PHY aspects in MMR-enabled networks

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Purpose:

Identify PHY issues in 802.16e MS behavior related to operation in MMR-enabled deployments

PHY aspects in MMR-enabled networks

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Topics

- We identify several issues which are related to MS PHY functionality and may affect backwards compatibility in the future, as MMR-enabled networks are deployed
  - Different start-of frame times for BS and RS transmissions
  - Channel estimation for relay transmissions
- Other issues
  - Delay compensation for relay transmissions

Different start-of frame times

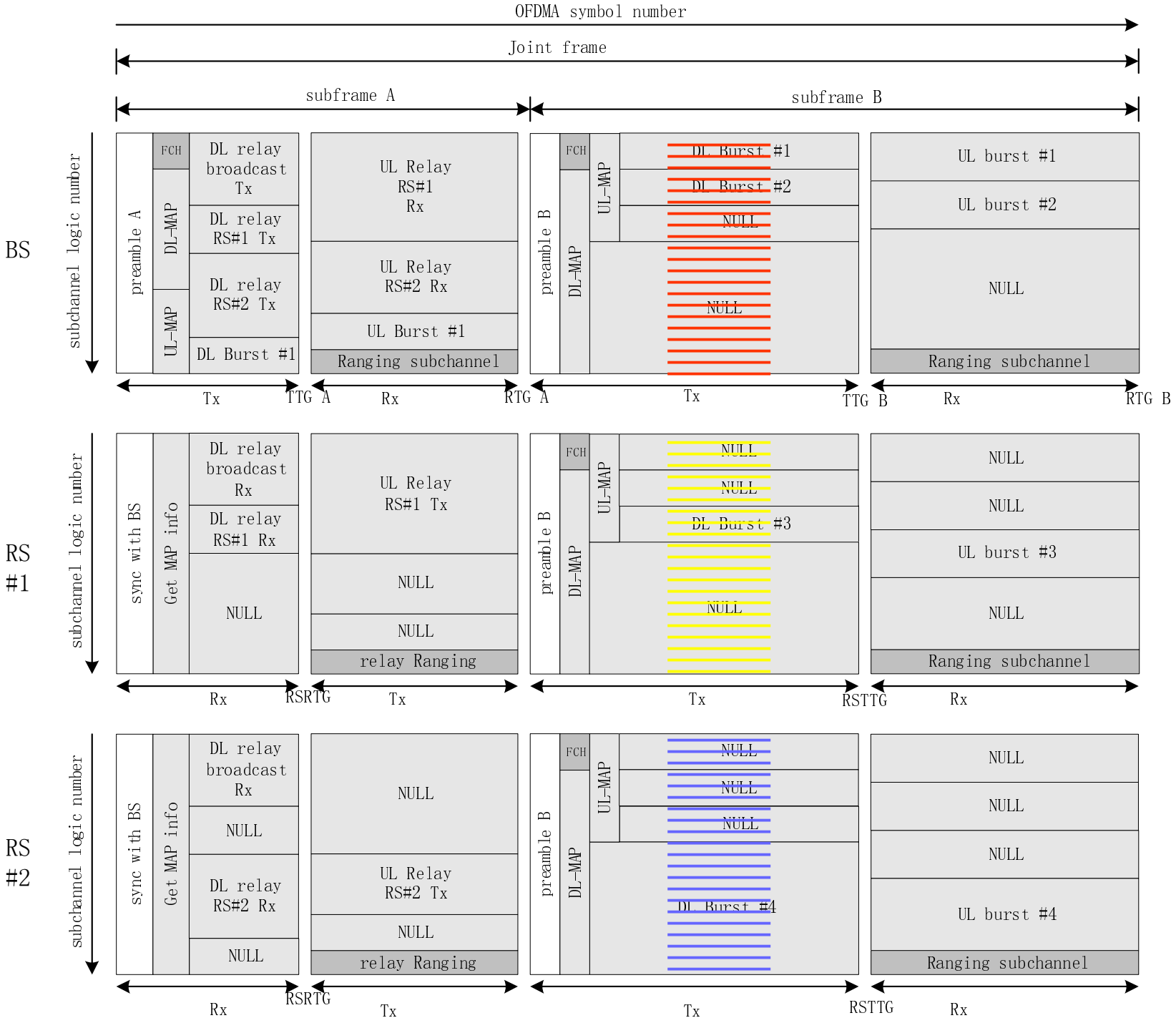
- The transmissions of BS and of RS each behave like valid DL frames
- However, they are staggered by a fraction of a frame.
- As MS traverses the cell, it encounters BS and RSs which have their frame staggered – a situation uncommon in 802.16e TDD deployment
- MS needs to be able to operate in TDD networks in which the start of frame times are staggered.

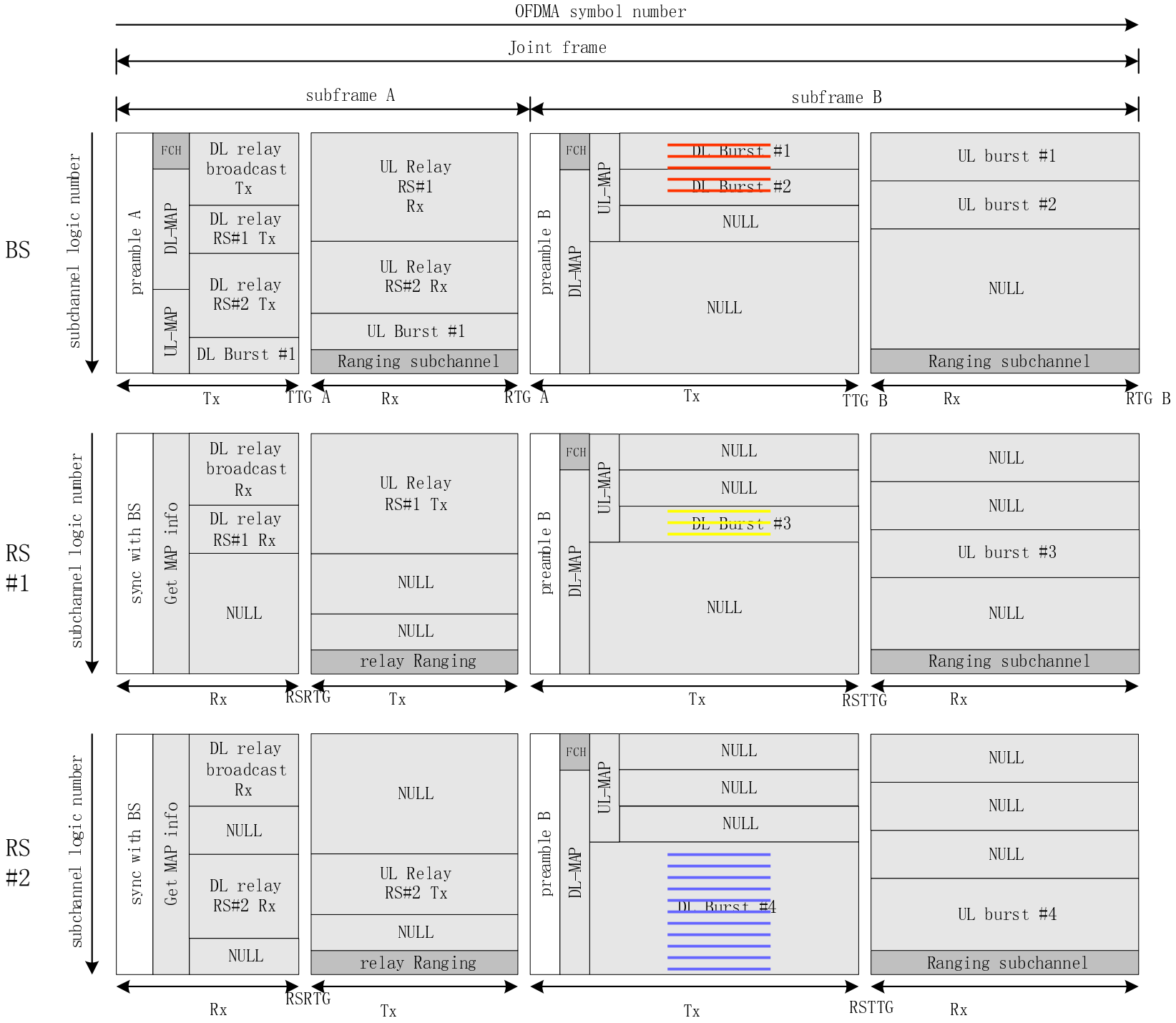
Channel training in relay Tx subframe

- Assume the deployment scheme proposed in C802.16mmr-05/004 [1]
  - Others (e.g. [2]) are similar in that they propose a subframe or zone for relay transmissions.
- Different relays transmit in different subchannels

The pilot issue

- Assume that each relay transmits data in part of the subchannels
  - Each relay uses different subchannels
- The data subcarriers do not collide
- The pilots do collide
  - MS estimates a sum of channels
  - Mismatch between channel estimate and true data channel
- Unless - dedicated pilots are used
  - See graphic illustration in next 2 slides
- Dedicated channels are essential for MMR reception


OFDMA symbol number
Joint frame
subframe A
subframe B
BS
RS #1
RS #2
subchannel logic number
preamble A
FCH
DL-MAP
UL-MAP
DL relay broadcast Tx
DL relay RS#1 Tx
DL relay RS#2 Tx
DL Burst #1
UL Relay RS#1 Rx
UL Relay RS#2 Rx
UL Burst #1
Ranging subchannel
preamble B
DL Burst #2
NULL
UL burst #1
UL burst #2
UL burst #3
UL burst #4
Tx
TTG A
Rx
RTG A
TTG B
RTG B
sync with BS
Get MAP info
DL relay broadcast Rx
DL relay RS#1 Rx
UL Relay RS#1 Tx
relay Ranging
DL Burst #3
DL relay RS#2 Rx
UL Relay RS#2 Tx
DL Burst #4
RSRTG
RSTTG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UL Relay RS#1 Tx
relay Ranging
DL Burst #3
UL burst #3
RSRTG
RSTTG
RS #2
DL relay RS#2 Rx
UL Relay RS#2 Tx
DL Burst #4
UL burst #4

Tx delay compensation for relays

- The users hear a combination of signals from relays and from the base station
  - BS can transmit in parallel to RSs
  - BS is higher power than RS
- We want to avoid large relative delay between the signals of BS and RS, as received by MS
- We recommend that RS transmit their DL at the same time they receive the DL from the BS, without RTD compensation

Summary

- It is important that the profiles according to which the MS devices are built will not break the future MMR functionality
  - Support of dedicated pilots
  - Proper behavior with staggered frames in TDD

- Can be handled either via “standard’s interpretation” process or via profiles.

References

[1] IEEE C80216mmr-05/004, Deng Shiqiang and John Lee, Recommendation on Design 802.16 TGe PMP mode backward compatible Frame Structure

[2] IEEE C80216mmr-05/011, Wen Tong et al., Duplex and Multiplex Configurations for OFDMA In-Band Relay.