

# [Transmit Diversity scheme for BCH transmission]

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Venue:

Call for Comments on Project 802.16m System Description Document (IEEE 802.16m-08/052)

Purpose:

To be reviewed and adopted by TGM for the 802.16m SDD

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# Transmit Diversity Schemes for BCH transmission: 2 streams vs 1 stream

*January, 2009*

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# Summary

- Purpose
  - To resolve the issue related to Tx diversity scheme for BCH transmission(which is currently FFS)
    - Transmit Diversity Schemes for 2 x 2
      - 2 stream (i.e.  $M = 2$ ): Data and pilots are different among antennas
      - 1 stream (i.e.  $M=1$ ): Data and pilots are the same among antennas
  - This contribution provides the considerations and the evaluation results
- Recommendation
  - Suggests 2 stream transmission for Tx diversity

# PBCH/SBCH related Working Assumptions

- Resource allocation [1]
  - PBCH and SBCH use **DRU**
- Multiplexing [1]
  - PBCH and SBCH in SFH are **FDM** with data within same subframe
- Transmission format
  - The AMS is not required to know the antenna configuration prior to decoding the PBCH [1]
  - Minimum DL antenna configuration: **2 x 2** [2]

# Considerations for Evaluation

- Need performance evaluation using 2 stream pilots as common pilot
  - For FDM of PBCH/SBCH and data within the distributed region, both channels are transmitted in shared PRUs with DRU allocation. This can be achieved in following two ways:
    - Option 1: Use rank-1 precoder in shared PRUs, data channels in the DRU region are restricted to use the same precoded pilot.
    - Option 2: Use pilot pattern A as specified in section 11.5.3 [1] to share the pilot tones
- Using option1 means that data channels use only rank-1 transmission → unacceptable limitation

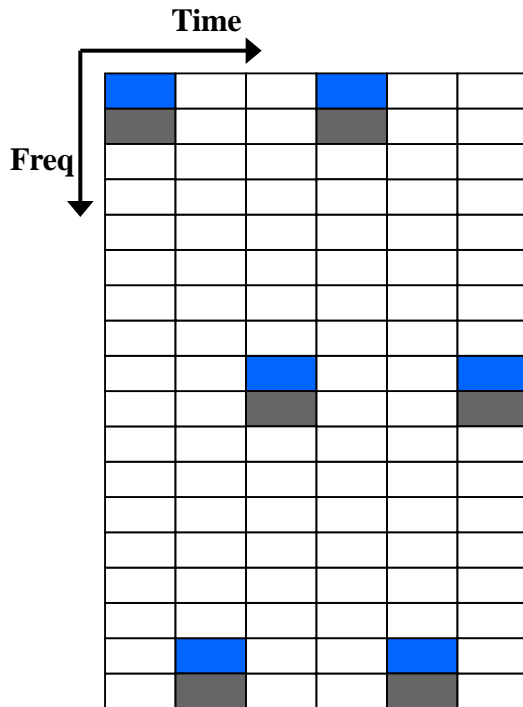
# Simulation Environments



<b>Contents</b>	<b>Value</b>
<b>Carrier frequency</b>	2.5 GHz
<b>OFDM symbol</b>	102.86 us (with 1/8 CP)
<b>Bandwidth / FFT size</b>	5 MHz / 512 (used subcarrier : 432 subcarriers)
<b>Channel Codig</b>	CTC
<b>Payload size</b>	96 bits (for using full diversity)
<b>Modulation &amp; Code rate</b>	QPSK $\frac{1}{2}$ with 8 repetitions
<b>Antenna configuration</b>	2 Tx - 2 Rx
<b>Channel estimation</b>	PRU based 2D MMSE
<b>Tx Diversity Schemes</b>	1 stream: Phase rotation (rotation value = 1/256) 2 stream: SFBC
<b>Resource unit</b>	DRU
<b>Pilot pattern</b>	Pilot pattern A (no boosting)
<b>Channel Model</b>	Ped-B 3 km/hr, Veh-A 120 km/hr (Uncorrelated channel)

# Pilot Patterns

- **1 stream transmission**

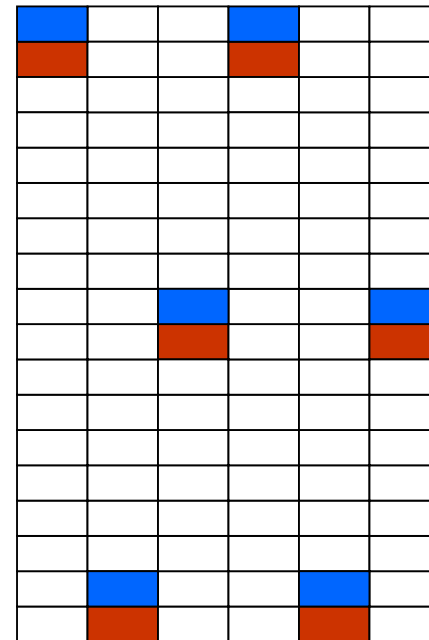
- Uses pilot stream 1





 Pilot stream 1  
 Pilot stream 2 (not used for 1 stream transmission)

- **2 stream transmission**

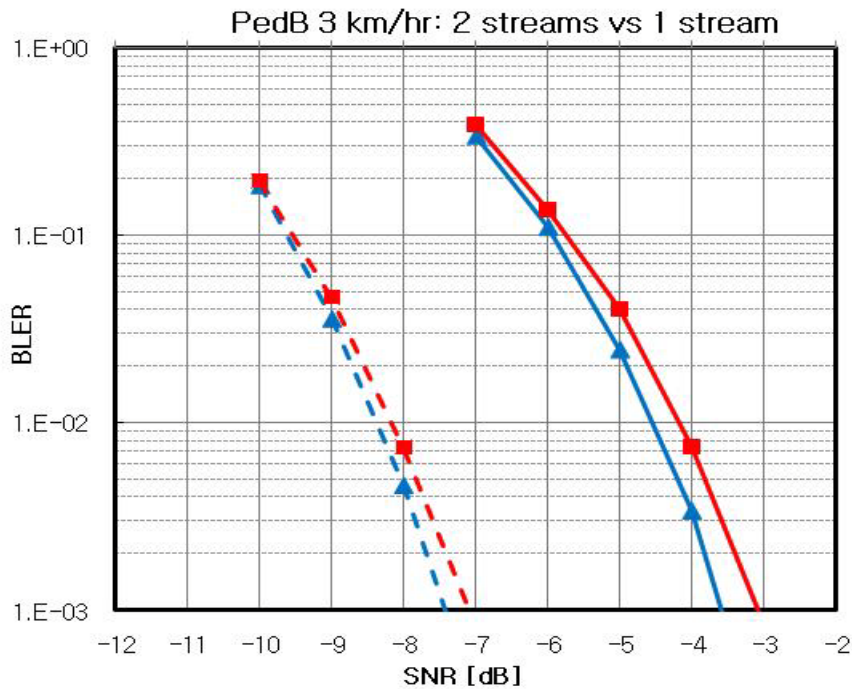
- Uses both pilot stream 1 and pilot stream 2



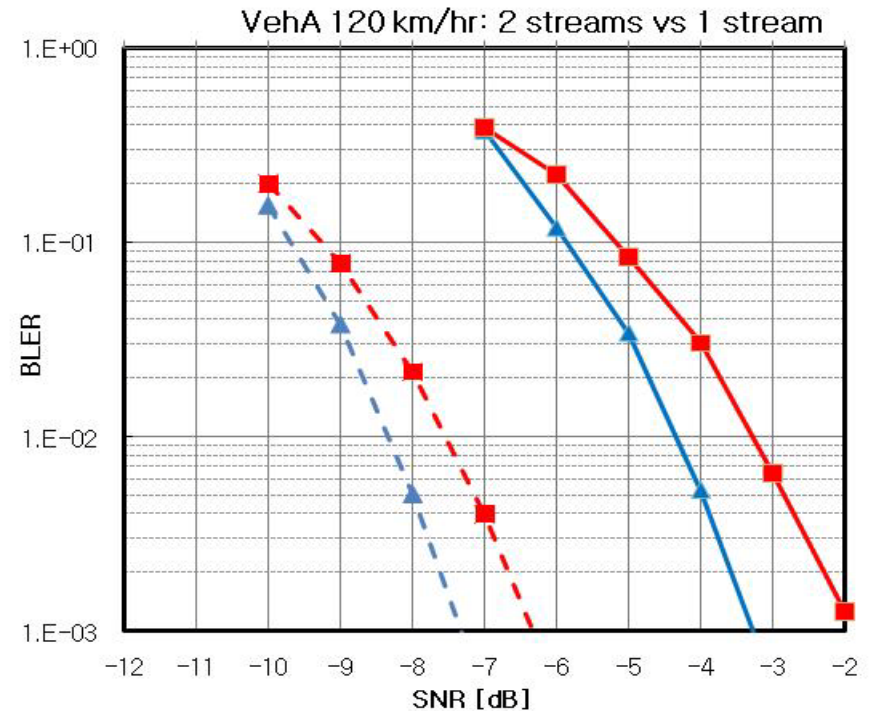
 Pilot stream 1  
 Pilot stream 2

# Performance Comparison

- Summary
  - With 2 streams pilot, SFBC is better than 1 stream transmission



—▲— SFBC (Ideal CH)      —■— 1 stream (Ideal CH)  
—▲— SFBC (Estimated CH)      —■— 1 stream (Estimated CH)



—▲— SFBC (Ideal CH)      —■— 1 stream (Ideal CH)  
—▲— SFBC (Estimated CH)      —■— 1 stream (Estimated CH)



# Text Proposal for 80216m SDD

===== Start of text proposal =====

*Modify the sentence in section 11.7.2.2.4, page 92, line 13 as follows*

Multiple antenna schemes for transmission of the PBCH/SBCH are supported. ~~Transmission of PBCH and SBCH as one stream or two stream is FFS.~~ The transmit diversity scheme for PBCH and SBCH is SFBC (i.e.  $M = 2$  streams) using the 2 Tx rate-1 mode.

===== End of text proposal =====

# References

- [1] IEEE 802.16m-08/003r6, “Project 802.16m System Description Document (SDD)”
- [2] IEEE 802.16m-07/002r7, “IEEE 802.16m System Requirements”