Update on
EPoC Upstream Pilot Proposal

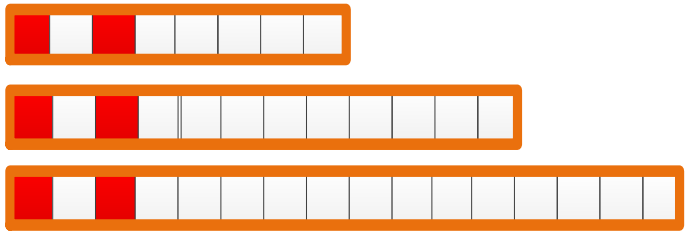
Resource Block Rules

- RBs are fixed in frequency
- Comprised of a single subcarrier and 8,12,16 symbols
- All RBs have the same number of symbols . Changing the number of symbols requires restart
- RBs are configured with a RB type and bit loading
  - RB type determines the pilot pattern
  - RBs may have different pilot patterns and bit loading
- A single grant (TX burst) may comprised of a series of RBs of different types and different pilot patterns
- At least eight RBs are required for a single grant
- Exclusions
  - A minimum of eight contiguous used subcarriers are required between exclusion bands and between exclusions and the first or the last subcarriers of the OFDMA frame ~~boundaries~~ ~~is eight subcarriers~~
    - Word more clearly. Minimum occupied? What are frame boundaries? Between the exclusion band and the frame boundary? AK> See corrections above and below – do they answer the questions?
  - RBs must not be allocated to subcarriers between exclusions that are less than 8 subcarriers to the subcarriers between exclusions If the gap in frequency between these exclusion bands is less than 8 subcarriers wide ~~than eight RBs are not allocated~~
  - RBs must not be allocated to subcarriers between an exclusion band and the first subcarrier of the OFDMA spectrum if there are less than 8 subcarriers between them
  - RBs must not be allocated to subcarriers between an exclusion band and the last subcarrier of the OFDMA spectrum if there are less than 8 subcarriers between them

RBs and Pilot Patterns

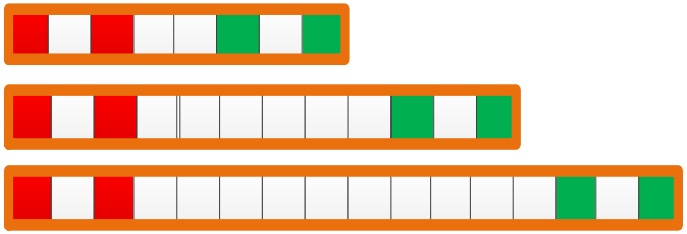
- Three types of RBs
  - Type 0 – RB does not include pilots
  - Type 1 – RB includes two pilots
  - Type 2 - RB includes two pilots and two low-density data subcarriers ("LD pilots")
    - LD density is four bits lower than data density or QPSK, the largest of the two.

    How low density is LD? 1, 2 bits less? State clearly.
- Figure below depicts RB type 1 and Type 2 with 8,12 and 16 symbols



RB Type 1

Two pilots on the first and third symbols



RB Type 2

Two pilots on the first and third symbols and two LD pilots on last and second to last symbols

Pilots Rules

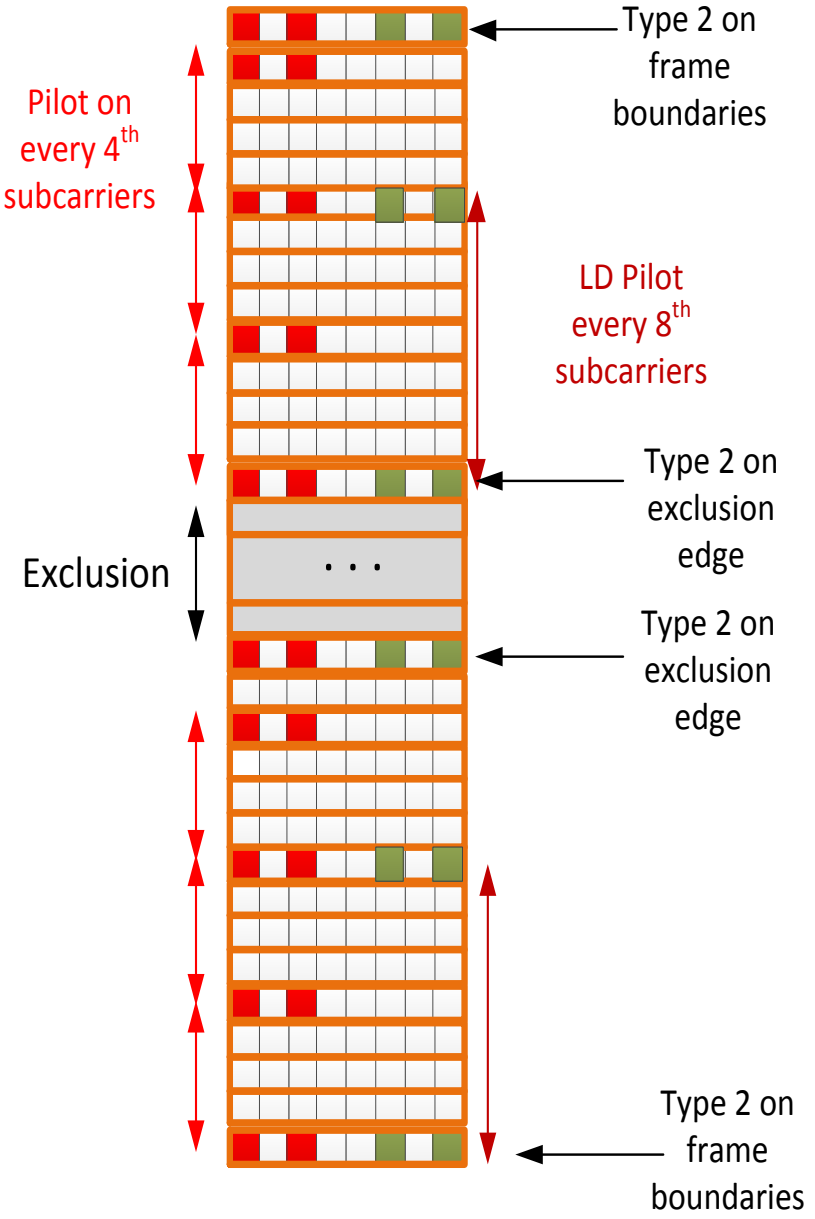
- Configurable pilot locations
  - Pilot patterns are configurable during network initialization and constant over the frequency grid
    - Configurable in what way? (e.g. every subcarrier can have a different type?)
    - What are the bounds on configurability?

    AK> Could be a good idea to have the bounds, but it will complicate the specifications. We can decide once this concept is acceptable. Note that pilot structure is upto the CLT
- Pilots on Boundaries
  - Type-2 RBs are always used on OFDMA frame boundaries and exclusions edge subcarriers
    - Is not "Frame Boundary" treated the same as an exclusion edge? AK> Didn't understand the question
- Start of a transmission burst
  - First RB in a transmission burst (grant) is always of type #2
    - How do these relate to burst marker placement? AK> There is a proposal for BM placement including pilots
- End of a transmission burst
  - Last RB in a transmission burst (grant) is always of type #2

Pilot Rules – Examples (1)

- Pilot grid example:
  - Pilots repeat every four subcarriers
  - LD pilots repeat every eight subcarriers
- This pilot pattern is configured during initialization and is fixed in frequency
- Can you mix RB lengths from RB to next RB? Make clear. Duane: right now, one value for time interleaver (RB) Ed: changing interleaver would require restart. Mark: side need to have an enumerated list for what requires or does not require a restart.

AK> I agree with the discussion. All RBs have the same length. Changing length requires restart (added to the first slide)



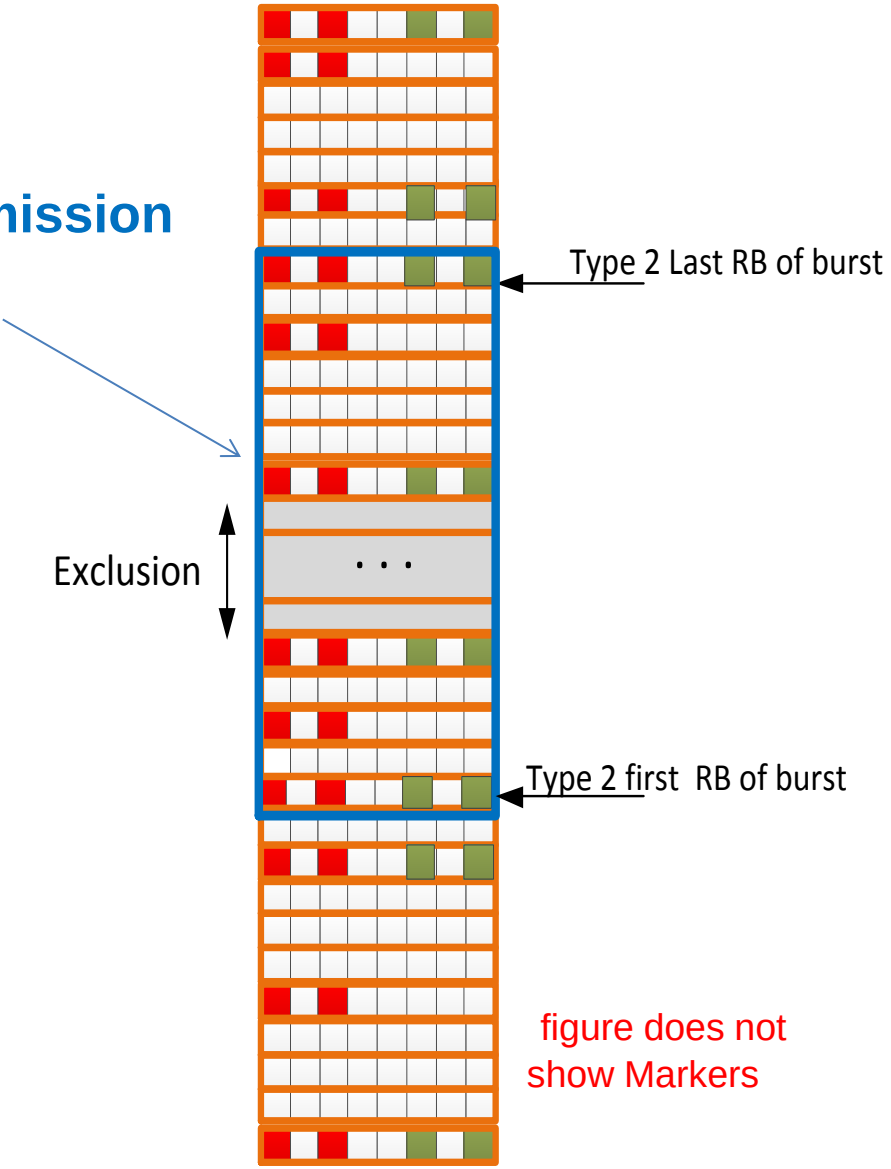
Pilot Rules – Examples (2)

- A transmission burst starts and ends with a Type 2 RB
- These pilots are added over the fixed pilot pattern
- When a start or end “lands” on a Type 1, does it then become a Type 2? How do markers align? and with LD use?

AK> There is a proposal on how BMs are mapped. See three added slides from Leo’s presentation in Norfolk

- Why do start/stop pilots necessary? Make part of marker definition (floating) and not part of pilot definition (fixed)?

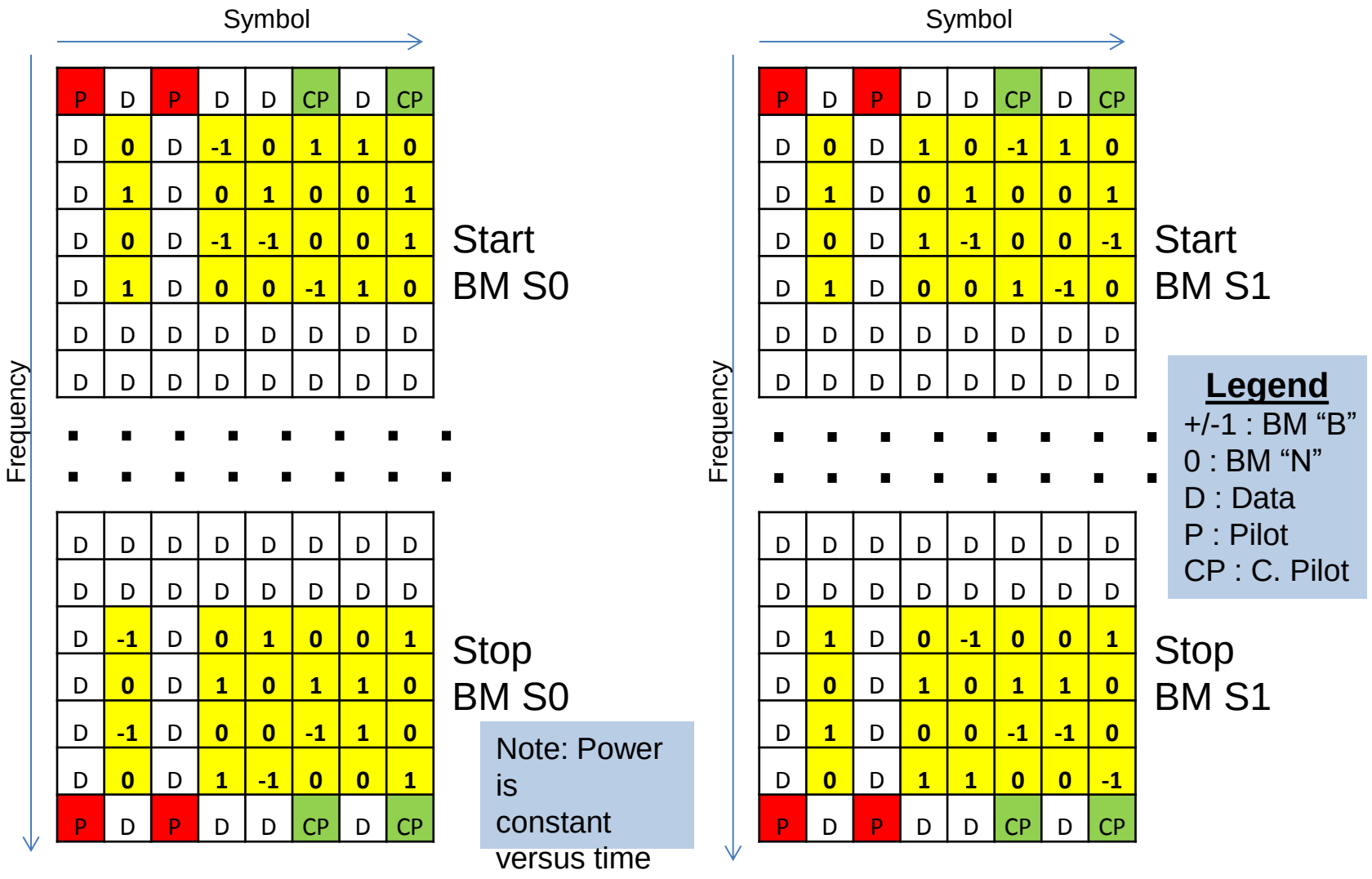
AK> You may consider these pilots as part of the BMs. See contribution on the BMs structure and how it is combined with the pilots



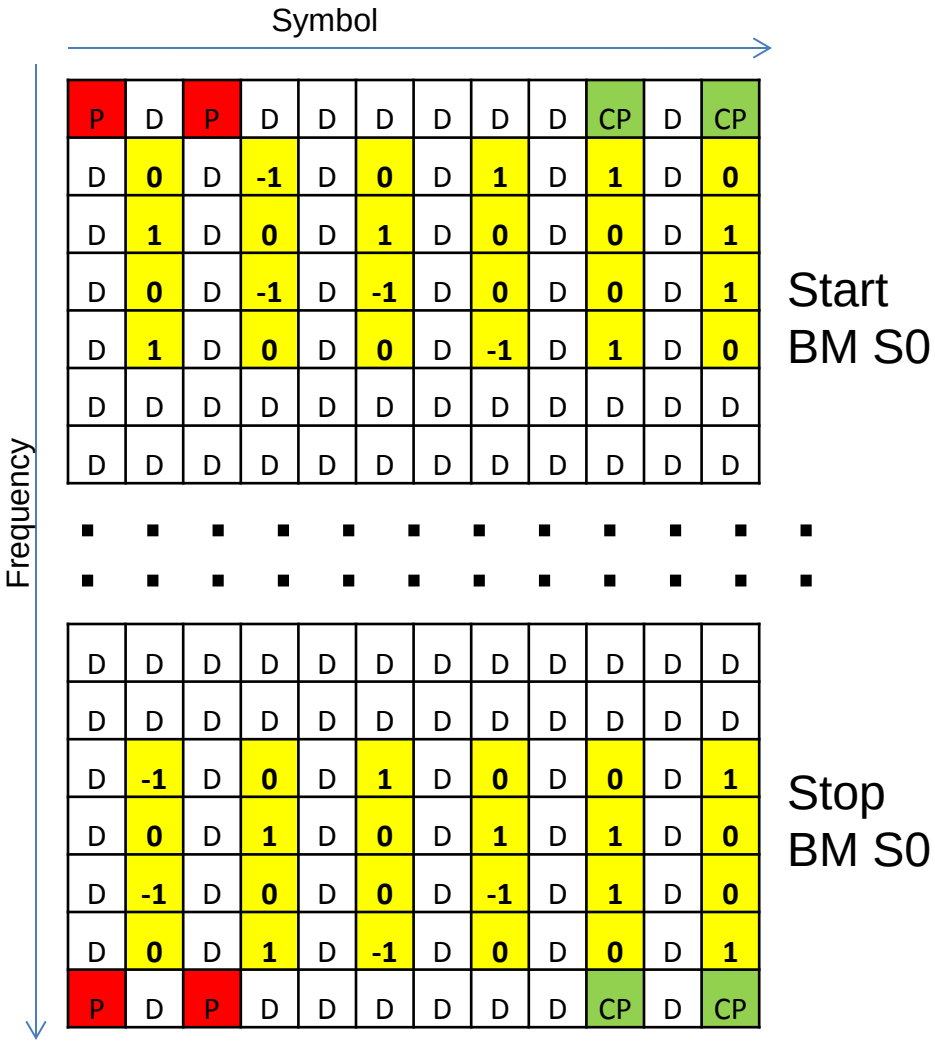
Configuring the RB Profile

- Profile Information (PI) – 8 bits per RB
  - 2 bits for RB type
  - 4 bits for bit loading
  - 2 reserved
- RB MAP is the mapping of the PIs to subcarriers over the full bandwidth
  - Upto ~4K PIs can be define
- The CLT sends a PI description message with the description of the RB MAP over the DS PLC
- To shorten the PI description message repetitions of strings of PIs can be used
  - Each string of PIs is defined, with the number of contiguous repetitions of the string
    - Use either explicit or algorithmic, don't do both
- Upto TBD entries can be allowed in the message
- What this mean in terms of MDIO registers?
- Perhaps select method that reduces amount of configuration?
  - Would like to understand tradeoffs, so include justification

Examples BM 4x6 in 8 symbols RB



Examples of BM 4x6 in 12 symbols RB

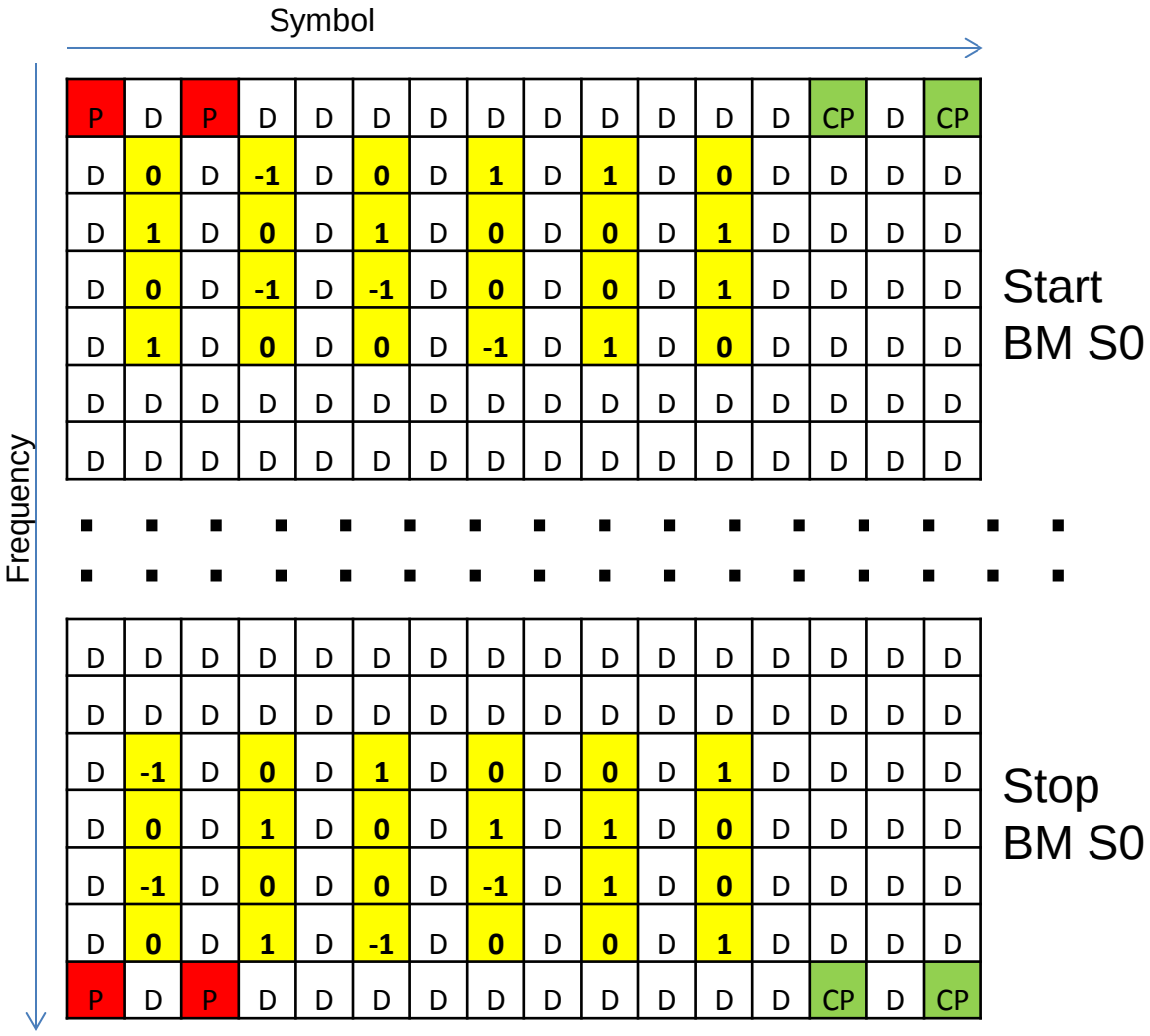


Legend

+/-1 : BM “B”
0 : BM “N”
D : Data
P : Pilot
CP : C. Pilot

Note: Power is constant versus time

Examples of BM 4x6 in 16 symbols RB



P	D	P	D	D	D	D	D	D	D	D	D	D	CP	D	CP
D	0	D	-1	D	0	D	1	D	1	D	0	D	D	D	D
D	1	D	0	D	1	D	0	D	0	D	1	D	D	D	D
D	0	D	-1	D	-1	D	0	D	0	D	1	D	D	D	D
D	1	D	0	D	0	D	-1	D	1	D	0	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	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	D	D	D	D	D	D	D	D	D	D	D	D	D	D
D	-1	D	0	D	1	D	0	D	0	D	1	D	D	D	D
D	0	D	1	D	0	D	1	D	1	D	0	D	D	D	D
D	-1	D	0	D	0	D	-1	D	1	D	0	D	D	D	D
D	0	D	1	D	-1	D	0	D	0	D	1	D	D	D	D
P	D	P	D	D	D	D	D	D	D	D	D	D	CP	D	CP

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+/-1 : BM “B”
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