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Re:	TGm Call for Contributions on Project 802.16m System Description Document (SDD), IEEE 802.16m-08/016r1 Topic: Uplink Control Structures
Abstract	This contribution proposes text for the SDD on uplink control structures
Purpose	Discussion and adoption of SDD text
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1 *Proposed text for the SDD uplink control structures:*

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Contents

4

5	11.6 Uplink Control Structure.....	2
6	11.6.1 Uplink Control Information Types.....	2
7	11.6.1.1 Channel quality feedback type.....	2
8	11.6.1.2 MIMO feedback type.....	3
9	11.6.1.3 HARQ feedback type.....	3
10	11.6.1.4 Random Access Indication type.....	3
11	11.6.1.5 Uplink Bandwidth Request type.....	3
12	11.6.1.6 Uplink Synchronization type.....	3
13	11.6.1.7 Intercell-Indication type.....	3
14	11.6.2 Uplink Physical Control Channels.....	3
15	11.6.2.1 Uplink Physical Indication Control Channel.....	3
16	11.6.2.2 Uplink Physical Fast Feedback Control Channel.....	4
17	11.6.2.3 Uplink Physical Sounding Control Channel.....	4
18	11.6.2.4 Uplink Physical Inband Control Channel.....	5
19	11.6.3 Mapping of Uplink Control.....	5

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22 **11.6 Uplink Control Structure**

23 The uplink time-frequency resources are partitioned in time-frequency to carry uplink control for
24 feedback, random access and other purposes.

25 **11.6.1 Uplink Control Information Types**

26 The uplink control channel carries multiple types of control information to support physical layer
27 procedures

28 **11.6.1.1 Channel quality feedback type**

29 The channel quality feedback type provides information necessary for link adaption of the downlink and
30 uplink modulation and coding levels, power control, pilot formats, etc. The following types of feedback
31 are included in the channel quality feedback type.

- 32 • Physical CINR – Measured carrier to noise plus interference of target BS, including mean and
33 standard deviation of CINR measurements across subcarriers
- 34 • Effective CINR – Effective carrier to noise plus interference accounting for the MS receiver
35 design
- 36 • Velocity – Speed as measured at the MS

1 **11.6.1.2 MIMO feedback type**

2 The MIMO feedback type provides information necessary for managing the spatial link adaptation of the
3 channel including the number of streams and level multiplying (e.g. SU-MIMO vs MU-MIMO). The
4 following types of feedback are included in the MIMO feedback type:

- 5 • Precoder Matrix Index – Best MIMO precoder as selected by the mobile station
- 6 • Rank Adaptation – Number of spatial streams supported by the current channel as MS
- 7 • Channel Sounding/Analog Feedback – Sounding transmission by the MS for measurement at the
8 BS for TDD ; Analog transmission of the downlink channel coefficient by MS for FDD

9 **11.6.1.3 HARQ feedback type**

10 The HARQ feedback type provides acknowledgement of downlink traffic. The acknowledgement may
11 contain acknowledgement for one or more codewords.

12 **11.6.1.4 Random Access Indication type**

13 The random access information is sent by a mobile requesting the exclusive allocation for uplink
14 physical inband resources

15 **11.6.1.5 Uplink Bandwidth Request type**

16 The bandwidth request type conveys information about the queued traffic at the MS including buffersize,
17 quality of service and priority.

18 **11.6.1.6 Uplink Synchronization type**

19 The uplink synchronization type provides a means for measuring and adjusting the uplink timing offset.

20 **11.6.1.7 Uplink Common Control type**

21 The intercell-indication type provides a mechanism for MSs to signal adjacent cells. The following are
22 two examples of services that could require intercell-indications.

- 23 • MBMS – Service dependent common uplink feedback channel from MBMS MSs
- 24 • Interference Overload Mitigation – MS feedback to adjacent regarding excessive interference
25 warranting adjustment of FFR configuration or other mitigation

26 **11.6.2 Uplink Physical Control Channels**

27 The uplink control information is carried in set of physical uplink control channels having specific
28 performance characteristics.

29

30 **11.6.2.1 Uplink Physical Indication Control Channel**

31 The Uplink Physical Indication Channel UL_PICC is a waveform that communicates one-bit of
32 information. The UL_PICC should have the following properties:

- 33 • Maximize transmission power for coverage by spanning the entire length of the uplink interval
34 and utilizing all of the MS's PA capacity

- 1 • Have a flexible structure to accommodate variety of TDD splits; the uplink interval may be 1 to 7
- 2 sub-frames long
- 3 • Employ frequency diversity benefit for the sake of robustness

4 **11.6.2.2 Uplink Physical Fast Feedback Control Channel**

5 The Uplink Physical Fast Feedback Channel UL_PFFCC is an m-ary waveform communicating multiple
6 bits of information. The UL_PFFCC should have the following properties

- 7 • Should be time limited to allow for scheduling and processing delay
 - 8 ○ Need to allow for decoding and other delays of downlink data
 - 9 ○ Need to allow for scheduling delay for next downlink interval
- 10 • Flexible structure to accommodate variety of TDD splits
- 11 • Consider options for multiplexing functionality
 - 12 ○ May create multiple instances of the fast feedback channel
 - 13 ▪ Independent HARQ ACK/NACK Channel
 - 14 ▪ Independent Channel Quality Feedback
 - 15 ▪ Non-overlapping time-frequency regions
 - 16 ○ May code multiple different functions onto one fast feedback channel
 - 17 ▪ Partition the code space for each function (e.g. CQI, HARQ)

18 **11.6.2.3 Uplink Physical Sounding Control Channel**

19 The Uplink Physical Sounding Control Channel (UL_PSCC) is an analog waveform spanning the
20 frequency band of interest. The UL_PSCC should have the following properties:

- 21 • The UL_PSCC may be both a reference signal or encode information in an analog format
 - 22 ○ Reference signal transmitted MS and measured at the BS for TDD systems
 - 23 ○ Analog signal encoded signal encoded with downlink channel information transmitted by
 - 24 the MS
- 25 • Broadband and narrowband configurations supported
 - 26 ○ Enable sounding for both distributed and localized allocations
- 27 • Sounding channel
 - 28 ○ Sounding channel spans over 1 subframe (6 symbols)
 - 29 ○ Retain same overhead as one dedicated sounding symbol
 - 30 ○ Cell-edge users can use more power compared to sounding symbol
 - 31 ○ Facilitate inter-cell interference control (by cell-specific sounding channel allocation)
 - 32 ○ Facilitate power boosting for sounding by stealing power from data

1 **11.6.2.4 Uplink Physical Inband Control Channel**

2 The Uplink Physical Inband Channel (UL_PIBCC) provide multi-bit information that is transmitted in
 3 the data bearer. The UL_PICC may be appended to the data or transmitted in place of data. The
 4 UL_PIBCC carries information such as the buffer status, maximum transmission power header, etc.
 5 The UL_PIBCC may be allocated a unicast transmission or be assigned with a persistent allocation. The
 6 MS may also usurp a data allocation for control or append a header to the data transmission.

7 **11.6.3 Mapping of Uplink Control**

8 Table XX below captures a mapping of the uplink control types to the uplink physical channels.

Uplink Physical Control Channel	Uplink Control Type
Indication Control Channel (UL_PICC)	Random Access Indication Uplink Synchronization Uplink Common Control
Fast Feedback Control Channel (UL_PFFCC)	Channel Quality Feedback MIMO Feedback HARQ Feedback
Sounding Control Channel (UL_PSCC)	MIMO Feedback
In-Band Control Channel (UL_PIBCC)	Channel Quality Feedback MIMO Feedback Uplink Bandwidth Request

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