Correlated Scrambling Diversity Scheme for 802.16m E-MBS in SFN

Document Number:

IEEE S802.16m-08/893

Date Submitted:

2008-09-05

Source:

Hsien-Wen Chang, Ming-Hung Cheng, Chorng-Ren Sheu, Voice: +886-3-5915729
Ming-Chien Tseng, Chi-Fang (Richard) Li E-mail: seanchang@itri.org.tw
ITRI
Kun-Yi Lin, Hsin-Piao Lin
NTUT

Venue:

80216m-08/033

Base Contribution:

IEEE C802.16m-08/893

Purpose:

Discussion and adoption for 802.16m SDD

工業技術研究院

ITRI
Industrial Technology
Research Institute

Correlated Scrambling Diversity Scheme for 802.16m E-MBS in SFN

Hsien-Wen Chang, Ming-Hung Cheng, Chorng-Ren Sheu,
Ming-Chien Tseng, Chi-Fang (Richard) Li
ITRI
Kun-Yi Lin, Hsin-Piao Lin
NTUT

Outline

- Background
- Proposed correlated scrambling diversity scheme
- Simulation results
- Conclusion

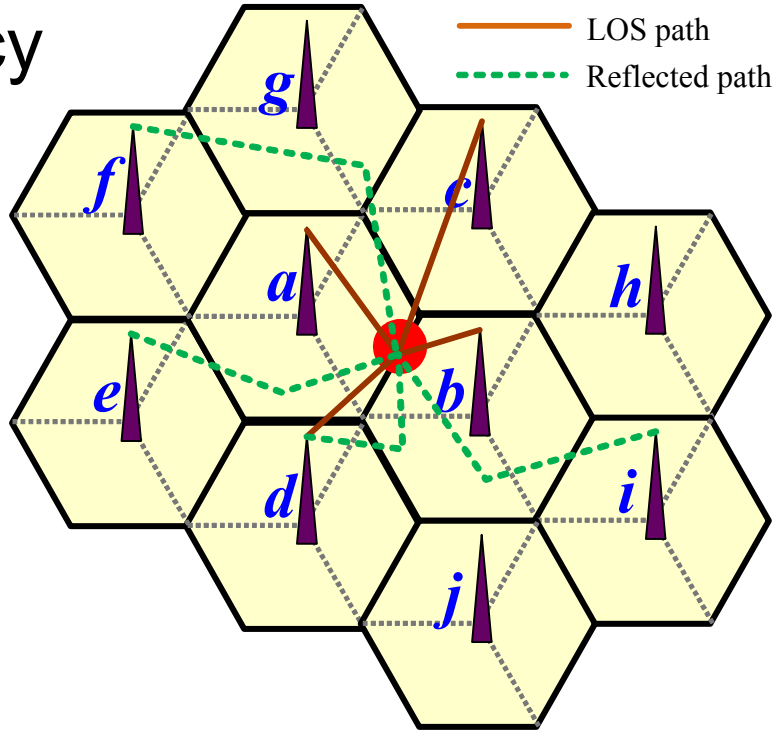
工業技術研究院

BACKGROUND

工業技術研究院

SFN and cell edge problem

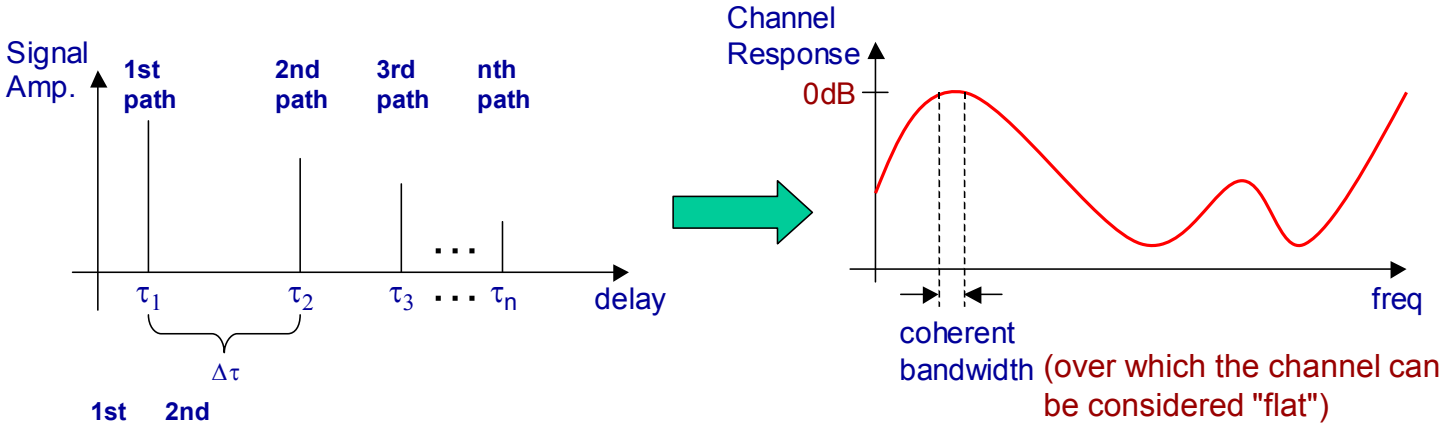
- 802.16m can be used as a digital broadcast mechanism through a Single Frequency Network (SFN).
- At the cell edge between transmitters in an SFN, a receiver may receive the same signal from two transmitters almost simultaneously.



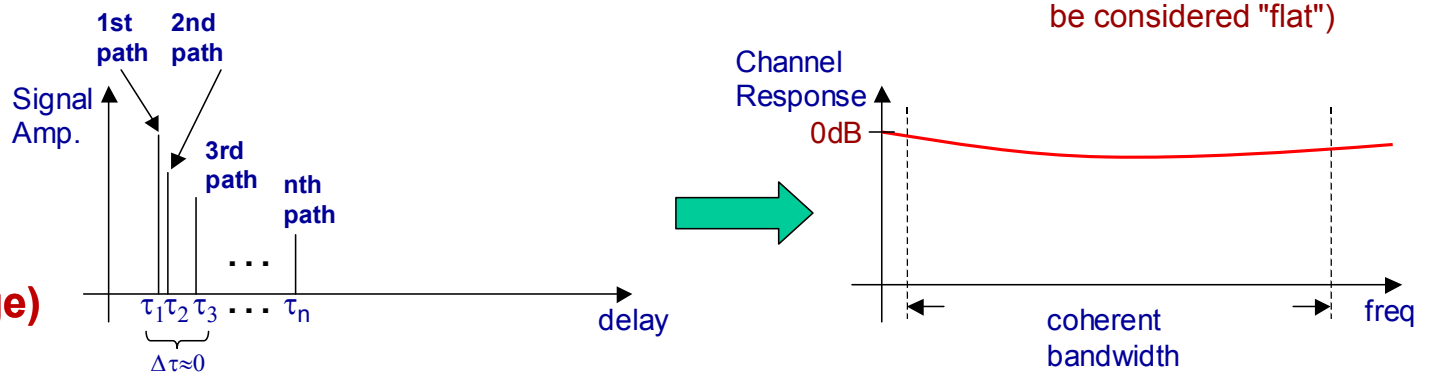
工業技術研究院

Delay spread and channel response

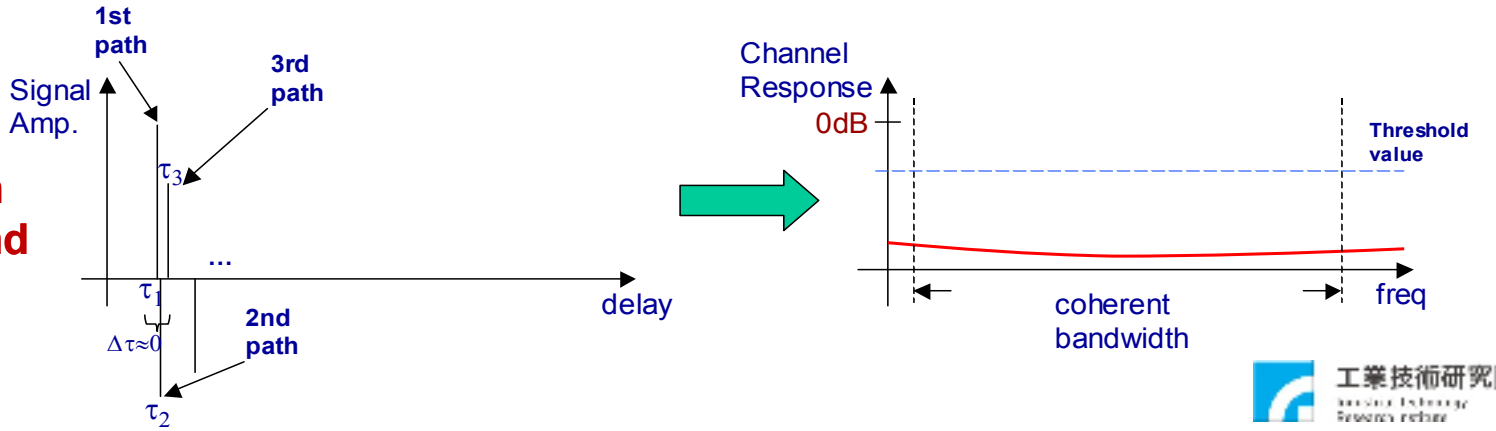
1. large multipath delay spread $\Delta\tau$



2. small multipath delay spread (transmitter edge)

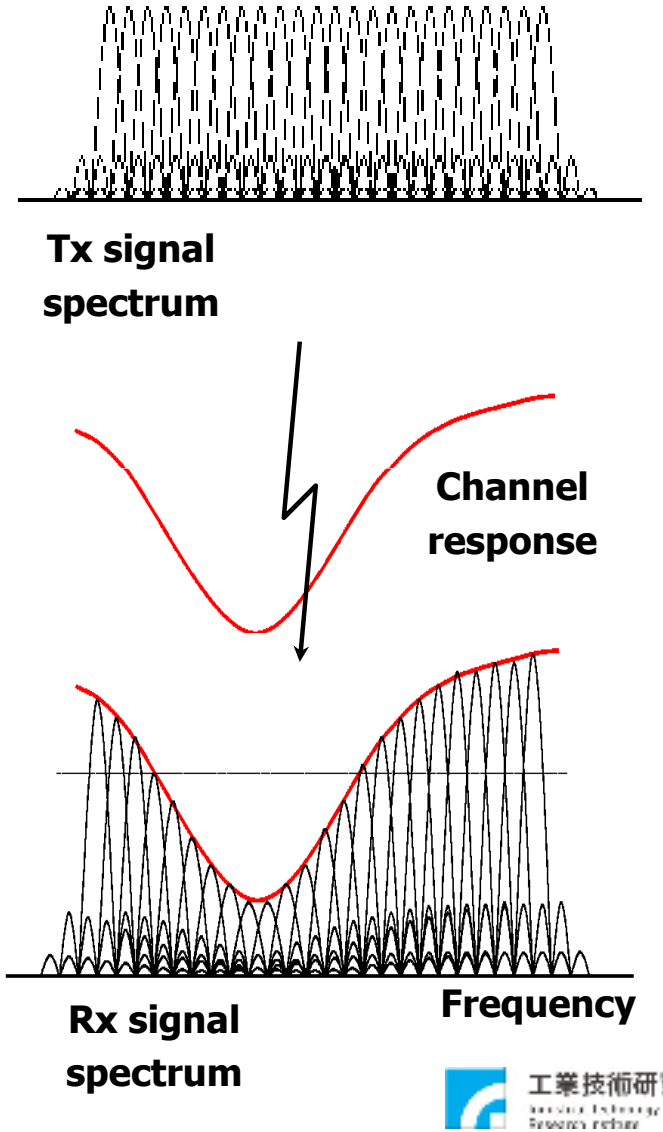


3. small multipath delay spread and inversed phase rotation



OFDM and channel diversity

- Multi-carrier transmission technique
- Channel coding together with time interleaving technique can correct the faded signal parts by non-faded parts.
- It's important to "*create*" diversity for solving the problem at cell edge.



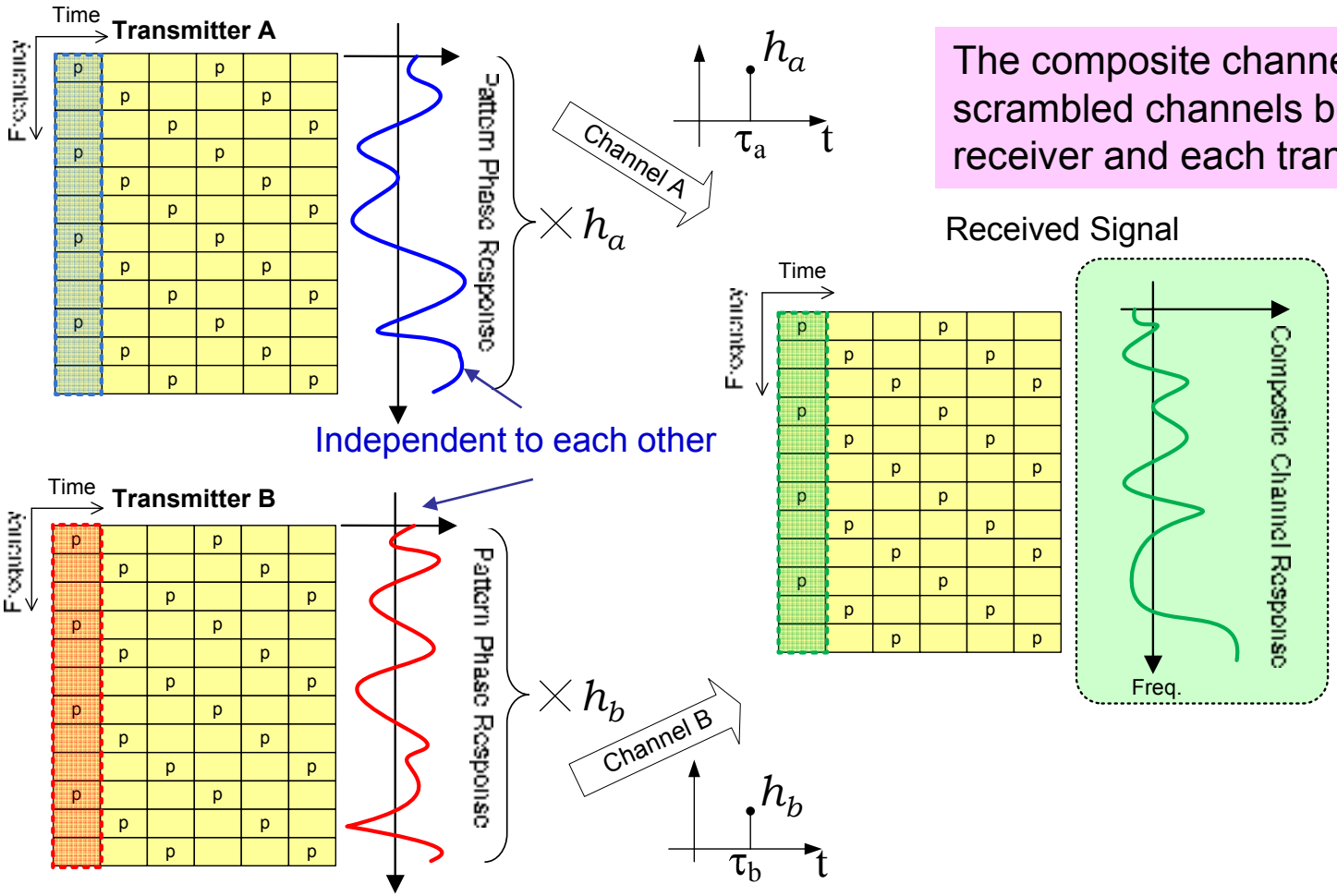
工業技術研究院

PROPOSED CORRELATED SCRAMBLING DIVERSITY SCHEME

工業技術研究院

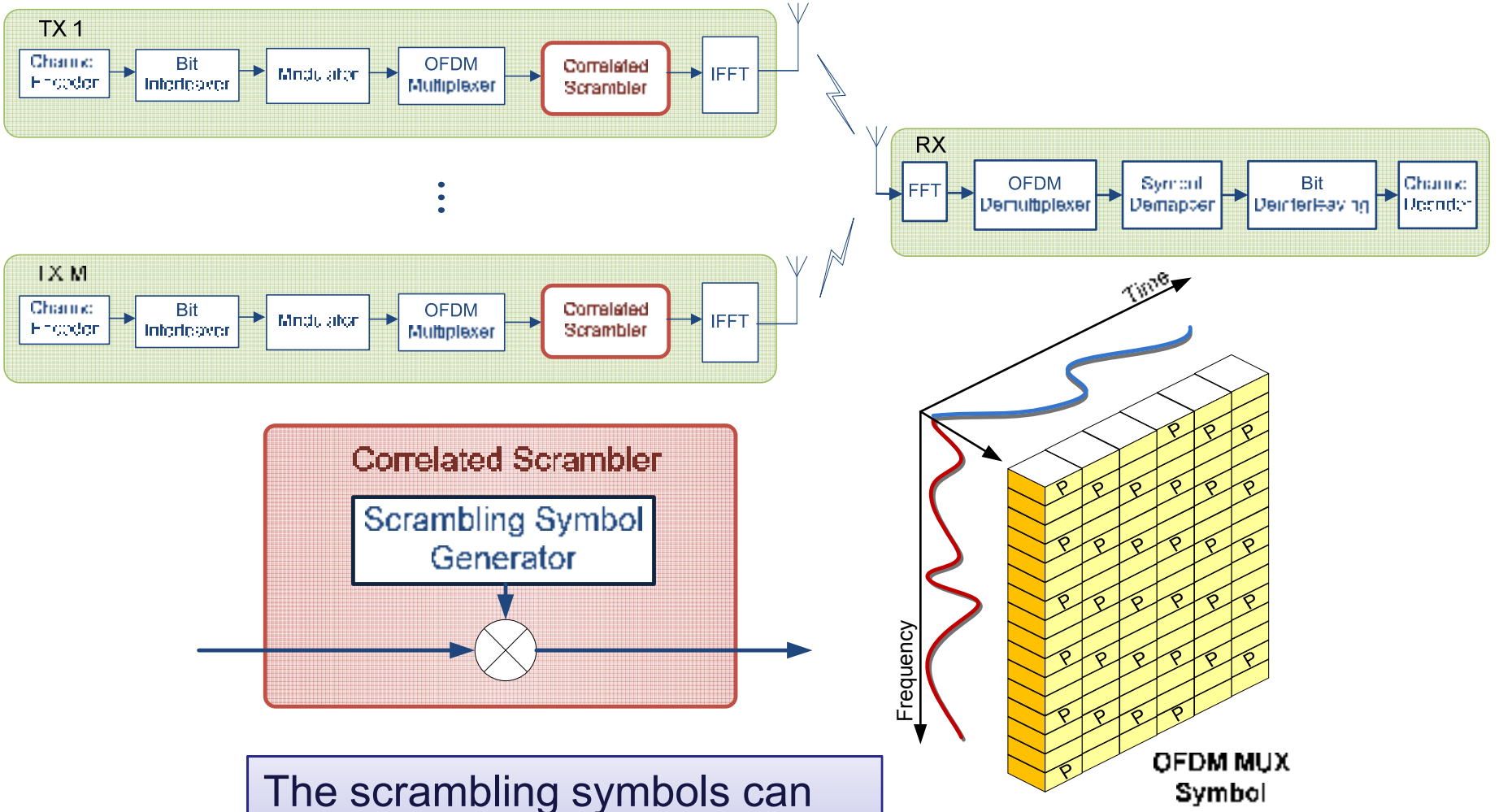
Correlated scrambling diversity (CSD)

Phase of each sub-carrier is rotated by multiplying a scrambling symbol which has unity gain (to keep signal power) and correlated phase for contiguous sub-carriers.



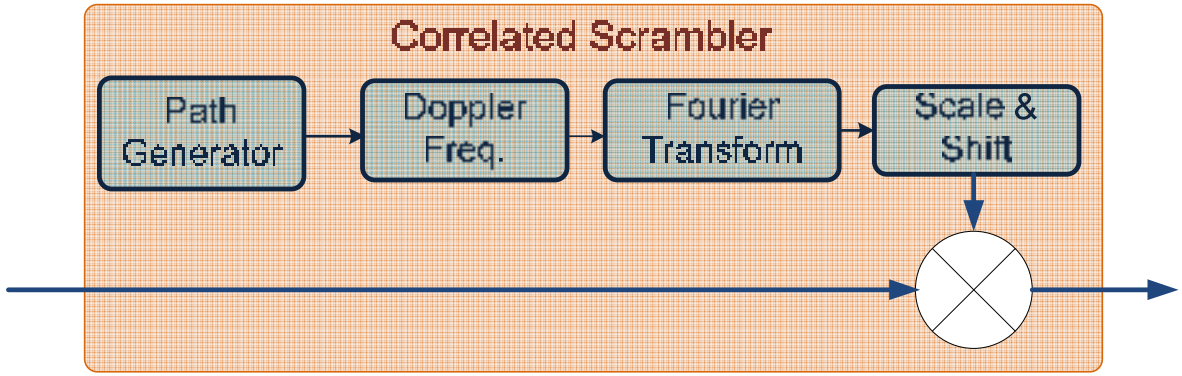
The composite channel is sum of the scrambled channels between the receiver and each transmitter

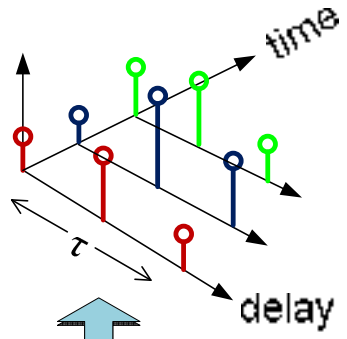
Apply CSD to the system

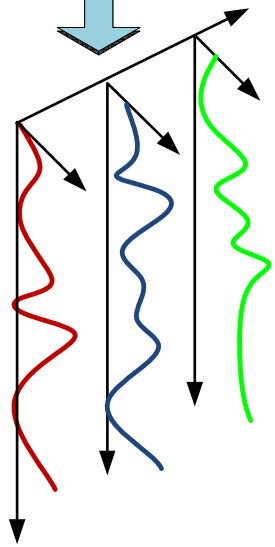


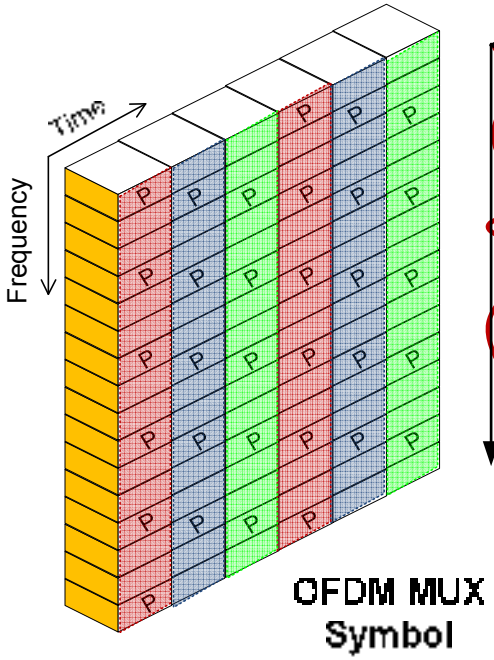
The scrambling symbols can be correlated in frequency or time domain, or both.

CSD pattern generation example









With controllable Doppler frequency, scrambling symbols are correlated in time domain in addition to frequency domain.

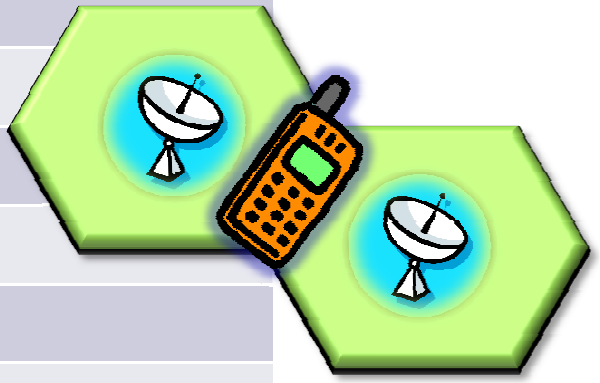
工業技術研究院

SIMULATION RESULTS

工業技術研究院

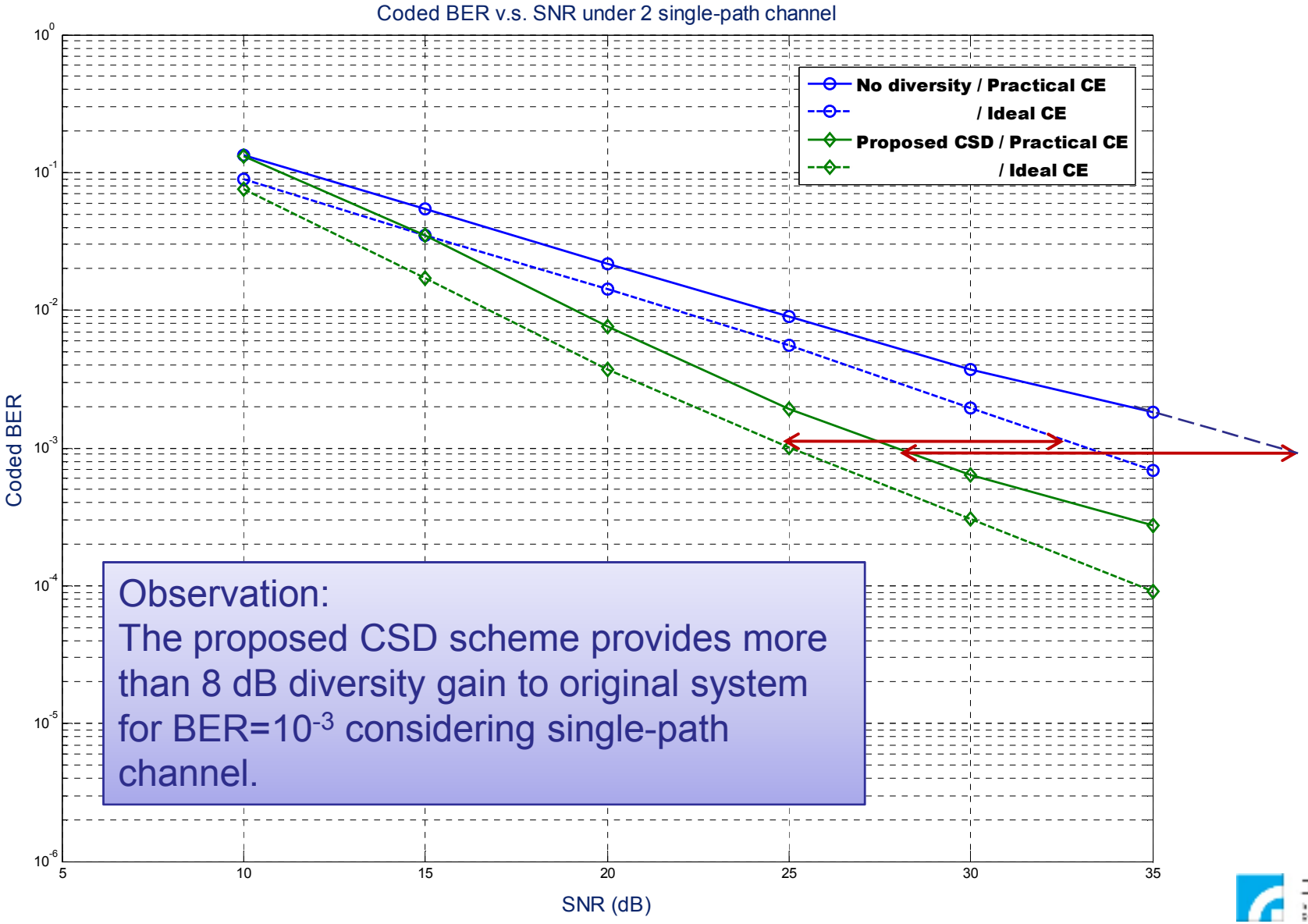
Simulation parameters

Parameter	Value
Channel bandwidth	10 MHz
Number of subcarriers	1,024
Subcarrier permutation	PUSC
Cyclic prefix	1/8
Modulation and Code rate	16-QAM 1/2
Channel coding	Convolutional turbo code (CTC)
FEC data block size	480 bits
Carrier frequency	2.5 GHz
Simulation time	3 sec
Number of cells	2
Channel model	ITU Vehicular A (VA) or single-path
Mobile station speed	30 km/hr
Channel estimation	Cluster based linear interpolation

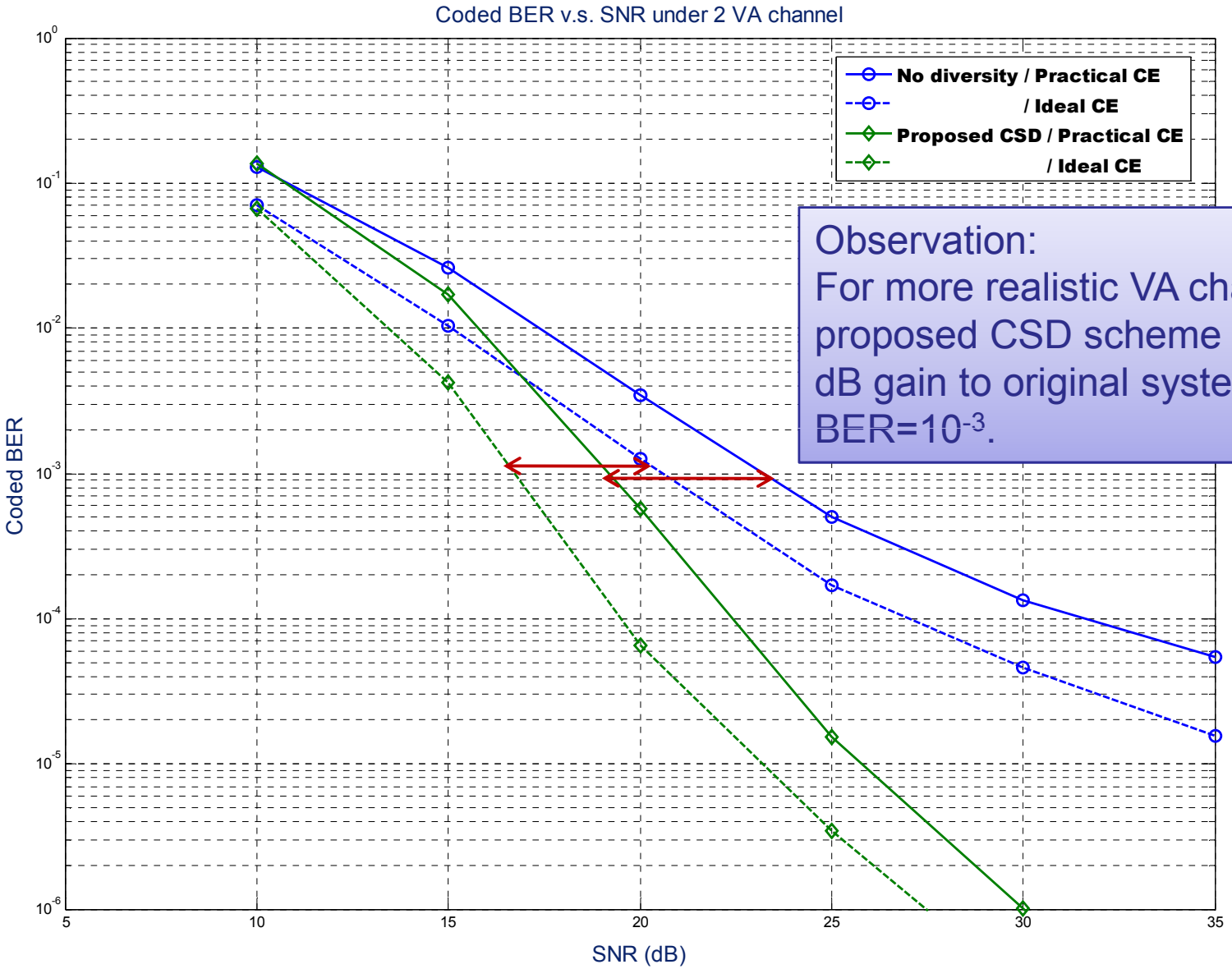


工業技術研究院

Simulation results: single-path



Simulation results: VA channel



Observation:
For more realistic VA channel model, proposed CSD scheme still exhibit 4 dB gain to original system for BER=10^{-3}.

工業技術研究院

CONCLUSION

工業技術研究院

- In SFN, UE at cell edges experiencing flat and/or slow fading cannot operate well.
- A novel correlated scrambling diversity scheme is proposed to overcome this problem.
- Through simulations the proposed scheme has provided significant diversity gain compared to the original system.

工業技術研究院

THANK YOU

工業技術研究院