

## Cumulated HARQ Reports

### IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE S802.16m-09/0526r1

Date Submitted: 2009-3-8

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Venue: IEEE 802.16m AWD

Base Contribution: N/A

Re: 802.16m AWD Call for Contributions on Project 802.16m Amendment Working Document (AWD) Content

Purpose: To be discussed and approval by IEEE 802.16m TG

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# Introduction

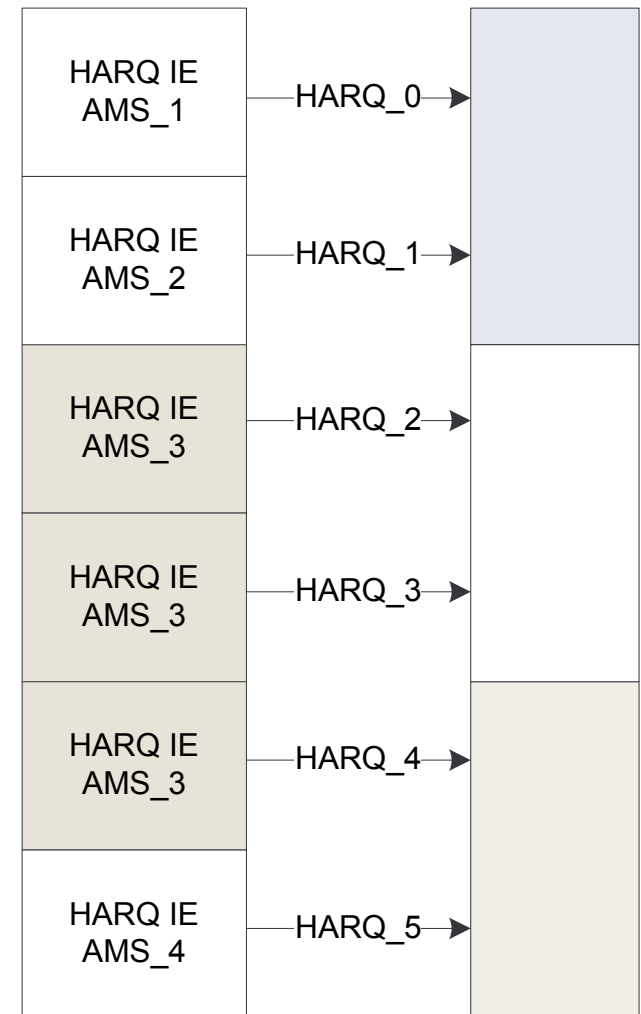
- In the UL Ctrl DG has been proposed using cumulated HARQ report, in the situation where an AMS has more than one concurrent transmissions on the DL (i.e.  $> 2$  ACIDs).
- Mainly two options are on the table in order to achieve this:
  - Cumulating 2 reports in 1 HARQ channel (1/2 HMT)
  - Cumulating 2 HARQ channels in 1 HMT.

# Assumptions

- The A-MAP carries *fixed* size IE to indicate the HARQ allocations.
- Separate mapping is used per AMS.
- An AMS identifies its HARQ channel index based on the position of its IE in the group of IEs for HARQ.
- An AMS may have concurrent transmissions on DL due to different states of each ACID.
- When concurrent DL TX occurs, the HARQ IEs are consecutive for an AMS.

# No cumulative TX

- In each HARQ channel there is a TX, irrespective if an AMS has DL transmission concurrent or not.
- *AMS\_3 has to TX 2 HARQ reports in the 2<sup>nd</sup> HMT.*



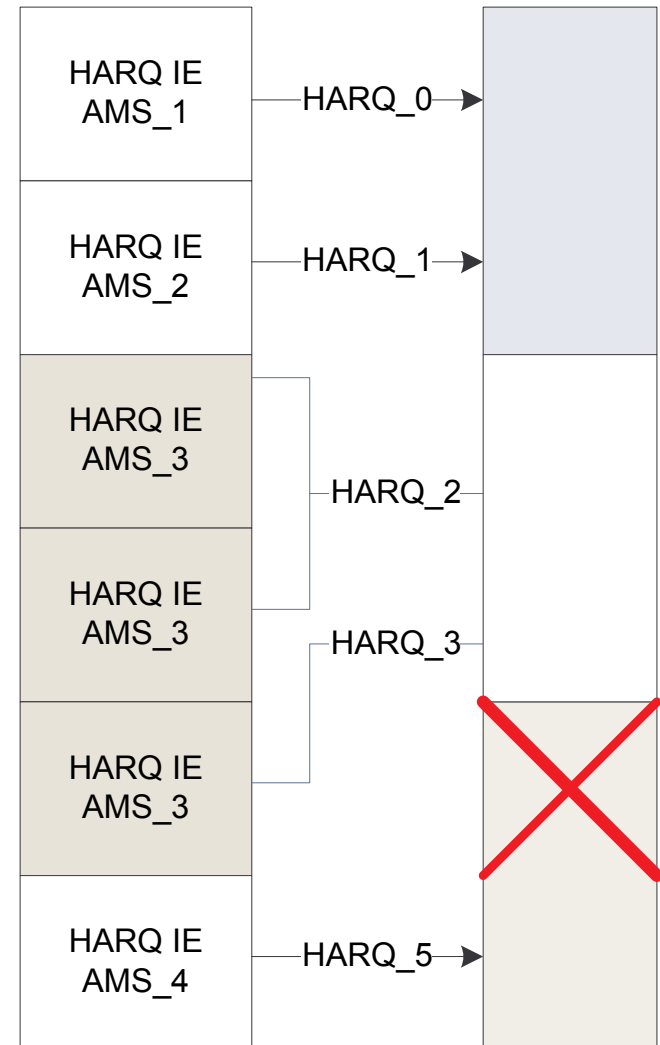
# Cumulating 2 reports in 1 HARQ channel

- One solution for this case proposes to TX 2 reports per 1 HARQ channel, being it even or odd channel in HMT.
- This creates some *gaps* in the utilization of the HMT.

<u>Sequence index</u>	<u>Orthogonal sequence</u>	<u>2-bit Feedback (even/odd channel)</u>
<u>0</u>	<u>[+2 0 +2 0]</u>	<u>ACK/ACK</u>
<u>1</u>	<u>[0 +2 0 +2]</u>	<u>ACK/NACK</u>
<u>2</u>	<u>[+1+j +1-j +1+j +1-j]</u>	<u>NACK/ACK</u>
<u>3</u>	<u>[+1-j +1+j +1-j +1+j]</u>	<u>NACK/NACK</u>
<u>4</u>	<u>[+2 0 -2 0]</u>	<u>ACK/ACK</u>
<u>5</u>	<u>[0 +2 0 -2]</u>	<u>ACK/NACK</u>
<u>6</u>	<u>[+1+j +1-j -1-j -1+j]</u>	<u>NACK/ACK</u>
<u>7</u>	<u>[+1-j +1+j -1+j -1-j]</u>	<u>NACK/NACK</u>

# Cumulating 2 reports in 1 HARQ channel

- According to the IE order, AMS\_3 cumulates the reports for 1<sup>st</sup> and 2<sup>nd</sup> IEs in the HARQ\_2; its 3<sup>rd</sup> report goes into HARQ\_3.
- AMS\_4 *does NOT know* that the previous 3 IEs are for the same AMS.
- So based on the order, AMS\_4 TX in HARQ\_5. HARQ\_4 is *NOT used*.
- HMT\_2 is overused, while HMT\_3 is underused.
- *Remapping* required at A-MAP to fully use the HMT\_3.



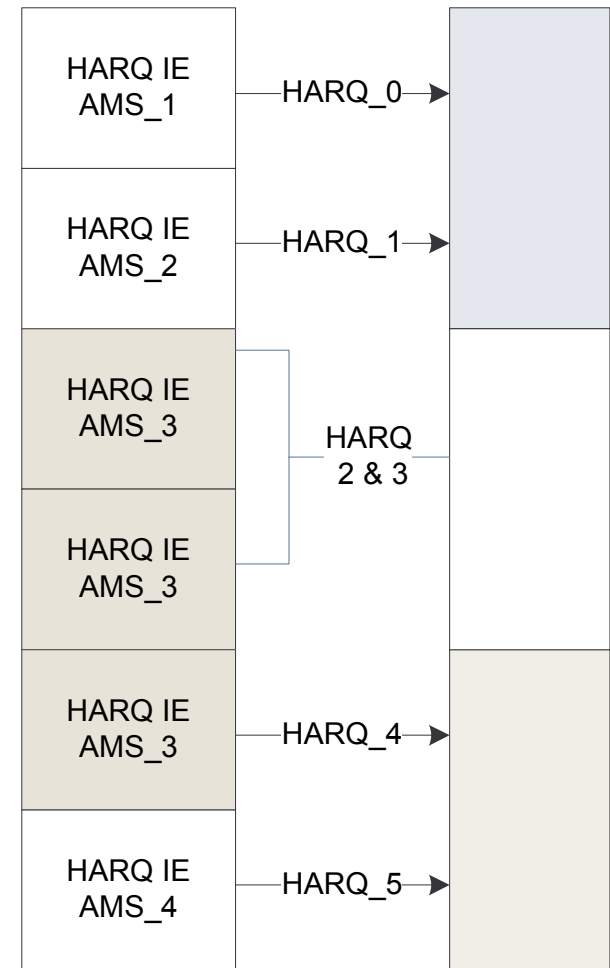
# Cumulating 2 HARQ channels in 1 report per HMT

- 2 concurrent DL TX are reported with 1 report in an HMT.

Sequence index	Orthogonal sequence	1-bit Feedback	<u>2-bit Feedback (even/Odd channel)</u>
0	[+1 +1 +1 +1]	Even numbered channel ACK	<u>ACK/ACK</u>
1	[+1 -1 +1 -1]	Even numbered channel NACK	<u>ACK/NACK</u>
2	[+1 +1 -1 -1]	Odd numbered channel ACK	<u>NACK/ACK</u>
3	[+1 -1 -1 +1]	Odd numbered channel NACK	<u>NACK/NACK</u>

# Cumulating 2 HARQ channels in 1 report per HMT

- AMS\_3 cumulates its 1<sup>st</sup> and 2<sup>nd</sup> IEs in 1 report, transmitted in the HMT\_2.
- Its report for the 3<sup>rd</sup> IE is normal, in the HMT\_3
- No under/over-utilization of the HMT.





# Conclusion

- Cumulating 2 HARQ channels in 1 report per HMT:
  - Avoids over/under-utilization of the HARQ channels.
  - No need for remapping.
- Cumulating 2 reports in 1 HARQ channel
  - Has over/under-utilization of the HARQ channels.
  - Requires remapping if in order to compact the HARQ allocation.
- *First option is desirable.*

# Proposed Text

*[In C80216m-09/0386 on p. 13 line 12, delete the sentence “The support and details...”, and insert on line 14 the following]*

When AMS has two consecutive concurrent HARQ bursts on DL that have to be reported in the same HMT, one HARQ report per HMT that carries 2-bit feedback is used for providing the decoding status of the two HARQ bursts, as defined in Table x1.

Table x1. Orthogonal sequences for 2-bit feedback UL HARQ

Sequence index	Orthogonal sequence	2-bit Feedback (per HMT channel)
0	[+1 +1 +1 +1]	ACK/ACK
1	[+1 -1 +1 -1]	ACK/NACK
2	[+1 +1 -1 -1]	NACK/ACK
3	[+1 -1 -1 +1]	NACK/NACK