

# PHY Link Frame adjustments

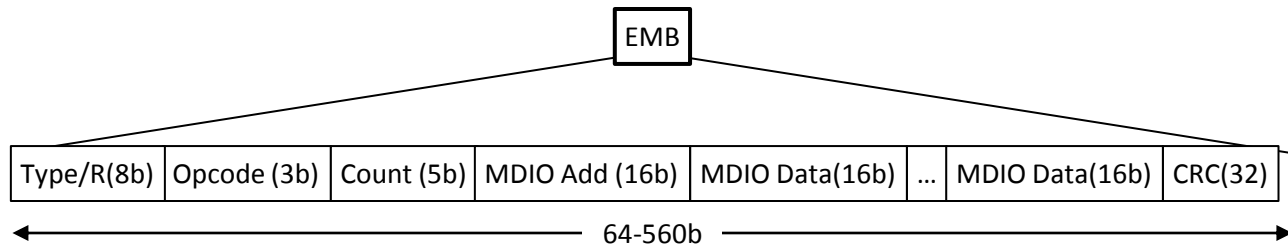
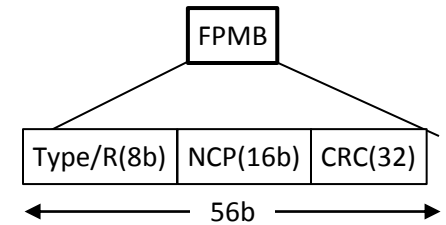
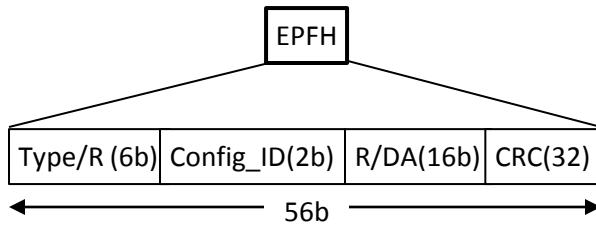
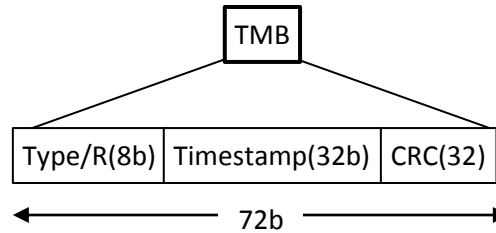
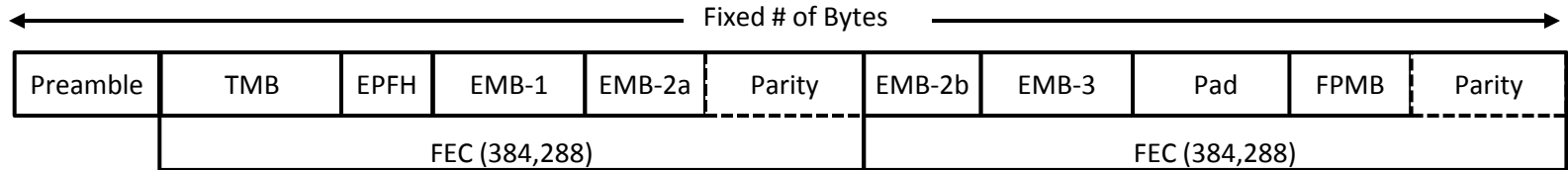
to align with US Superframe

Authors:

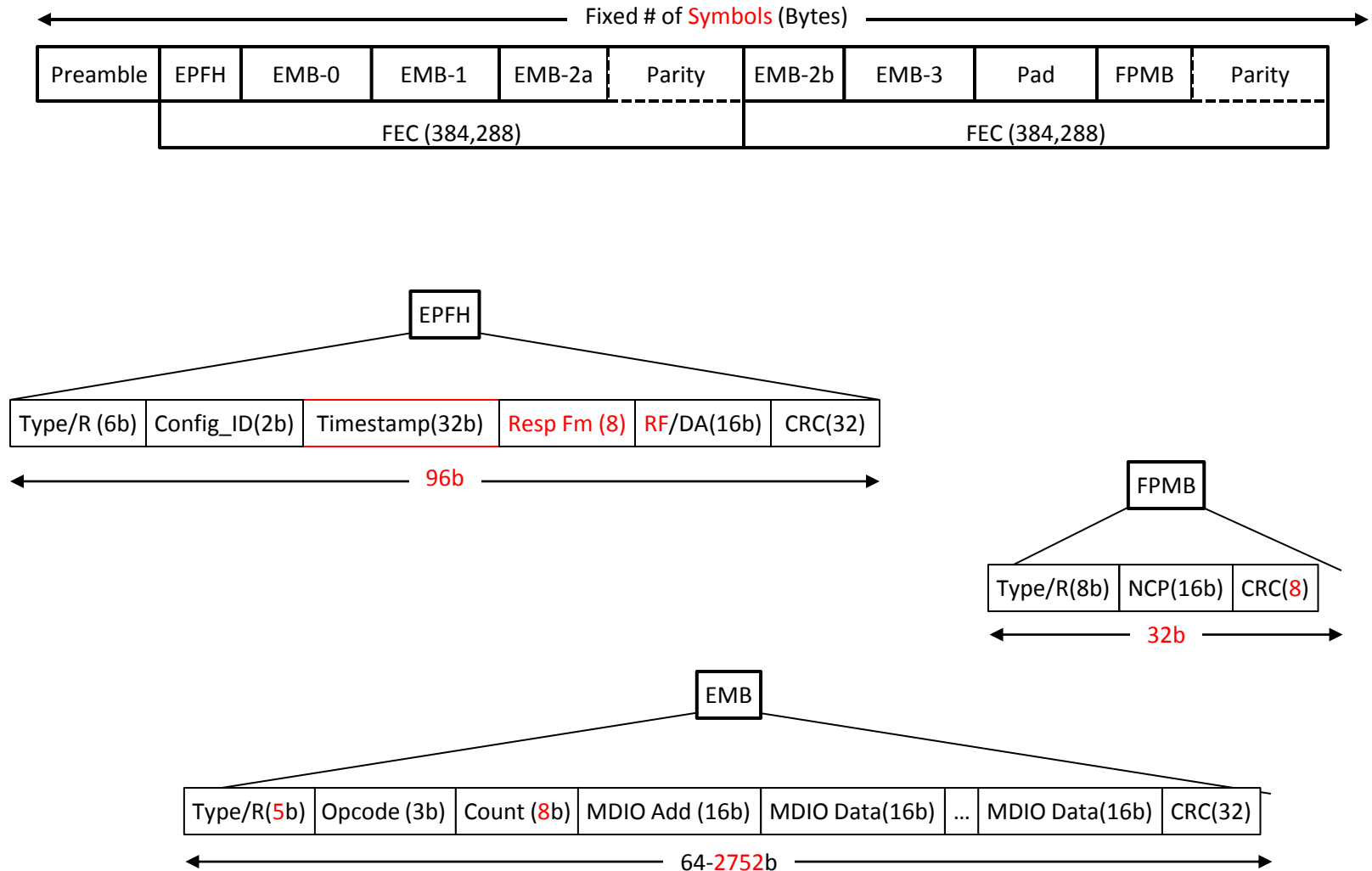
Duane Remein; Huawei

Avi Kliger; Broadcom

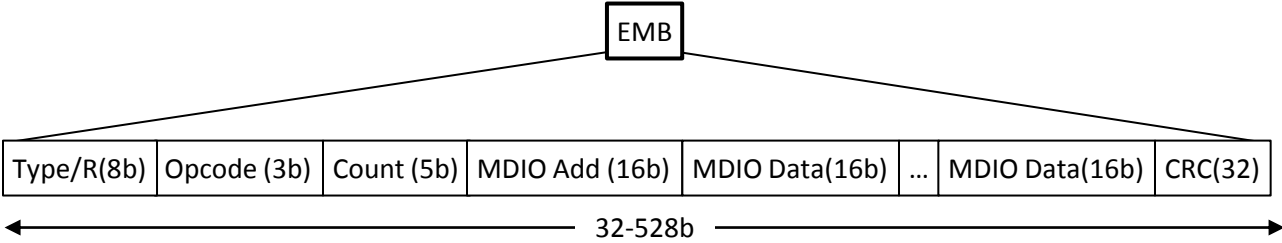
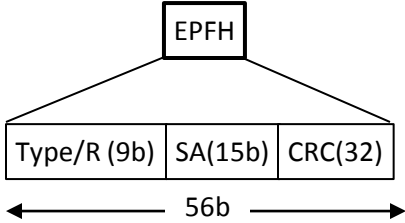
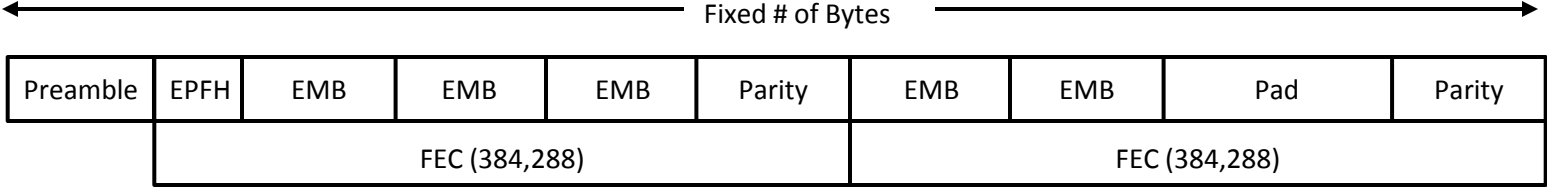
# Current Downstream Frame



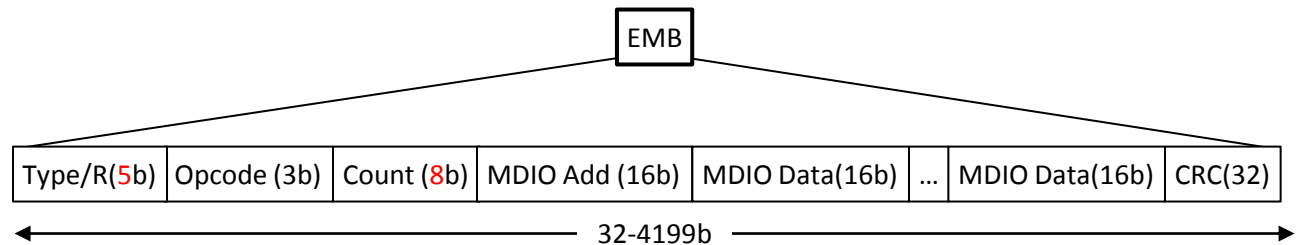
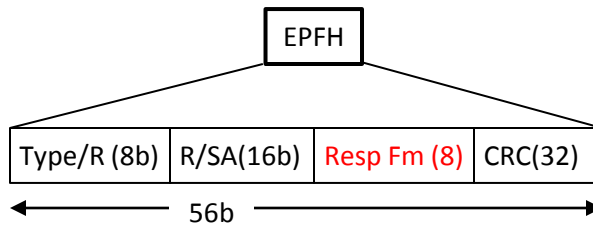
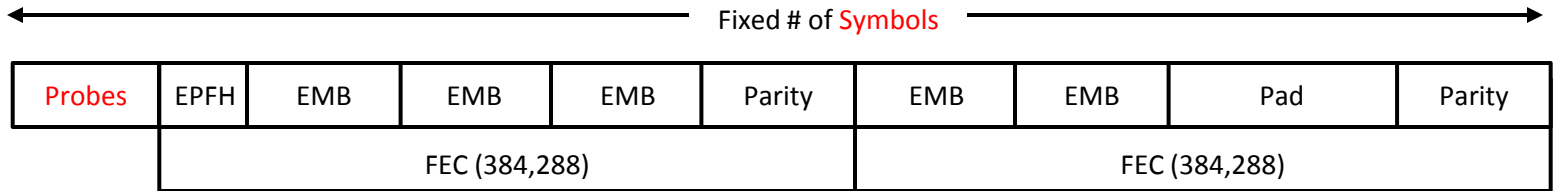
# Proposed Downstream Frame



# Current Upstream Frame



# Proposed Upstream Frame



# New PHY Link Field

- PHY Response Frame ID (DS)
  - 8 bits
  - Identifies the OFDMA Frame (i.e., RB column within a Superframe) in which the target CNU is to begin an US PHY Link response (PHY Link or Fine Ranging)
- Response Flag (DS)
  - 1 bit
  - Indicates to the CNU the type of response expected (PHY Link or Fine Ranging)
  - Note PHY Discovery window starts based on a specific DS Message which includes a the timestamp at which to start the window and a duration, in OFDMA Frames ([see 102.4.1.3](#))
  - Response Precedence
    - 1st PHY Discovery Window
    - 2nd Fine Ranging Response
    - 3rd US PHY Link

# PHY Link

## Downstream Frame

- Fixed Duration
  - 8 Preamble symbols
  - 120 PHY Link data symbols
- EMB capacity fixed by frame size & QAM-16 bit loading
  - ≤ 168 registers
  - Constraints:
    - Cannot cross a frame boundary

## Upstream Superframe (SF)

- Configured Duration
  - 2-4 Probe symbols
  - 16-48 Resource Block columns
  - Constraints:
    - Min duration; 2.7625 ms  
 $= 2 * \min(D_{Su}) + 16 * \min(D_{Su}) * \min(D_{RB})$   
 $= 2 * (20 + 1.25) + 16 * (21.25) * 8$
    - Max duration; 9.1675 ms  
 $= 2 * \min(D_{Su}) + (48 * \min(D_{Su}) * \min(D_{RB}))$   
 $= 2 * (20 + 3.75) + 48 * (23.75) * 8$  (min RB)  
 $= 2 * (23.75) + 32 * (23.75) * 12$  (mid RB)  
 $= 2 * (23.75) + 24 * (23.75) * 16$  (max RB)
    - must be > 5 \* RTT
    - conforms to RB boundaries
- EMB capacity determined by message Count field, Superframe size & bit loading
  - ≤ 255 registers (Cnt)
  - Constraints
    - May cross a SF boundary

# Existing PHY Instruction response

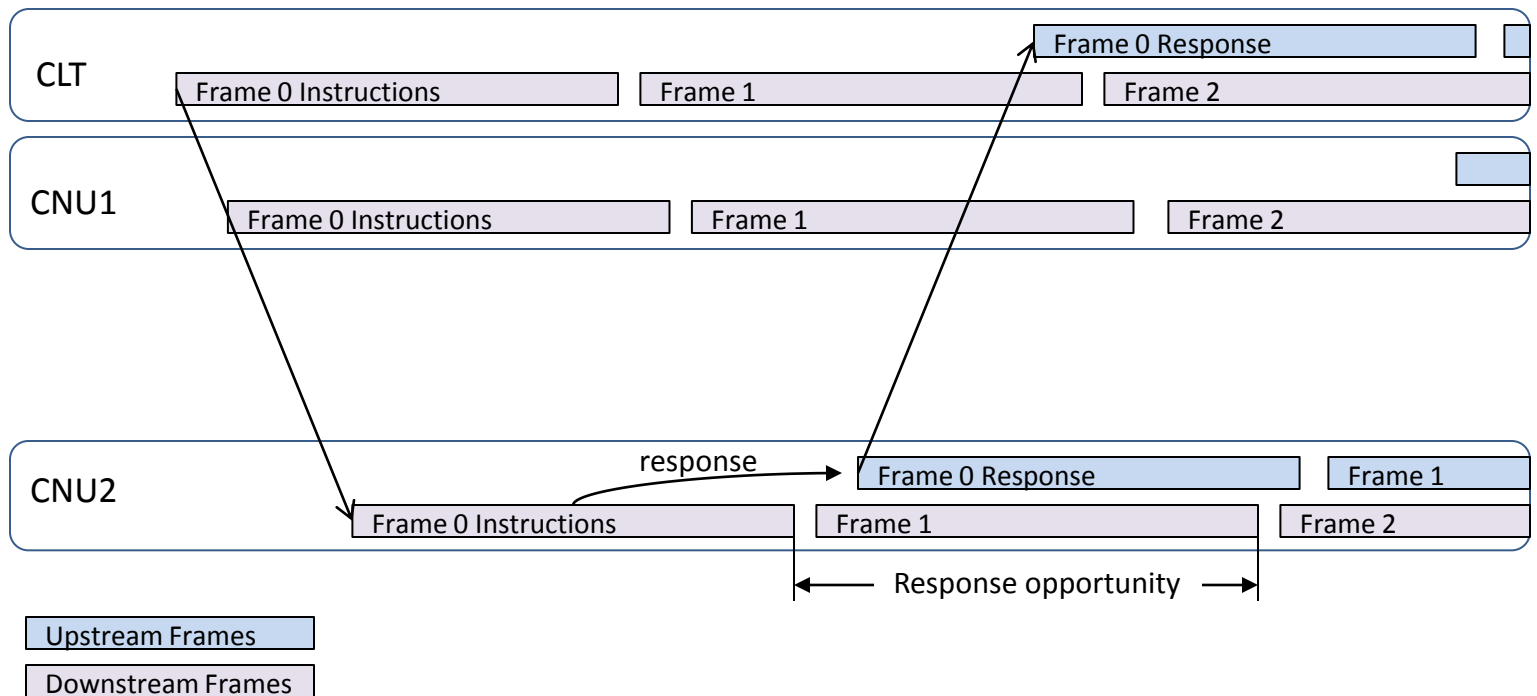
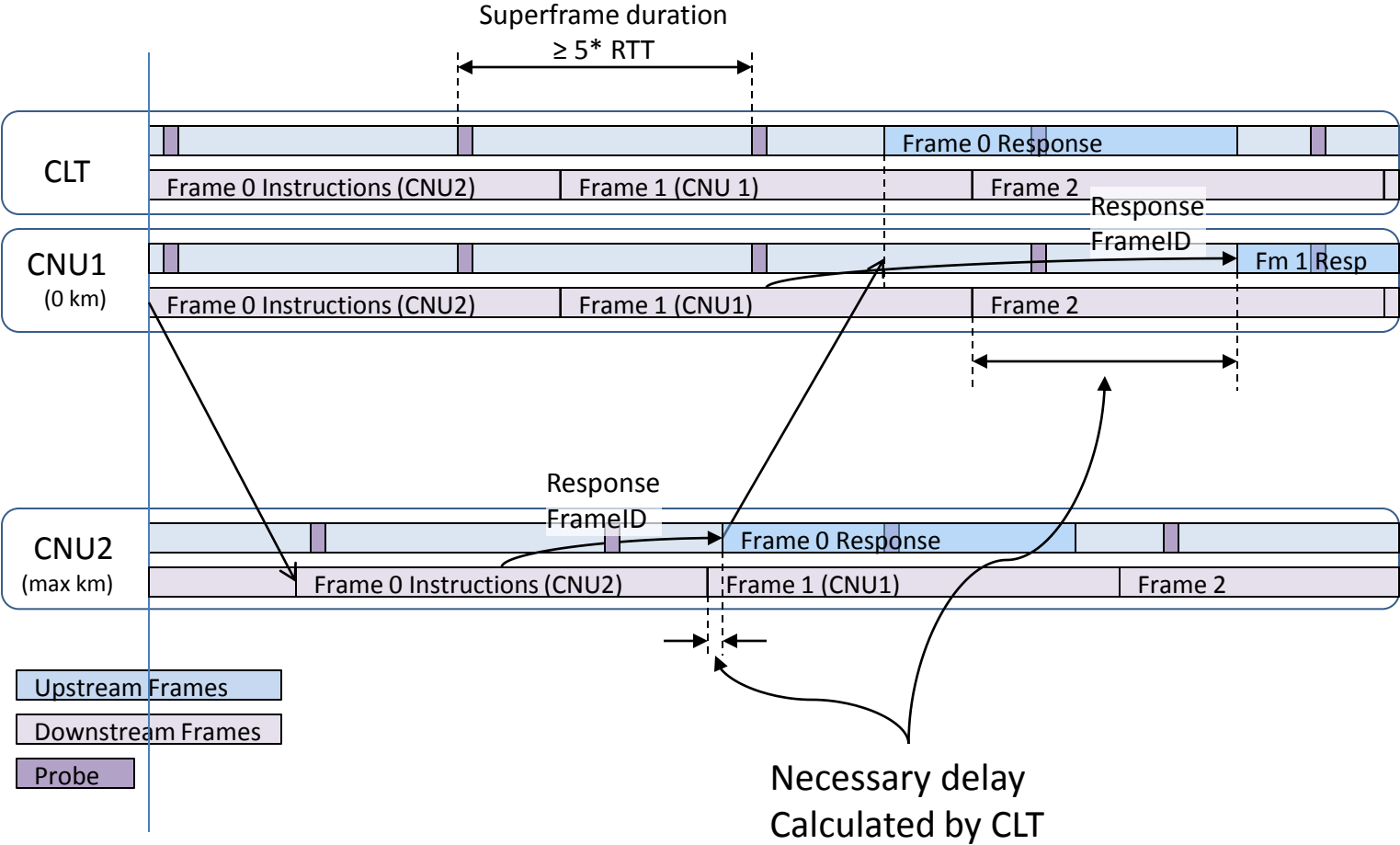


Figure 102–3—PHY Instruction response



# Proposed PHY Instruction response



Revised Figure 102-3—PHY Instruction response

# US PHY Link

- Consists of a integer number of normal RB's
  - Number message dependent
  - Spectrum fixed at TBD (400 kHz?)
  - Starting subcarrier fixed by provisioning
- Bit Loading not necessarily restricted to 16-QAM
- aligns to same boundary and placement conditions as RBs
- Precedent
  - 1<sup>st</sup> PHY Discovery Window
  - 2<sup>nd</sup> Fine Ranging
  - 3<sup>rd</sup> US PHY Link transmission
- Signaling (PHY Link, Fine Ranging & PHY Discovery Window) limited during SFs containing these signals so MAC Data rate in a SF is constant)

# Some definitions

- US SC Types

**Excluded SC:** a SC in which there are no transmissions allowed

**Unallocated SC:** a SC which may be used for Probe symbols but is not allocated to any Resource Block

**Allocated SC:** a SC which is assigned to a RB to be used for US data transmission (either MAC or PHY Link)

- Resource Element

- 1 allocated Sub-carrier for 1 symbol

- Resource Blocks

- Contiguous spectrum of 1, 4, or 8 SC's

- No included Unallocated SC's

- No included Excluded SC's

- Duration of RB

- 8, 12 or 16 symbols

# Bring-up process

- Establish DS PHY Link
  - CNU synchronizes (frequency & time) to DS signal
  - gathers US OFDMA Channel Descriptor & Profile Descriptor
- PHY Discovery
  - Initial ranging, roughly align CNU to US OFDMA timing/frame using timing offset and set tx power
  - Assign CNU\_ID
- Fine Ranging
  - OFDMA fine tuning using timing offset
    - OFDMA Symbol alignment
    - Superframe alignment
- Fine Ranging (cont)
  - Verify CNU\_ID set
  - CLT may iterative Fine Ranging until CNU is properly synchronized to the US network timing
  - Number of iterations are not defined in the spec and are implementation dependent
- Establish US PHY Link
  - Channel/Profile descriptor verification & update
- Probe
  - Channel Estimation
  - Precision power setting
  - Precision timing setting
  - Set Pre-equalizer Coef for all subcarriers

Questions?

Comments?

**THANK YOU**

## Motion #

Adopt upstream and downstream PHY Link frame changes described in remein\_3bn\_0x\_0514.pdf Slides 3, 5-7, & 9-11 and incorporate in the draft.

Moved: Duane Remein

Second:

For:

Against:

Abstain:

Motion is Technical ( $\geq 75\%$ ) Procedural ( $> 50\%$ )

Motion Passed/Failed