

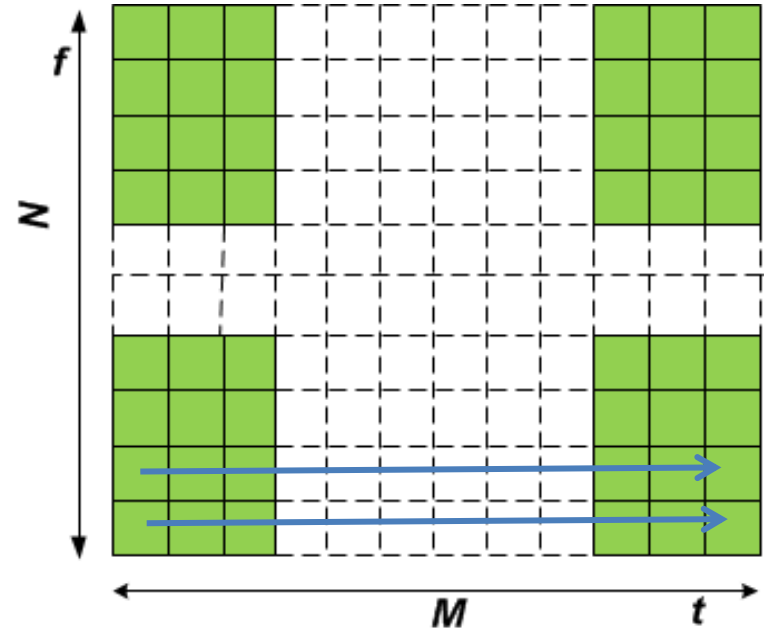
EPoC Upstream Pilot Proposal

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Resource Block

- Resource block (RB)
 - Allocation unit comprised of N contiguous sub-carriers and M OFDMA symbols
 - $N * M$ Resource Elements (RE)
- Each RB can only be allocated to a single CNU
- RBs are mapped to fixed frequencies in the upstream channel
- One grant may include one or more RBs.



Data is written horizontally subcarrier by subcarrier to allow time interleaving of codewords

Resource Elements

- Each element in the RB is called a Resource Element (RE)

- A constellation symbol
- A RB contains $M \times N$ REs

- Resource Elements can be of type

- Data (D)
- Pilots (P)
 - Used for frequency acquisition and channel estimation
 - CE interpolation can be used to avoid pilots on every subcarrier
- Additional Edge pilot (Pe)
 - Edged subcarriers in a transmission burst have pilots to avoid extrapolation
 - These pilots could be part of the marker since markers are known symbols after detection.
- Marker (M)
 - Used as delimiters of transmission bursts
 - Start Marker – identify the start of a burst and corresponding profile
 - End Marker – identify the end of the burst

Pe	M	M	M	Pe	M	M	M	Pe
D	D	D	D	D	D	D	D	D
D	D	D	D	D	D	D	D	D
P	D	D	D	P	D	D	D	P
D	D	D	D	D	D	D	D	D
D	D	D	D	D	D	D	D	D
D	D	D	D	D	D	D	D	D
P	M	M	M	P	M	M	M	P

Resource Block Size Considerations

- Number of symbols (M)
 - Equals to the OFDMA Frame size which is determined by the Upstream Interleaver depth
 - Number of symbols should be configured by the CLT according to the usage of Interleaver and its size
- Number of subcarriers (N)
 - Is determined by the granularity
 - Large number of subcarriers provides better frequency tracking performance and lower pilots overhead
 - Smaller number of subcarrier has smaller granularity
- Number of pilots on pilot subcarriers
 - Large provides better tracking and channel estimation
 - Smaller provides lower overhead
 - Selection of pilots is very much dependent on the plant conditions

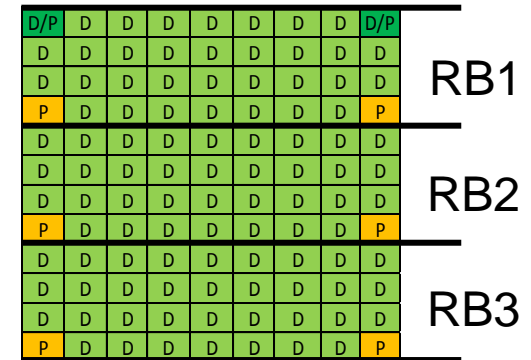
RB size and Pilot Spacing

- Configurable number of symbols
 - {1 to 17} with 20 uSec symbols
 - 17 corresponds to 400 uSec interleaver depth
 - {1 to 9} with 40 uSec symbols
 - 9 corresponds to 400 uSec interleaver depth
- Configurable number of subcarriers
 - {1, 2,3, 4,5, 8,9, 16,17, 32,33}
- Configurable Pilots spacing (P_s)
 - {1,2,4,8,16,32}
- Pilot repetition (P_r) in symbols
 - {2 or 3}

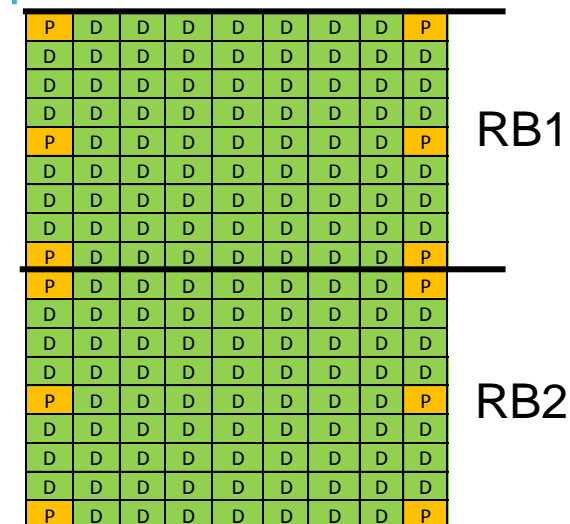
RB Size and Pilots Structure

- Two optional pilot structures can be used
 - Option 1
 - RBs do not necessarily contain edge pilots
 - Pilots form a uniform grid when multiple RBs are appended
 - Use of the markers or additional edge pilots to avoid extrapolation of the channel at the edges of a grant
 - Option 2
 - Self contained RBs
 - Pilots at the first and last subcarriers Number of RB
- Use at least two symbols with pilots to allow more accurate frequency acquisition
 - A third symbol can provide better robustness to burst noise
- The pilot spacing could be profile specific

Option 1

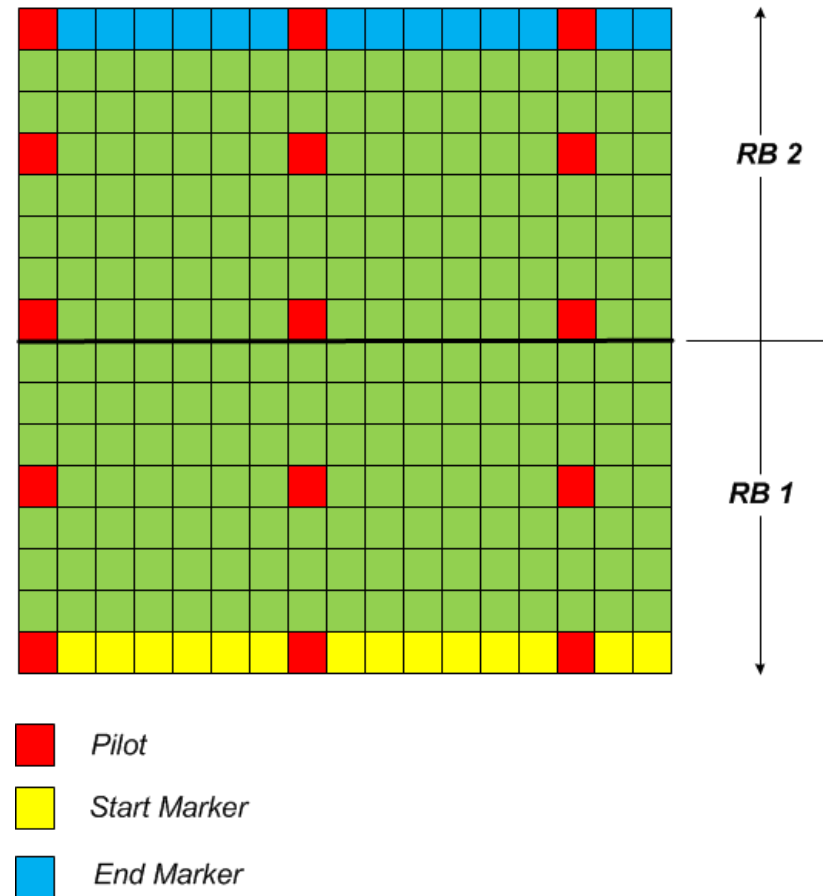


Option 2



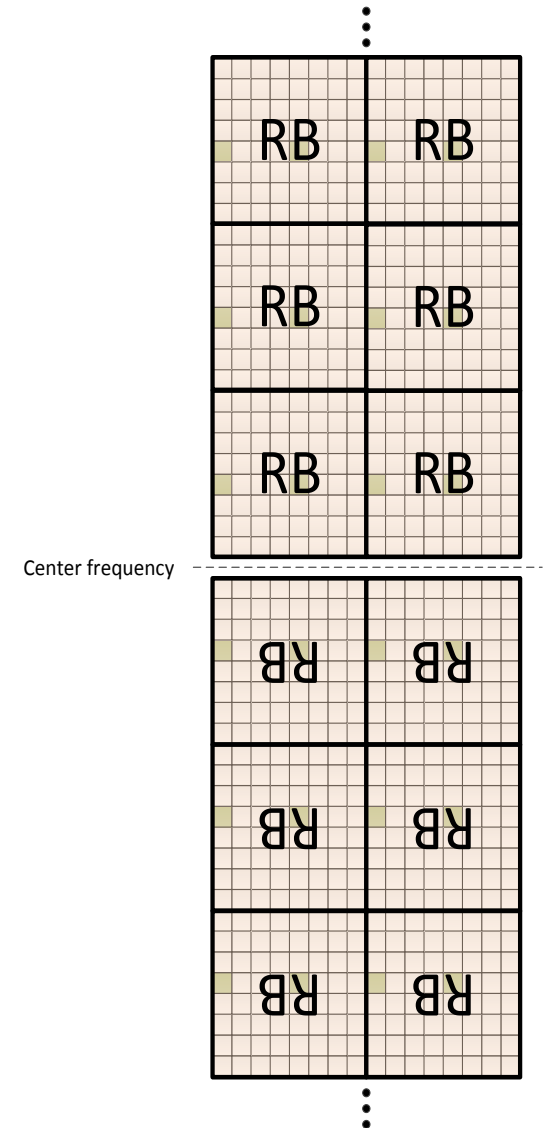
Burst Markers

- Start and End Markers indicate the boundaries and profile of a transmission burst
- The markers are detected incoherently, without prior knowledge of the transmission profile
- Number of profile is TBD
- Markers are contained in the first and last RB and do not overwrite pilots
- Marker structure is TBD



RB Placement For TDD Top split

- RBs are placed symmetrically around the center frequency:
One RB covers subcarriers $\pm Nn+1$ to $\pm N(n+1)$ where n is the RB index counted from the center frequency



EPoC Upstream Pilots

THANK YOU