Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**HARQ protocol operation in IEEE 802.16m**
Date Submitted	**2008-05-05**
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Re:	IEEE 802.16m-08/016r1: Call for Contributions on Project 802.16m System Description Document (SDD). Target topic: “HARQ”.
Abstract	This contribution proposes a high level HARQ operation
Purpose	For discussion and approval by TGm
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802.16m Basic Frame Structure

This Contribution discusses HARQ timing, ACK/NAK feedback offsets and HARQ feedback method for the basic frame structure as defined in SDD

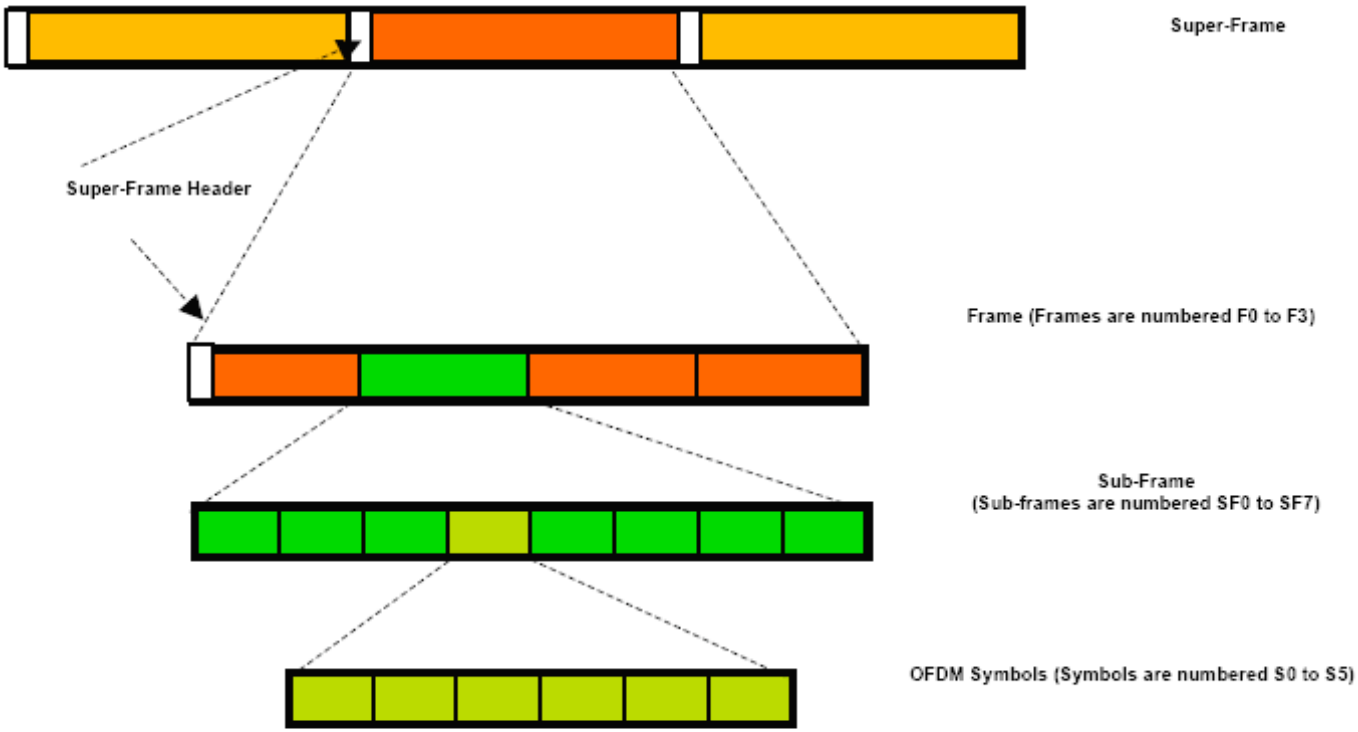
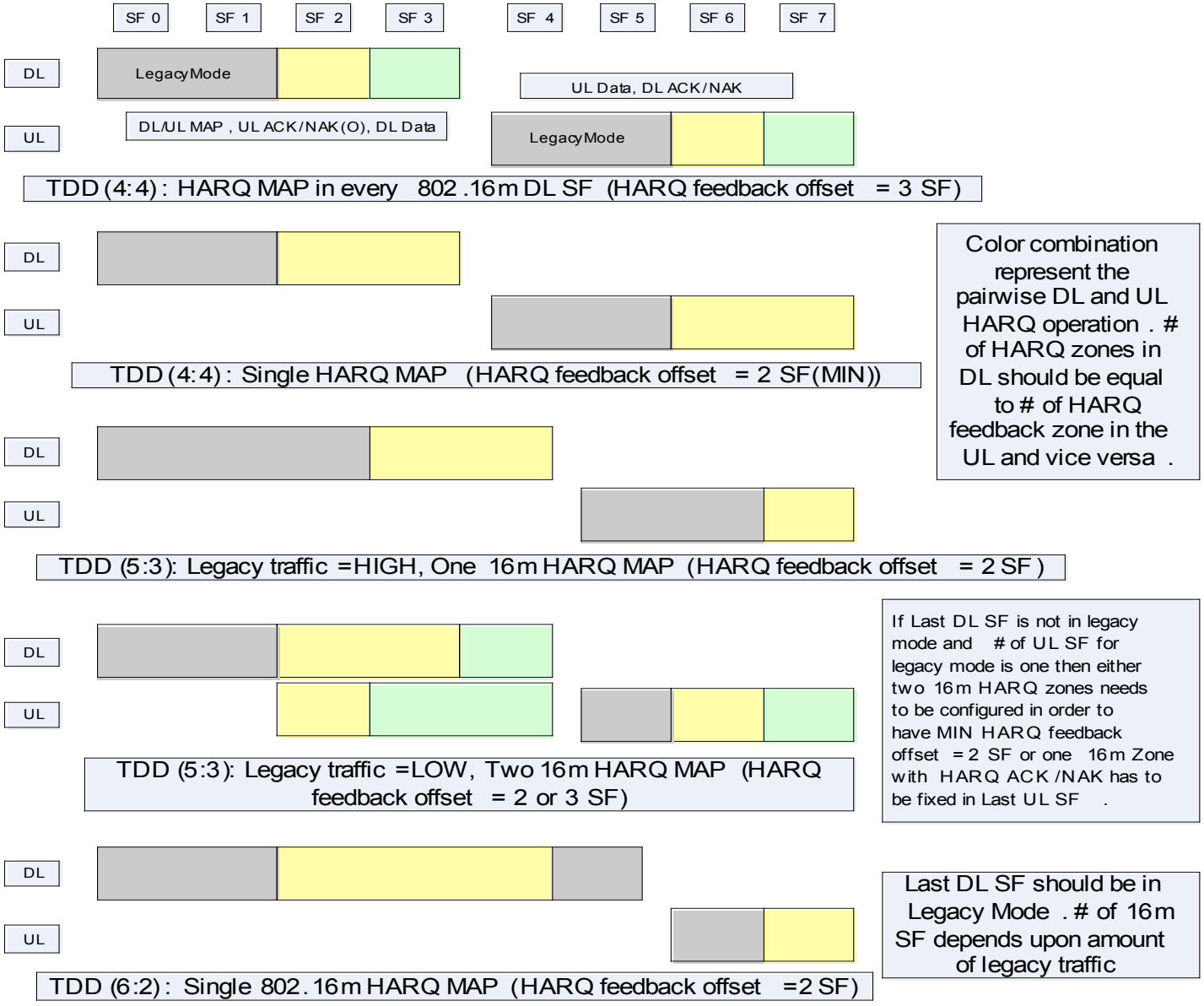
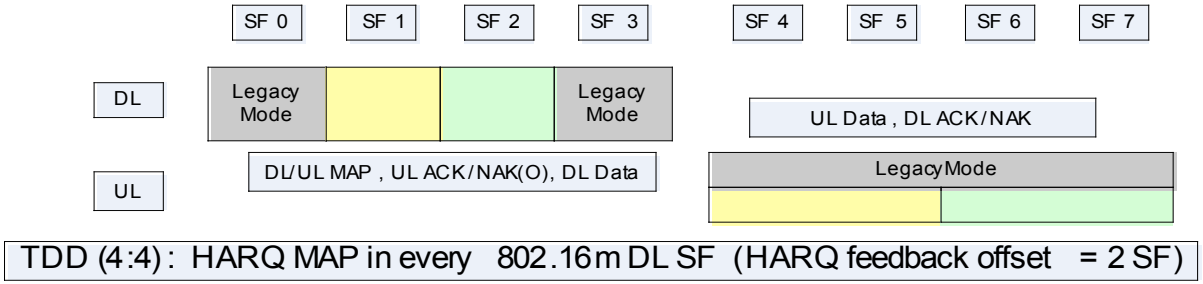


Figure 11.4-1: Basic frame structure

HARQ timing and feedback offset in 802.16m TDD with legacy support (UL – TDM)

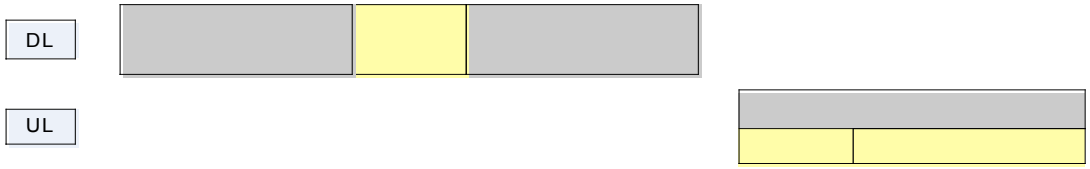


HARQ timing and feedback offset in 802.16m TDD with legacy support (UL – FDM)



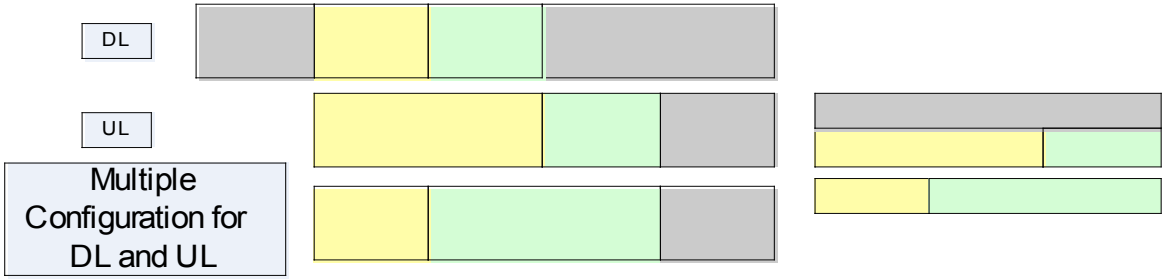
TDD (4:4) : HARQ MAP in every 802.16m DL SF (HARQ feedback offset = 2 SF)

In Order to have MIN HARQ feedback offset = 2, either insert Legacy DL SF at the end of DL frame or fix the HARQ ACK / NAK offset in the corresponding 2nd UL SF . # of 16m SF depends upon amount of legacy traffic .



TDD (5:3): Legacy traffic =HIGH, One 16m HARQ MAP (HARQ feedback offset = 2 SF)

If # of 16m DL HARQ zone is one , then last two DL SF should be in Legacy Mode . # of 16m SF depends upon amount of legacy traffic .

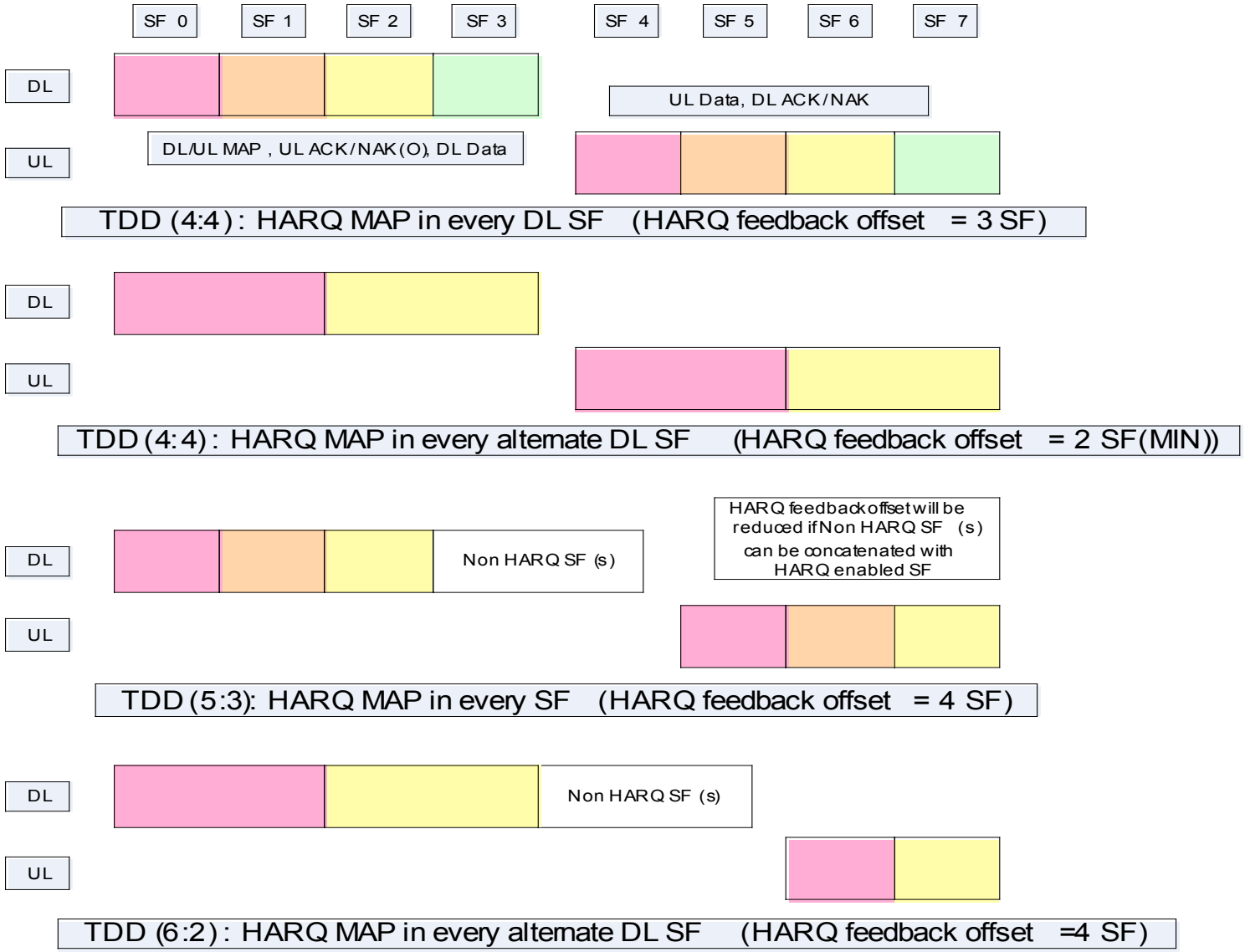


TDD (5:3): Legacy traffic =HIGH, One 16m HARQ MAP (HARQ feedback offset =2 or 3 or 4 SF)

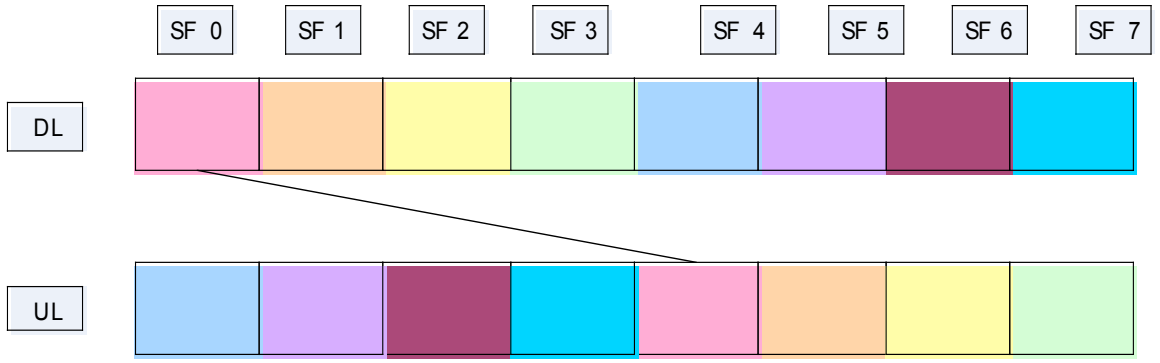
Having multiple 16m HARQ Zone provide variable HARQ feedback offset to support different capabilities of MS

TDD (6:2) : Similar configuration options as 5:3 split

HARQ Timing and feedback offset in 802.16m TDD mode



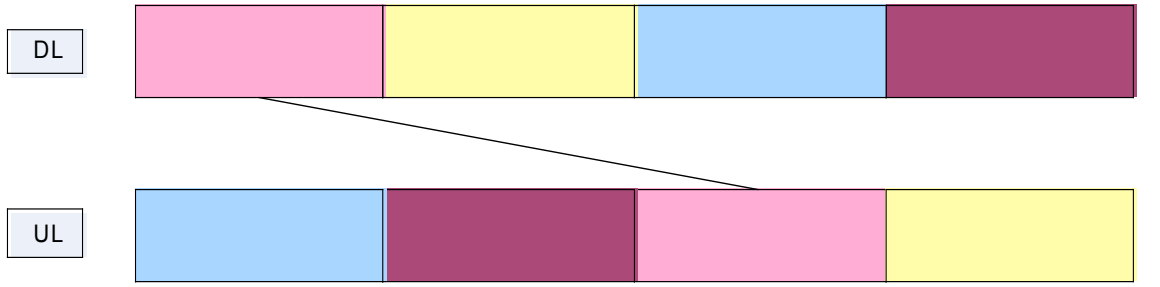
HARQ timing and feedback offset in 802.16m FDD



DL/UL MAP , UL ACK/ NAK(O), DL Data

UL Data, DL ACK/NAK

FDD : HARQ MAP in every DL SF (HARQ feedback offset = 3 SF)



Combination of these two configuration support variable HARQ feedback offset to support different MS capabilities or type of traffic .

FDD : HARQ MAP in every alternate DL SF (HARQ feedback offset = 2 SF)

H-FDD MS can be supported with above configuration

HARQ ACK Channel multiplexing Method

- HARQ ACK Channel can be TDM or CDM
- TDM (Time Division Multiplexed)
  - Scalable
    - # of HARQ ACK channels depends on # of HARQ burst
  - Resource allocation
    - Joint coding
      - MS follows the order in which HARQ allocations are transmitted.
    - Separate coding
      - MS can not find its own location based on ordering
      - Require specific ACK channel index position
- CDM (Code Division Multiplexed)
  - All users transmits orthogonal codes in the same location.
  - Not scalable
    - HARQ ACK region granularity does not depends on # of HARQ burst. Resource wastage if # of transmitted HARQ burst are less.

Conclusion

- When UL is FDM, “legacy zone” may be required at the end of DL sub-frame in order to maintain MINIMUM HARQ feedback offset.
- HARQ ACK/NAK feedback offset can be fixed or variable
- Variable HARQ ACK/NAK feedback offset can support different MS capabilities and traffic types.
- HARQ ACK/NAK feedback offset either can be indicated in the sub-frame where data is transmitted or in the sub-frame configuration information in the super-frame.
- Propose to have HARQ ACK channel as TDM.

Proposed Text to be included in SDD

11.X HARQ Protocol

11.x.1 HARQ protocol timing

[insert slides 3 to 6 here]

11.x.2 HARQ feedback offset

HARQ ACK/NAK feedback offset can be fixed or variable .Variable HARQ ACK/NAK feedback offset can support different MS capabilities and traffic types. HARQ ACK/NAK feedback offset is indicated in the sub-frame configuration information in the super-frame.

11.x.3 HARQ ACK Channel multiplexing method

HARQ ACK Channels are Time Division Multiplexed.