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Title	Mobility Zone for Uplink MIMO	
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Re:	IEEE 802.16m-08/024: Call for Contributions on Project 802.16m System Description Document (SDD). Target topic: "Uplink MIMO".	
Abstract	This contribution provides the pilot for UL MIMO operation	
Purpose	To be discussed and adopted by TGM for the 802.16m SDD	
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Mobility Zone for Uplink MIMO

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1. Introduction

Based on the Mobility-Zone (MB-Zone) structure as proposed in C802.16m-08_444r2, we implement the MB-Zone design and simulation by using certain pilot patterns proposed by some companies. In the MB-Zone design the original structure of the pilot patterns is maintained but its number of pilot increases when the mobile speed increases.

2. Basic Simulation Parameters

The Basic simulation parameters are listed in Table 1.

Parameter	Baseline
Carrier Frequency	2.5 GHz
System BW	10 MHz
Channel Model	Veh A. with 3km/hr, 120km/hr and 350km/hr
Channel Coding	No Use
Antenna Configuration	2x2 MIMO
Modulation and Coding	QPSK
Resource Allocation	1. 9 symbols * 4 subcarriers 2. 9 symbols * 9 subcarriers 3. 18 symbols * 6 subcarriers 4. 18 symbols * 12 subcarriers 5. 18 symbols * 18 subcarriers
Pilot Tone Boost	2.5dB over data tone
Channel Estimation	MMSE

Table 1 Simulation parameters

2.1 Different Speed Zone Structure: The Different Speed Zone as MB Zone proposed in C802.16m-08_442r2 has the structure as shown in Fig.1 and its simulation result is shown in Fig. 2. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. It reveals from the simulation result that when the mobile speed is low we can use few pilots to get the same results as obtained by using dense pilots to increase the number of data placement. If we use the pilot structure for high mobility to design the pilot pattern for low mobility situation some extra SNR gain around 1dB can be obtained.

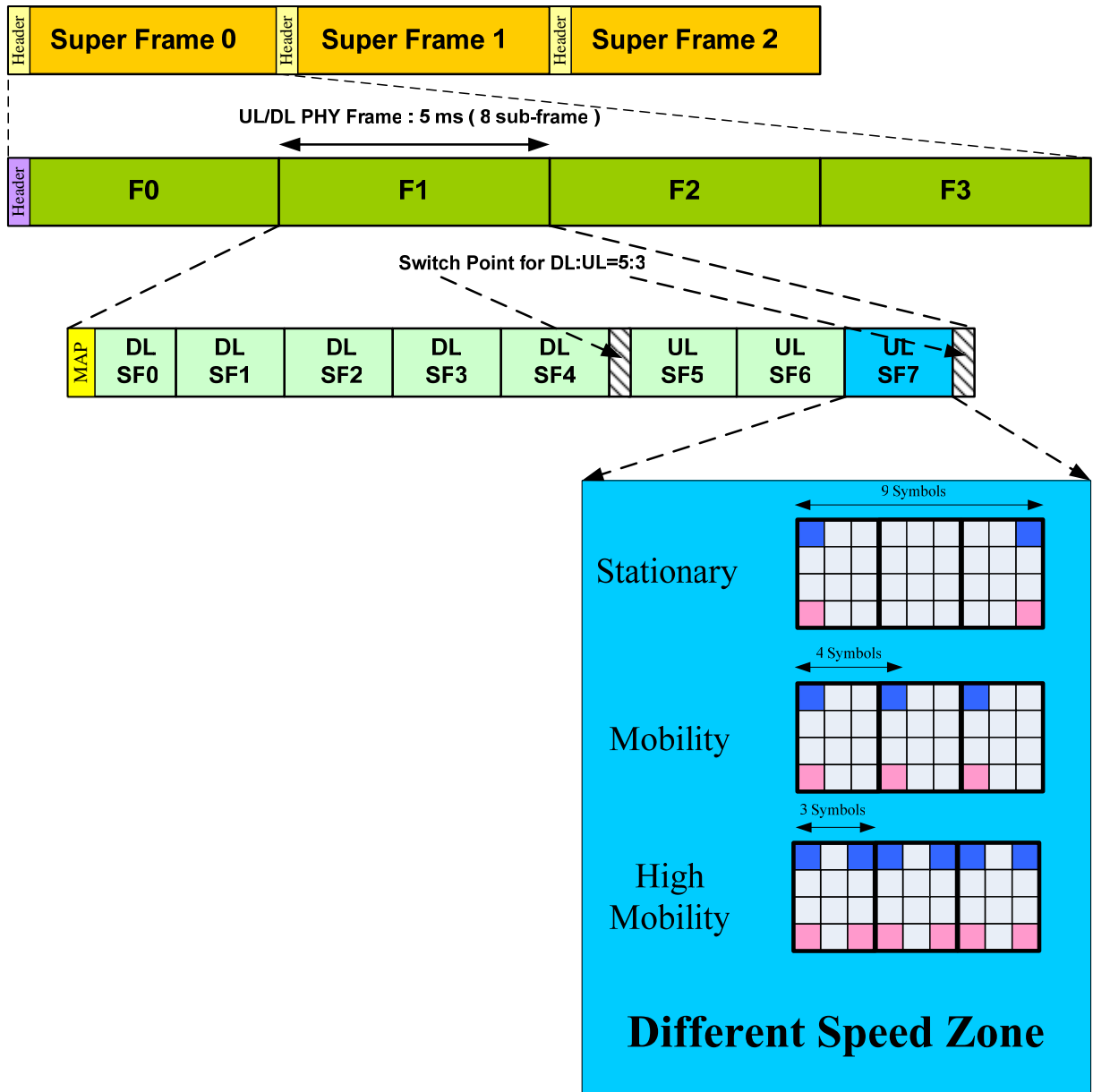


Fig. 1 Different Speed Zones

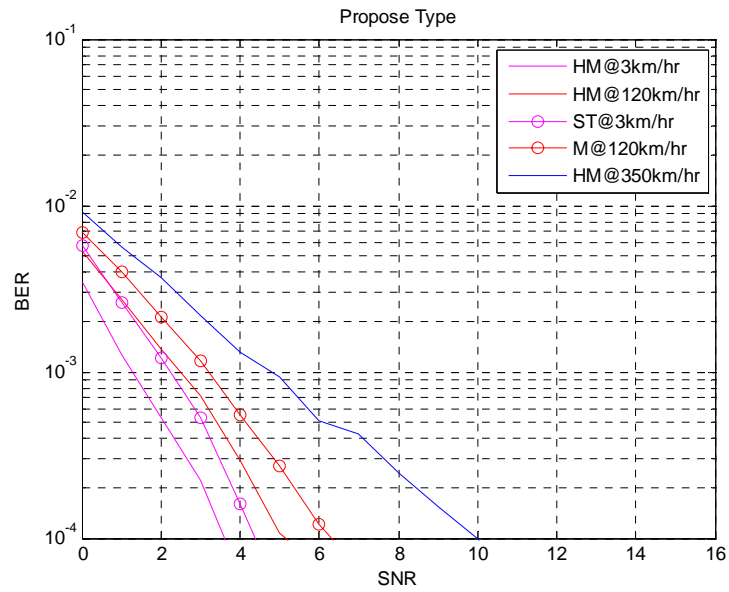


Fig .2 Simulation Result for Proposed Uplink Pilot Format

2. Simulation of Various Types of Pilot Patterns

2.1 Type A RB

As shown in Fig. 3 is an illustration of Type A Resource Block (RB) and at various mobile speeds they have the Different Speed Zones structure shown in Fig. 4. The simulation results when the mobile speeds are at 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 5. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. When the mobile speed is low we can use few pilots to attain the same performance result.

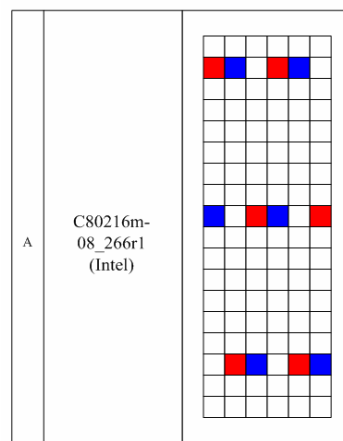


Fig. 3 Type A RB

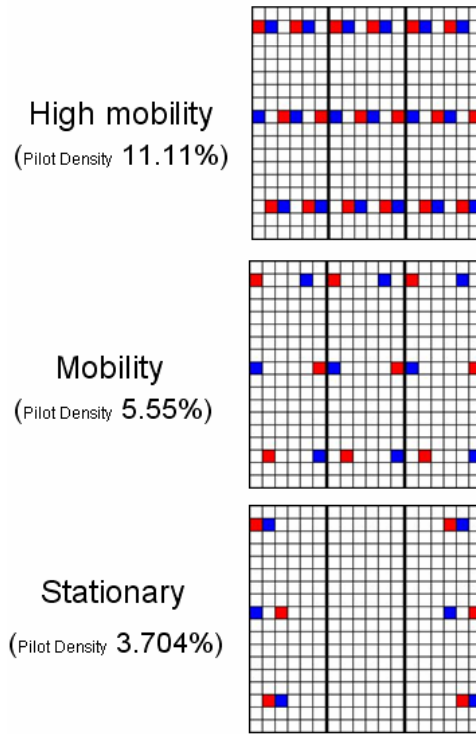


Fig. 4 Type A Different Speed Zones

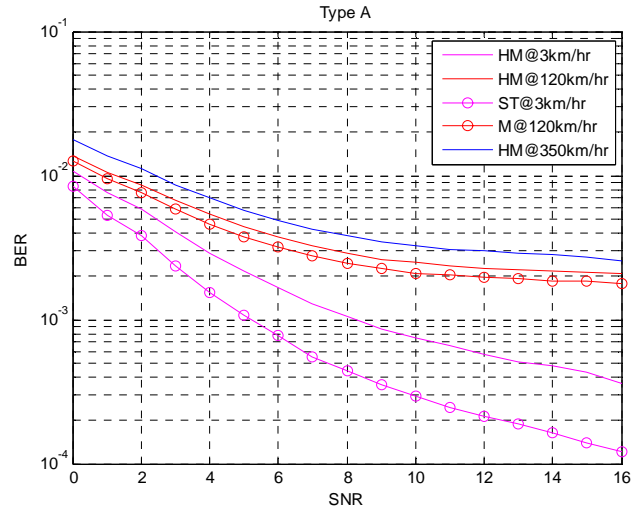


Fig. 5 Simulation Result for Type A Uplink Pilot Format

2.2 Type B RB

As shown in Fig. 6 is a Type B Resource Block, its Different Speed Zones has the structure as shown in Fig. 7. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 8. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g.

HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

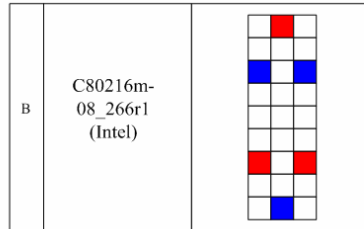


Fig. 6 Type B RB

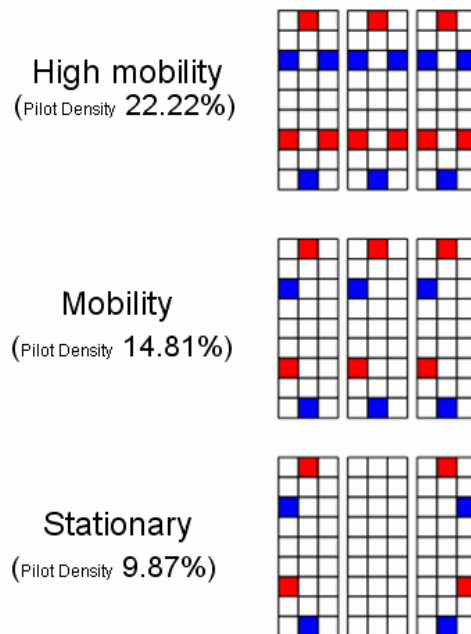


Fig. 7 Type B Different Speed Zones

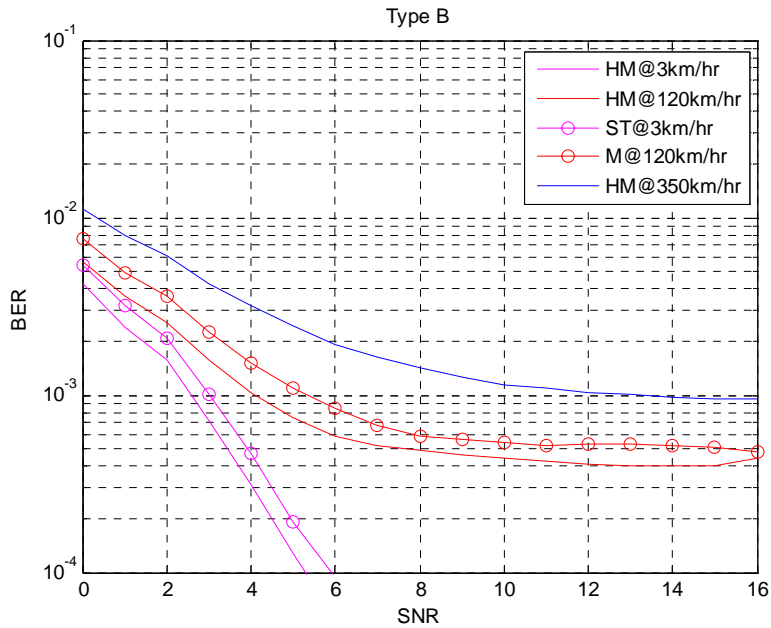


Fig. 8 Simulation Result for Type B Uplink Pilot Format

2.3 Type C RB

As shown in Fig. 9 is a Type C Resource Block, its Different Speed Zones has the structure as shown in Fig. 10. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 11. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

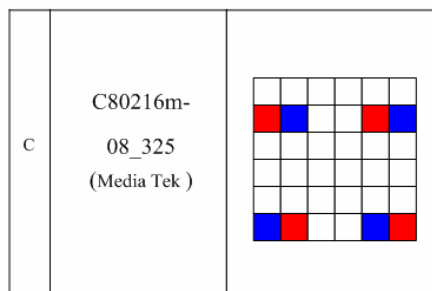


Fig. 9 Type C RB

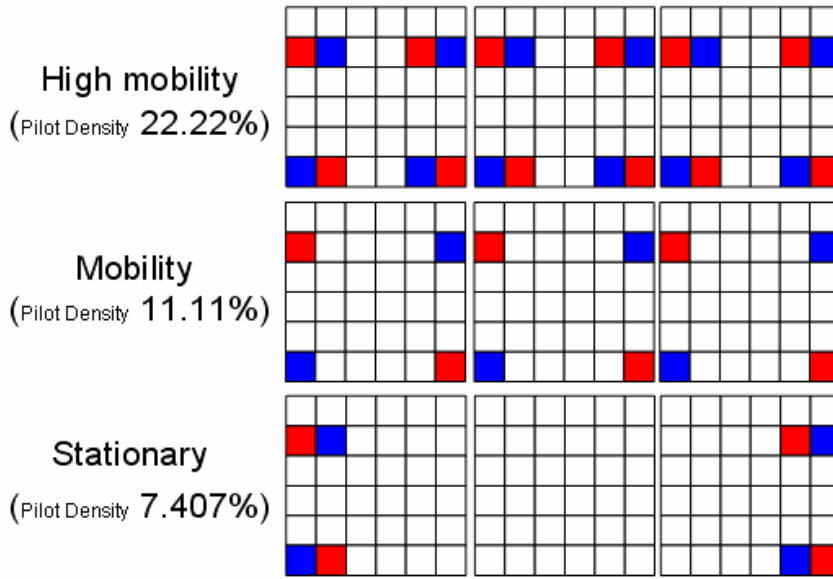


Fig. 10 Type C Different Speed Zones

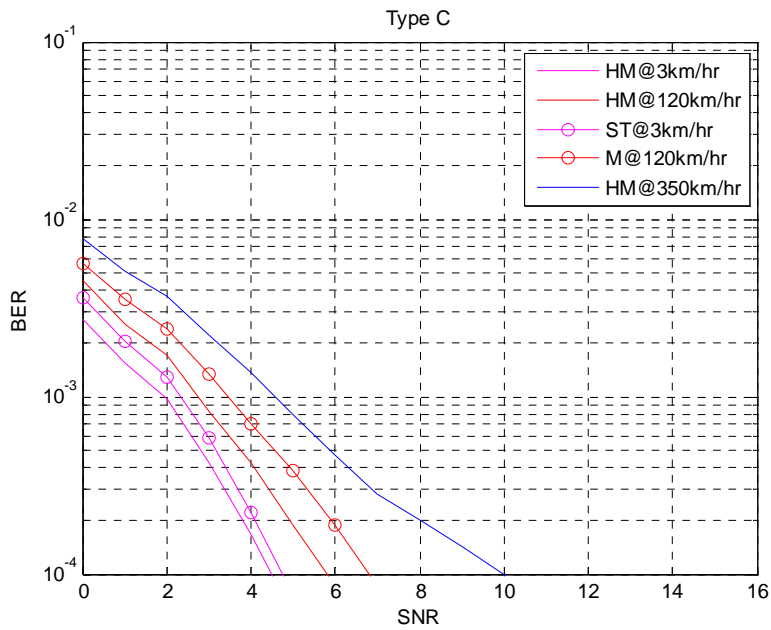


Fig. 11 Simulation Result for Type C Uplink Pilot Format

2.4 Type D RB

As shown in Fig. 12 is a Type D Resource Block, its Different Speed Zones has the structure as shown in Fig. 13. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 14. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g.

HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

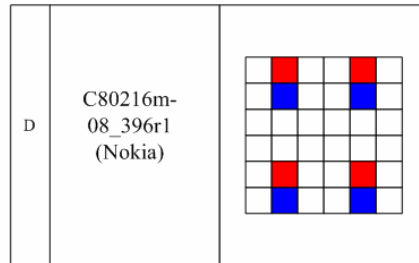


Fig. 12 Type D RB

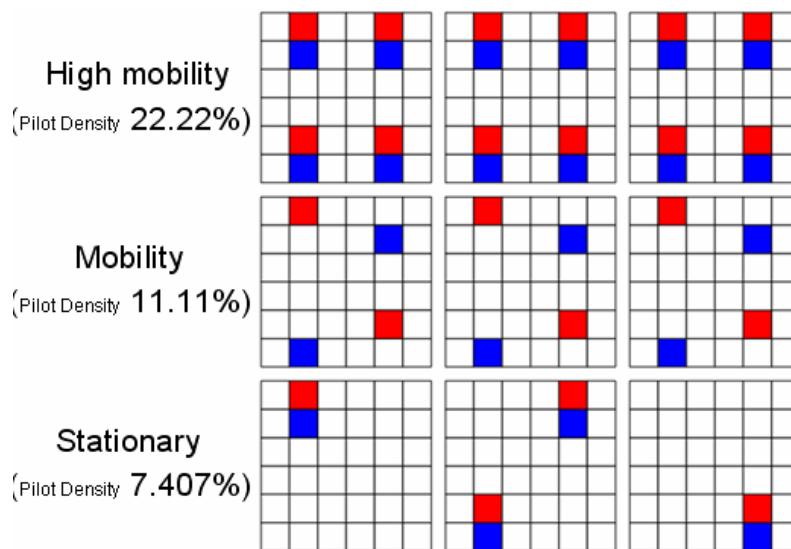


Fig. 13 Type D Different Speed Zones

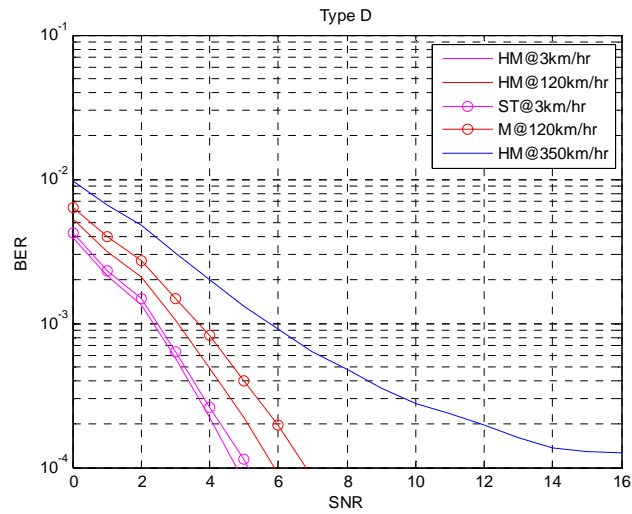


Fig. 14 Simulation Result for Type D Uplink Pilot Format

2.5 Type E RB

As shown in Fig.15 is a Type E Resource Block, its Different Speed Zones has the structure as shown in Fig. 16. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 17. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

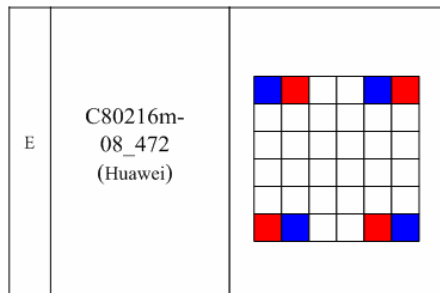


Fig. 15 Type E RB

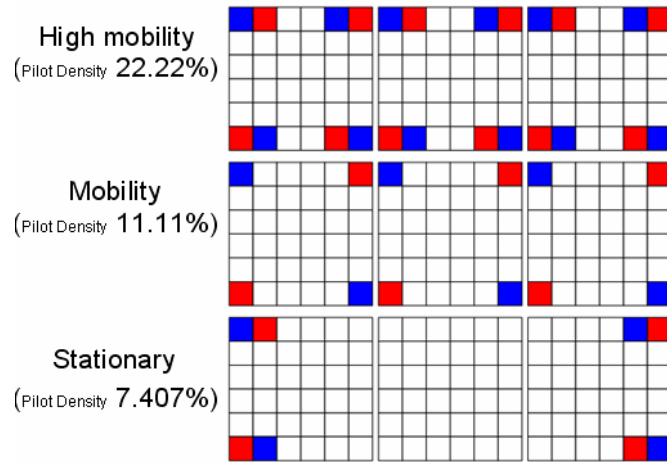


Fig. 16 Type E Different Speed Zones

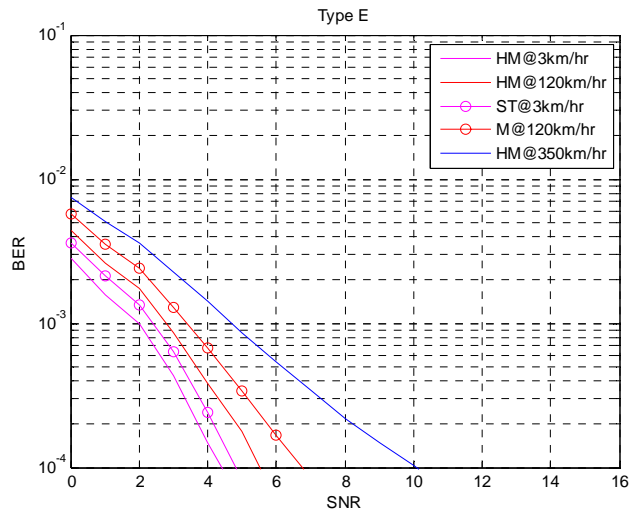


Fig. 17 Simulation Result for Type E Uplink Pilot Format

2.6 Type F RB

As shown in Fig. 18 is a Type F Resource Block, its Different Speed Zones has the structure as shown in Fig. 19. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 20. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

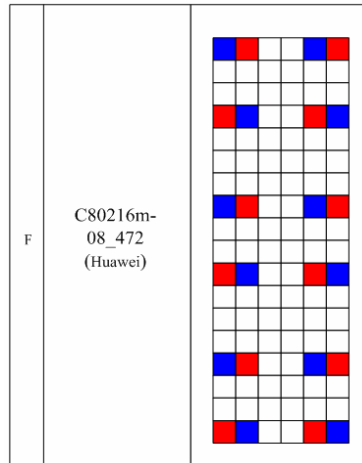


Fig. 18 Type F RB

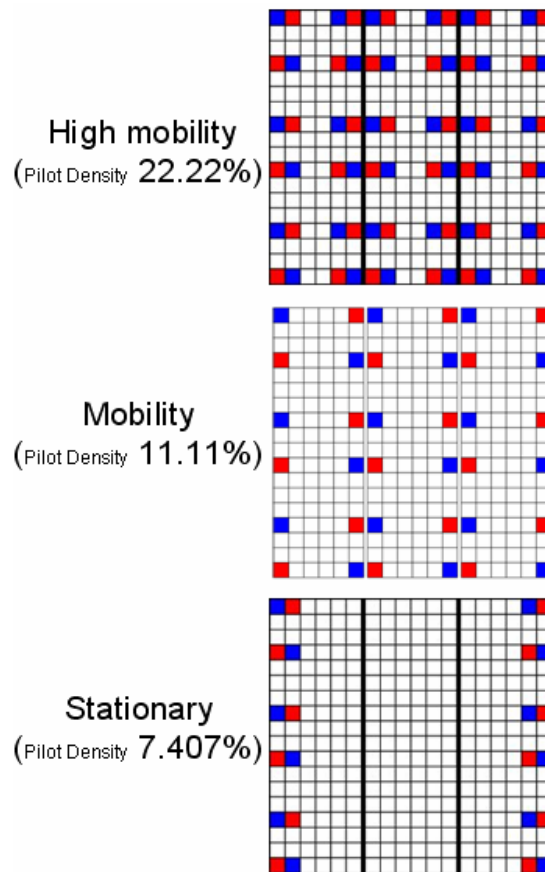


Fig. 19 Type F Different Speed Zones

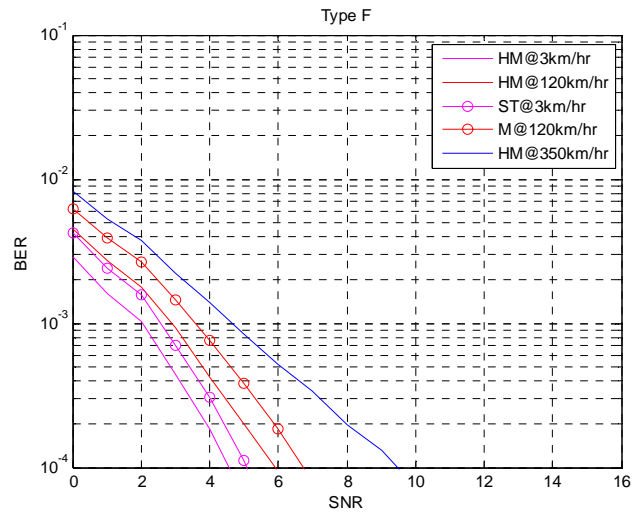


Fig. 20 Simulation Result for Type F Uplink Pilot Format

2.7 Type G RB

As shown in Fig. 21 is a Type G Resource Block, its Different Speed Zones has the structure as shown in Fig. 22. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 23. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

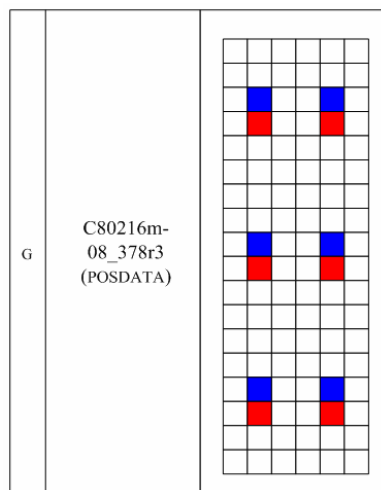


Fig. 21 Type G RB

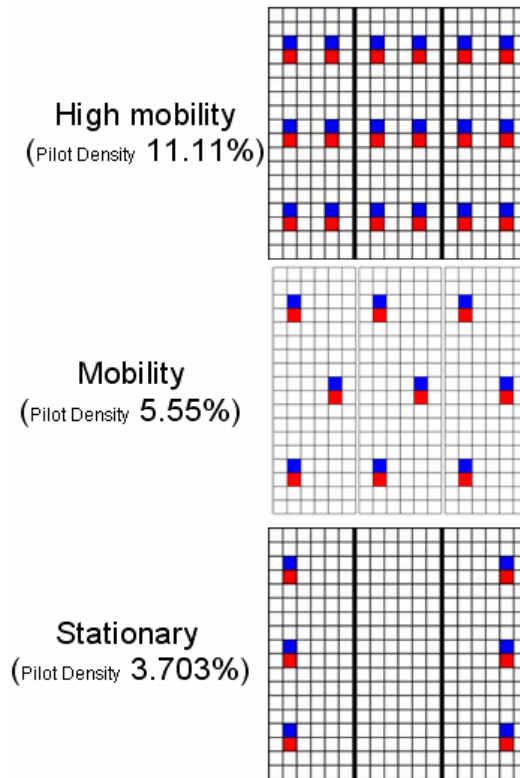


Fig. 22 Type G Different Speed Zones

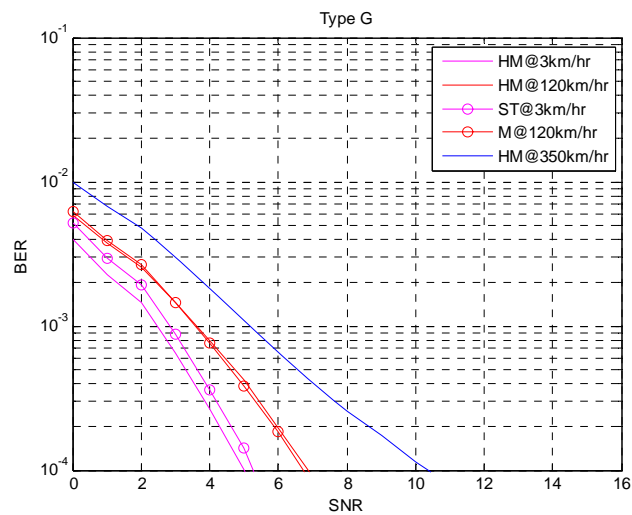


Fig. 23 Simulation Result for Type G Uplink Pilot Format

2.8 Type H RB

As shown in Fig. 24 is a Type H Resource Block, its Different Speed Zones has the structure as shown in Fig. 25. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 26. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are

based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

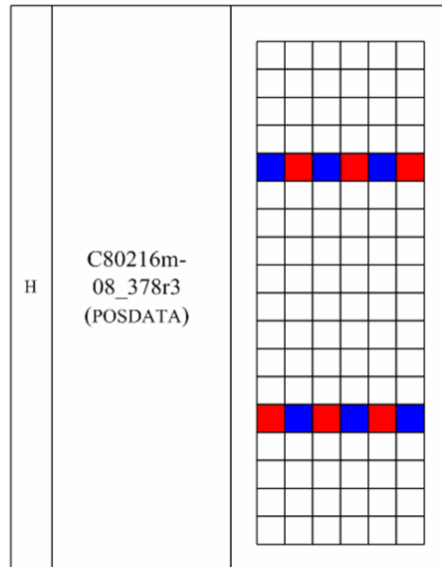


Fig. 24 Type H RB

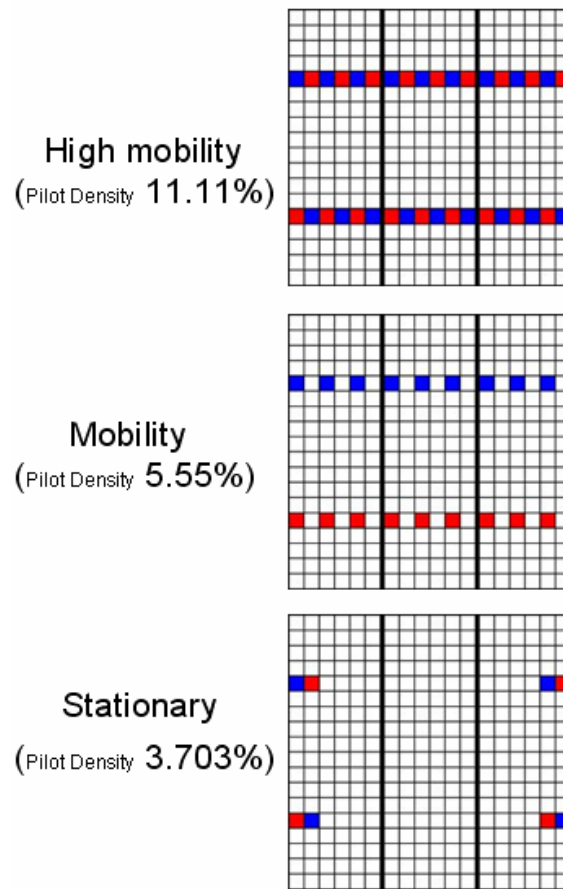


Fig. 25 Type H Different Speed Zones

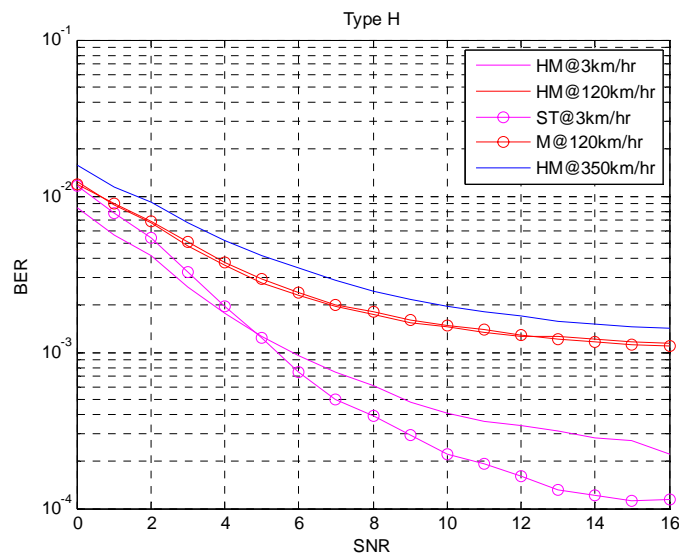


Fig. 26 Simulation Result for Type H Uplink Pilot Format

2.9 Type I RB

As shown in Fig. 27 is a Type I Resource Block, its Different Speed Zones has the structure as shown in Fig. 28. It is for 2 antennas situation. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 29. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

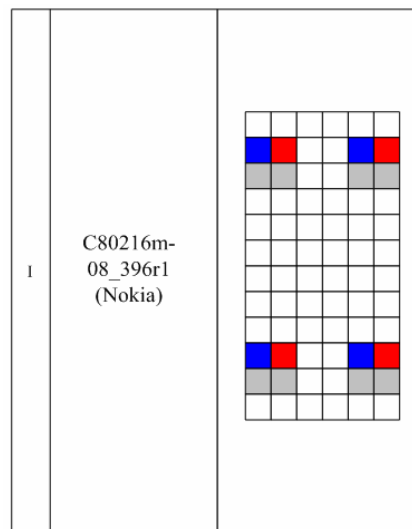


Fig. 28 Type I RB

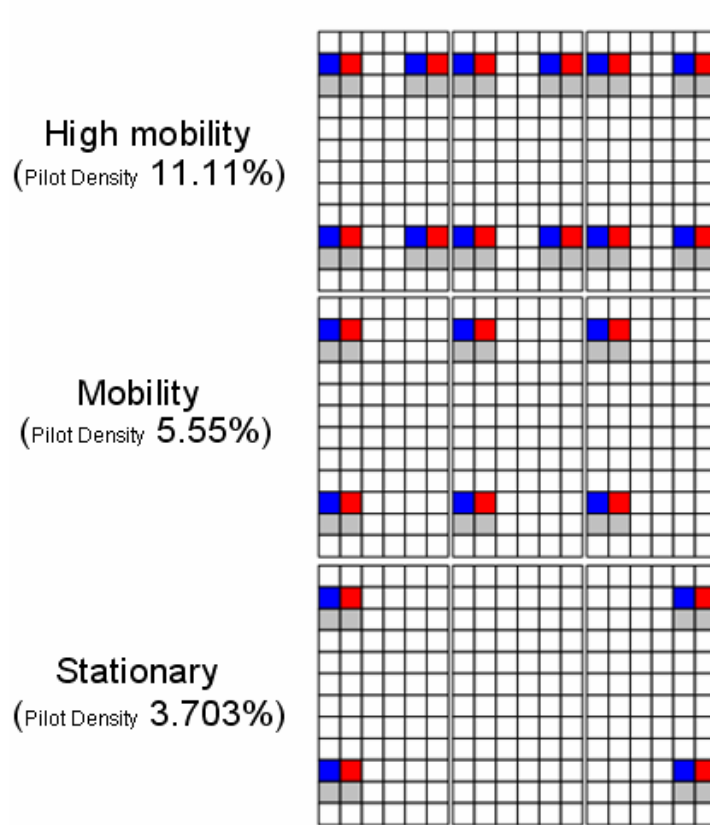


Fig. 28 Type I Different Speed Zones

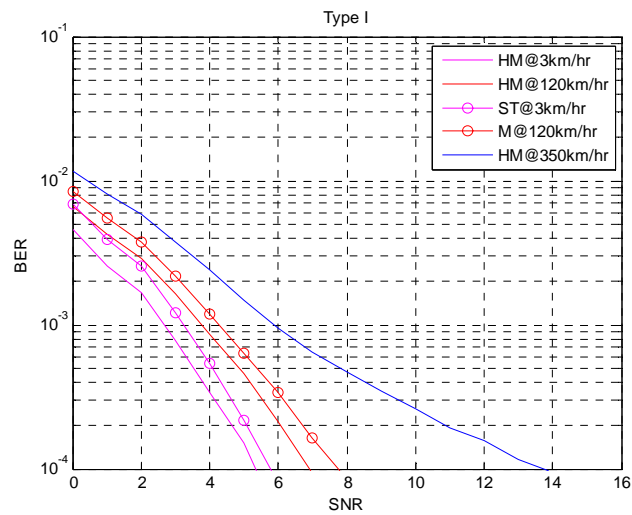


Fig. 29 Simulation Result for Type I Uplink Pilot Format

2.10 Type J RB

As shown in Fig. 30 is a Type J Resource Block, its Different Speed Zones has the structure as shown in Fig. 31. It is for 2 antenna situation. The simulation results at mobile speeds of 3 km/hr, 120 km/hr and 350 km/hr are shown in Fig. 32. In the simulation we also include the results when the pilot patterns implemented for 3 km/hr and 120 km/hr are based on the pilot structure for high mobility situation, their results are identified by prefixing with HM, e.g. HM@3km/hr for MS with 3 km/hr MS. As shown in the simulation results it still can get the same system performance by using few pilots when the mobile speed is low.

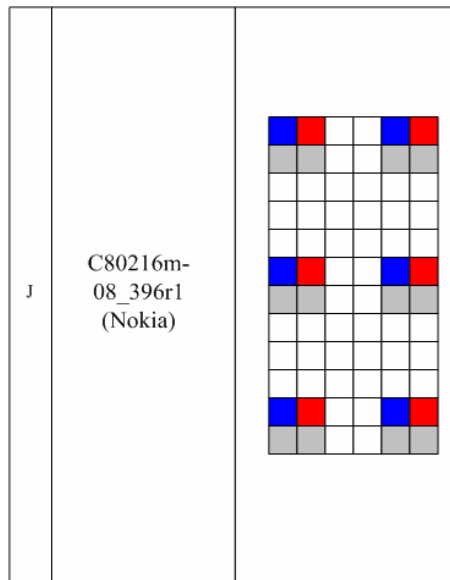


Fig. 30 Type J RB

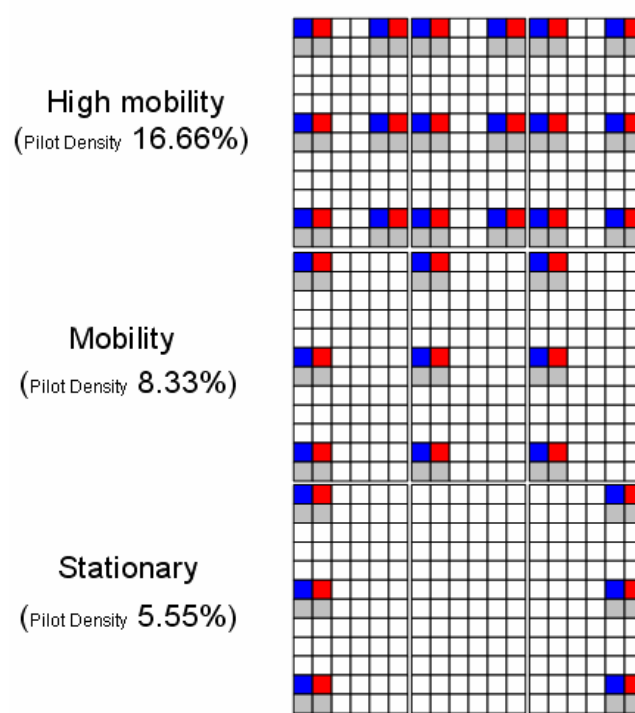


Fig. 31 Type J Different Speed Zones

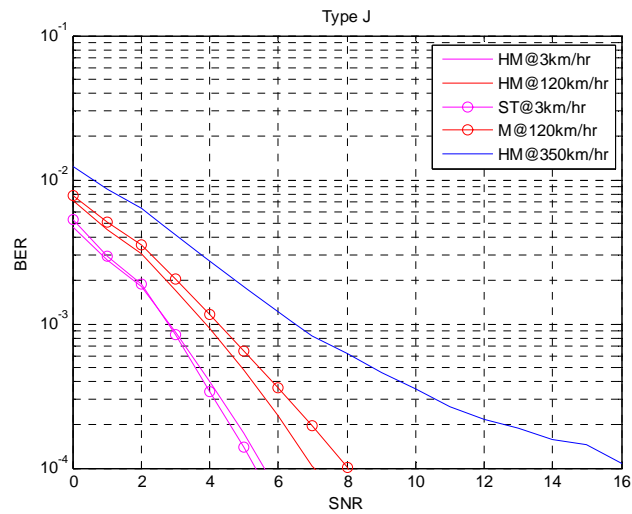


Fig. 32 Simulation Result for Type J Uplink Pilot Format

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Text Proposal for the 'Uplink MIMO Schemes'

=====Start of Proposed Text=====

XX.X Uplink MIMO Schemes

Different densities of pilot patterns can be exploited to estimate the channel impulse response to the same extent of accuracy when mobile speed varies. In Fig.X.1, it shows an example of pilot structures when the SS is moving in different speed zones.

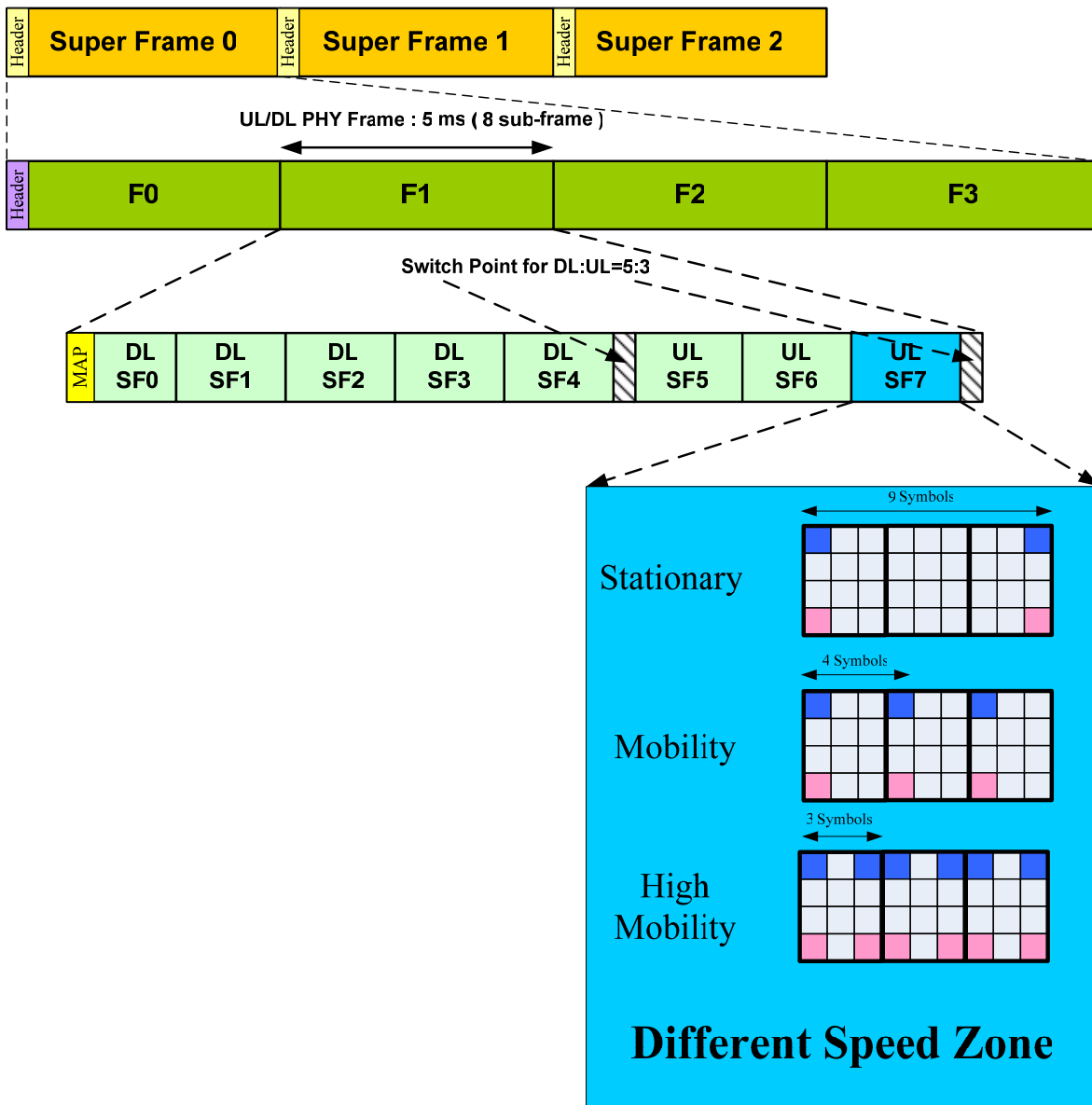


Fig.X.1. Pilot structures in different speed zones

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