

Proposed text of 8-stream pilot structure for the IEEE 802.16m amendment

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N/A

Purpose:

To be discussed and adopted by TGM for the IEEE 802.16m Amendment Working Document.

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Throughput Demand

- 8 x 8 MIMO technology with rate up to 8 may be demanded or recommended in 4G wireless systems
 - In 3GPP TR 36.913 V8.0.0 (2008-06) system aim to support DL peak spectral efficiency of 30 bps/Hz and UL peak spectral efficiency of 15 bps/Hz
 - 8 x 8 MIMO for 8-stream transmission shall be supported in 3GPP LTE-A std. to enlarge peak transmission data rate
 - In IEEE 802.16m SDD Draft – possible to use 8 Tx antennas with transmission up to rate 8
- It is necessary to have pilot structure for 8-stream transmission

Design Considerations

- Basic design considerations
 - Higher density higher accuracy but higher overhead
 - Physical limitation: Maximum pilot spacing may be designed according to
 - Coherent bandwidth: Depends on delay spread
 - Coherent time: Depends on user mobility
- Design considerations in IEEE 802.16m SDD
 - Equal or similar pilot density per transmission stream
 - There may be no need to have equal pilot density per OFDM symbol of DL subframe
 - Equal or similar number of pilots for each PRU of data burst assigned to one MS

- Maximum throughput (peak SE) vs. pilot density

$$\eta = \frac{(N_{c,RU} \times N_{s,RU} - N_{p,RU}) \times N_{RU,Subframe} \times R_c \times M \times N_{Stream}}{T_{Subframe} \times BW} \quad (\text{bps/Hz})$$

- Upper bound (8-stream): 2 pilots per stream

- **EX1:** 16m frame structure w/ BW = 10 MHz, 8 x 8 MIMO w/ 8-stream transmission, 64QAM, rate-8/9, **3** pilots per stream within an 18 x 6 RU

$$\eta = \frac{(108 - 24) \times 48 \times (8/9) \times 6 \times 8}{(5 \times 10^{-3} / 8) \times (10 \times 10^6)} = 27.52 (< 30) \quad (\text{bps/Hz})$$

- **EX2:** 16m frame structure w/ BW = 10 MHz, 8 x 8 MIMO w/ 8-stream transmission, 64QAM, rate-8/9, **2** pilots per stream within an 18 x 6 RU

$$\eta = \frac{(108 - 16) \times 48 \times (8/9) \times 6 \times 8}{(5 \times 10^{-3} / 8) \times (10 \times 10^6)} = 30.14 (> 30) \quad (\text{bps/Hz})$$

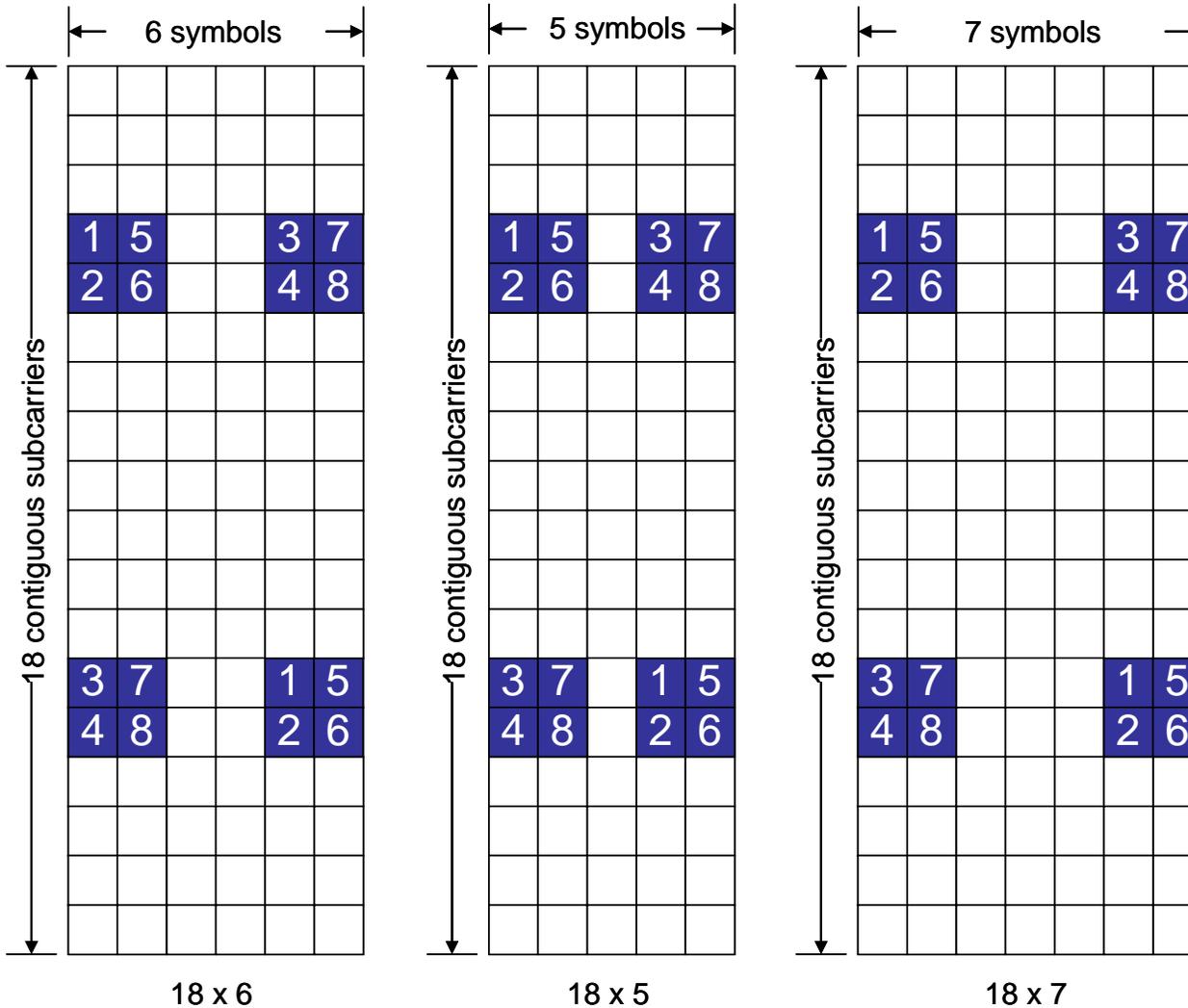
Application Scenarios

- High received power is necessary to support 8-stream transmission
- Possible 8-stream application scenarios, such as WLAN or similar applications – the ones with low mobility, low delay spread & short range
 - **Low mobility:** ≤ 3 km/hr
 - Low pilot density in time domain
 - **Low delay spread (due to short range (< 100 m)) but rich scattering:** < 2 us
 - Low pilot density in frequency domain

Proposed Pilot Structure

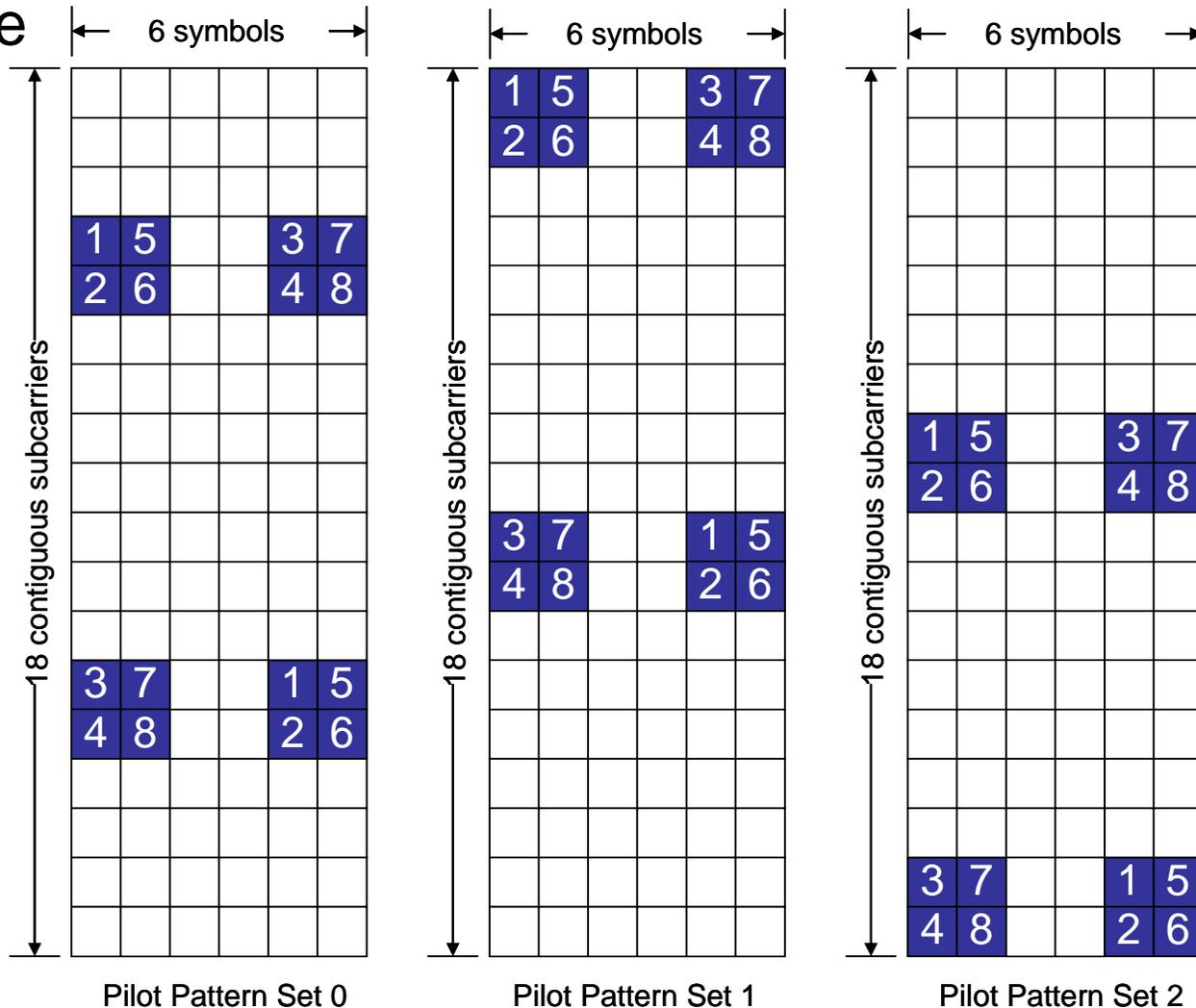
- 2 pilots per stream within an RU
- Basic pilot structure
 - Square-shaped pilot cluster with opposite pilot pattern and the associated mirror pattern
- Interlaced pilot structure
 - Avoid interference from different cells/sectors
- Extension of pilot structure
 - Contiguous RUs in frequency domain
 - Boundary pilot pattern
 - Avoid channel estimation extrapolation in frequency domain

- **Basic pilot structure: 3 patterns for 3 different RU sizes**

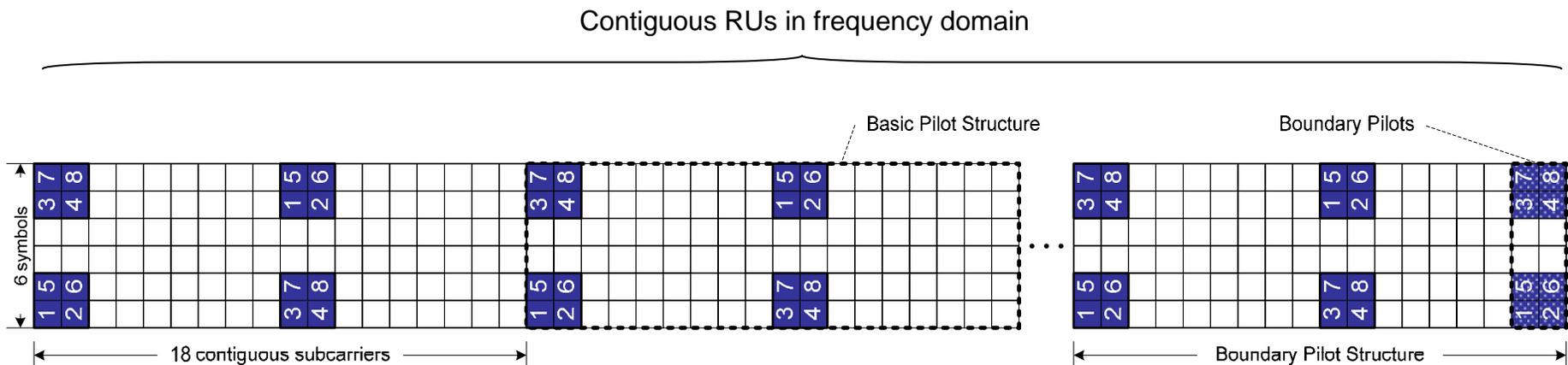


- 2 pilots per stream
- About 15% pilot overhead
- About 30 bps/Hz peak SE

- **Interlaced pilot structure:** RU = 18 x 6 w/ interlaced structure



- Extension of pilot structure:** Additional pilots are allocated at last RU's boundary in freq. domain for $RU = 18 \times 6$



Proposed Text

15.3.5.4.1 Pilot patterns

The pilot patterns for eight pilot streams are shown in Figure xxx with the subcarrier index increasing from top to bottom and the OFDM symbol index increasing from left to right. Subfigure (a) in Figure xxx shows the pilot pattern for eight pilot streams in subframe with six OFDM symbols; Subfigure (b) in Figure xxx shows the pilot pattern for eight pilot streams in subframe with five OFDM symbols; Subfigure (c) in Figure xxx shows the pilot pattern for eight pilot streams in subframe with seven OFDM symbols.

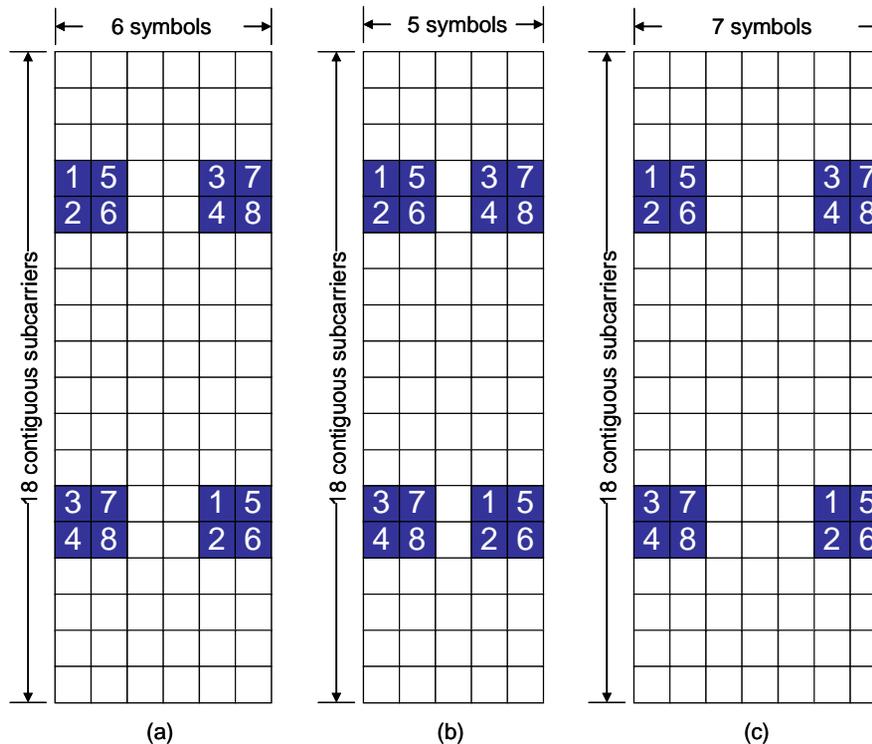


Figure xxx—Pilot patterns for 8 pilot streams