Uplink Control Channel Required Functions

- *Channel quality feedback*
 - ➔ **Physical CINR** – Measured carrier to noise plus interference of target BS (includes the mean and standard deviation)
 - ➔ **Effective CINR** – Effective carrier to noise plus interference accounting for the MS receiver design
 - ➔ **Velocity** – Speed as measured at the MS
- *MIMO related signaling*
 - ➔ **Precoder Matrix Index** – Best MIMO precoder as selected by the mobile station
 - ➔ **Rank Adaptation** – Number of spatial streams supported by the current channel as MS
 - ➔ **Channel Sounding/Analog Feedback** – Sounding transmission by the MS for measurement at the BS for TDD ; Analog transmission of the downlink channel coefficient by MS for FDD
- *HARQ*
 - ➔ **Ack/Nack signaling** – HARQ acknowledgement of downlink traffic
- *Random Access Indication*
 - ➔ **Uplink Bandwidth Request** – Buffersize or other indication of traffic queue at the MS
- *Uplink Synchronization*
 - ➔ **Ranging** – Method for providing the timing advance of uplink traffic
- *Uplink Common Control*
 - ➔ **MBMS Feedback** – Service dependent common uplink feedback channel from MBMS MSs
 - ➔ **Interference Overload Mitigation** – MS feedback to adjacent regarding excessive interference warranting adjustment of FFR configuration or other mitigation

Physical Uplink Control Channel Types and Mappings

- ***Uplink Physical Indication Control Channel***
 - ➔ Random Access Indication
 - ➔ Synchronization
 - ➔ Uplink Common Control
- ***Uplink Physical Fast Feedback Control Channel***
 - ➔ Channel Quality Feedback
 - ➔ MIMO Related Signaling
 - ➔ HARQ Ack/Nack
- ***Uplink Physical Sounding Control Channel***
 - ➔ Channel Sounding
 - ➔ Analog Feedback
- ***Uplink Physical In-Band Control Channel (e.g. Feedback Header)***
 - ➔ E.g. Buffer Status, Tx Headroom,

Uplink Physical Indication Control Channel

- ***Indication Channel is a waveform***
 - ➔ Communicates one-bit of information
- ***Maximize transmission power for coverage***
 - ➔ Should span the length of the uplink interval to utilize all of the MS's PA capacity
- ***Flexible structure to accommodate variety of TDD splits***
 - ➔ Uplink interval may 1, 2, 3, 4 or 5 sub-frame long
 - ➔ Structure must be parameterized to span multiple sub-frames
- ***Provide a frequency diversity benefit***
 - ➔ Allocated at multiple frequency locations

Uplink Physical Fast Feedback Control Channel

- ***M-ary waveform communicates multiple bits***
 - ➔ Defines the physical properties
- ***Should be time limited to allow for scheduling and processing delay***
 - ➔ Need to allow for decoding and other delays of downlink data
 - ➔ Need to allow for scheduling delay for next downlink interval
- ***Flexible structure to accommodate variety of TDD splits***
- ***Consider options for multiplexing functionality***
 - ➔ May create multiple instances of the fast feedback channel
 - ➔ Independent HARQ ACK/NACK Channel
 - ➔ Independent Channel Quality Feedback
 - ➔ Non-overlapping time-frequency regions
 - ➔ May code multiple different functions onto one fast feedback channel
 - ➔ Partition the code space for each function (e.g. CQI, HARQ)

Uplink Physical Sounding Control Channel

- Analog waveform spanning frequency band of interest
 - ➔ **Reference signal transmitted MS and measured at the BS for TDD systems**
 - ➔ **Analog signal encoded signal encoded with downlink channel information transmitted by the MS**
- *Broadband and narrowband configurations supported*
 - ➔ **Enable sounding for both distributed and localized allocations**
- Sounding channel
 - ➔ **Sounding channel spans over 1 subframe (6 symbols)**
 - ➔ **Retain same overhead as one dedicated sounding symbol**
 - ➔ **Cell-edge users can use more power compared to sounding symbol**
 - ➔ **Facilitate inter-cell interference control (by cell-specific sounding channel allocation)**
 - ➔ **Facilitate power boosting for sounding by stealing power from data**

Uplink Physical In-Band Control Channel (e.g. Feedback Header)

- ***Multi-bit feedback information transmitted with the data***
 - ➔ Buffer Status, MS Tx Headroom, etc
- ***Resources are allocated as data is allocated***
 - ➔ Unicast transmission assigning resources for individual control bursts
 - ➔ Persistent scheduling may assign resources for repetitive or periodic control
 - ➔ MS may usurp data allocation for control or append header to data transmission

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